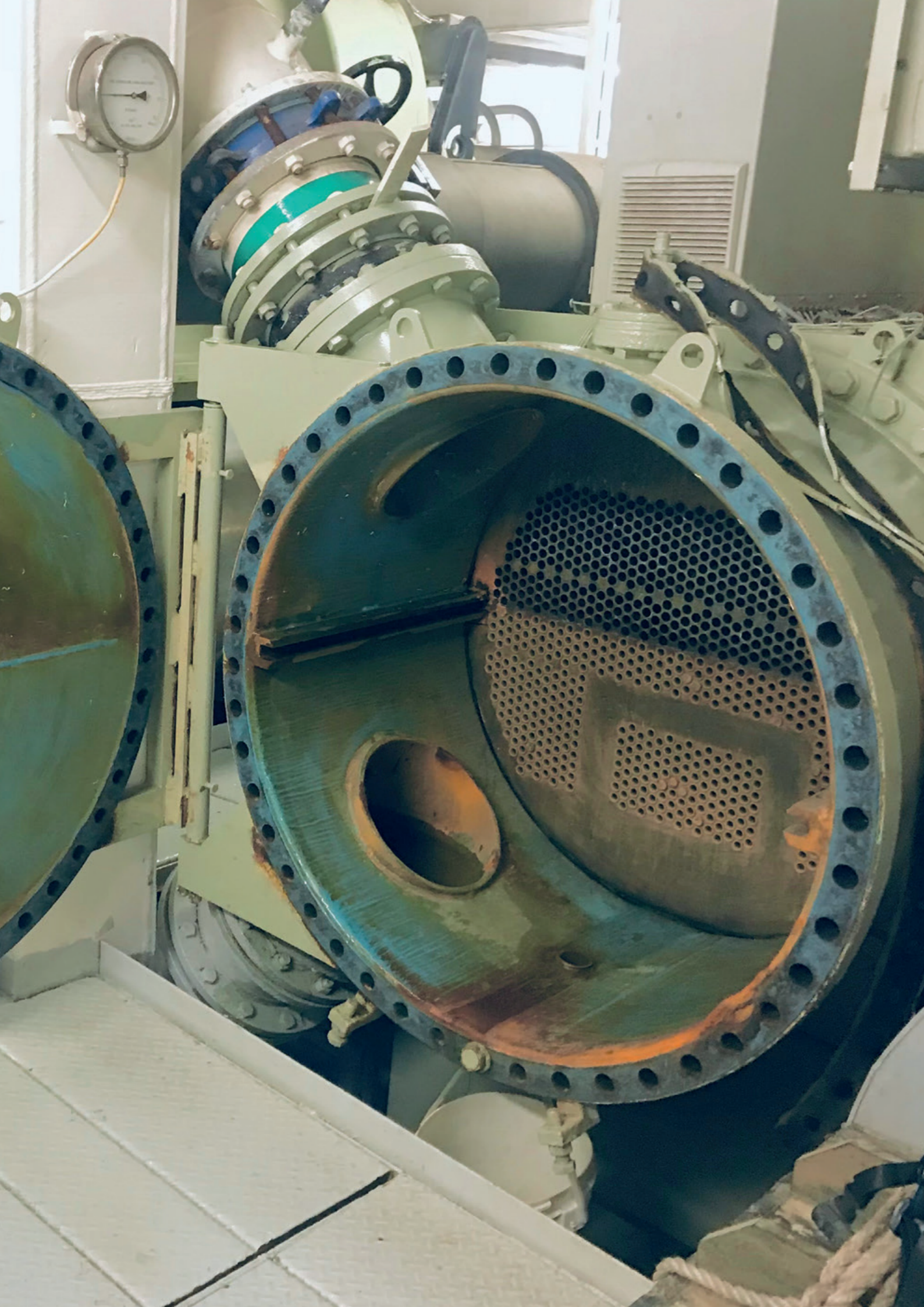


Heat transfer solutions - Tubes

Home of forensic investigations

 **The Lab**
at Brookes Bell



Heat transfer solutions – Tubes

When you need to ensure the integrity of your heat exchangers and condenser tube bundles, The Lab at Brookes Bell can help with our full-lifecycle electromagnetic testing, inspection and analysis tools.

Heat exchangers (or tube bundles) and chiller systems are a regular sight on all types of vessels in the maritime industry. Marine Heating Ventilation and Air Conditioning (HVAC) chiller systems are made up of two heat exchangers, one is an evaporator the other a condenser.

