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Tubular Inspection

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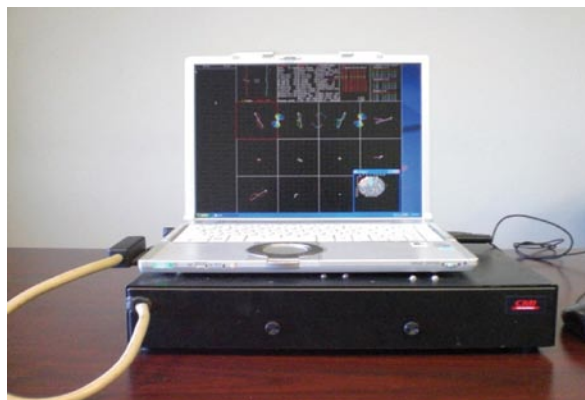
Tubular Inspection

PetroChem Inspection Services, Inc. offers Eddy Current, Remote Field, and IRIS Tubular Inspections of ferromagnetic and non-ferromagnetic tubes in air coolers, chillers, boilers, condensers, evaporators, and other heat exchangers. These tube inspections provide a cost-effective method of preventative maintenance, reduction of unplanned shutdowns, and supply quantitative data for repairs and future inspections. Each method has its own respective rate of speed for data acquisition that is stored and acquired for immediate analysis. Analysis can be performed on-site or dependent upon the magnitude of data, can be performed at a remote location, and a final report can be written and submitted immediately. The Advanced Inspection Services Department utilizes three of the most advanced Eddy Current and IRIS instruments in the field today.

PetroChem Inspection Services offer conscientious personnel and powerful Eddy Current and Remote Field equipment to assist the respective clients with their tubular inspection needs.

Petrochem insists on safety-conscious personnel who are:

- Professional and courteous.
- Knowledgeable of Eddy Current and Remote Field advantages and disadvantages.
- Knowledgeable of the test equipment utilized to perform Eddy Current and Remote Field inspection.
- Able to utilize the full features of the test instrument, such as frequency transformation, to distinguish between relevant and non-relevant indications.
- Able to provide the client with accurate and useful information after the inspection utilizing the powerful analysis and mapping software





PetroChem Inspection Services offer conscientious personnel and powerful IRIS equipment to assist the respective clients with their tubular inspection needs.

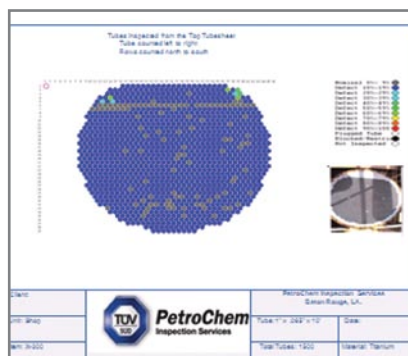
Petrochem insists on safety-conscious personnel who are:

- Professional and courteous.
- Knowledgeable of IRIS advantages and disadvantages.
- Knowledgeable of the test equipment utilized to perform IRIS inspection.
- Able to utilize the full features of the test instrument such as automatic detection of defect and measurement with visual and audible alarm.
- Provide the client with accurate and useful information after the inspection utilizing the powerful analysis and mapping software.

PetroChem Eddy Current Personnel

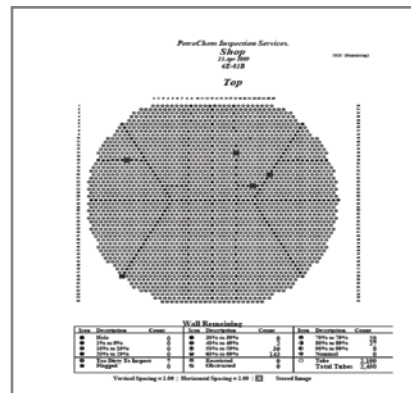
Personnel training plays a major role in the success of Eddy Current tubular analysis. PetroChem provides highly trained Eddy Current personnel who are certified in accordance with the American Society of Nondestructive Testing (ASNT-TC-1A) requirements. PetroChem requires that the technician participate in ongoing training of signal analysis. The purpose of this ongoing training is to ensure accurate interpretation of relevant and non-relevant indications.

