

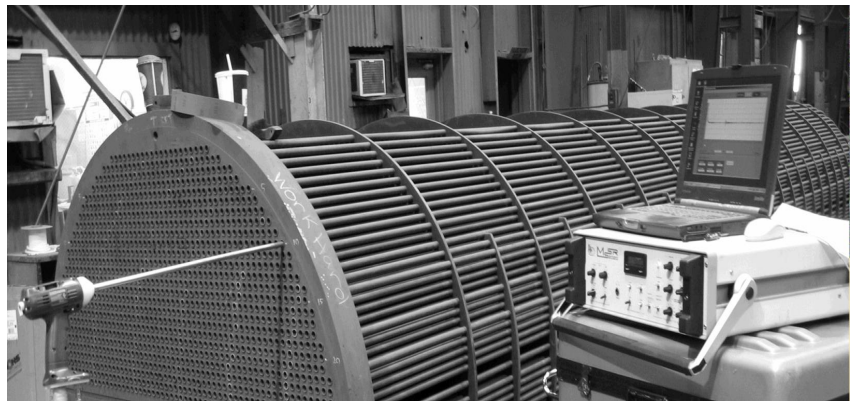


## Rapid Screening of Heat Exchanger Tubing Using Guided Waves

**ISWT's Heat Exchanger Guided Wave screening tool is based on Magnetostrictive Sensor (MsS) Technology. The MsS system introduces guided waves into the tube electro-magnetically from a local spot with no extended tube cleaning required prior to the examination. It can significantly increase the amount of inspection information available and simultaneously shorten the examination time to approximately 10 seconds per tube. 100% screening of an entire tube bundle with full coverage of U-bends and obstructed areas can be achieved in a cost effective manner.**

There are a number of generally accepted methods for examining carbon steel heat exchanger tubing such as internal rotating ultrasonic testing (IRIS), remote field eddy current testing (RFEC), and magnetic flux leakage (MFL). The major disadvantage of these methods is that they require the probe to be pulled through the entire tube and they require extensive cleaning

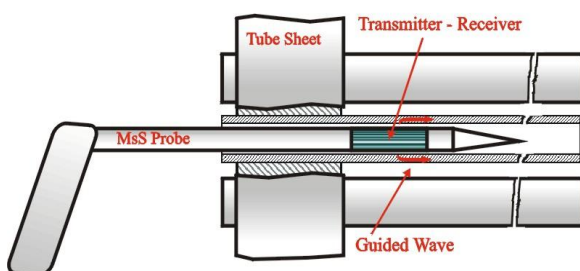
of the tube ID. Additionally, this leads to limited inspection speed and difficulties in covering U-bends and obstructed areas. Due to the inspection speed limitations, it has become standard practice in industry to inspect only a sample of the tubes in a given heat exchanger. In many cases fewer than 10% of the tubes in a heat exchanger tube



bundle are examined. This can require maintenance and

fitness for service decisions to be made on the basis of these limited inspections.

*Heat Exchanger inspection using GWUT screening tool*



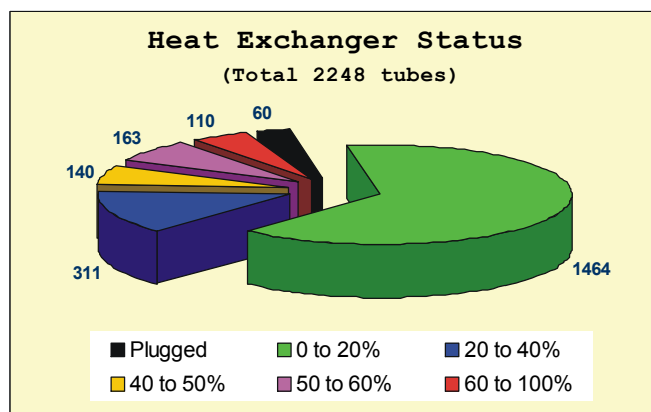
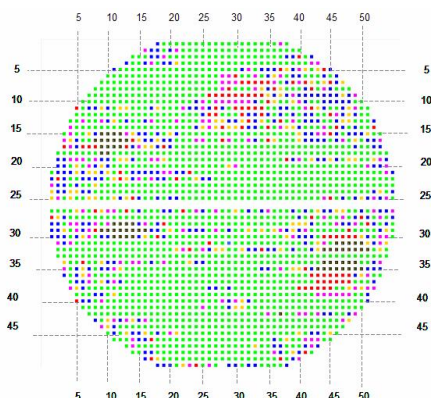
*Diagram of probe inside HX tube*

ISWT's MsS Guided Wave screening tool allows faster interrogation of the entire tube bundle so that better decisions can be made. The system uses ultrasonic guided waves as the method for rapid screening of the tubes. The ultrasonic waves are initiated using a small probe that is partially inserted in one end of the tube. The probe contains receiver coils, which receive the ultrasonic wave signals after they travel the length of the tube. The tube serves as a guide for the ultrasonic signal and any abnormal conditions in the tube are indicated on the waveform

presentation. Since the probe is only inserted a short distance into the tube, minimal pre-examination cleaning is required and can normally be achieved by simple wire brushing by the inspection personnel. This significantly reduces the cost of the inspection preparation.



The reporting and analysis software includes a tube sheet mapping tool together with an A-scan data browser and powerful statistical analysis features. The inspection results can be easily summarized and depicted on a tube sheet map. The tube sheet map illustrates the entire corrosion damage pattern ranging from 0% to 100 % on the tube sheet map. It is then easy to designate which suspect tubes must be reported, plugged, and/or cleaned for further examination with more accurate conventional techniques.



Heat exchanger tube sheet mapping shows areas of corrosion based on percentages which can reveal patterns of potential problems that can then be addressed

ISwT's MsS Guided Wave screening tool key features:

- Screening of the entire heat exchanger tube bundle at a rate of 2-6 tubes per minute, depending on the screening mode;
- Full coverage of the length of the tube including U-bends and obstructions;
- Full coverage of the tube metal volume (internal and external corrosion);
- Up to 70 ft inspection range;
- Accurate readings of defect positions together with an assessment of metal loss.

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