PULSED EDDY CURRENT (PEC) INSPECTION

FOR ALL YOUR INSPECTION NEEDS

Dacon uses Pulsed Eddy Current (PEC) technology to measure wall thickness of steel pipes and vessels without the need for direct contact with the metal.

Shell Global Solutions developed PEC and licensed and trained Dacon to use PEC for the following applications:

- Measurement of wall thickness without removing insulation and fireproofing of up to 250mm / 10" of obscuring material.
- Readings made through up to 20mm of marine growth, coatings, and corrosion products, without the use of divers.
- In-service wall thickness monitoring of critical equipment to extend run times and reduce shutdown frequency and duration.
- Annular ring inspection to measure wall loss of the annular rings.

How PEC Technology Works

The technology uses special probes that are placed near the inspection site. PEC can be used in the proximity of air, water, soil, and even corrosive products between the probe and the inspection area. The probe sends out a pulsed magnetic field that penetrates coatings and creates eddy currents in the steel. The receiver coils in the PEC probe senses the eddy currents and in turn calculates the average wall thickness of the inspection area.


PEC Inspection of Insulated Pipeline

Advantages of PEC Technology

The main benefits of PEC technology include the following:

1. Ability to measure the thickness of steel without surface preparation. There is no need to remove deposits, corrosion product or paint.
2. PEC measurements are hardly influenced by variation in sensor lift-off.
3. PEC readings can be made highly repeatable. The high reproducibility makes PEC well suited for wall thickness monitoring.
4. PEC can be applied at high temperatures.

PEC in Practice

A PEC measurement has two phases, as illustrated in ***Figures 1 and 2***. In the first phase electrical current flows through the transmitter coils of the PEC probe. This current generates a magnetic field around the probe, known as the 'primary field'. The primary field penetrates undisturbed through to the steel below. In this way, the carbon steel directly beneath the transmitter coils is magnetised. Since the carbon steel is ferromagnetic, only the top layer of the steel is magnetized.

The second phase of the measurement the current in the transmitter coils is switched off, collapsing the primary magnetic field. The changing magnetic field induces electrical 'eddy' currents in the surface of the steel. These eddy currents generate a secondary magnetic field, which reaches the receiver coils of the PEC probe. The secondary magnetic field induces an electrical voltage in the receiver coils. The magnitude of this voltage as a function of time is referred to as the 'PEC signal'.

The PEC signal contains information about the thickness of the steel, as described below. A specimen has a near and a far surface. Initially, the eddy currents are confined to the near surface (closest to the PEC probe) but, as time elapses, they travel (or 'diffuse') outwards towards the far surface ***(Figure 3)***. As long as the eddy currents experience free expansion in the wall, their strength decreases relatively slowly. However, upon reaching the far surface, their strength decreases rapidly. The moment in time where the eddy currents first reach the far surface is indicated by a sharp decrease in the PEC signal, known as the 'transition point'. The time of the transition point is therefore a measure of wall thickness. For example, the earlier the transition point, the sooner the eddy currents reach the far surface and the thinner the wall must be. Alternatively, if the transition point occurs later in time, the eddy currents take longer to reach the far surface, so the wall has a larger thickness.

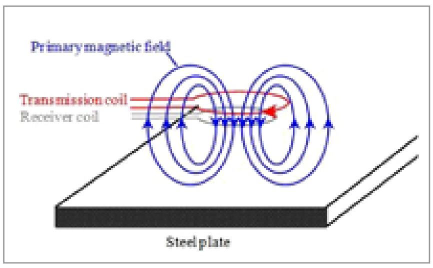

Figure 1: *Magnetization of the steel*

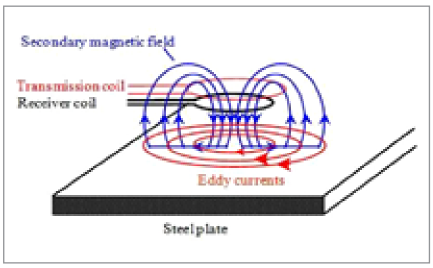

Figure 2: *eddy currents generate secondary magnetic field in the receiver coil*

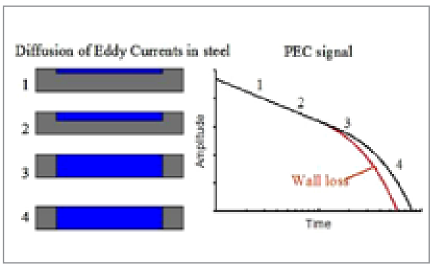

Figure 3: *Diffusion of eddy currents. The onset of fast decay occurs when the far surface is reached*