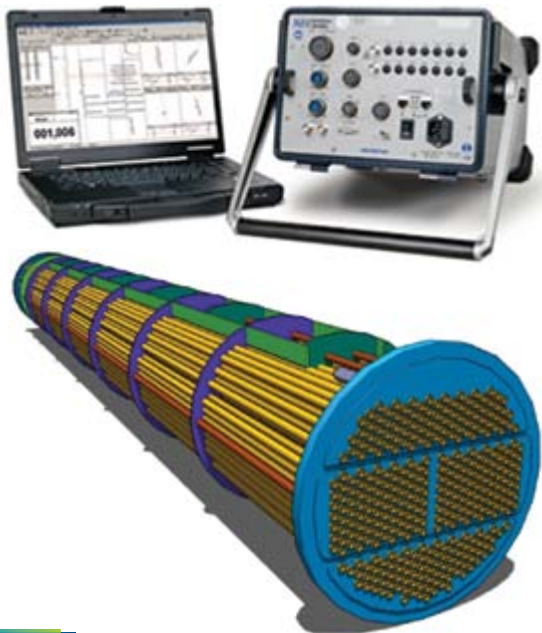


SA-International utilizes five techniques to perform tubular testing on heat exchangers, air coolers, boilers, etc. Four of the five techniques are Electromagnetic based techniques (ET), and the last technique is IRIS an Ultrasonic Technique (UT). Having all five techniques at our disposal makes our Tubular Division a much diversified inspection group. Being this diversified can help meet the needs of our customers, as well as each crew having the capability of these techniques to perform complimentary inspections providing the most comprehensive inspection possible.

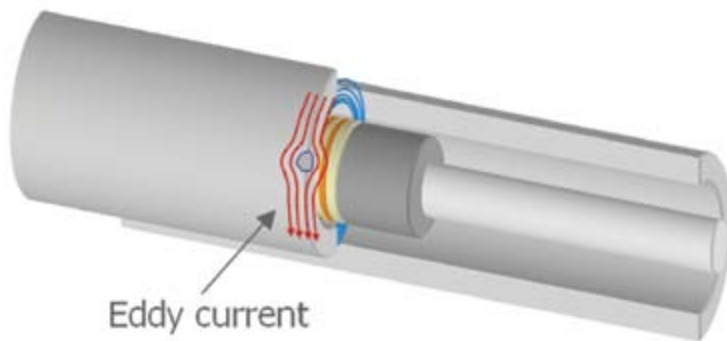


## Eddy Current Testing (ECT)

Eddy Current Testing (ECT) is the most commonly used method, but limited to non-ferromagnetic and slightly magnetic alloys (Monel 400). The Eddy Current technique is based on the induction of an electromagnetic field in the tube being examined and can detect various forms of internal and external damage. The purpose of this application is to detect I.D. and O.D. degradation such as cracking, corrosion, erosion, pitting, fretting and gradual wall loss generally found in non-ferromagnetic tubing.

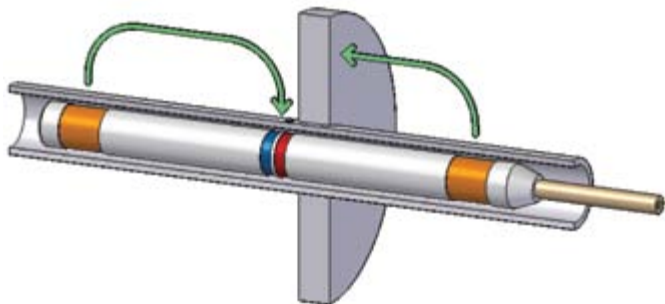
### Applications:

- Inspection of Non-Ferromagnetic Tubing
- Can detect and size wear (wall loss) at baffle locations.
- Can detect and size isolated pitting, corrosion, cracking, and gradual wall loss.
- Can inspect tubes from 3/8 to 2- 1/2" diameter. (Larger with special probe designs i.e. Array).
- Can distinguish between ID and OD Orientations.
- Can inspect tubing that has been coated with non-conductive coating.



## Remote Field Testing (RFT)

Remote Field Testing (RFT) is an electromagnetic examination which utilizes the through transmission effect to produce a resultant field that is effected by anomalies and is measured a few or more tube diameters away from the AC excitation source without any tube magnetization or saturation. The purpose of this application is to detect I.D. and O.D. degradation such as corrosion, erosion, pitting, fretting and gradual wall loss generally found in ferromagnetic tubing.



### Applications:

- Inspection of prime surface and low fin Ferromagnetic Tubing (SA-214 to SA-789 Alloy 2205).
- Can detect and size wear (wall loss) at baffle locations.
- Can detect and size isolated pitting, corrosion, and gradual wall loss.
- Can inspect tubes from 1/2 to 3" diameter. (Larger with special probe designs i.e. Array).
- Can inspect wall thicknesses from .035" to .300" wall (depending on material)
- Can inspect tubing that has been coated with non-conductive coating.
- Boiler tube inspections.

