Next Generation Tank Floor Scanning – Total Inspection

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Abstract

These instructions have been prepared to assist authors in the preparation of papers for reproduction in Above Ground Storage tanks are subject to obligatory and periodic inspection routines. Due to the harsh operating environments and the catastrophic impact of failure, storage facilities are governed by regulatory practices to ensure the assets are fit for service.

There are numerous potential damage mechanisms associated to the in-service operation of tank storage and each risk of failure requires careful management and routine inspection. Underfloor corrosion is specifically related to the soil interface underneath the tank floor. Regarded as one of the most significant threats in tank storage, floor corrosion often is identified as a risk during integrity management programs and inspection of this potential defect will regularly be included within the written scheme of examination/inspection.

Due to the large service area of a tank floor, the typical inservice condition of the scanning service and the general working conditions inside a storage tank, the inspection method identified to detect underfloor corrosion, must be fast, robust, reliable and provide a high value of confidence for minimum detectability.

Magnetic Flux Leakage systems have been historically deployed for this part of the inspection process and the technology has a proven track record for being able to provide consistent results within these harsh and uncomfortable environments.

However, the historical practices have been challenged for inefficiency and asset owners are insisting for improved productivity, without sacrificing accuracy and traceability.

The latest generation of MFL technology has been developed to significantly improve inspection efficiencies and has identified specific areas within the work flow and scanning parameters that can provide an asset owner with a final report in as minimal time as possible. This results in direct cost savings for reduction in labor time, indirect savings by getting the tank back in-service and reduces risk of confined entry by minimizing the time spent inspecting.

Such developments include; Minimising setup time using software driven inspection plans, onboard LED lighting system to reduce the need for pre-inspection setup, paperless reporting strategy that
will include assisted defect recognition and focussed supplementary inspection, minismised dead-zones to maximise floor coverage and curved scanning capability to map the critical zone of the annular plates.

Key words: Tank Inspection, MFL, integrity management, minimum detectability

1. Introduction

A tank inspection project is made up numerous components, takes precise planning and has significant operational impacts across the site. In addition to the inspection these operations include product management, cleaning activities and potentially building scaffold access. All of these activities have considerable cost to the asset owner and therefore getting the tank back into operation as efficiently as possible is extremely important.

It is the asset owners desire to get the tank cleaned, inspected and reported within the quickest time possible and to have the highest level of confidence in the data output and operational competency.

With the above in consideration, a new age of tank floor scanning is soon to be available. Using the experience of 3 decades of product development and taking advantage of the highest end technology, the new inspection equipment can scan more quickly, detect smaller defects and report more accurately on any areas of damage.

This paper presents key functionality of the new MFL tank scanner to help display the overall efficiency improvements that can make sure a reliable tank inspection report is delivered in the quickest time possible.

2. System Overview

2.1 Interactive Laser Guide

marking the floor while you map is now fast and easy, thanks to laser-assisted defect location. The laser line is simulated live in the C-scan, allowing to correlate the physical location of tank floor defects with C-scan indications.
This software coordinated laser positioning guide allows the user instantly mark the area of the floor that may require further investigation for reporting. Without pausing the scan or repositioning, the operator will quickly locate the defect on the real time CSCAN, place the coordinated cursor over the defect by moving the scanner head and turn the laser on to mark the spot on the floor.

2.3 Onboard Powerful lighting

Front dimmable, focalized LEDs, with diffusing lenses and rear LEDs. Based on chip-on-board technology providing high and uniform intensity, inline with API recommendations for visual inspection, to perfectly highlight product-side pitting and scan obstacles.
2.4 Adjustable bridge height

Reach maximum sensitivity where conditions allow, and easily raise the bridge to scan even in the most challenging conditions, such as undulated plates, repair plates and lap welds or when surface preparation is not ideal.

For optimal MFL performance it is desirable to get the magnet and sensor boards as close to the test surface as possible. This will ensure that the plate is fully saturated and that the smallest defects can therefore be resolved. However, it is clear that any 2 tanks are not identical and there are many restrictions that can prevent the sensor head getting close to the surface. In the past, operators may have recorded dead areas in the report, or relied on other technology to cover these areas. The new MFL scanner can now mechanically change the height of the bridge and although in some circumstance, sensitivity maybe sacrificed, it will make sure the inspection is completed and coverage is maximised.

2.5 SmartMAGNET™

Variable automated magnetic flux strength for optimized inspection performance depending on plate thickness. Besides, literally turn off powerful rare earth permanent magnets for easier storage and shipping, and safer handling.

Possibly the most significant development feature of the new system, the SmartMAGNET™ has a motor driven rotating pole piece that allows the system to be set into 2 flux density positions. On thin floor plates, the low position is pre-set and the operator will benefit from reduced drag and power consumption, however on thicker plates the high flux position is selected and minimum detectability for corrosion defects is improved.

In addition to the performance optimisation, the magnet can also be totally switched off using the same motor drive. This not only improves transportation but cleaning, scanning handling and positioning is now much easier.

Fig 3: Showing the ease of passing the scanning head through a manway
2.6 Precision Active Steering

For fast, high-quality curved scans in the critical zone. It drastically reduces dead zones by placing sensors where they are needed most: within 12mm of the tank shell. Comes with the capability to return to straight line driving at the simple push of a button.

The cylindrical shape of a storage tank means that there are inherent deadzones when using a traditional straight line scanning system. It is unfortunate that the most critical part of a storage tank is the area directly adjacent to the tank shell and is often referred to the annular plate section. These plates are generally slightly thicker than the standard floor plates and are regarded as the load bearing section of the floor.

Typically these areas are scanned with supplementary inspection technology as there has not been a system that can efficiently scan straight sections of the floor, but also get into the tight space of the annular curvature.

The new MFL scanner has steering capability that allows the system to scan around a curve as tight as 5 metre/16.5 feet and get the sensors within 10mm of the annular weld. This feature will revolutionise the way that tank inspections are managed and no longer will inspectors need to use UT or other devises to scan the critical zone.

![Critical zone scanning](image)

2.7 Paperless Reporting

Seamless and intuitive work flow the ensures the operator does not have to pick up a pen throughout the inspection. The custom built tablet and automated defect listing software, means that if an inspector sets up the plate dimensions and scan sequence before inspecting, a pen and paper will not be required. This will reduce the overall inspection time and more importantly improve traceability and confidence in the reported results at the end of the inspection. The software allows for visual inspection and UT data to be imported directly into the report and this information is exported as part of the inspection file at the end of the shift.
CONCLUSIONS
MFL technology is tried and tested within the tank inspection industry. Its track record for speed, ease of use and reliability of detection has seen it become an integral part of integrity strategy programs. However, the industry is looking for efficiency improvements and does not want to sacrifice output and performance. The unique features identified in this paper are significant in their independence, however combining these improvements into one system has resulted in the total step change the industry has been requesting.