

## CASE STUDIES

# High Voltage Testing Services Water Treatment Plant

### CABLE JOINT ISSUES

When discovered, pinpointing the location of PD on a cable is imperative. LIVE HV's extensive cable database has proven tolerance levels for mid-cable are far lower than PD detected from a joint or termination and must be remedied with greater urgency. Following repair, it is important to retest the cable to confirm its conditional integrity.

### PROJECT DESCRIPTION

During REFCL high voltage compliance testing the resilience of an essential 22 kV cable required confirmation. Proving the ability of this cable to maintain regular service conditions and sustain REFCL overvoltage's involved the application of Insulation Resistance (IR), Partial Discharge (PD), Tan Delta (TD) and monitored withstand testing.

Records indicated that there were no joints on the cable, so any failure points were likely to emanate from the terminations.

### CABLE FINDINGS

PD and TD testing was performed concurrently so either diagnostic measurement indicating an issue would result in the test being aborted to prevent damage to the cable. The TD test results were acceptable however the PD indicated discharge emanating from within the cable.

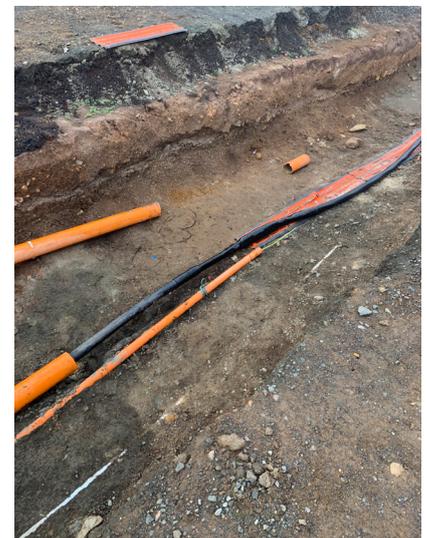
TD measures the overall dielectric properties of a cable whereas PD measurements detect a localised breakdown. It could therefore be concluded that the overall condition of the cable was healthy however there was an area of localised breakdown that required attention.

Using time domain reflectometry techniques, it was possible to calculate the location of the discharge. The PD was determined to be midway along the cable and pinpointed with a tolerance of less than 1 metre over a 500-metre cable. Generally, this would indicate a joint at the location, however the customer was unable to confirm a joint due to incorrect schematics. As no joint could be confirmed the testing was stopped due to the high risk of accelerated failure that mid cable PD can pose to a cable. An excavation of the cable was recommended.

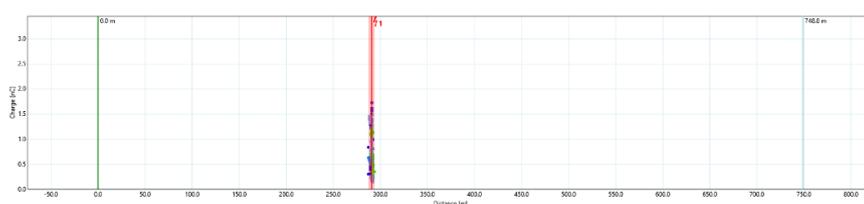
Upon excavation a joint was revealed at the precise location PD had been identified.



*Cable Test Setup*



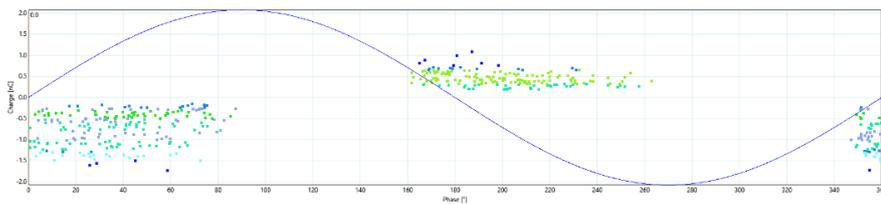
*Excavated Joint*



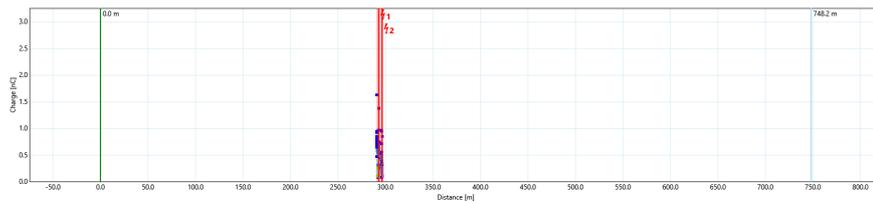
*PD Location*

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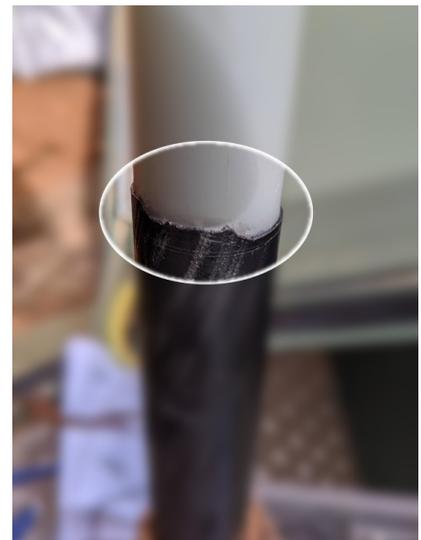
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PD Phase Pattern



PD Location of First Replacement Joints



Semi Conductive Layer Cut

## FOLLOW UP

The discharging joint and a small section of cable was removed and replaced with two new joints. Upon testing both of these new joints also had unacceptable levels of PD! As such they were also replaced, and repeat testing showed the cable was now 'healthy'.

An investigation was performed on the replacement joints and found that the semi conductive layer was not cut level and the shear bolt from the cable joint was protruding above the joint sleeve.



Protruding Shear Bolt

## THE OUTCOMES

- Partial Discharge was diagnosed and accurately located to a previously unknown joint
- Repairing required cutting a small section of cable and replacing with two new joints
- Repeat testing discovered both new joints were discharging and also had to be replaced!
- An investigation determined that the semi conductive layer cut was not level
- This highlights the importance of performing PD testing when commissioning assets or making alterations