The Lab's tube inspection services can be used across multiple systems, including:

- Shell-and-tube heat exchangers
- AC chillers
- Steam generators
- Boilers
- Coolers/heaters
- Condensers/evaporators

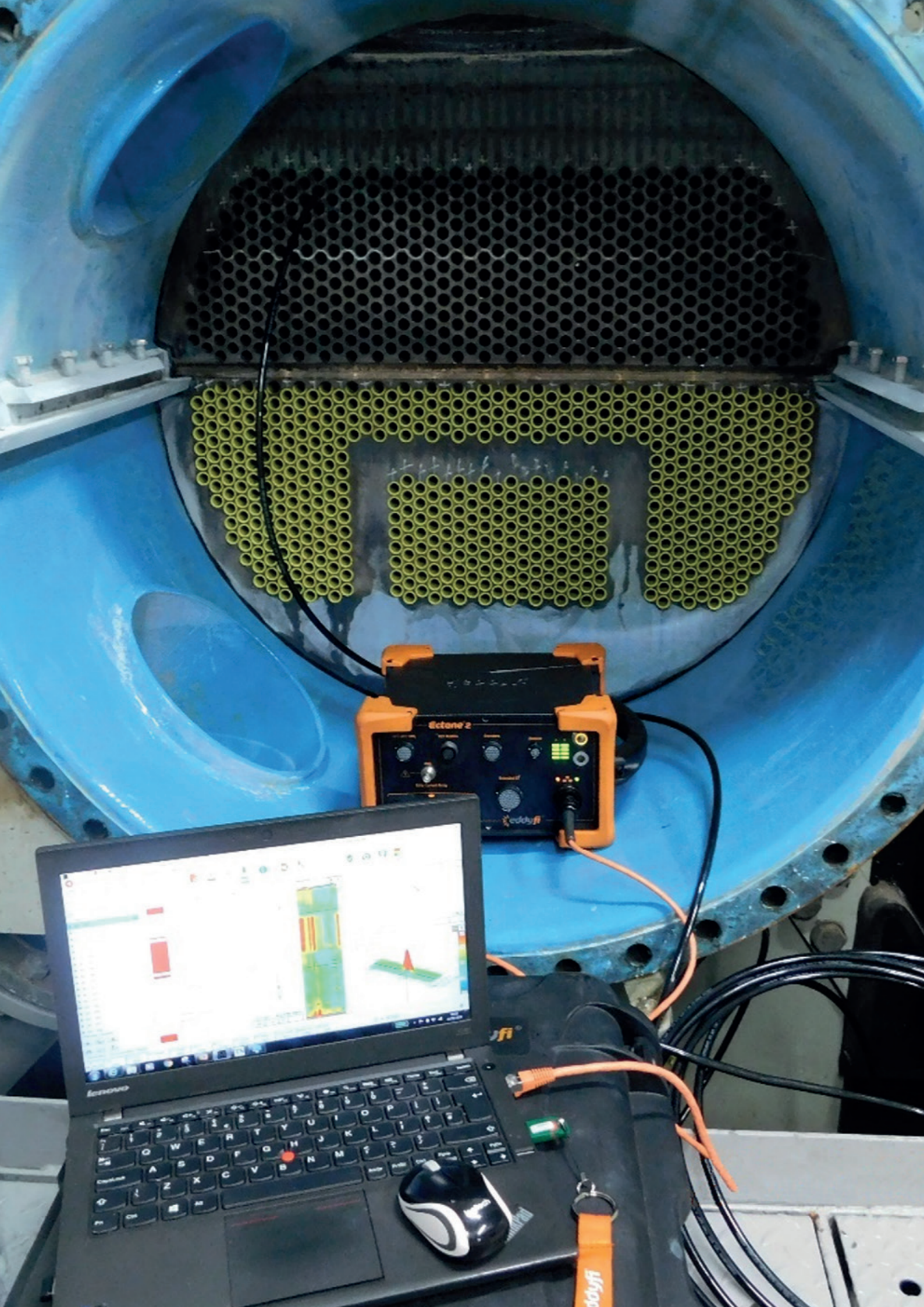
As a part of an asset managers compliance schedule, regular inspection of the evaporators and condensers is imperative to ensure efficient heat transfer, avoid costly unscheduled maintenance and failure of equipment, such as leaking. This is especially true on cruise ships and other passenger vessels, where energy use in HVAC units for passenger comfort is second only to propulsion. In fact, data from shipping companies and equipment manufacturers shows it can account for 30-40% of fuel consumption which could be 50,000 tonnes of bunker oil for a large cruise ship each year.

Bi-annual inspection of the tube bundles by way of non-destructive testing is recommended on all vessels with HVAC systems to ensure that no cross contamination occurs, and that any corrosion and degradation is monitored and can be stopped before this happens. Other problems such as partial or full blockages of tubes from deposits or biofouling also drastically reduce chiller efficiency.

Our eddy current test method is widely used across the maritime world for copper and cupronickel heat exchanger tubing and provides a high-speed inspection technique. Once tested, our expert engineers provide the HVAC maintenance companies, operators or ship owners with a comprehensive overview of the material state of the heat exchanger bundles, giving HVAC engineers the confidence to make informed decisions about the safe and efficient operation of the assets under their control.

