NIIGATA Drives Manufacturing Innovation

The goal is powerful, world-class manufacturing in which we think and act by ourselves

Niigata Power Systems Co., Ltd. has successfully halved the costs and shortened the lead time to one third as well as improved production capacity while getting rid of conventional manufacturing practices. To this end, its production division reviewed the upstream design to standardize and visualize processes and eliminate waste work.

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Cell production assembly plant

Much appreciated NIIGATA brand products

Key products handled by Niigata Power Systems Co., Ltd. (NPS) include diesel engines, gas engines, and gas turbines, as well as power generators and Z-type propulsion units (Z-PELLER®) powered by them. NPS is engaged in manufacturing, sales, and after-sale service of these products.

In the marine market, NPS delivers diesel engines as the main and auxiliary engines for fishing boats, high-speed vessels, and various other workboats. Z-PELLER is often used in tugboats, supply boats, and other workboats.

For the land market, power generators powered by NPS's diesel engines, gas engines, and gas turbines are used for different purposes, including in-house power generation for plants, power generation on isolated islands, backup power supply for hospitals and other buildings, and emergency power supply for nuclear plants. In addition, NPS has a long history of providing diesel engines that drive railcars and locomotives in the railway vehicle market.

Customers value NPS for its ability to offer an extensive product lineup and cover required power ranges, as well as to provide quality, durable engines and accurate after-sales services.

Manufacturing innovation transforms craftwork into industrial products

As such, NPS products under the NIIGATA brand have a broad customer base. However, NPS was engaging in conventional manufacturing practices in old-fashioned plants, and the processes were not visualized. Consequently, it often had to stop production due to problems such as failing to supply the required quantity of parts needed for a process on the production line on a tray in a way that is easy for production line workers to grab when they are needed. Other problems included inconsistency between the numbers and quantities of collected parts and the figures on the drawings. In addition, pipes were bent and cables were wired for instrument piping and electrical wiring on site. As such, products were more like craftwork that were dependent on the skills of craftsmen.

Therefore, with the establishment of the new company, NPS committed to production innovation by thinking about what could be done to manufacture a fixed quantity by a fixed number of persons at a fixed location and with a extremely tight schedule.

The following introduces the details and results of NPS's production innovation activities, from changing the production system and creating task scenarios through to their use and deployment, and to the relocation of plant equipment.

Changing from takt production to cell production

First, under the assumption that it would be more efficient if assembly process tasks were divided by time, NPS carried out the work using takt lines in which the work location moved once a day. Since the man-hour requirement differs depending on the model due to low-volume high-mix production, wait times occurred for time adjustment according to the difference with the takt time. On the other hand, if there was not enough time, more people were assigned to tasks on the line, making workers unavailable for tasks on other lines, which was inefficient. Therefore, NPS changed the production system to "cell production" for stationary assembly by eliminating takt lines and creating multiple assembly cells in their place.

This eliminated waste due to wait times and remarkably improved the flow of supplies.

Task scenarios and scenario-based parts supply on a tray

Next, in an attempt to deal with the problem of wait times due to a stopped process as a result of failing to supply parts needed for the process on a tray for line workers due to inability to keep track of progress, NPS analyzed tasks from the viewpoint of preventing the flow of supplies from stopping. In this regard, NPS made improvements thanks to the cell production system. As a result, it was found that the progress of tasks must be visualized in order to understand the order in which tasks are carried out and the current state of the tasks, which led NPS to create "task scenarios."

