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Residual Field MFL – Wire Rope Inspection, removing Risk & Uncertainty

The condition of wire ropes on site is often overlooked and has dogmatically been categorised as ‘run to failure’ or unnecessarily scheduled for early replacement.

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Wire ropes are typically critical for plant operation with no redundancy. Following the traditional replacement strategy can be a costly choice with premature replacement and unplanned downtime costs proving astronomical.

The smarter strategy is routine inspection and condition monitoring; allowing for the replacement of the assets to be strategically managed, maximising rope lifetime and minimising downtime.

Australia currently lags behind the rest of the world in Wire Rope Inspection Strategies. Countries such as China mandate compulsory wire rope inspection, which has advanced their strategies and techniques typically beyond Australian current practice. ARI seeks to change this, bringing Australia into the modern era of Reliability Engineering and improving our client’s Asset Life-Cycle strategies.

What is Residual Field MFL Wire Rope Inspection?

Wire rope MFL is a replacement for the slow process of visual inspection, which is difficult due to lubrication products and inability to detect internal breakages. ARI utilises the latest Residual Field Magnetic Flux Leakage Technique. Residual Field MFL works through the inspection and analysis of the residual magnetic field of a magnetised ferromagnetic wire rope. Changes in magnetic flux are detected where defects are present in the rope due to a change in cross sectional area (broken wires, corrosion or abrasion) or a change in permeability due to work hardening (fatigue).

ARI’s inspection unit is capable of detecting internal and external broken wires, corrosive pitting, abrasion, fatigue, including a summation of the multiple defect types.



Residual MFL Wire Rope Inspection Set-Up.

Advantages and Uses for Wire Rope MFL

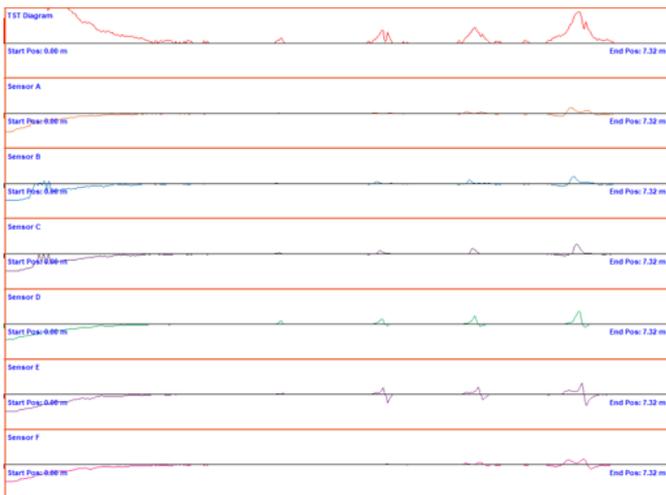
The applications for Residual Field MFL inspection are broad. The technology can be used to monitor and assess the condition of dynamic or static wire ropes for stackers, reclaimers, shiploaders, bridges, conveyor uptake towers and more.

MFL inspection goes above and beyond visual inspection by allowing for internal defects to be detected and quantified. ARI’s equipment allows for rapid inspection of up to 3m/s and creates an interpretable report that ensures a permanent record of the rope condition to enable future inspection and replacement strategies to be planned.

Recommended Inspection Frequency

For initial inspection ISO4309 recommends that when it is the intention to use electromagnetic means of NDT as an aid to visual examination, the rope should be subject to an initial electromagnetic NDT examination as soon as possible after the rope has been installed.

For subsequent inspections testing frequency should be based on expected rope life operating cycles, operating conditions and rope constructions. AS4812



Typical Inspection Diagram.



Shiploader Wire Rope Support Stays Prior to Inspection.

recommends that frequencies do not exceed one sixth of the expected rope life, with a limit of between 6 and 30 months depending on the type of rope.

Inspection should be carried out following an incident that could have caused damage to the rope and/or its termination, or if a rope has been brought back into operation after dismantling followed by re-assembly.

Limitations of Wire Rope Residual Field MFL

- Interference from electromagnetic equipment may interfere with results.

- Inspection is limited to ferromagnetic ropes.
- Inspection of terminations is difficult using MFL due to the presence of magnetic poles.
- The equipment used must suit and be calibrated to the diameter range being examined.

Contact ARI to discuss strategies for reducing the limitations of Residual Field MFL.

Discard Criteria

As a guide, for a decrease in actual rope diameter greater than 3% for rotation resistant ropes or 10% for non-rotation resistant the rope shall be discarded even if no broken wires are visible.

For further discard criteria refer to ISO4309 or contact ARI.

Competent Personnel

Inspectors using Residual Field MFL should be trained and certified by the manufacturer or a certified agency.

As best practice ARI sent their degree qualified engineers overseas to receive manufacturer training, examination and certification.

Using service providers to assist with your Wire Rope Inspection needs instead of rope suppliers will eliminate any conflict of interest.

ARI's Future Plans for Wire Rope MFL

ARI plans to work symbiotically with Asset Owners to study the effect of rope choice and maintenance on rope life. Contact us if you are interested in taking part in ARI's research effort.

For further information about Wire Rope Inspection with Residual Field MFL you can contact the author at tom.horton@ari.com.au

References

- Standards Australia 2003, Non-destructive examination and discard criteria for wire ropes in mine winding systems, AS 4812-2003
- International Organisation for Standardisation, Cranes – Wire Ropes – Care, maintenance, installation, examination and discard, ISO 4309 – 2004