Liquefied natural gas (LNG) tank
– Optimizing quality and cost with automation technology for the world’s largest class LNG tank

Kawagoe Thermal Power Station LNG tank Nos. 5 & 6 for Chubu Electric Power

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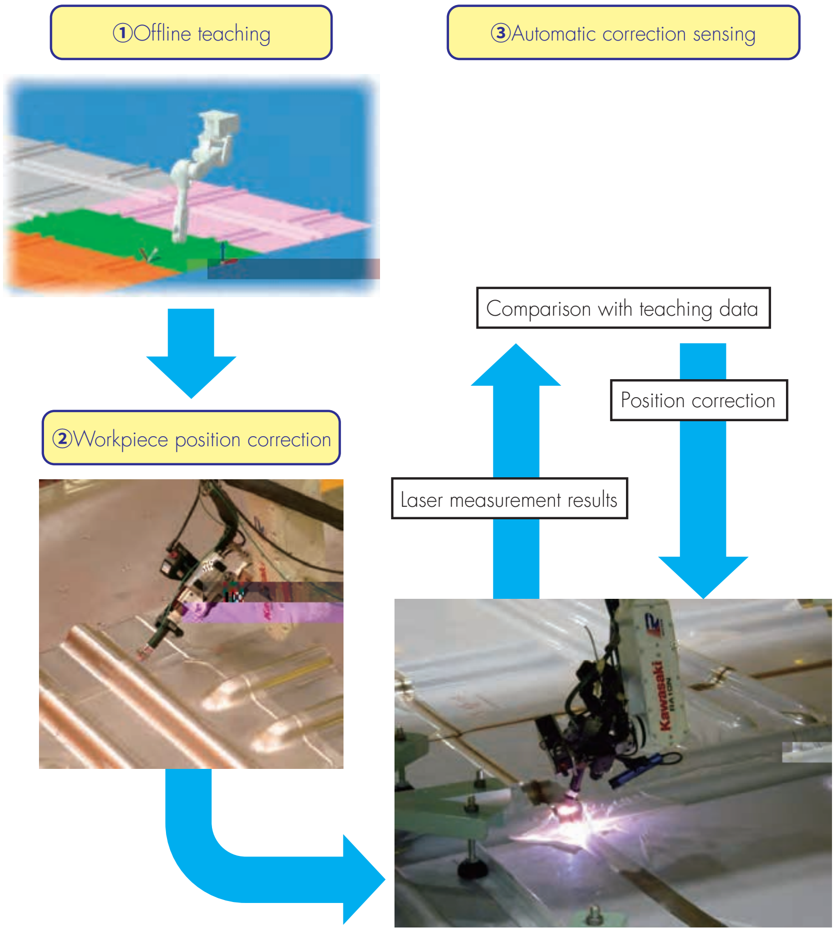

Fig. 7 Automated weld seam tracking system

overview of the automated weld seam tracking system.

① Offline teaching

Teaches welding robots offline (feeds CAD-based weld seam data on a computer, without using the actual robot).

② Workpiece position correction

Corrects the welding position of membrane panels using the touch sensing function of the welding robot.

③ Automatic correction sensing

Measures the position and height of lap joints as well as gaps in real time during welding operations using a laser sensor. Calculates the amount of correction based on the difference with teaching data, and automatically corrects the welding target position to an accuracy of 0.1 mm.

(iii) Weld distortion prediction technology

Membrane panel modules are fabricated in shop by combining 18 panels into a block of approximately 5 x 11 m. To maintain the quality of the modules and shorten the time required for installation on site, it is important to minimize the weld distortion of the overall modules. However, when seam welding multiple joints, it used to be difficult for the operator to accurately predict the amount of weld distortion in the finished work. We sought to solve this issue by simulating the weld distortion of sheet metal membrane panels and determining the optimal welding procedure to minimize distortion.

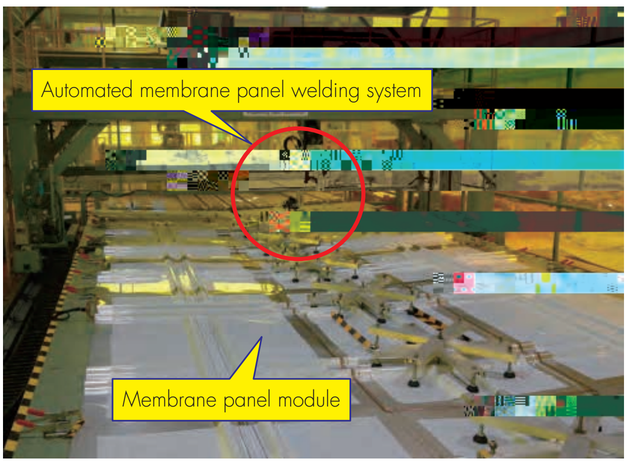

Fig. 8 Automated welding of membrane panels

We verified the simulation results by testing the procedure on a mockup and comparing the weld seams with those welded by a skilled welder using the conventional procedure. This test demonstrated that the new procedure can reduce the amount of weld distortion by half. We applied this procedure to the actual shop fabrication of modules and successfully minimized weld distortion.

(iv) Application

We were able to achieve excellent weld quality by applying an automated membrane panel welding system featuring an automated weld seam tracking system and a welding condition database to in-shop module fabrication. We also achieved an automation rate of approximately 95% for the welding of prefabricated modules by eliminating the need for an operator to monitor the process. Figure 8 shows an automated membrane panel welding system in operation.

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Welding operations at construction sites of aboveground LNG storage tanks overseas can be faced with such issues as difficulty securing skilled welders with the required skill level for nickel steel welding, or inability to use special automated welding equipment due to obstacles related to construction site facilities or environmental factors. To address these issues, the use of flux-cored arc welding (FCAW) has been required in pressure-resistant components of the inner tank. FCAW is a highly efficient welding method that does not rely heavily on the skill level of the operator, and can also help shorten the construction period. Kawasaki has been applying FCAW to non-pressure-resistant components of storage tanks in Japan from about 10 years ago. With a view to applying the process to pressure-resistant components of the inner tank, we evaluated the weldability and joint performance of FCAW materials. As a result, we were able to confirm that the process fully satisfies the performance requirements of LNG storage tanks, and offers excellent fracture toughness as well as joint strength and toughness that are at least equal to the level achieved by the shielded metal arc welding method currently used. We have also established appropriate welding conditions that ensure crack resistance. Therefore, we have started applying the process to the fabrication of pressure-resistant components of the inner tank in LNG storage tanks currently under construction overseas. We are working with an eye to applying the process to the pressure-resistant components of LNG storage tanks in Japan as well, once we have accumulated sufficient technical data and experience.


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LNG continues to be in high demand around the world as an environmentally-friendly, clean energy source. As part of its ongoing contribution to society, Kawasaki is working to develop products that help ensure a steady supply of energy through lower cost, higher quality, and more efficient processes.