MAC
Magnetic Analysis Corporation

Testing Finned Copper Tube

MultiMac® Eddy Current Equipment

Industries:

- ☑ HVAC
- ☑ Refrigeration/Appliance
- ☑ Electronic Cooling

Equipment:

- ☑ 2 Channel MultiMac®
- ☑ MID- Magnetic Inclusion Detector
- ☑ CP 10
- ☑ "ZZ" Magnetic Dual Coil
- ☑ 3500 Pinch Stand

Defects:

- ☑ Surface, ID & OD
- ☑ Splits
- ☑ Broken Discs
- ☑ Metal Incrustation
- ☑ Inclusions
- ☑ Tears
- ☑ Pin Holes

Standards:

- ☑ 3mg Inclusion in cork
- ☑ Longitudinal Notch
- ☑ Drilled Hole
- ☑ ASTM E 309, E 243-09
- ☑ EN 10246-3, 12452

Tube Specifications:

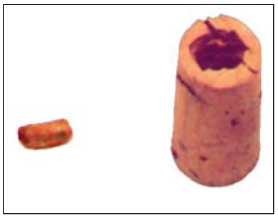
- ☑ Heat Exchanger Tube
- ☑ Size 0.75" OD
- ☑ Straight Cut

Lengths

- ☑ 2 to 5 Lands

Dual Coil

The dual coil sensor consists of one primary with its associated secondary arranged in differential mode, and one single absolute winding for detection of metallic inclusions. Both sections of the sensor coils are shielded in order to avoid interferences between them.



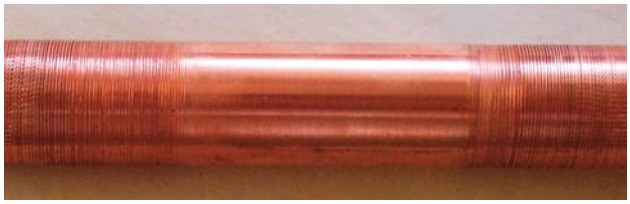
In order to calibrate the equipment, metal filings are placed inside of a cork to simulate an inclusion.

Metallic inclusions in copper tubing may appear from two major sources. The first one comes from the material itself which can contain residual impurities from continuous casting. The second and major source of metallic inclusions in copper finned tubes occurs during the manufacturing process. They can appear in the tube when the tool used to make the fins is breaking. Small particles of metal (tungsten) make inclusions on the OD or even through the wall. This leads to potential leaks when heat exchanger tubes are mounted in the shell. Metal inclusions such as filings from finning tools can be as small as 3 mg. Therefore they are not commonly detected by using a simple eddy current coil. In this instance a Magnetic Inclusion Detector (MID) must be introduced to the system for better results.

In order to detect such small inclusions, the MultiMac electronics uses a second channel connected to the second half of the coil sensor consisting of a single absolute winding located in the DC field and generated by the two permanent magnets. The Flux lines that are generated between the two poles (North and South) run the entire length of the tube under test.

While the tube passes through the coil, if a magnetic inclusion appears, it will concentrate the DC flux, making flux line deviations and DC field changes. This test method comes from the basic theory of Faraday's Law which states that an EMF (electro magnetic force) is induced in a circuit whenever there is a change in the magnetic flux linking the circuit.

Using this test method, when a magnetic particle on/or within the non-ferrous product passes through the test coil, it will distort the magnetic field. A voltage is then induced in our sensor winding. We monitor this voltage with the MultiMac test equipment.



Tubes tested are for heat exchangers and mounted in shells in which you can find several support plates. Therefore tubes can have different lengths and different number of lands (lands are areas with no fins, fitting in the support plates).

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