

Partial Discharge on Outdoor Terminations

Contamination of cable terminations causes PD

Cable terminations are often used outside on riser poles or substation structures to convert cables to overhead lines or busses. These terminations convert the very tightly controlled cable electric field into an uncontrolled air insulated application. When applied properly, the field strengths are less than the insulation strength and therefore no partial discharge exists.

Under certain circumstances, even a well applied termination can have partial discharge as a result of contamination.

Humid salt air leaves conductive deposits that often result in partial discharge. Because of this, terminations in coastal areas are highly prone to PD.

Other types of contamination can result from pollution, or even dusty air. When an insulator gets unevenly coated in hydrophilic contamination, you can get what is called dry band discharge. The uncontaminated sections of insulator tend to be hydrophobic, so the insulator has dry and wet areas that are insulating and conductive. This disturbs the field distribution and leads to discharge across the dry bands.

Given time this will erode the insulator and lead to flashover.

The challenge

A high voltage asset owner in central Canada has numerous terminations on substation structures. Clearly salt contamination is not the issue. However other contamination is building up unevenly on their terminations.

This operator is very proactive and does periodic PD surveys of both indoor and outdoor assets as part of their regular preventative maintenance. They use the EA Technology UltraTEV Plus2 with the UltraDish attachment for scanning terminations from the ground.



Cable termination H3 with uneven contamination

The test results

Two of the terminations (H1 and H3) scanned returned very high levels of ultrasonic energy. The phase resolved plots show typical PD results. The source is frequency locked to the power system and the impulses are occurring twice a cycle, half a cycle apart.

The levels are approaching 40dBuV which is very high. The ANSI/NETA MTS 2019 standard calls for immediate action on levels greater than 6 dBuV.

Action taken

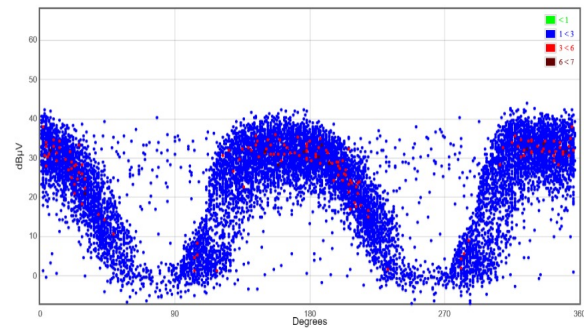
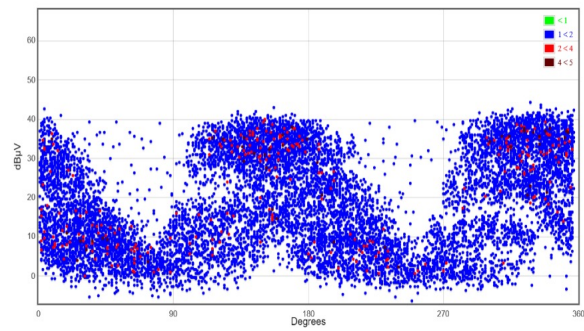
During the next scheduled outage, the insulators were cleaned and then rescanned. The ultrasonic energy was gone, proving that the discharge was a result of the contamination.



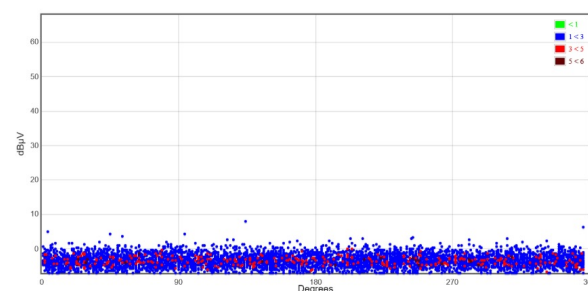
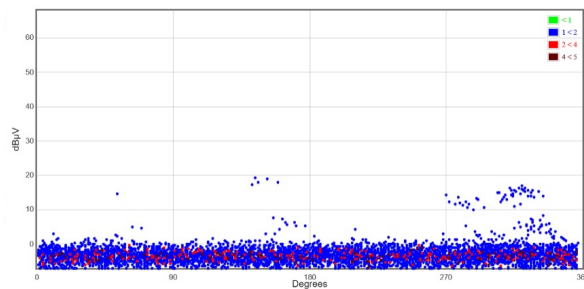
Cable termination H3 after cleaning

