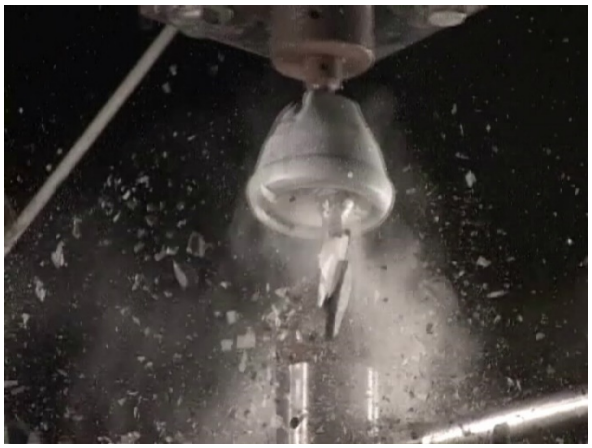
EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Testing of Porcelain/Glass Suspension Insulators to Assess an Aging Population



- This research is focused on improving safety and reliability.
- Sample equipment testing can provide advanced understanding of insulators at the near-end of service life.
- Inspection schedules are optimized by understanding the health of transmission line components.

Background, Objectives, and New Learnings

Utilities' assessment of the health of their porcelain or glass insulator population includes sample testing. By testing a small sample of the population, a statistical analysis can reveal potential risks of failure. The ability to assess the strength of a population enables the utility to better coordinate remedial measures. EPRI's data on and understanding of insulators at the near-end of service life can help mitigate risk before insulator failure.

EPRI has developed a guide to population assessment by applying specific testing techniques that generate substantial new learnings by identifying possible quality issues with the porcelain or glass, understanding the condition of aged in-service units, and recognizing failure modes. Benefits of these new learnings can help improve safety by removing high failure risk.

Benefits

With the increasing age of the porcelain and glass insulator population across the industry, the ability to identify end of life is important to help utilities make better-informed maintenance decisions. This project provides a large, homogeneous sample set to understand the current, in-service conditions of aged insulators, helping to identify degradation modes, and better understand insulator life expectancy.

The results help support R&D efforts in developing population assessment techniques and practices. By increasing data collection and improving identification and understanding of the health of transmission line components at or near-end of service life, utilities can optimize inspection schedules, utilize resources efficiently, and replace transmission line components prior to a public safety risk event in which the conductor falls to the ground after component failure.

Project Approach and Summary

Up to seven tasks have been identified for this population assessment, depending on the sample of porcelain or glass suspension insulator types and sizes. Below are examples of tasks EPRI intends to complete, in order.

1. Visual Assessment: Perform visual inspection for the corrosion, wear, cracking, cement problems, tracking and displacement. Photograph all insulator strings and provide identifiable markings in the same photograph. Document anomalies and variations.
2. Confirm dimensions on insulators in accordance with ANSI C29.2.
3. Axial and radial alignment of suspension shell in accordance with IEC 60383-1.
4. Thermal-mechanical load cycle test in accordance with ANSI C29.2 Section 8.2.5.A 96-hour stress test to promote defect growth within the insulators.
5. Perform a resistance test and three 60-Hz flashover tests to verify the low frequency electrical integrity of the insulator.

6. Steep front of wave puncture testing in accordance with IEC 61211 to assess the integrity of 10 percent of the insulators under impulse stress such as lightning.
7. Combined mechanical and electrical (M&E) strength tests in accordance with ANSI C29.1. Record the ultimate failure load, the mode, and location of failure of each insulator tested.

Deliverables

A report presenting the test results will be made available. The non-proprietary results of this work will be incorporated into EPRI R&D Program 35 and made available to the public, for purchase or otherwise.

Price of Project

Sample size insulators – cost can vary by numbers and types	Price estimation based on quantities to be tested in all tasks
100	$30,000
500	$113,000
1000	$220,000

Project Status and Schedule

Project estimates range from five (5) to (12) months, depending on the number and types of equipment to undergo the tasks.

Funder Obligations

The utility is expected to provide EPRI the following:

- The GPS coordinates of the framing structures
- Plan and profile drawings
- Nominal mechanical load on the insulators
- Historical maintenance and failure data

Who Should Join

Utilities with proactive maintenance schedules to forecast insulator replacement and cost estimates

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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