

High-temperature TOFD for high-pressure steam lines

On-stream weld root erosion inspection of high-pressure steam pipelines.



Key Deliverables

- WQS NDT were able to conduct on-stream **time-of-flight diffraction (TOFD)** at temperatures **between 300 and 320 °C** to determine the integrity of the high pressure steam lines.
- **Accurate, repeatable** results of identified weld root erosion. Enabling repeatability of the inspections to allow for further monitoring of the assets until repairs and replacements could be conducted at the next turnaround.
- **Increased productivity** by completing 7x the production of previous inspections due to the portability and reduction of the equipment needed to perform the high temperature scans from on-stream assets.
- **Reliable Data** - Data allowed for more certainty in decisions related to the remaining life of the assets and eliminated the risk of false calls.

Overview

Wright Quality Services (WQS), a leading NDT service provider across western Canada successfully executed routine maintenance inspections for a high-pressure steam line, focusing on detecting weld root erosion under extreme temperature conditions exceeding 300 °C. The inspection, performed for a refinery operator, combined advanced Phased Array Ultrasonic Testing (PAUT) and high-temperature Time of Flight Diffraction (TOFD) methods. PAUT was utilized for comprehensive scanning, providing high-resolution images of the weld and surrounding material. TOFD was employed for its superior accuracy in detecting and sizing potential defects, particularly in identifying weld root erosion, a common concern in high-pressure steam systems. The Ionix HotSense TOFD solution maintained consistent acoustic coupling and data reliability, throughout the temperature range, crucial for identifying early signs of deterioration in the welds.

The Challenge

Inspecting weld root erosion & corrosion damage of high-pressure steam lines whilst on-stream has historically been difficult to identify and quantify precise amounts of material loss to calculate the remaining life of the pipeline assets, due to the extreme temperatures. Legacy systems had only been moderately successful in these efforts as the probes required constant cooling systems, or frequent duty cycling, to prevent thermal damage to the transducers, and which lead to reduced fidelity of the data collected.

For the inspection of the high-pressure steam line, the challenges were;

- Continuous surface temperatures of 300 to 320 °C
- Accurate sizing requirements of remaining ligament depth to ensure safe fitness for service assessment

The Solution

Given the challenging environment, WQS NDT deployed the HotSense high-temperature TOFD probe kit solution, specifically designed for reliable performance in high-temperature applications. This technology enabled precise and efficient inspection without compromising data accuracy, ensuring real-time monitoring of weld integrity.

- The HotSense TOFD transducers operate over a wide temperature range -55 to +350 °C (-67 to +662 °F).
- Increased wear resistance and robust construction to offer longer probe life.
- Increased sensitivity to make reliable and accurate remaining ligament measurements even at elevated temperatures.
- Manufactured in compliance with international standards to easily fit directly into existing inspection procedures
- Quick to deploy, calibrate and begin taking measurements.

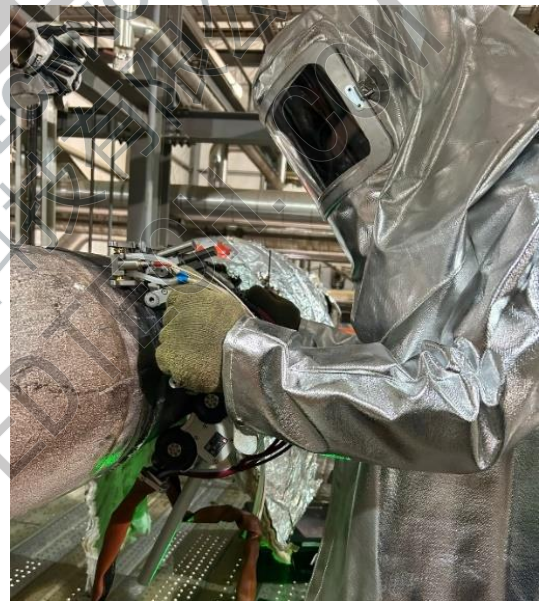


Figure 1: TOFD inspection conducted on the high-pressure steam line by WQS NDT

Execution

The high-pressure steam line maintenance inspections, performed without the need for shutting down the system, ensured minimal downtime for the client, enhancing their operational efficiency while maintaining high safety standards and data reliability. WQS NDT's skilled team delivered detailed inspection reports with actionable insights, helping the client take preventive measures to mitigate further degradation, thus prolonging the service life of the steam line.

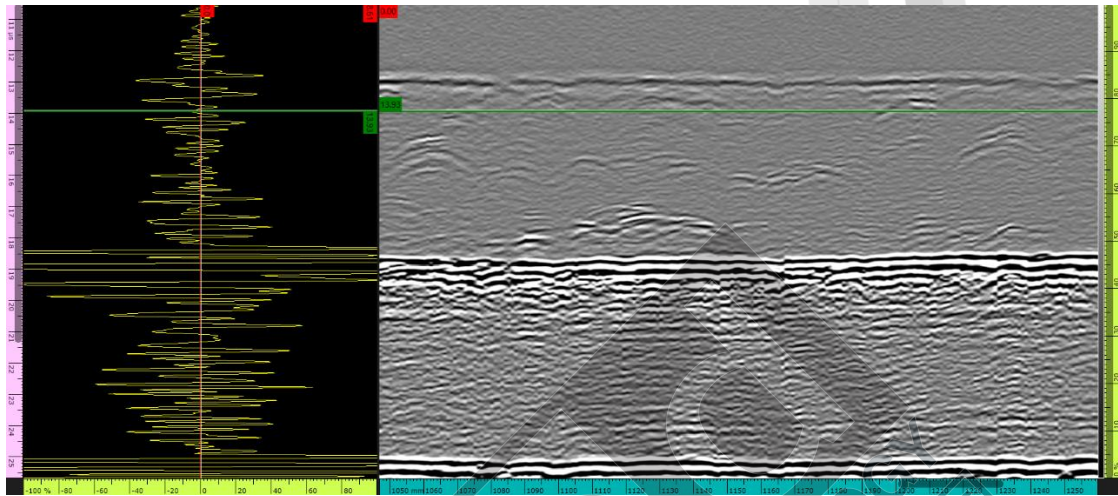


Figure 2: B-scan of weld root corrosion collected with TOFD at temperature from the high-pressure steam line by WQS NDT