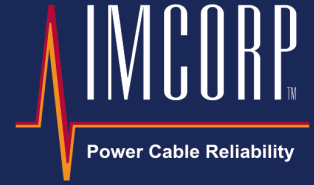


Commissioning of Underground Transmission Systems



Preventing Service Outages by Identifying Installation Issues with INCORP Factory Grade® Technology

HIGHLIGHTS

OVERVIEW

Substandard PD in a 230kV transmission accessory pinpointed with Factory Grade® technology.

CHALLENGE

Doubts related to the accuracy and severity of the PD results

RESULTS

Successful localization and remediation of substandard accessory installation before circuit operation confirms confidence in Factory Grade® test technology

A utility requested INCORP to commission two, 1.2 mile, 4000 kcmil 230kV circuits as part of a transmission resiliency upgrade project. The client recognized the value of employing a field assessment comparable to the factory quality control test on the cable and accessories to confirm correct installation (continuous 50/60Hz overvoltage partial discharge (PD) test with 5pC sensitivity for less than one minute). The initial profile assessment confirmed the performance of all components except for a substandard joint over three quarters of a mile away (>5pC at 1.5U₀ per IEEE 404, U₀ = 133kV). The assessment was repeated for confirmation with identical results. Since there was no observable evidence of a defect on the outside of the joint, there was some doubt on the part of some stakeholders and an additional voltage test was requested. After the joint failed under test, there was no longer any doubt from all the stakeholders.

A dissection confirmed the initial test results on the substandard joint. The installation of a shear bolt conductor connector was not properly completed, and a small burr created at one of the threaded holes remained. When the pre-molded joint was slid into place, this burr sliced through the interior surface of the joint, resulting in substandard PD activity, electrical/carbon treeing and subsequent failure. The cable ends at the joint were cleaned, sanded, and the repair joint was installed within 24 hours. The new 230kV cable systems are initially operating in service at the 115kV level and will be for several years until future upgrades are completed. Had this cable only been tested to the 115kV levels (such as during an online test), no issues would have been detected and it mostly likely would have survived in service until energization at the full 230kV level, years after the warranty expired. Ultimately, the INCORP Factory Grade® test technology saved the client a future outage and enabled immediate root cause investigation and corrective actions for future installations.



The Manufacturers' Standards



Component Standard	Testing Frequency	Thresholds Sensitivity	Thresholds Voltage
Terminations			
IEEE 48	50/60 Hz	5pC	≤1.5 U ₀
Joints			
IEEE 404	50/60 Hz	5pC	≤1.5 U ₀
HV / EHV Extruded Cable			
ANSI/IEEE S-108-720	50/60 Hz	5pC	≤2.0 U ₀

U₀ is the RMS operating voltage line to ground