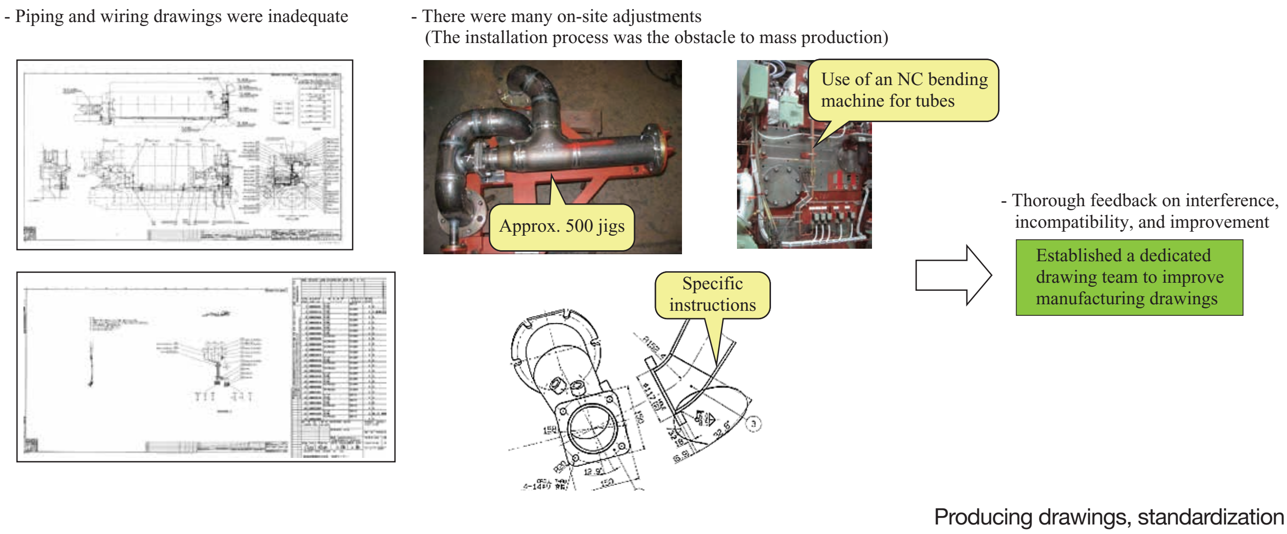
A task scenario specifies a series of workflow steps including the task items, task order, workers, and times. Keeping the fixed quantity, fixed number of persons, and fixed location requires a task scenario to be carried out on a tight schedule, and it became clear what parts must be delivered at what timing. Then, NPS introduced "scenario-based parts supply on a tray," in which the logistics division gathers and distributes the required parts according to the task scenario. As a result, NPS successfully reduced the time wasted waiting for and searching for parts.

In addition, in order to follow a tight schedule based on the task scenario, NPS supplied "unpackaged parts on a tray to line workers," having the logistics division remove packaging materials in advance. NPS also expanded the use of returnable boxes with subcontractors so that packaging materials would not be used for parts supplied by them, ensuring that unpackaged parts are provided for work.

Innovation that goes back upstream through the use of drawings and standardization

Having created and implemented task scenarios, it became apparent that when the number and length of parts such as bolts indicated on a drawing do not match parts available on site, workers gathered parts again using their expertise.

For instrument piping, the workers planned routes, created brackets for fastening pipes, and bent pipes by hand while adjusting them to the actual equipment and facilities due to inappropriate drawings. This was also true for electrical wiring, and it became an obstacle to improving productivity.



Naturally, NPS asked the design department to create and correct drawings. However, the design department back then was very busy creating drawings for each instrument piping specification, which was different for each customer, and thus had a hard time fulfilling this request. NPS then established a drawing team within the manufacturing department and corrected the drawings of parts such as bolts so that anyone would be able to gather parts without relying on expertise.

As for instrumentation-related piping and wiring, the manufacturing department also determined the shapes of pipes and wires and produced and modified drawings by itself. In this way, the department promoted the use of drawings and standardized parts by receiving approval from the design department. As a result, on-site adjustment is no longer necessary, and internal production and outsourcing are now possible. In addition, it became possible to supply pipe jigs to outsources and assemble delivered pipes as they are.

Meeting requests from on-site workers while going back to designing in this way led to a significant reduction in the assembly man-hours and stable manufacturing in terms of quality as well.

Today, with much data accumulated because of the number of pipe and wire drawings that were produced, NPS has created a system in which requests for improvement from the manufacturing department are corrected by the design department.

Linking task scenarios with the production management system

Next, in order to shorten the time for scenario-based parts supply on a tray, NPS incorporated a function that uses a task scenario number as an ordering key into the production management system. When an order is received and the date of shipment or date of delivery to the site of operation is determined, the delivery date of the parts and the delivery date from the warehouse are calculated backward using task scenarios.

In this way, by linking a task scenario to the production management system, NPS made it possible to find out the time of parts supply and engine delivery during manufacturing. It also allows customer support staff to see the time of maintenance for individual engines as well as the delivery or supply of parts used for maintenance, constructing a comprehensive system aimed at overall optimization from ordering to aftermarket. Today, this system is not only used by the Production Center, but also sales, procurement, customer support, and many other departments as an integrated system. Furthermore, the system has continued to evolve according to changing production methods.

