CASE STUDY

Using Factory Grade® Technology to Identify Systemic Manufacturing Defects

IMCORP Power Cable Reliability

VLF Test vs. the IMCORP Factory Grade® Technology

HIGHLIGHTS

OVERVIEW

0.1 Hz VLF test and IMCORP's Factory Grade® technology are compared side-by-side at utility solar site.

CHALLENGE

VLF test passes cables but terminations were still failing and unknown systemic manufacturing issues are completely missed.

RESULTS

Utility uses IMCORP's Factory Grade® technology to identify manufacturing issues and direct repair and replacement decisions.

A utility client requested IMCORP to commission cable systems at a new generation facility after experiencing several in-service termination failures. The installation contractor had already tested the cable systems with a very low frequency (VLF) test and thought that all components were installed correctly and to be of sufficient quality. After the in-service termination failures, the owner utility asked us to profile all of the plant cable systems with our Factory Grade® technology. Many terminations where found to be substandard and repair actions were recommended. That story is the subject of another case study. There was, however, a more troubling discovery with the cable insulation. Almost unbelievably, nearly 30% of new cable systems showed substandard performance in the cable insulation. Cable samples were sent to our laboratory for dissection and root cause analysis. The two most concerning anomalies found were small voids on the insulation shield interface and "fall-in" cable insulation problem at the conductor shield interface. The manufacturer acknowledged the quality issue and worked with the installation contractor to fix the issues.

This case serves as yet another example of the superiority of our Factory Grade® technology over legacy test methods. By partnering with IMCORP, our client utility was able to use their experience with distribution and nuclear cable systems to address a systemic failure problem, uncover unknown systemic manufacturing defects in the cable insulation and effectively direct repair and placement decisions.

The Manufacturers' Standards

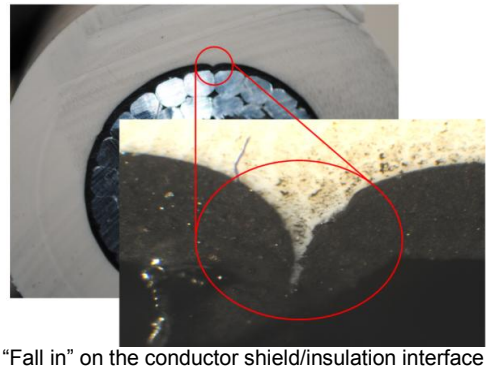
Component Standard	Testing Frequency	Thresholds* Sensitivity	Voltage
Terminations IEEE 48	50/60 Hz	5pC	≤ 1.5 Uo
Joints IEEE 404	50/60 Hz	5pC	≤ 1.5 Uo
Separable Connectors IEEE 386	50/60 Hz	5pC	≤ 1.3 Uo
MV Extruded Cable ICEA S-97/94-682/649	50/60 Hz	5pC	≤ 4.0 Uo^
HV / EHV Extruded Cable ICEA S-108-720	50/60 Hz	5pC	≤ 2.0 Uo

** No partial discharge should be observable above the sensitivity threshold up to the voltage threshold*

^200 V/mil

Table I: Manufacturers' Standards[1]

Void on insulation shield/insulation interface



"Fall in" on the conductor shield/insulation interface

[1] IEEE standards are classified as:
- **Standards**: documents with mandatory requirements.
- **Recommended Practices**: documents in which procedures and positions preferred by the IEEE are presented.
- **Standard Guides:** documents in which alternative approaches to good practice are suggested but no clear-cut recommendations are made.