Advances in Phased Array Weld Inspection Scan Plan Designs

Use of Compound S-scan for Improved Weld Flaw Detection and Sizing

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Advances Scan Plan Designs – Presentation Overview

- ASME phased array scan plan design definitions
- Compound S-scan setup and configuration
- ASME compliance and essential variables
- Compound S-scan vs S-scan coverage comparison
- Compound S-scan API 650 9%Ni cryogenic data example
- Compound S-scan ASME B31.3 carbon steel weld data example
Advances Scan Plan Designs – ASME V Definitions

- **E-scan**: A single focal law multiplexed across a group of elements for a constant angle beam stepped along the probe length.
- **S-scan**: Set of focal laws that provides a fan like series of beams through a defined range of angles using the same elements.
- **Compound S-scan**: Set of focal laws using a fan like series of beam movements through a defined range of angles and elements. The compound S-scan combines the E-scan and S-scan in a single acquisition group.
Select probe frequency and aperture.
The aperture is limited by pulser configuration and element pitch. A simple rule of thumb is to reproduce the size of the equivalent UT probe.
Position probe as close to the weld as possible with respect to the first and last A-scan position\angle that is needed for full volumetric coverage.
The beam resolution will determine the # of A-scans in the compound S-scan.
This parameter affects flaw resolution, file size, and scanner speed significantly.
The beam resolution will determine the # of A-scans in the compound S-scan and the beam to beam distance on the weld bevel that affects flaw height sizing.
The compound S-scan scan plan is defined for the PA calculator or work procedure by populating the parameters of both the linear E-scan and S-scan in ASME V Art 4 Appendix V Table V-421.
The compound S-scan is compatible with traditional phased array sensitivity and TOF calibrations. With regard to UT settings, gate position, C-scan configuration and other functions, the compound S-scan does not require any special accommodation and is compatible with normal work procedure.
Below is a comparison of a standard and compound S-scan of same aperture and focus inspecting a 12.7mm V weld.
Advances Scan Plan Designs – Data Sample 9%Ni LNG Shell

- Ability to use fewer setup configurations for a range of bevel thickness.
- 4L32 1mm pitch probe
Advances Scan Plan Designs – Data Sample 9%Ni LNG Shell

- Demonstrate ES Beam Tool Scan Plan
Advances Scan Plan Designs – API 620 9%Ni Movie
Live demonstration of compound S-scan data analysis in 9% Ni LNG tank shell with Innonel625 weld. (25mm thickness)
Advances Scan Plan Designs – ASME B31.3 Piping

- 25mm double V weld bevel coverage comparison of compound and standard S-scan with 1mm pitch, 60 element probe.
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- Flaw detection, sizing, and characterization meet and exceed needs of ASME B31.3, I, V, VIII, and similar referencing codes.

31mm V weld bevel coverage using a 32mm aperture compound S-scan.
Advances Scan Plan Designs – ASME B31.3 Piping

- Fewer files, faster setup and calibration, fewer acquisitions, less analysis made possible through use of compound S-scan.
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- Live demonstration of compound S-scan data analysis in carbon steel B31.3 piping girth weld (25mm thickness)
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