The benefits

The immediate benefit is that these terminations are now less likely to fail. Long term the asset owner has learned how the PD survey process can be used to control cleaning cycles. Some terminations may need less frequent cleaning some may need more.



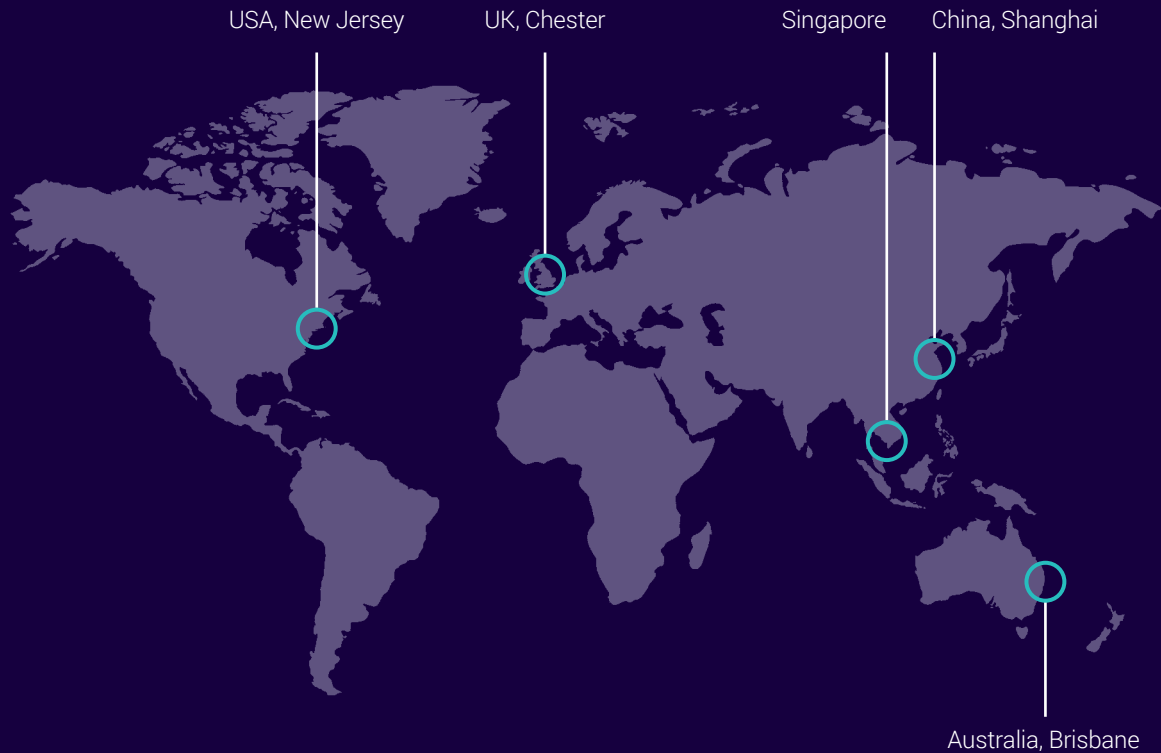
Ultrasonic PD results prior to cleaning



Ultrasonic PD results after cleaning

Global Footprint

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Founded in 1966 we have over 50 years' experience in the industry and 6 regional offices around the world to support our global customer base.

We work with a lot of our clients on a long-term basis to help them safeguard their power networks.

We advise our clients on strategy and implementation of a range of technology solutions to manage power assets, delivering maximum life and minimise cost.



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