

# AT A GLANCE

## Polymer Bushing Life Management

Program 37.113

### Research Value

- Greater confidence in adoption of polymer bushings
- A sound technical basis for decisions when specifying, operating, and maintaining new polymer bushing technologies
- Lower life-cycle risks and costs to improve reliability and affordability
- Help in assessing and managing risks through early insights gleaned from laboratory testing and field experience
- Better understanding of the efficacy of various monitor and diagnostic test technologies applied to polymer bushings

### Member Benefits

- Access to research findings and recommendations on the use of polymer bushings, enabling informed decision-making for equipment specification, operation, and maintenance.
- Enhanced risk management of new bushing technology adoption through early access to insights from long-term testing and simulated field conditions.
- Access to guidelines on the selection, application, operation, and diagnostics of polymer bushings, facilitating smoother technology adoption.
- Potential to improve overall power transformer reliability and reduce failure rates by better understanding and mitigating bushing-related issues.

The reliability and availability of a utility's power transformers depend highly on the condition and performance of transformer components such as bushings. Today, as much as 20% of transformer failures could be related to bushing issues. There is not a significant body of experience with newer bushing technologies. In particular, the longevity and reliability of dry-type bushings are a significant unknown.

A portion of the work proposed under this effort aims to understand some of the unknown information surrounding application of polymer bushings through long-term testing under simulated field conditions and climate extremes.

The objective of the proposed research is to investigate the following key questions by performing long-term laboratory experiments on polymer bushings simulating operating stresses and environmental extremes in a simulated field environment in EPRI's Lenox Laboratory's 138kV Research Substation:

- How do polymer bushings perform under extreme environmental conditions and operating stresses (electrical and thermal)?
- How would the polymer bushings be affected by overloading, and does this require different specification and/or operating practices?
- Are present monitoring and diagnostic test methods sufficiently effective for assessing the condition of polymer bushings?
- Are there unique operating or maintenance concerns with polymer bushings?
- Can we identify prevalent failure modes or emerging reliability issues earlier to mitigate concerns with widespread adoption?

## Research Highlights



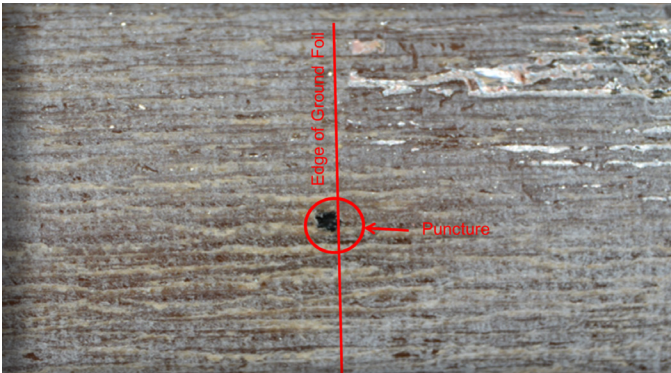
### 138kV Research Substation

Long-term field performance testing of three polymer bushings will continue in 2024. This testing will be conducted in the 138kV research substation in Lenox, MA, which affords the opportunity for convenient outdoor testing under a wide range of ambient temperatures and precipitation type. In addition, installed rain spray equipment is utilized to simulate wet climates. The bushings will be simultaneously energized to rated voltage while circulating currents up to, and in excess of, rated current.



### Guidelines on Specification and Maintenance of Polymer Bushings

Under this task, EPRI intends to further develop guidance on applications, operation, and diagnostics of polymer bushings. A complete draft of these guidelines has been completed. Work will continue to incorporate the distilled guidance developed through this research and through the combined operating experience of participating utilities.



### Analysis of the Reliability and Performance Experience of Polymer Bushings

This task will provide the results of a broader study to classify the reliability, performance, and life expectancy of polymer bushings and guide EPRI in developing a future research test plan. This task will rely on voluntary contribution of data and field experience with EPRI. EPRI will endeavor to extract all possible insights from available information and document those insights.

### EPRI Technical Contact

ERIKA WILLIS, Program Manager  
704.595, 2670, [ewillis@epri.com](mailto:ewillis@epri.com)

For more information, contact:

EPRI Customer Assistance Center  
800.313.3774 • [askepri@epri.com](mailto:askepri@epri.com)

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EPRI

3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 650.855.2121 • [www.epri.com](http://www.epri.com)

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