

# Hydrogen Induced Cracking

## Current Condition

In the petrochemical industry, there are pressure vessel and heat exchanger applications that result in the internal release of hydrogen gas from the steel shells used in fabricating these structures. Process heat and chemistry routinely affect the internal structure of these materials and can result in a series of internal linear delaminations.

These delaminations can range from a condition that merely needs to be monitored to conditions requiring removing the vessel from service. Once internal delamination is detected (which in itself is difficult), it is necessary to determine the severity of the cracking relative to the remaining strength of the shell. This is currently performed using manual ultrasonic shear techniques, which are time-consuming and difficult.

## Solution

Our Large Structure Inspection (LSI) System is an automated, programmable, configurable ultrasonic inspection system that provides a 100% scanned image of the internal structure of the interior of pressure vessel and heat exchanger shells.

This inspection method can be performed quickly (on the order of 1/2 meter<sup>2</sup> per minute\*) using moderate scan resolutions. Higher resolutions can also be used for specific areas to provide quantitative results. The internal ultrasonic data "map" that is generated is available numerically or with color-coded graphics (as shown in Figure 1). By integrating the location (time-of-flight and scan position) of internal indications with their geometric shape and magnitude of

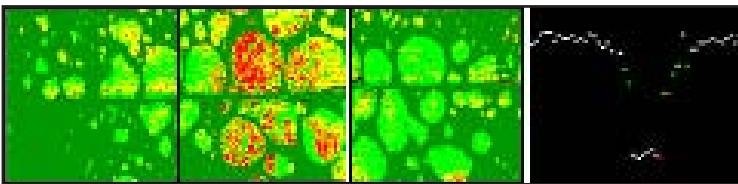


Figure 2: High Resolution C-Scan and B-Scan views of suspect areas of a shell.

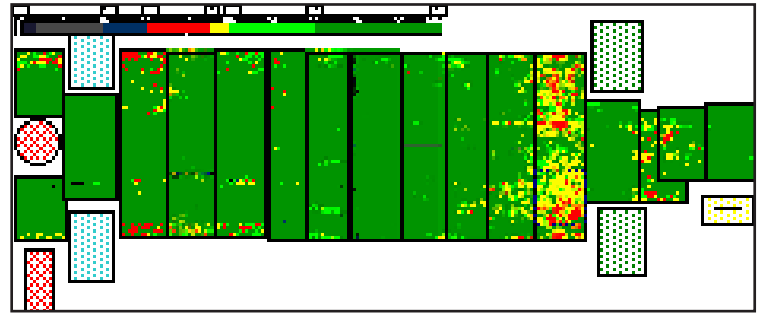


Figure 1: Overall heat exchanger shell 100% C-Scan Inspection

ultrasonic reflection, we can assess the general condition of the internal wall structure and detect the presence of HIC conditions and their potential severity.

Suspect areas can then be closely inspected at extremely high resolutions, providing the 2-D C-Scan images and cross-section B-Scan views (shown in Figure 2). The information contained in these high-resolution images can significantly aid in determining the presence and severity of HIC conditions. Additionally, in this typically difficult ultrasonic data collection environment, the use of NDT Automation LSI systems' unique integrated squirter/bubbler scanning head coupled with a highly focused transducer can significantly enhance ultrasonic performance.

\*These rates are for comparison purposes; higher or lower resolutions may be appropriate for differing conditions

MISTRAS Products & Systems division, is a team of skilled researchers, engineers, technicians and manufacturing personnel dedicated to the development of practical and cost saving solutions to your challenging inspection needs.

For a demonstration or additional information, please contact our Princeton Junction headquarters at 609-716-4000.