Improved Phased Array UT Inspection of Dissimilar Piping Welds

Dissimilar metal (DM) welds have become a major concern since PWSCC (Primary Water Stress Corrosion Cracking) was found in nozzle-to-pipe welds in PWR-type nuclear plants worldwide. Nuclear regulatory bodies, including the NRC in the United States, have mandated the use of qualified procedures for in-service inspections (ISI) of welds susceptible to PWSCC. Back in 2005, ZETEC accepted the challenge and developed what is now the most widely used phased array inspection technique for DM welds under ASME requirements.

Using lessons learned from field experience, ZETEC has now qualified an improved solution for encoded phased array UT examination of DM piping welds using its latest PA UT portable system, the ZIRCON™ and the DYNARAY® product line.

**Scope of Work**

Dissimilar metal (DM) welds typically join two or more different materials, and often involve inconel alloys. DM welds are very difficult to inspect with ultrasound due to the various propagation issues in austenitic structures, the presence of multiple acoustic interfaces and the complex geometries generally involved.

The inspection solution covers detection, length sizing and through-wall sizing of circumferential and axial cracks in dissimilar metal piping welds from the outside surface, for diameters 1.5"NPS and up, and for wall thicknesses from 0.210" to 6.50" (5.3 to 165.1 mm) according to ASME Code Section XI, Appendix VIII, Supplement 10.

For more information on the ZETEC turnkey solutions, please go to www.zetec.com.
ZETEC’s Solution: 
Simpler, Faster and Better

Improved Qualified Solution

ZETEC has developed a DM piping weld inspection solution that covers detection, length sizing and through-wall sizing of circumferential and axial cracks in dissimilar metal piping welds from the outside surface.

With state-of-the-art ultrasound acquisition systems and software, ZETEC carried out an equivalency demonstration of its solutions that takes full advantage of 2D matrix array technology by using more elements. For all typical PDI specimens that are part of the scope of the procedure, beam simulations have been performed in order to evaluate the influence of the focusing position on the acoustic beam and showed significant improvements to previously qualified solutions.

Those improvements are made possible by ZETEC’s high-performance phased array UT systems (such as the ZIRCON™) and its feature-rich software (UltraVision® 3) that allow for better focusing and 16-bit amplitude resolution. The inspection is done by performing a multi-line scanning sequence with a limited number of phased array probe and wedge assemblies to cover the full range of pipe dimensions.

Results

ZETEC has overcome the challenges in developing and qualifying its DM piping weld inspection solution through the PDI program according to ASME Code Section XI, Appendix VIII, Supplement 10 and covers detection, length sizing and through-wall sizing of circumferential and axial cracks.

The multiple-line scanning sequences significantly reduce inspection time and offers reliable detection and accurate sizing of circumferential and axial flaws.

Candidates qualified to the previous ZETEC/EPRI procedure (PA03) are automatically qualified to this new, improved procedure.

ZETEC’s MPS scanner is designed for rapid ultrasonic examination of various pipe weld configurations with either phased array or conventional UT techniques. It is compatible with all ZETEC UT and Phased Array UT equipments.

Key Features of ZETEC’s Solution:

- Powerful PC-based software
- Advanced Focal Law Calculator
- 3D ray-tracing
- Acoustic beam modeling
- Overlay of CAD-drawing
- Fast and reliable
- Handles large data files: up to 20 GB
- Volumetric Merge for rapid and efficient data analysis
- Drives all ZETEC UT & Phased Array UT systems
- Formally qualified with various UT & Phased Array UT procedures in several countries (USA, Finland, France, Japan...)
- Over 350 licences and upgrades sold worldwide since September 2005

A complete UT and phased array inspection package that provides a 3D work environment.

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