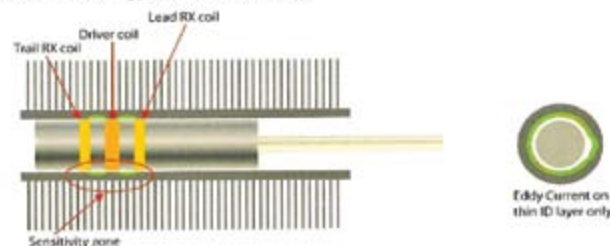
## Near Field Testing (NFT)

Near Field Testing (NFT) is intended specifically for fin fan carbon steel tubing inspection without the requirement for externally referenced coils. This technology relies on a simple driver-pickup eddy current probe designed to provide very simple signals for analysis.

NFT probes are specifically designed to detect internal corrosion, erosion, or pitting on the ID of carbon steel tubing. These probes actually measure the lift-off or "fill factor" and convert it to amplitude-based signals.



Standard near field testing probe with stainless steel casing

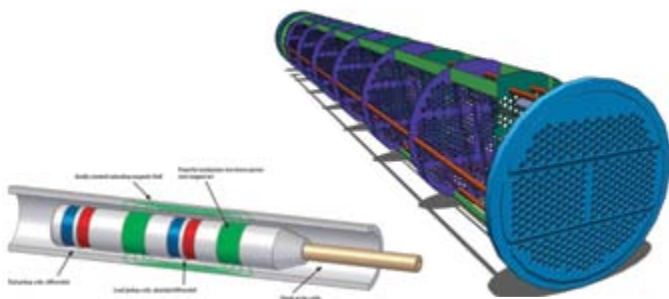


### Applications:

- Inspection of ferromagnetic tubing w/ aluminum fins or carbon steel welded fins.
- Excellent sensitivity to Inlet erosion at the tube ends.
- Can detect and size isolated pitting, corrosion, and gradual wall loss.
- Induced field is not magnetic
- Inspection of tubing with OD diameters of 3/4" to 2".
- Can inspect tubing that has been coated with non-conductive coating.
- No limitations to the wall thickness.
- OD Detections is Very Limited.

## Flux Leakage Testing (FLT)

Flux Leakage Testing (FLT) or Steel test inspection of ferromagnetic tubing. This application is based on the magnetization of the part under inspection and the detection of magnetic flux lines “leakage field” from the discontinuity in the magnetized area. The purpose of this application is to detect I.D. and O.D. degradation such as corrosion, erosion, pitting, fretting, and gradual wall loss generally found in ferromagnetic tubing. This method works extremely well on fin fan tubing in conjunction with NFT testing.

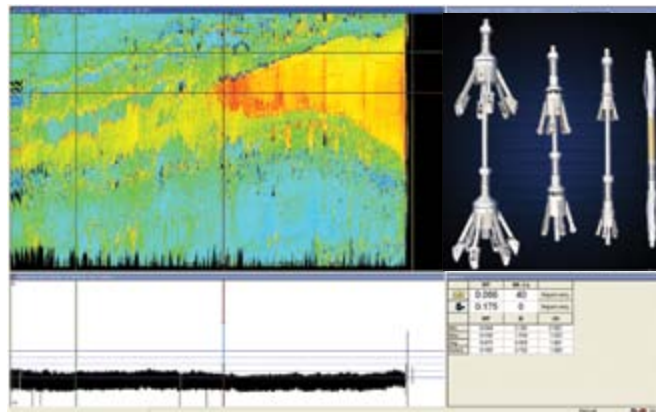


### Applications:

- Inspection of Ferromagnetic Tubing With externally attached fins. (i.e. Aluminium fins, Spot Welded fins,)
- Accuracy of plus or minus 10%.
- Excellent technique for detection and sizing of ID Inlet erosion in air coolers.
- Air Cooler or Fin Fan applications.
- FLT is a good technique for the detection of baffle fretting, because the signal is unaffected by the support structures and only detects the wall loss
- FLT can also detect ID circumferential cracking. (With specially designed Array FLT probes.)

## Internal Rotating Inspection System (IRIS)

Internal Rotary Inspection System (IRIS) technique uses unique water driven rotating mirror to direct an ultrasonic beam, which is reflected 90 degrees to the internal tube wall. The ultrasonic transducer is mounted axially in the tube and the ultrasonic beam is directed toward the mirror, which is placed at a 45-degree angle to the transducer. Using special ultrasonic electronics and computer a B-scan and/or C-scan image is presented.



### Applications:

- Inspection of Ferromagnetic and Non-Ferromagnetic Tubing
- Provides accurate wall thickness readings.
- Can detect and size isolated pitting, corrosion, and gradual wall loss.
- Can inspect tubes from 5/ 8 to 3” diameter. (Larger with special probe designs).
- Can distinguish between ID and OD Orientations.
- Can inspect tubing that has been coated with non-conductive coating.
- Complimentary Technique to ECT, RFT, NFT & MFL