MAXWELL PECT
IN-SERVICE PULSED EDDY CURRENT INSPECTION SYSTEM

- Compact magnetic field and fast high energy pulse delivers optimal signal to noise.
- High range WT (2”/5cm) and insulation thickness, suited for vessels, not just pipework.
- Dedicated Pulse Power with hot-swap batteries.
- Robust and rugged design ideal for typical on-site conditions.
- Easy to use software: setup wizards, simple pdf/excel reporting, USB export.
- Rapid and reliable data collection, based on 25 years experience of on-site operation.
- Desktop PC software allows for off-line analysis.
Pulsed Eddy Current (PEC) is an inspection technique for inspecting carbon steel objects such as pipes and vessels, without the need for contact with the steel surface. PEC can measure percentage variations in steel thickness through any non-conductive and non-magnetic materials between sensor and surface such as air, insulation material, concrete, plastics, coatings, sea water and marine growth, paint, deposits, oil, composite repairs, fireproofing, "scabs" aluminium sheeting and other non-magnetic insulation covers; so ideal for Corrosion Under Insulation (CUI) applications.

The MAXWELL PECT instrument is designed for the inspection of carbon steel and low-alloyed steels, which are magnetic. For magnetic test specimens, the eddy currents are concentrated on the surface directly after the magnetic pulse. Subsequently, the eddy currents diffuse into the test specimen, until the backwall is “found”. This results in a characteristic shape A-scan: a straight line, corresponding to the diffusion of the eddy currents, followed by a curved section when the backwall is sensed.

The image above, to the left, shows an example of the Maxwell PECT kit with a PEC probe on top of an insulated steel pipe to detect wall loss caused by corrosion under insulation (CUI). The probe is connected to the main battery-operated instrument, which in this illustration displays A-scan signals and a colour-coded wall thickness C-scan. The instrument is operated using touch screen technology.

Weighing in at 7.8kg (17.3lbs), including the batteries, the Maxwell system is highly portable; and with a typical battery life of 8 hours is an ideal inspection partner in the field.

PEC can normally be applied to ferromagnetic steel with wall thickness (WT) between 3mm (0.15") - 50mm (2.0"). A maximum surface temperature of up to 550°C (1020 °F) may be inspected with the PECT technique, provided the PECT probe is kept below 80°C (175 °F).

Maximum Lift-Off range is 0 – 250mm (0-10”).

Application Case Studies

PULSED EDDY CURRENT INSPECTION OF JETTY PILES

The tidal zone of jetty piles are commonly protected by a ‘splash zone’ coating. When this gets damaged, severe corrosion can occur, potentially undermining the structural integrity of vital harbour installations. Conventional inspections are hampered by the thick splash zone coating and build up of marine growth.

Pulsed Eddy Current Testing (PECT) measures remaining steel thickness without having to remove the coating, and detects and quantifies the thickness. The splash zone can be inspected by rope access techniques or from boats using jigs strapped to the pile. Divers are frequently used for inspection at greater depths.

Based on many years of practical experience, the Maxwell PECT System has been developed with a strong magnetic field to overcome the challenges of an offshore inspection. As a result:

- No need to remove splash zone corrosion or marine growth, which can be as thick as 250mm (9.84ins).
- The Maxwell PECT system is powerful enough to measure through thick layers of corrosion, which is a key requirement for reliable wall thickness measurements.
- Data is recorded in a single pulse, even through thick marine growth, enabling reliable data collection. Strong waves and sea currents do not de-stabilise readings and it is easy to maintain a steady probe contact during inspection data recording.
- 250m (820ft) long underwater umbilicals are available to connect to a range of underwater probes. Depth rating is either 50m (164ft) or 1000m (3280ft).
- Right is an example of a colour-coded wall-thickness table of PECT measurements recorded on a jetty pile, showing areas of severe wall loss. Such reliable data helps to schedule and focus maintenance programs.

PEC INSPECTION OF STORAGE TANK ANNULAR RINGS

The Maxwell PECT is powerful enough to measure through thick layers of corrosion products (iron oxides) underneath the tank floor, which is essential for annular ring inspection. The removal of corrosion materials is clearly unacceptable for in-service inspection, as this may trigger a leakage, but with the Maxwell PECT system this removal process is not required.

Maxwell NDT has developed a flat PEC probe that can be inserted underneath the annular ring of a tank floor, meaning that in-service inspection can be conducted, extending the time period between the more costly “offline” inspection programmes.

Advantages of the Flat PEC Probe

- Compact magnetic field increasing defect sensitivity.
- High range in WT, 5cms (2”), and insulation thickness so also suited for vessels, not just piping.
- Fast single pulse including at high insulation thickness. Scanning possible also at high lift-off.
- Powerful batteries, with hot-swap capabilities.
- Rugged and robust, designed for use outdoors, very easy to use in field.

