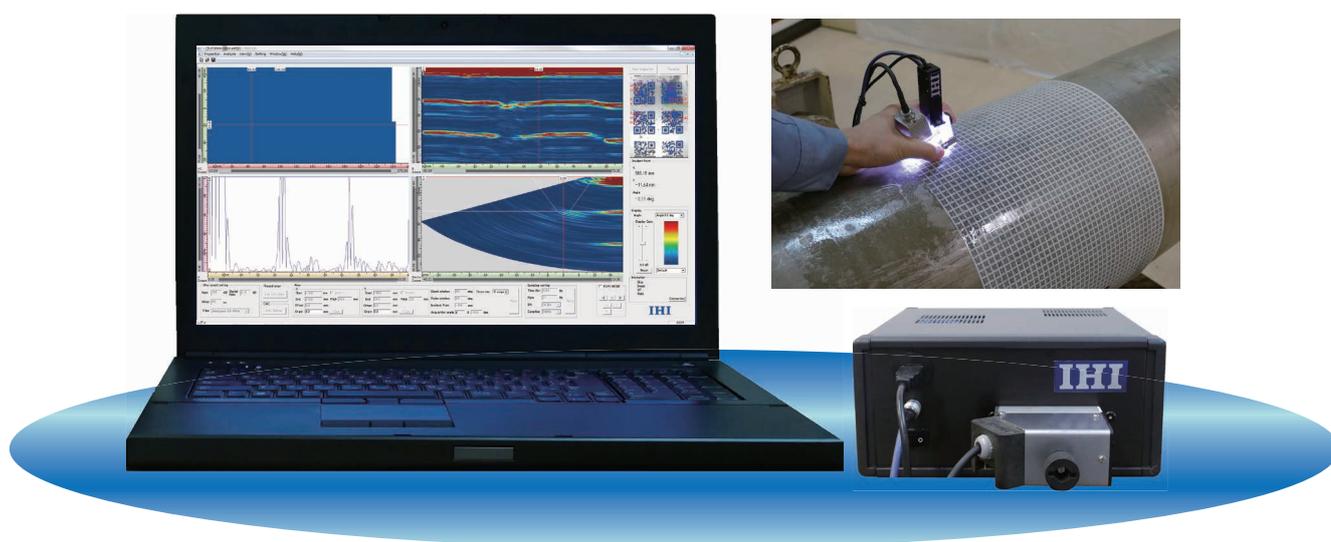


A Significant Technological Advancement in Ultrasonic Inspection

ARMUT[®] — A state-of-the-art ultrasonic inspection system for simple and advanced nuclear component inspections

Over the years, IHI has worked to provide advanced inspection technologies and ensure the safety and reliability of nuclear component. This article introduces a state of the art ultrasonic inspection system based on our know-how cultivated at the sites of nuclear component inspections, which must be maintained at the highest level.



ARMUT[®]

After a critical component is brought into service in a nuclear power plant, a periodic inspection (in-service inspection) is carried out to check for the integrity of the safety related component. A test with ultrasound plays a central part in this in-service inspection. After the accident at the Fukushima Daiichi Nuclear Power Plant, which was caused by the Great East Japan Earthquake, such periodic inspection of Japanese nuclear power plants are very rarely carried out. On the other hand, there is a need for an initiative to develop nuclear component inspection rules so as to increase the inspection transparency, safety and reliability of nuclear energy and gain recognition from the society. This would be beneficial due to a growing demand for technological innovation when inspecting nuclear component.

Developing a device that incorporates the best features for inspection

There are two types of Ultrasonic Testing (UT): manual and automated. Manual UT (Non-Encoded) is when only an ultrasonic waveform is displayed. It can easily be performed using a relatively economical device, so it is widely used for general purposes. However, this type of UT requires the inspector to check and record information obtained during inspection (such as the ultrasonic waveform and defect positions) on-site, thus posing a heavy burden on the inspector.

In contrast, automated (Encoded) UT has the function of automatically saving to the computer all data obtained during inspection, including the ultrasonic waveform and defect

positions. Therefore, data can be recorded and reviewed afterwards. As inspection data can be retained after the inspection, thus the transparency of the inspection can be ensured. This will lead to a reduction in the workload of the on-site technician for inspection. However, automated UT is more expensive than manual UT because it requires the use of automatic devices and robots, so its applications have been limited.