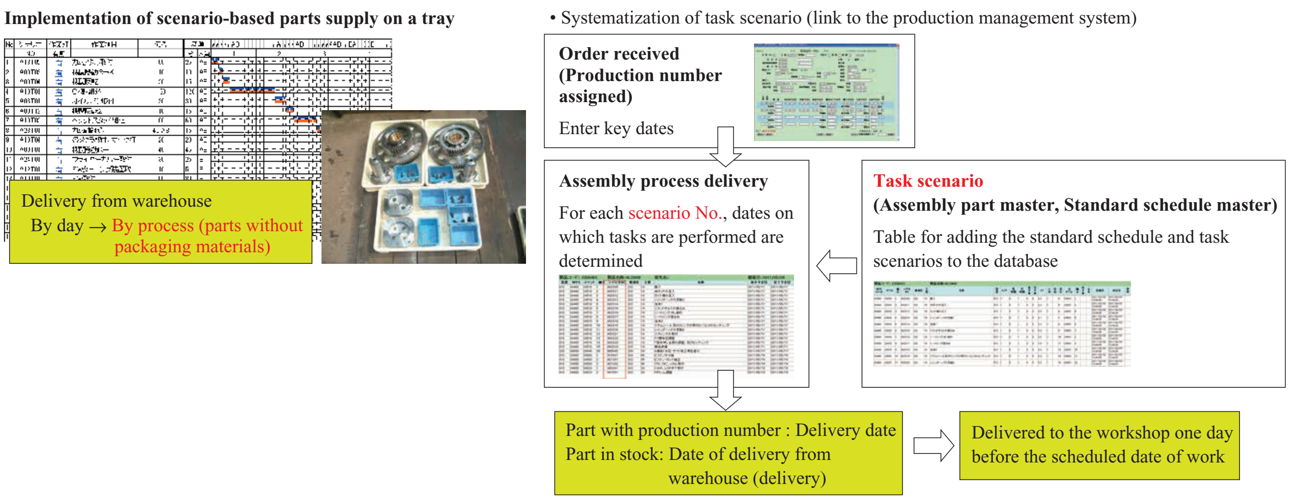
Machining specialized at plants

Because NPS’s engine plants, located in Ota City, Gunma Prefecture and Niigata City, Niigata Prefecture, were divided by the size of engines manufactured, both plants had the same machining equipment to process cast parts and forged parts individually, though the sizes of parts to be processed differed.

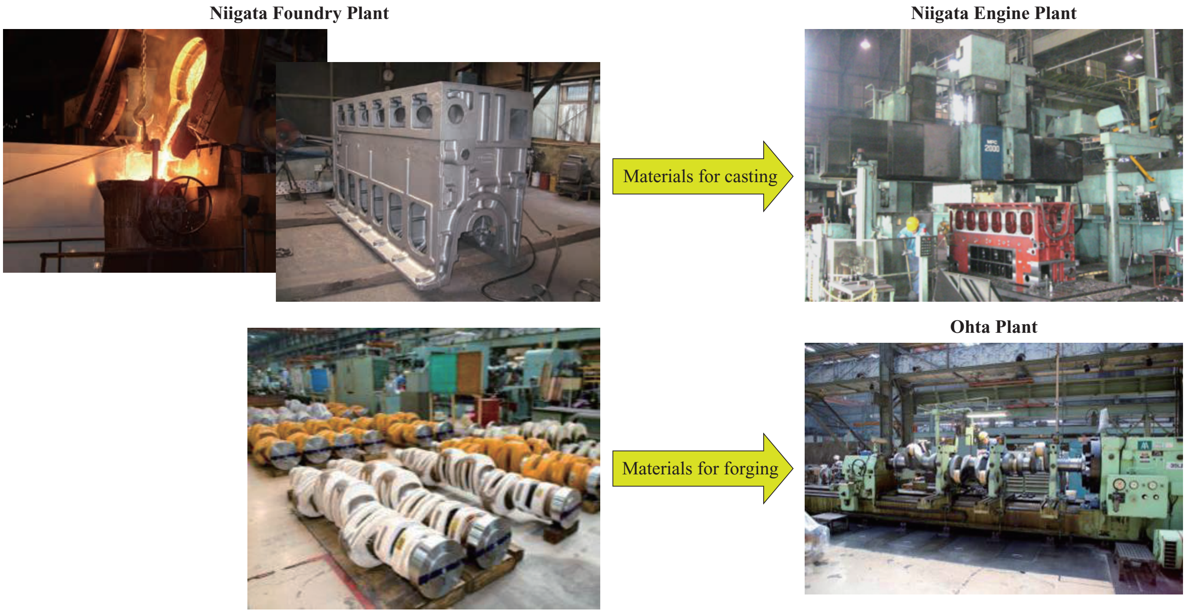
Recognizing that carrying out the same machining at two plants may be a waste and on the assumption that consolidating items to be processed and specializing in each machining process would be more efficient, NPS pursued a machining innovation involving a large-scale relocation of machines such that cast parts, including crankcases, cylinder heads, and pistons, are processed in the Niigata Plant, which was located next to the casting plant, while forged parts, including crankshafts, camshafts, and connecting rods, are processed in the Ohta Plant.

