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The Advantages of using Eddy Current Technology for Weld Inspection

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Introduction

Many problems are encountered during In-Service Inspection of Welded Components particularly when the Components are covered with coatings, paint or even metallic coating. Removal of such coatings, to allow magnetic particle inspection (mpi) or ultrasonic (ut) scans for example, prior to the Inspection can often cost more money than the Inspection itself, not to mention the additional time spent on the performing this task. This Presentation will examine how proper use of standard Eddy Current Instruments along with specialized Eddy Current "Paint" and "WeldProbe." Probes can allow Welds to be accurately inspected for near-surface cracks effectively and efficiently. The Presentation will incorporate some basic Eddy Current theory. We will then consider some other applications of the "WeldProbe" technology such as for inspection of critical components in nuclear structures and train axles

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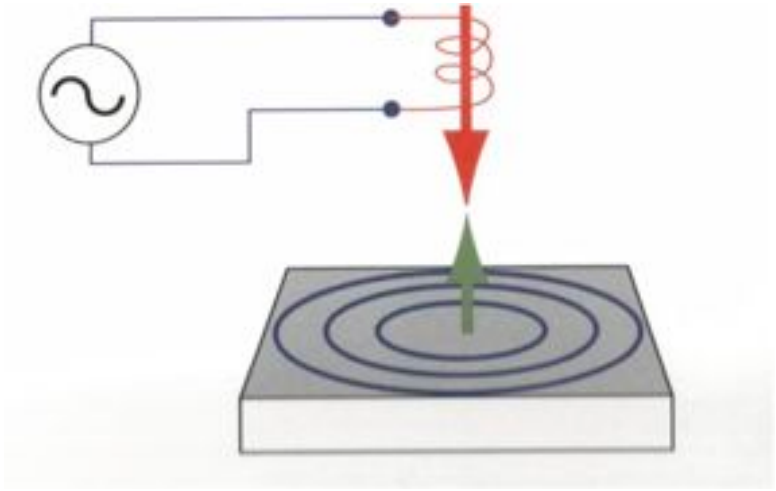
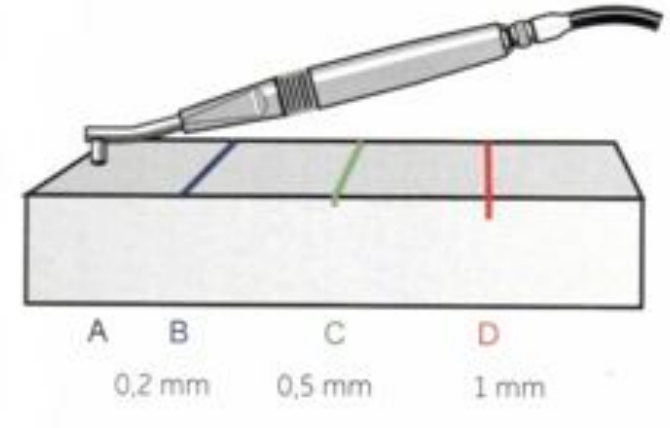
Eddy Current Theory 1

- Eddy Current are created by using a coil to induce an ac current into a conductive material
- The current is concentrated at the surface and in ferrous material there is little or no penetration





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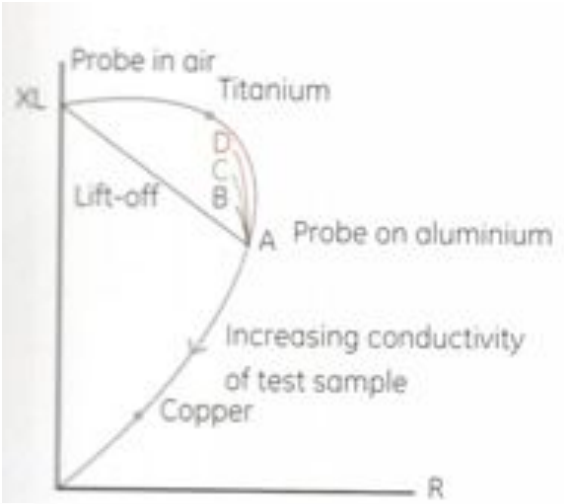
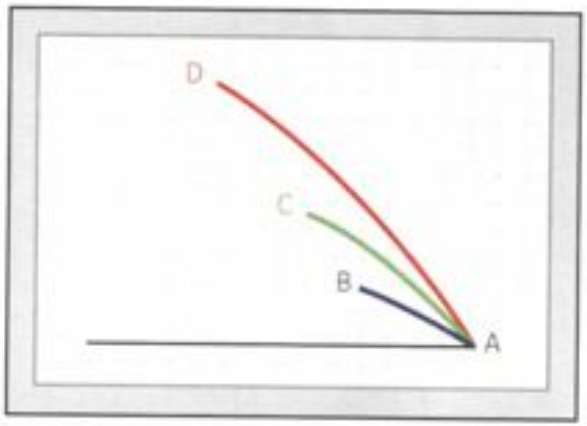
Eddy Current Theory 2