The recently developed ARMUT[®] (Absolute Recordable Manual Ultrasonic Testing system) incorporates the best of both types — in other words, it leverages the advantages of both manual UT and automated UT — and it can be described as a state-of-the-art ultrasonic testing system that would supersede the conventional technology.

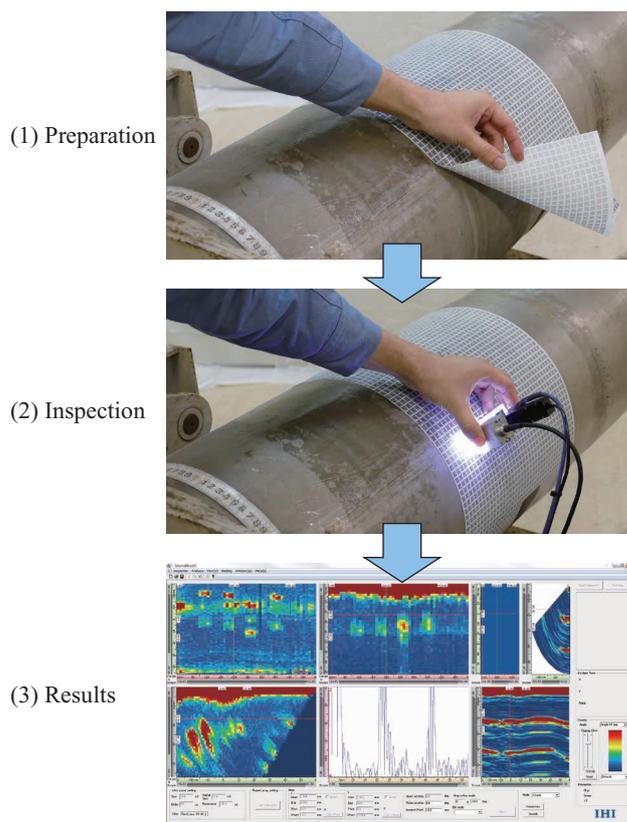
ARMUT[®] — An ultrasonic testing system that will revolutionize the conventional ultrasonic inspection

The ARMUT[®] is a small-sized, lightweight system, allowing the technician to carry the device to the inspection site by hand, as is the case for manual UT. The inspector then performs ultrasonic testing following a procedure that is virtually the same as for manual UT. As the technician is familiar with the procedure, he/she can perform this task quickly. The only difference is that the ARMUT[®] involves a step in which a sheet with a printed code representing the positional information is attached to the surface of the object being inspected. This one simple step allows all data, including the ultrasonic waveform and defect positions, to be automatically saved to the computer, as is the case with automated UT, this provides a simplified solution during the inspection that can be reproduced at any given time. As a result, the transparency of inspection can be maintained.

The ARMUT[®]'s principle of operation is very simple, making it possible to achieve good on-site usability and high reliability. Moreover, functions that are not available in the conventional manual or automated UT have been successfully added by leveraging this principle. For instance, the ultrasonic sensor has to be kept in close contact with the sheet with printed positional information code while scanning the code, otherwise the data obtained will be incomplete. The ARMUT[®] operates in such a way that we have successfully eliminated in principle the possibility of overlooking a flaw detection. Furthermore, by using a camera for reading the positional information code integrated with the ultrasonic sensor, a function has been successfully incorporated to automatically halt data collection when there is insufficient contact between the ultrasonic sensor and the surface to be inspected, or when the incident direction is incorrect because the ultrasonic sensor is skewed excessively.

As such, the ARMUT[®] is a reliable system that can be used easily at inspection sites and can automatically prevent the omission of inspection and the failure of data collection.

This system has already been used for piping inspections at Japanese fossil fuel power plants, and it will be used for



Procedure for using the ARMUT[®]

inspections of multiple units of nuclear equipment outside Japan as well. In addition, public relations activities to provide this system to Japanese nuclear power plants have been carried out with favorable responses.

IHI has been developing sophisticated technologies for inspections and maintenance works for nuclear components which must always be maintained at the highest level. Also, accumulating know-how on inspections and maintenance works. We are committed to utilizing the ultrasonic testing system ARMUT[®] to provide inspection services that are significant technological advancement over conventional services, thereby contributing to initiatives to realize a safe and reliable nuclear energy society.

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