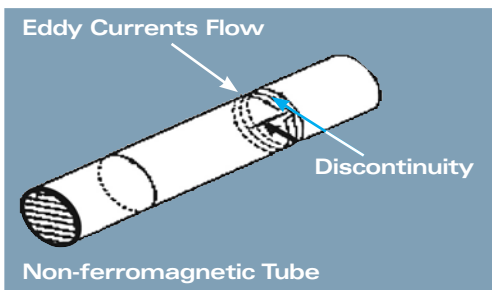
Prior to performing work in any respective plant or facility, our technicians are required to pass extensive mock-up test bundles which are established in the industry for qualifying personnel. In an effort to expedite all necessary servicing and/or the return to routine operation, the analyst will first interpret the data and issue a draft report.



The IRIS software provides a tube sheet map based upon defect depth and damage condition of the tubes in the final report.
(Type IRIS 9000 report shown)

The Eddy Current software provides a tube sheet map, based upon defect depth in the field for tube condition update and for the final report.
(Type ECT 48LT report shown)





Eddy Current flow patterns

Eddy Current Application

Eddy Current is an electromagnetic technique that induces electrical currents (Eddy Current) in electrically conductive/non-ferromagnetic materials. The electrical currents are affected by any change in the geometry, material, and permeability, that will interfere with the flow of the eddy currents and the result of such interference produces a signal.

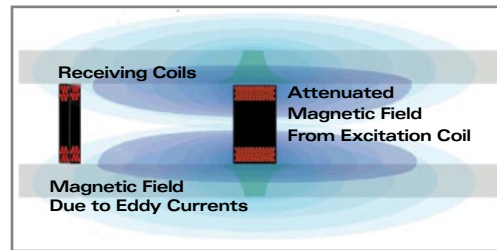
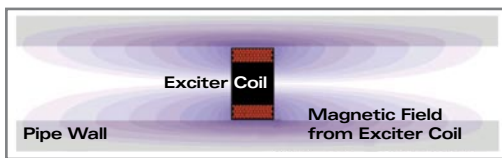
Eddy Current features

- Inspects non-ferromagnetic materials: Stainless Steel, Copper Nickel, Brass, Titanium
- Inspects 500 to 700 tubes per 8-hour shift, dependent on tube length
- Distinguishes between ID and OD flaws
- General cleaning – capable of probe to traverse full tube length

This technique is suitable for detecting and sizing

ID or OD discontinuities such as:

- General or local corrosion/erosion
- Cracking
- Pitting
- Baffle cuts



REMOTE FIELD APPLICATION

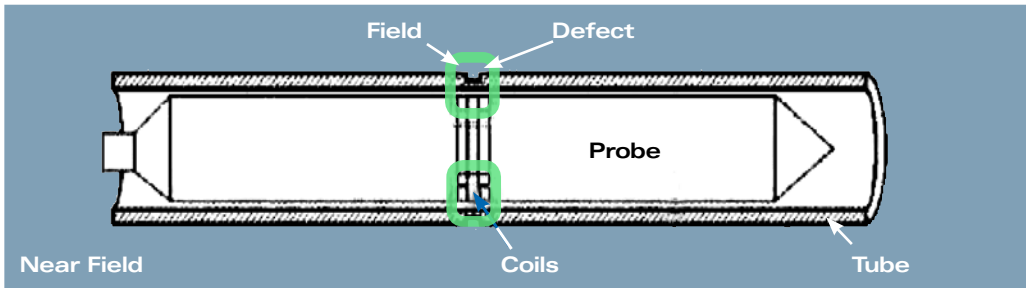
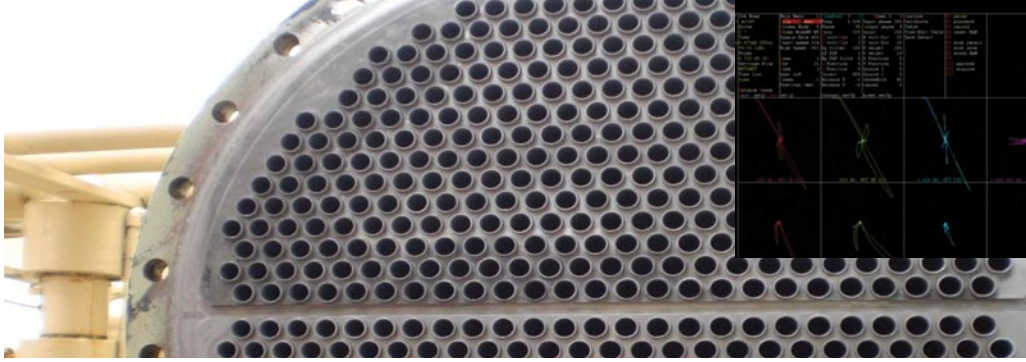
Remote Field testing is an electromagnetic technique for the inspection of ferromagnetic tubes and takes advantage of low frequencies to penetrate the material. Remote Field is a send/receive through wall transmission technique that does not utilize magnetization to saturate tube material. The send and receive coils (exciter and pickup coils) are separated by 2 to 3 tube diameters.