- Changes in the impedance with a simple coil are indicated with lift off giving a distinctly different signal to a defect.





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Why a special probe for Weld Inspection?

- MPI for weld inspection needs to have the paint/coating removed.
- Eddy current can potentially work through paint but a simple absolute coil probe is very sensitive to lift-off and variations in material properties caused by the heat affected zone.
- The WeldScan probe overcomes the above by using a differential coil configuration.

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History

- 1966 Admiralty Materials Laboratory in the UK develops the Amlec for ferrous weld inspection (Hocking NDT licence the technology) using a simple absolute coil probe
- 1982 the Hocking Weld Probe was developed by John Calvert and John Hansen for use with impedance plane eddy current instruments
- 2000 inspection procedure standardised by BS EN 1711 Eddy current examination of welds by complex plane analysis

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Equipment Used

- Impedance plane display eddy current instrument (e.g. Veritor)
- Weld Probe
- Paint Probe to assess coating thickness and compensate calibration by means of shims
- Test block with 2, 1 an 0.5mm notches and 4 0.5 mm shims

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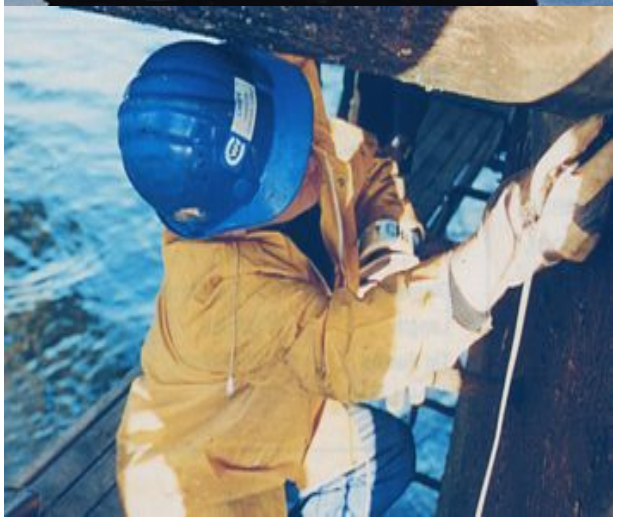
Applications - Offshore

- Widely used for weld inspection where it replaces MPI because of no need to remove surface coating and applicability to rope access inspection



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Applications - Nuclear

- Widely used in the nuclear NDT industry both for conventional manual inspection and also in automated scanners.

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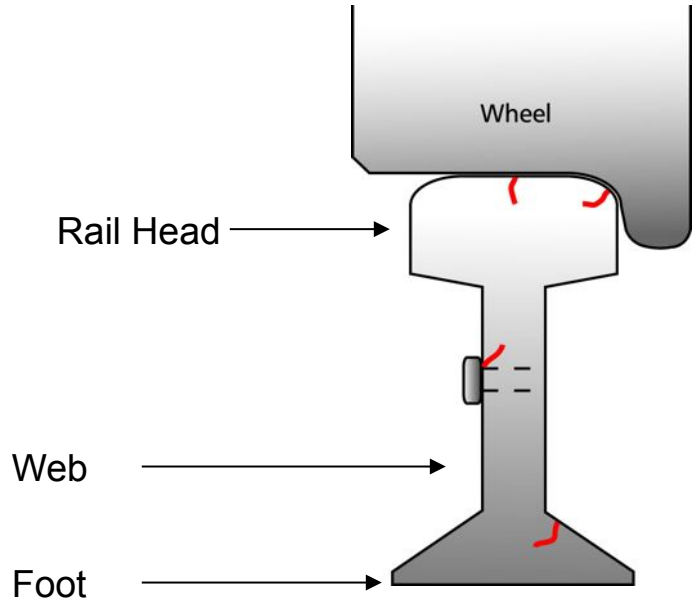
Applications - Rail

