



TIP 367: EPRI P37: Power Transformer Through-fault Risk Assessment

Context

Transformers are designed to withstand certain levels of stress (number of through faults, fault magnitude and duration) based on their application. Over time as the transformer experiences multiple through-fault events the resulting stress impacts the transformer's survivability. BPA has substation busses with significant fault duty, in excess of 20 times normal rated current during a through-fault event, which can cause over 400 times the normal force on the winding.

In spite of these large forces on the transformer winding, very little research has been performed on quantifying the degradation during through-faults. By contrast, significant research has taken place and continues to take place on evaluating degradation of transformer insulation as the result of heat generated in the transformer during normal and abnormal transformer loading. However, on BPA's Transmission system the mechanical degradation from through-faults is likely as large if not a larger driver of transformer reliability than thermal degradation of paper insulation.

EPRI, with support from member utilities, initiated the development and testing of methodologies that use test, maintenance, nameplate, and historical failure performance to assess transformer condition.

Description

The project approaches the power transformer as a system of major subcomponents, including main body, load tap changer, dielectric fluid, bushings, cooling, and other auxiliaries. Transformers are designed to withstand certain levels of stress such as number of through-faults, fault magnitude, and duration. Over time, as the transformer experiences through-faults, the resulting stress impacts the transformer's future survivability.

The project encompasses the following tasks:

- Catalogue readily available pertinent data
- Develop an assessment methodology
- Develop algorithms
- Investigate transformer application and operational considerations
- Apply algorithms with utility data and review results
- Make appropriate enhancements
- Document methodology approach, results, and findings

The scope of work can be accomplished within approximately 18 months of project kickoff. However, actual scope and progress will be dependent upon funding level.

Why It Matters

Project results may help utilities reduce capital costs and maintenance through the application of analytics-based approaches for transformer asset management. This project will:

- Improve assessment of transformer susceptibility to through-fault failure.
- Enhance replacement strategies.
- Reduce capital and maintenance costs.

Goals and Objectives

The objective of the research is to develop a new methodology to assess the susceptibility of a power transformer to a through-fault failure. The goal is to understand the impact as function of number of through-faults, fault magnitude and duration using readily available data and use results in utility transformer replacement strategy.

Deliverables

A comprehensive final report documenting the underlying methodology, approaches, and results of the above tasks will be delivered at the end of the project. Interim status reports and findings for individual tasks will be provided periodically.

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Project Start Date: May, 2016

Project End Date: July, 2019

Funding

BPA Membership: \$22,500

Reports & References

Links

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Participating Organizations

EPRI