Direct Current Voltage Gradient Meter (DCVG)

WHAT IT TAKES

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Cathtect Engineering is the most Technologically advanced Cathodic Protection Company, against its competitors. We have highly qualified Engineers in our electrical department who constantly seek innovative ways to modify our products for the benefit of our clients, putting our products one step ahead of our competitors.

**Introduction:**

The Direct Current Voltage Gradient (DCVG) technique is a technique for coating surveys on buried pipelines. It can be used for locating as well as sizing defects. The technique is based upon measuring the voltage gradient in the soil above a Cathodically protected pipeline. Relatively small defects can be located with this technique.

**Basic Theory**

Surrounding a defect in the coating of a buried Cathodically protected pipeline, a voltage gradient is established in the soil. The highest gradient is recorded in close proximity to the defect. In the DCVG methodology the DC signal used to measure the defect is usually pulsed utilizing a ratio of 0.3 seconds on and 0.7 seconds off. Different mark to space ratio’s can be utilized. Two purpose made lances are utilized to ensure contact with the soil and are connected to a sensitive milli-voltmeter to indicate the voltage gradient.

Apart from locating a defect, the sizing is also important in order to prioritize excavation and repair. The DCVG measurements allow for the %IR Value to be computed and thus the defects can be categorized.
Advantages

- Accurate defect location
- Reveals relative defect size.
- Can be combined with other techniques
- Requires a single operator.

The Direct Current Voltage Gradient (DCVG) coating survey equipment is the most technologically advanced version of the technique first developed in Australia. Features of the equipment include:

- Input filtering to remove interference caused by high voltage overhead AC power lines and stray traction currents
- Shielding which prevents instability caused by wind induced static
- Common AC adaptor and charger which plugs into survey meter, interrupter and reference probes. All equipment items have built – in battery charging circuits and rechargeable battery packs

Technique

An impressed current cathodic protection system may be used as a DC source, or a temporary system may be installed using a generator and a portable transformer rectifier. Heavy Duty lead acid batteries have also been used. The “anode” may be any electrically remote, immersed or buried length of metal e.g. scrap pipe or cable, fence or structure.

Electric current flows from buried or submerged “anode” through the ground to the pipeline via the exposed metal at pipeline coating faults.

The current flows through the soil to the exposed metal causes a voltage gradient in the soil. The gradient is more concentrated the closer it gets to the coating defect.

The potential gradient is detected as it appears and disappears (due to the switching of the CP system) by placement of the probes 1 – 2 meters apart along the pipeline. As current is travelling through the soil to the defect and the current is ON for half (0.3 sec) the time is OFF the meter “points” the surveyor in the direction of the current flow and towards the defect, the meter needle “flicks”.

The defect once pinpointed is sized, the relative size is expressed as a percentage (%IR) of the “signal” applied to the pipeline. The “signal” is the difference between the pipe-to-soil ON and OFF potentials measured at adjacent test points during the survey.

The magnitude of the gradient around a defect is dependant on many factors, the most significant of which is soil resistivity. The gradient around defect in low resistivity soils is less evident than the same sized defect receiving the same current in high resistivity soils.

How the Survey Works.
Equipment Description

**Survey Meter**

The survey meter has voltage ranges from 10 - 4000 mV (depending on the meter) which allows detection and measurement of almost all soil potential gradients in a large variety of environmental conditions.

The meter has a center zero needle, that is, with zero voltage across the meter input, the needle rests at mid-scale.

The meter circuitry has been engineered not to be affected by high voltage AC overhead power lines, wind induced static, stray traction currents and other "noise".

**Millivolt Range Switch**

The RANGE switch is used to select the millivolts range which will give the greatest degree of accuracy and flexibility.

**Copper Sulphate Reference Probes**

The probes are adaptable standard copper-copper Sulphate reference electrodes. They are lightweight, high-strength, static-shielded and made from aluminum tube.