- Used for manual inspection of defects in rail and wheels
- Axle inspection where it has been shown to be much more reliable than UT
- Weld inspection on chassis and bogeys



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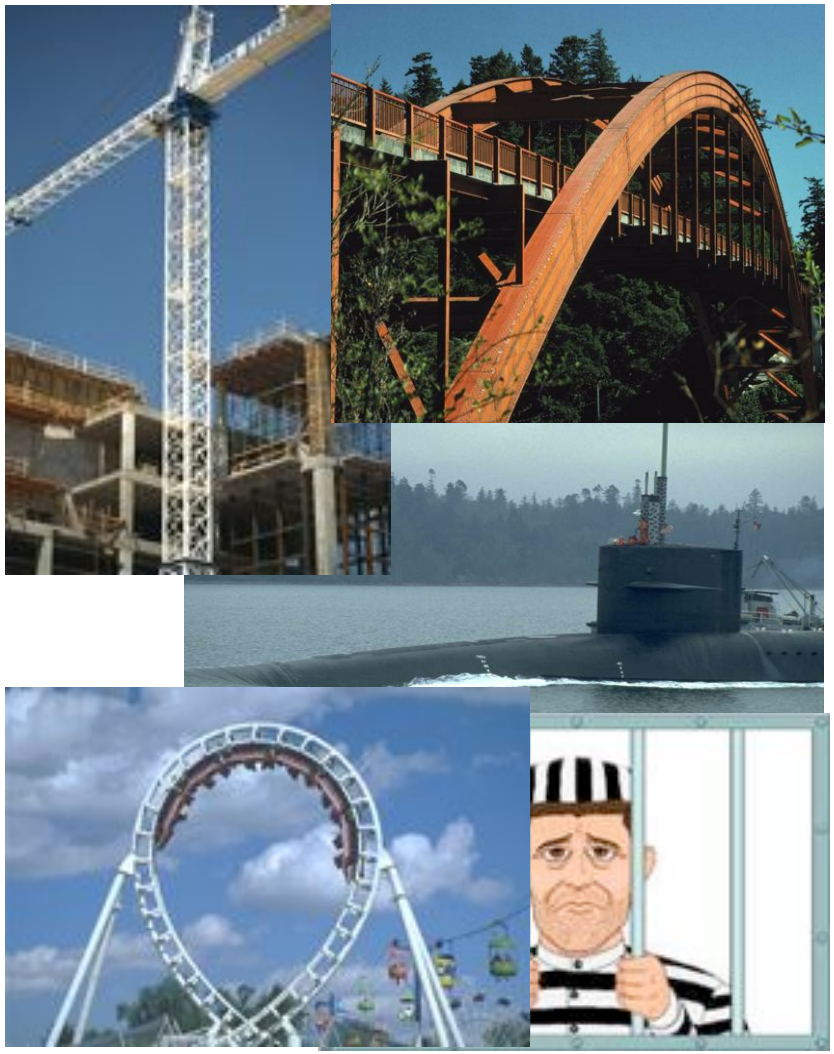
Applications - Other

- Bridges
- Steel framed buildings
- Prison bars to detect saw cuts
- Overhead traffic lights
- Amusement rides



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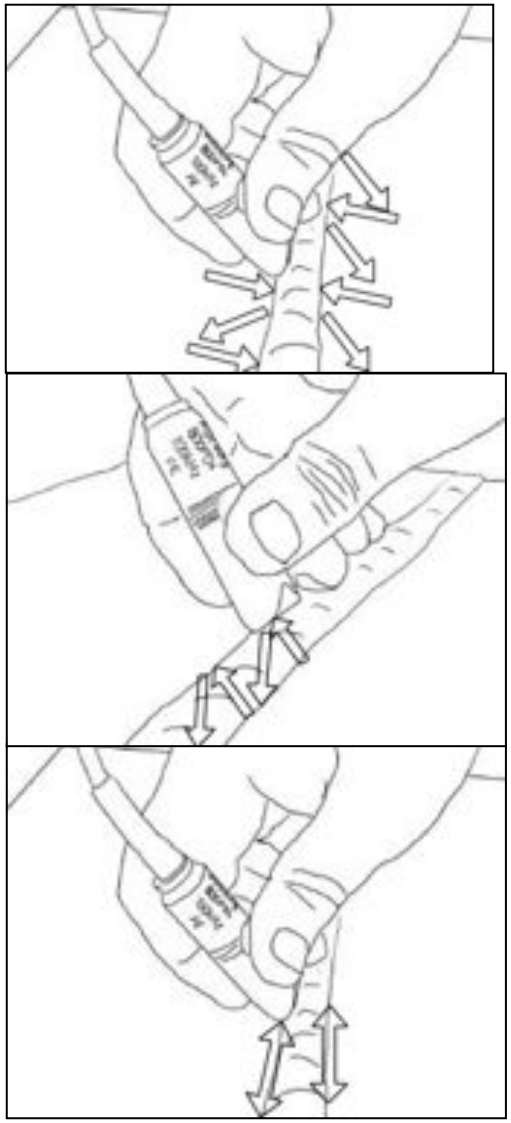
Scanning