During the period before the machinery was relocated and started up, production was performed ahead of schedule and subcontract processing services were used so that there would be no delay in the schedule.

When relocating machinery, NPS transferred people familiar with processing with the machines along with them. This approach was also effective in terms of human resource



Scenario-based parts supply on a tray and systematization



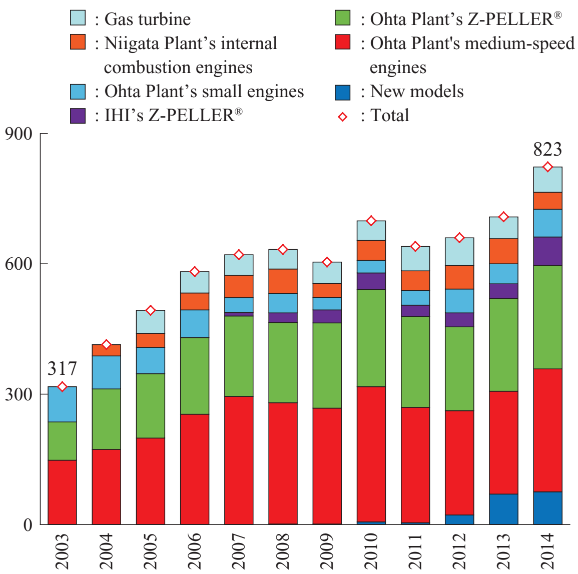
Consolidation of machining

development at each of the plants, transforming the two plants into even more specialized plants. In addition, isolating parts to be processed allowed NPS to level the production balance between the plants and eliminated the waste of duplicated equipment and human resources.

Innovation results

As a result of these innovation activities, NPS reduced the assembly man-hours by 58% and lead time by 53% compared with the former company (Niigata Engineering Co., Ltd.) for manufacturing of the 6L28HX middle-speed marine diesel engine, which is one of NPS' main models.

In addition, the number of Z-PELLERs produced increased from 8 units per month before the innovation to 20 units per month.



Change in output

In response to the production increase based on the medium-term business plan, "Jump NIIGATA 2011," in addition to earlier manufacturing innovations including earlier improvements through capital investment in production line modification and layout enhancement, NPS furthered along the plan by developing initiatives beyond the company, such as the scenario-based parts supply on a tray for Z-PELLERs at IHI's Yokohama Works. As a result, the total number of products manufactured increased from 317 units per year in 2003, the year in which NPS was established, to 823 units per year (260%) in 2014.

Future challenges

Under the medium-term business plan, "Jump NIIGATA 2016," which started in FY2016, NPS aims to expand the scale and activities of its business. As part of such efforts, NPS will aim to reduce costs and shorten the lead time that are accepted by countries around the world.

Specifically, NPS will engage in logistics innovation in the areas from purchasing to delivery, manufacturing innovation in the areas from materials to installation using 3D technology, aggressive quality innovation, and plant facility innovation based on preventive maintenance using IoT.

Furthermore, NPS will aim to realize powerful, world-class manufacturing by further advancing its earlier innovation approaches by encouraging each one of its employees to think by themselves and act quickly.

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