



ACFM® Tank Floor Weld Inspection

Petrochemical storage tanks are constructed using rectangular steel plates laid overlapping each other and lap-welded together to form the main tank floor. Around the outside, petal shaped plates are laid in a circle and butt-welded together. Finally the plates forming the tank wall are attached using fillet welds to the outer floor plates. These, and similar construction methods, produce specific defect inspection challenges for which TSC have developed unique solutions to tackle.

TSC's ACFM® solutions provide:

- Reliable, quick inspection of tank floor welds.
- Information on crack depth to prioritise repairs.
- No need for extensive cleaning or coating removal.
- Full recording & reporting of data for audit purposes.

Inspection Challenge

The main failure point in storage tanks is corrosion in the floor plates, from either the top surface or from the underside. This corrosion is detected by well established methods for measuring plate thickness, such as magnetic flux leakage, low frequency eddy currents, or ultrasonics. However, these inspections are not able to inspect the welds for defects. Detection of through-wall defects at the welds is normally carried out using vacuum box technology, although this can be difficult to deploy at complicated lap welds or near to obstructions. The traditional technology for inspecting the welds for non-through-wall defects is magnetic particle inspection (MPI), but this requires extensive surface cleaning, removal of any protective epoxy coating, and gives no information on depth of any defects found.

The Alternating Current Field Measurement (ACFM®) technique was specifically developed to detect and size surface-breaking defects at welds and is capable of working through several millimetres of non-conductive coating. Signal strength in ACFM is related to defect size, so, unlike MPI, the probability of detection increases for the more significant defects.



AMIGO™ Features

- Rapid scanning using a hand-held probe.
- Reliable crack detection
- Accurate sizing (length and depth).
- Reduced cleaning requirements,
- Rugged site unit, IP54 rated.
- Minimum 5 hr operation fully-charged battery pack
- Full data storage for back-up, off-line and audit purposes.

ACFM® is therefore a natural choice for inspecting storage tank welds to supplement the corrosion mapping, and has successfully detected large cracks missed by conventional techniques.

Standard ACFM® Inspection

ACFM® inspection of tank floor welds can be carried out using standard, general-purpose, single-sensor probes, or inspection can be speeded up using advanced multi-sensor array probes, or special purpose deployment trolleys.

Standard weld or pencil probes allow inspection of all geometries likely to be encountered, but inspection speeds are relatively slow, especially if non-through defects are to be detected. Inspection speed, particularly for the fillet welds, can be increased using an encoder weld probe. This contains extra sensors to inspect the HAZ as well as the weld toe, and a position encoder to speed up the sizing process.

ACFM® Array Probe Inspection

If inspection of all welds on the tank floor is required, the speed of the process can be increased using TSC's adjustable array probe. With eight sets of sensors and housed in an independently sprung module, the probe can be "set" to match any weld profile and cap width. The adjustable array probe also has an on-board position encoder to automatically record defect locations and to regulate data collection.

Novel Array Probes have also been specifically designed for inspecting the fillet weld at the wall-to-floor joint. A more "Compact Design" has been developed for inspecting a narrow range of cap widths. This model has one fixed sensor module for inspecting the floor toe and the heat affected zone (HAZ); and one adjustable module for the wall toe and adjacent HAZ. Compliant modules are also available for weld cap inspection. The compact design keeps all sensors sited in one line across the cap, which means data can be aligned without using an encoder and scans can be made close to obstructions.

The flexible, larger probe design enables the inspection of fillet welds of any size between 10mm and 25mm wide; using two separate modules offset from one another along the weld. The probe sensors are housed in a wheel-mounted, support frame, with an encoder. Handle attachments are also available to aid the "walking" operator to push the probe along the weld.

Approvals

The ACFM® technique has received approvals from various organisations including DNV, Bureau Veritas, Lloyds Register and ABS. Standard practice documents covering ACFM® have been issued by ASTM (E2261-03), ASME V and COFREND; and training schemes are available under CSWIP, PCN and ASNT.



Above: Lap Weld inspection using an adjustable array probe.



Above & Below: Inspection of a fillet weld using an encoder on-board a weld probe.



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