Further Applications include:

- Corrosion under fire proofing of supporting legs of storage spheres
- Inspection of column skirts
- Flow accelerated corrosion (power plants)
- Splash zone of offshore structures and risers.
- Subsea Pipelines, well casings, repair wraps.
- Ship Hulls
- High Temperature wall thickness monitoring.
**Specifications**

### Hardware

| Standard set | One PECT instrument: data acquisition unit permanently connected to a TA10 Durabook data acquisition computer.
| Four standard probes.
| Two signal cables, each 8m (26.25ft) long.
| Two batteries for PECT instrument.
| Three batteries for data acquisition computer.
| Two battery changers and adapters. |

| Optional items | 40m (131.2ft) extension leads.
| Splash zone probes, 3m (9.85ft) water depth, with 50m (164ft) umbilical, which can be extended to 150m (492ft).
| Underwater probes, 30m (98.5ft) depth rating.
| Underwater probe, depth rating to 1000m (3280.8ft) |

| Data acquisition computer | DURABOOK TA10 10.4” (26.4cms) Touch screen with LED backlight Sunlight Readable Display.
| Ambient Light Sensor, screen protector, Navigation keypad/ "Quick" keys, 8GB memory, 250 GB SSD. |

| Standard probes | Four standard probes. Automated Probe selection features during inspection set-up.
| Nominal lift-off ranges: 0-25mm (0-0.98ins); 25mm-75mm (0.98-2.95ins); 40mm-125mm (1.57-4.92 ins) and 75mm-250mm (2.95 9.84ins) |

| Batteries | Operation requires a set of two batteries for the data acquisition computer and one heavy-duty battery for pulse generation.
| A standard set includes a second set of batteries which can be recharged indoors with two external chargers. |

| Data storage | All PECT signals are fully stored in data files for verification purposes. |

| Software | Data capture software enables quick generation of field reports PC-based software for offline data verification and reporting. |

| Communication | Wi-Fi, Bluetooth®, USB 3.0 (×2) |

| Environment | Meets IP65. Salt and Fog resistant.
| Operating Temperature 0°C to +40 °C (32 °F - 104 °F).
| Relative humidity < 93%.
| Atmospheric pressure 70 – 105 kPa. |

| Compliance | CE, FCC Part 15B |

| Instrument Dimensions | 30cm x 15cm x 22cm (11.8ins x 5.9ins x 8.66ins) |

| Instrument Weight | 7.8kg (17.3lbs) (inc. batteries and data acquisition computer). The instrument is provided with 2 hoisting lugs. |

| Transport of standard set | Two “Explorer” cases 5823, each LxWxH = 67cm x 51cm x 26cm (26.3in x 20in x 10.25in). Weight 23kg (50.7lbs) each. |

| Transport of 25m extension lead | One “Explorer” case 5823, 67cm x 51cm x 26cm. Weight 15kg. Cable is configured in a figure of eight. |

### Instrument Operation

| Selection of measurement parameters | Probe selection and measurement parameters are automatically set at start of an inspection using test measurements. |

| Data Storage Software | All PECT signals are fully stored in data files for verification purposes. Data capture software enables quick generation of field reports. |

| Data collection speed | Typical recording speed (second per reading):
| 3mm< WT ≤12mm 0.5s (0.19in <WT≤ 0.47in 0.5s)
| 12mm< WT ≤25mm 1s (0.47in <WT≤ 0.98in 1s)
| 25mm< WT ≤50mm 2s (0.98in <WT≤ 1.97in 2s)
| Note: the measurement time depends on a number of parameters that are hard to quantify, such as pipe vibration. |

| Scan Mode | Data can be recorded point-by-point or in scan mode. The scan mode operation is designed not to deteriorate the reliability of the PECT data. |

### Typical Performance Parameters

| Wall thickness range | 0-50mm (0-1.97in) steel |

| Maximum Lift-Off range | 0-250mm for WT ≤ 15mm (0-9.84in for WT ≤ 0.6in)
| 0-150mm for 15mm < WT ≤ 30mm (0-5.9in for 0.59in <WT ≤ 1.2in)
| 0- 60mm for 30mm < WT ≤ 50mm (0 - 2.36in for 1.18in <WT ≤ 1.97in) |

| Minimum pipe diameter | 0mm insulation: 50mm (1.97in)
| 50mm (1.97in) insulation: 75mm (2.95 in) |

| Insulation Sheeting | Aluminium and stainless performance on galvanized (magnetic) sheeting depends on its properties. |

| Footprint Diameter | Typically 1.5 times the thickness of the insulation, with a minimum of 25mm (0.98in) |

| Typical accuracy of the average wall thickness in the footprint | ±10% |

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