- The active part of the probe is 3mm by 3 mm
- In order to scan the material multiple scans need to be performed, normally these are
  - Zig Zag scan of the toe in the HAZ (Heat Affected Zone) along the length of the toe.
  - Scan of the Weld Cap
  - A sweep along the toe.



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What's so special? 1

- Minimal spurious signals caused by lift-off because of differential connection
- Low lift off sensitivity variation; 8dB per mm as compared with a pencil probe at 40 dB per mm
- Directionality means that defects in line with scan give a +ve indication and defects at right angle give a –ve indication with a null at 45^{o}

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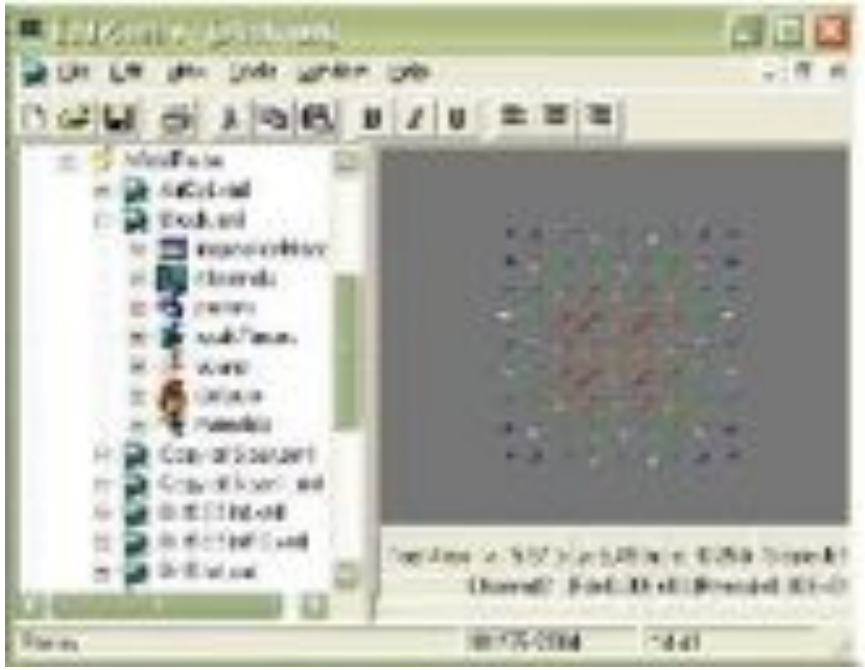
What is so special? 2

- The probe has been modelled and it shows an extremely linear filed in the active area leading to good sizing capability and excellent lift off characteristics



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Standardisation

- The technique has been widely accept by various bodies including PCN, DNV and Lloyds Register
- In 2000 BS EN 1711 was issued
  - Topics covered by this standard are:
    - Equipment and settings.
    - Personnel requirements.
    - Calibration and calibration blocks.
    - Acceptance criteria and weld considerations.
    - Scanning methods.
    - Coating measurements.
    - Testing plans.
    - Detectability of flaws.
    - Method flow diagrams.
    - Non-acceptable indications.
    - Recording and reporting of inspections

Conclusion

- The WeldProbe provides a good alternative to MPI inspection removing the need to remove and replace surface coatings and better suited for rope access inspections
- Furthermore the probe is relatively easy to use so finds application in axle inspection
- National standards, Training Courses with operator certification and acceptance by certifying authorities mean that the WeldProbe becomes a recognised solution

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