Common problems that the team at The Lab can identify are:

- Inner and outer-diameter pitting and corrosion
- Longitudinal cracks
- Circumferential cracks (especially at the tube sheet)
- Erosion
- Fretting
- Metal loss



The Lab at Brookes Bell's NDT team are experts in the field of tube testing. Dependant on tube material and heat exchanger type they routinely carry out inspection campaigns using eddy current testing (ECT), eddy current arrays (ECA), remote field testing (RFT), magnetic flux leakage (MFL), near field testing (NFT), near field array (NFA) and the internal rotary inspection system (IRIS).

At a glance: Selecting the best technique for the type of material and tube

Material/Tech	ECT	ECA	IRIS	RFT	NFT	NFA	MFL
Non-ferromagnetic	Tube	■	■	■			
	Finned Tube	■	■	■			
Low Ferromagnetic	Tube			■	■	■	■
	Finned Tube			■	■	■	■
Ferromagnetic	Tube			■	■	■	■
	Integral finned tube			○	■	■	■
	Aluminium finned tube			■		■	■

Detection Capabilities According to Defect Type

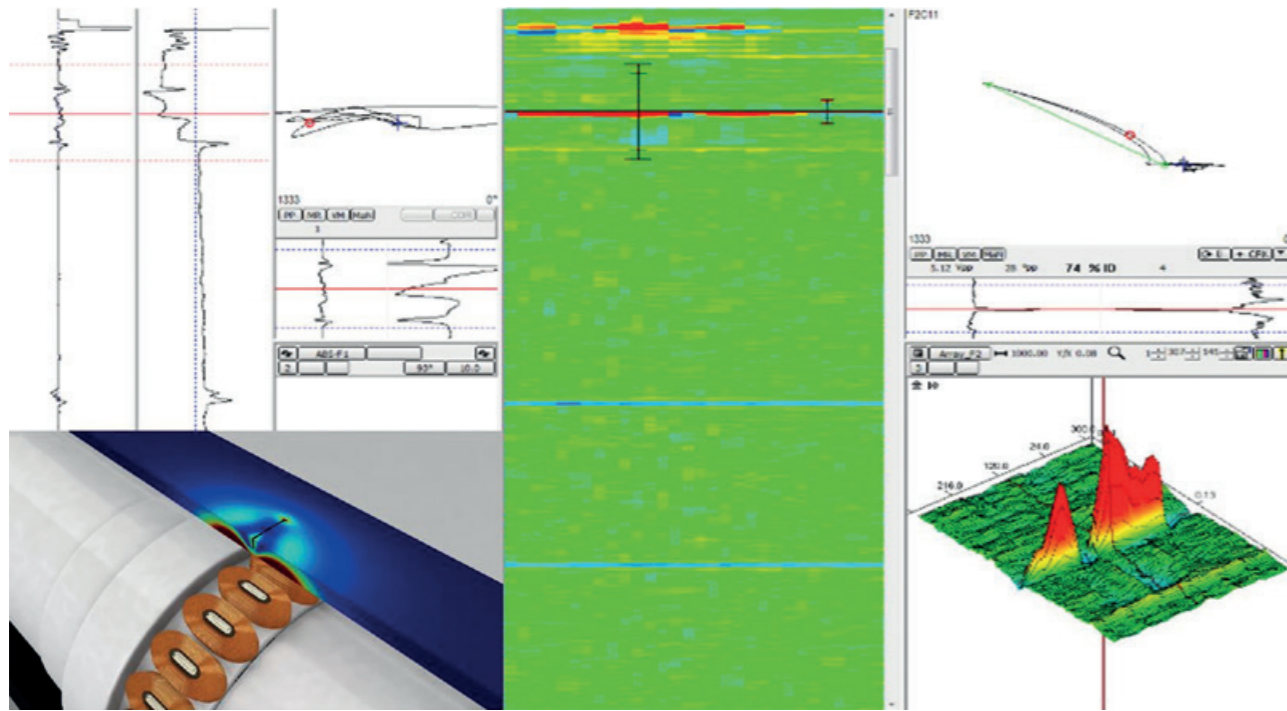
Defect/Tech	ECT	ECA	IRIS	RFT	NFT	NFA	MFL
ID pitting	■	■	■	○	○	■	■
OD pitting	■	■	■	○			■
Axial cracking	○	■		○	○	○	
Circumferential cracking	○	■				○	○
ID corrosion	■	■	■	■	■	■	■
OD corrosion	■	■	■	■		■	○
At tubesheet	○	■	■	○			○

■ Excellent ○ Acceptable but limited

Trend analysis and reporting

At The Lab we use Eddyfi's powerful Magnifi software to evaluate electromagnetic inspection data, the most advanced data acquisition and analysis tool in the heat transfer industry.

We also use TubePro reporting and modelling software, building highly accurate digital twins of heat exchanger tube bundles enabling us to conduct effective trend analysis, monitoring defect propagation and other features impacting on the efficiency of the heat exchanger.



Ensure the integrity of your heat exchangers and condenser tube bundles today, with The Lab at Brookes Bell.



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