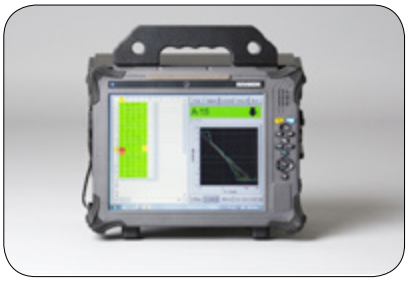
ETHER NDE

MAXWELL PECT

IN-SERVICE PULSED EDDY CURRENT INSPECTION SYSTEM



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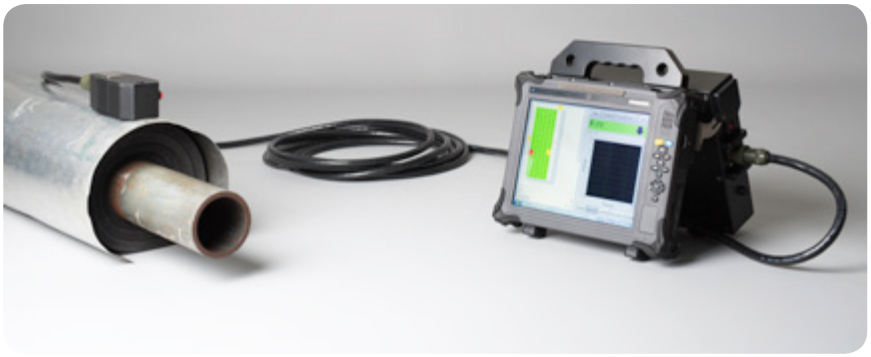


Pulsed Eddy Current (PEC) is an inspection technique for inspecting carbon steel objects such as pipes and vessels, without the need for contact with the steel surface. PEC can measure percentage variations in steel thickness through any non-conductive and non magnetic materials between sensor and surface 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.

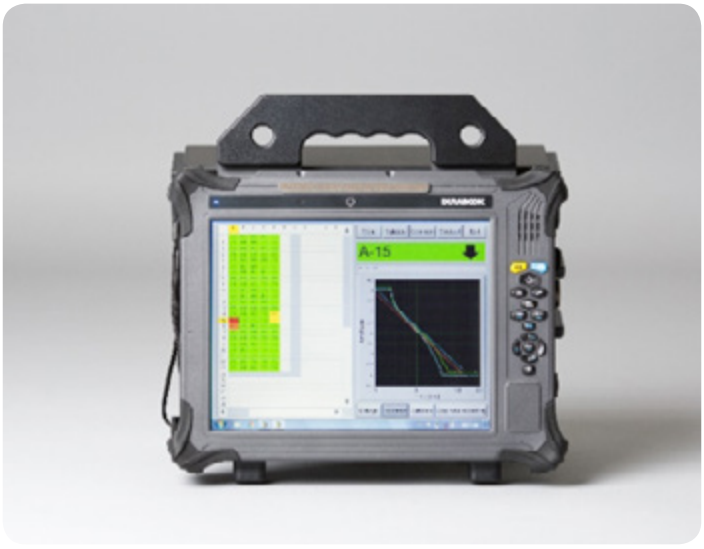
The MAXWELL PECT instrument is designed for the inspection of carbon steel and low-alloyed steels, which are magnetic. For magnetic test specimens, the eddy currents are concentrated on the surface directly after the magnetic pulse. Subsequently, the eddy currents diffuse into the test specimen, until 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 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 color-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.

PECT 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 – 250 mm (0-10”).



• The new PECT instrument comprises a ruggedized tablet computer connected to a data acquisition unit.

• The set is splash water tight, robust and easy to operate. Data collection is fast (two measurements per second) and has a scanning mode.

• The data is analysed in real-time with various quality control features that assists the operator to correctly analyse the data.

• There are four standard probes, each for a different lift-off range. The probes are optimized for defect sensitivity.

• The instrument can either be operated from the probe and from the tablet computer.

• Standard cable length is 8m (26ft). Up to 100m (328ft) can be provided.

Application Case Studies

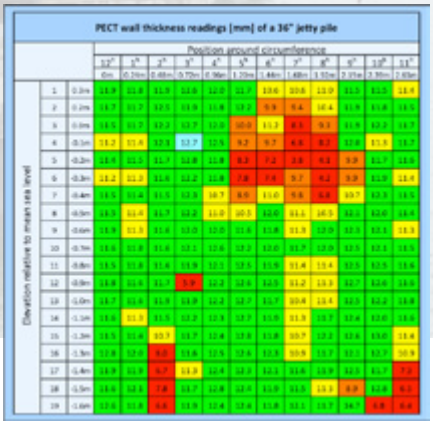
PULSED EDDY CURRENT INSPECTION OF JETTY PILES

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.

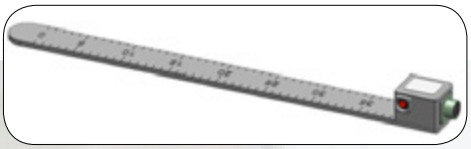
Pulsed Eddy Current Testing (PECT) measures remaining steel thickness without having to remove the coating, deposits and marine growth. The splash zone can be inspected by rope access techniques or from boats using jigs strapped to the pile. Divers are frequently used for inspection are greater depth.

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, with thick marine growth, enabling reliable data collection, even if waves and sea currents make it hard to keep the probe steady during 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. These reliable data serves helps to optimize maintenance programs.



IN-SERVICE PEC INSPECTION OF STORAGE TANK ANNULAR RINGS

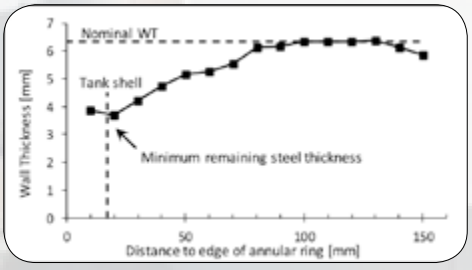


Maxwell NDT has developed a flat PEC probe that can be inserted underneath the annular ring of a tank floor for in-service inspection. Such inspection is of great value, as it can help to extend the intervals between out-of-service inspection.

The Maxwell PECT is it 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.

Advantages of the Flat PEC Probe

- Compact magnetic field increasing defect sensitivity.
- High range in WT, 5.0 cms (2.0"), 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.
- Very robust, designed for use outdoors, very easy to use in field.



The above graph represents an example result of an annular ring inspection with the MAXWELL PECT, showing severe wall loss close to the tank shell. The corroded area extends over a length of about 80mm (3.15ins) in this case.

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. Typical battery life: 8 hours . Batteries are hot-swappable. 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	7.8 kg (17.3 lbs) (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 51 cm x 26cm (26.3in x 20in x 10.25in). Weight 23 kg (50.7lbs) each.
Transport of 25m extension lead	One Explorer cases 5823, 67cm x 51 cm x 26cm. Weight 15 kg. Cable is configured in a figure of eight.
Transportation splash zone probes	One Explorer case, 7630, each LxWxH = 86cm x 56 cm x 36cm Weight at 50m umbilical length: 31 kg.
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 a 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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