Remote Field features

- Inspects ferromagnetic materials: Carbon Steel, 400 Series stainless, Duplex stainless, etc.
- Inspects 250 to 500 tubes per 8-hour shift, dependent upon tube length.
- Inspects heavy wall thickness (up to .180").
- Equal sensitivity of ID and OD flaws.
- Dual exciter probes are best to detect defects adjacent to tube supports and tube sheets

This technique is suitable for detecting and sizing ID or OD discontinuities such as:

- General or local corrosion/erosion
- Pitting >1/8" diameter
- Baffle cuts



NEAR FIELD APPLICATION

Near Field is not a through-wall transmission, because it has the sensor coils close together and relies upon the condition of the tube close to the coils for a response as the signal barely penetrates outside the tube wall. Near Field testing also takes advantage of lower frequencies than Remote Field testing to penetrate the material. This technique is utilized with probes that accommodate both remote field and near field coils or just near field coils alone.

Near Field features:

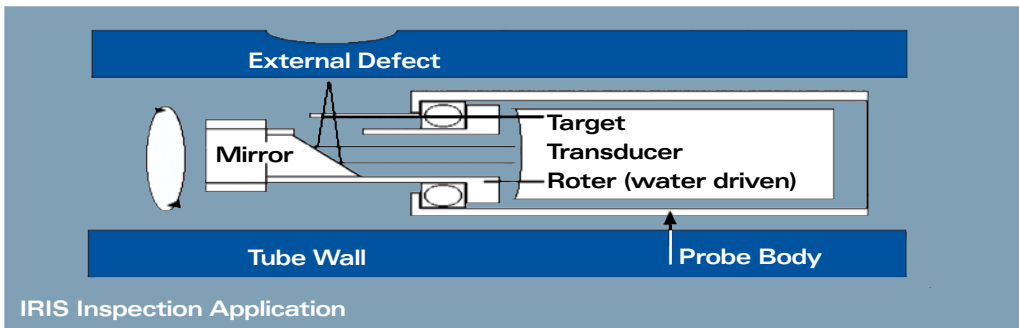
- Inspects ferromagnetic materials: Carbon Steel, 400 Series stainless, Duplex stainless, etc.
- Measures defects close to support plates and tube sheets.
- Able to detect a hole under a support plate.
- Can distinguish between inside and outside defects.
- Ideal for inspecting fin fan tubes.
- General cleaning – capable of probe to traverse tube full length.

This technique is suitable for detecting and sizing

ID or OD discontinuities such as:

- General or local corrosion/erosion
- ID Pitting – Not sensitive to OD pitting
- Baffle cuts





IRIS INSPECTION APPLICATION

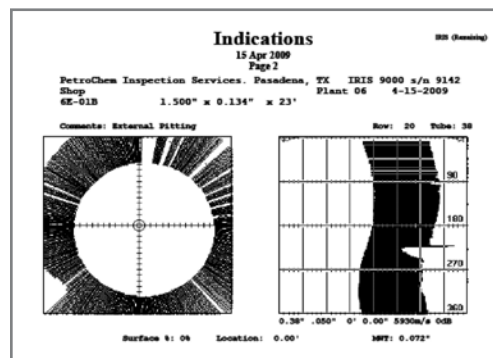
IRIS is an acronym for Internal Rotary Inspection System that employs an ultrasonic immersion pulse echo technique. The ultrasonic pulses are emitted from the transducer, which is traveling parallel to the tube axis, to a rotating 45 degree mirror that reflects these pulses so that they are directed onto the tube wall. As the mirror rotates, the ultrasonic beam is traversed around the tube circumference and each successive pulse is mapped out as a B-scan line on the screen.

IRIS features:

- Inspects ferromagnetic and non-ferromagnetic materials.
- Accurate measurements of defects.
- Inspects 200 tubes per 8-hour shift, dependent upon tube length.
- Wall thicknesses smaller than .035" cannot be measured reliably in some materials.

This technique is suitable for detecting and sizing ID or OD discontinuities such as:

- General or local corrosion/erosion
- Pitting
- Not sensitive to cracking
- Baffle cuts





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