1.14.15. MODIFIED PHASED ARRAY CONCEPT FOR AUT OF LNG STORAGE TANKS

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Natural Gas needs, in order to be liquefied, a low temperature and is stored under cryogenic conditions. Typical storage temperature is below –160° Centigrade. Apart from the fact that this requires the tanks to be fitted with effective thermal insulation and cooling equipment, the tank shell is made out of a steel alloy containing 9% Nickel in order to remain ductile at low temperatures. Wall thicknesses vary between 10 mm (top rings) and 30 mm (bottom ring).

In recent years, a tendency can be observed to switch, for NDT of the welds, from Radiography to automated ultrasonic testing (AUT). Not only does this increase inspection speed and detection capabilities of critical defects, due to the absence of radiation the AUT activities can also be performed in the vicinity of personnel at work, enabling continuous welding and instant NDT results. Since welding is done with high-alloyed welding consumables, resulting in the weld structure to be anisotropic and coarse grained, ultrasonic techniques using angled longitudinal waves have to be used. These techniques include longitudinal beams under 45 to 70°, creeping waves and round trip tandem technique. If performed with conventional dual element TRL probes, a typical probe arrangement contains 6 to 10 probes. Their indices have different distances to the weld centre line, to optimise for the different parts of the weld. In addition, a probe arrangement similar to ToFD is used to pick up possible root defects, using reflection rather than diffraction signals. Inspection is usually done in accordance with API 620, 10th edition, February 2002. Dual phased array probes to mimic the functions of dual element TRL probes are commercially available. However, these have only limited abilities to steer the beam in lateral direction to correct for different focal depths, and they have only one fixed index for all beams (index cannot be shifted to optimise for zones).

This paper will discuss a novel, simple dual phased array design, allowing a weld scan plan that is very similar to dual element TRL probes, with the possibility of using creeping wave and flexible tandem techniques, without needing an excessive amount of elements. This probe design does not need lateral steering to be effective in all zones. Its capabilities for detection and sizing, in accordance with the Code's requirements and acceptance criteria (table U1 and U2) will be discussed. Field experience and validation results will be presented.