Supplemental Project Notice

38-KV RECLOSER PERFORMANCE AND LIFE-CYCLE TESTING

Example 38-kV recloser installation

PROJECT HIGHLIGHTS

- Examination of newly released 38-kV reclosers
- Understand deployment and design challenges of 38-kV reclosers
- Investigate long-term performance of 38-kV reclosers
- Facilitate utility information and experience exchanges focused on 38-kV reclosers
- Generate test results to improve recloser specification and application
- Refine accelerated life testing protocol for reclosers

Background, Objectives, and New Learnings

Reclosers are a critical component of modern electric distribution systems. Electric service providers install reclosers to prevent extended outages caused by momentary interruptions and increase system awareness when integrated with distribution supervisory control and data acquisition (SCADA) and distribution management systems (DMS). Distribution reclosers can improve customer reliability but are a significant investment. Solid dielectric reclosers that use a vacuum bottle as the interrupter first came to the market over two decades ago. Electric companies who operate 35-kV distribution and sub transmission systems face unique challenges related to the design and application of 38-kV reclosers. These challenges include:

- **Dielectric Integrity**: The vacuum interrupter used in 38-kV designs experiences higher electrical stresses on the vacuum bottle and recloser module than reclosers used as lower voltages, requiring improved insulation. This can be quite a challenge reclosers at normally open points.
- **Partial Discharge (PD)**: When solid dielectric reclosers are manufactured, small voids can be created. When in the presence of high electric fields, partial discharges may be generated within those voids that can eventually lead to arcing and subsequent catastrophic failure of the recloser.
- **Basic Insulation Level (BIL) and Lightning Protection**: This rating is needed to allow the recloser to withstand lightning and switching surges, and there has been a desire to increase this rating for 38-kV reclosers. The proper sizing of surge arresters is a challenge for all reclosers but especially with the higher voltage ratings of 35-kV class systems.
- **Sensors**: Sensing in 38-kV reclosers is more problematic due to increased electrical stresses on the embedded current transformer and voltage dividers.

Over the last 10+ years, EPRI has developed and implemented a test protocol for reclosers to better understand their lifecycle, including expected future field deployed performance and potential degradation mechanisms and failure modes. This project plans to perform laboratory testing and analysis of 38-kV reclosers to understand their design and life-cycle characteristics and to help inform utility specification, design, and maintenance decisions.

Benefits

Electric companies may benefit from this research through enhanced knowledge of recloser functionality and aging, resulting in more informed decisions related to the performance and lifecycle of 38-kV reclosers. Public benefits include increased reliability of the grid through adaptation of reclosers on 35-kV systems.

Project Approach and Summary

EPRI plans the following tasks for this project:

1. **38-kV Recloser User Group**: Electric companies who operate 35-kV class systems have unique challenges when applying 38-kV reclosers to their systems. The intent of this user group is to share challenges and work together to develop solutions to better specify and apply these reclosers.
2. **Laboratory Testing**: Perform laboratory testing on each recloser, tailored to each recloser's integrated sensor types and dielectric formulations. Testing may include:
   - *Functionality Testing*: Perform laboratory testing to evaluate the performance and functionality of 38-kV reclosers. The testing may include electrical testing as well as targeted performance tests of individual components of the reclosers including wildlife guards and arresters.
   - *Sensor Accuracy Testing*: Evaluate the accuracy of the embedded voltage and current sensors. The recloser may be subjected to testing across a range of possible load currents before and after accelerated aging.
   - *Accelerated Aging Test*: This task subjects sensor systems to accelerated aging for 2,500 hours. Sensors are energized during the aging process. The environmental stressors may include rain, salt fog, humidity, thermal cycling, and UV. Functional and accuracy tests may be repeated after aging to understand performance changes.
   - *Impulse Testing*: This task aims to perform laboratory testing to evaluate the BIL rating and withstand capabilities of the 38-kV recloser with specified lightning arresters.
   - *PD Testing*: This task plans to evaluate reclosers for the presence of partial discharges that could lead to catastrophic failure.
3. **Teardown and Design Review**: Systematically dismantle each recloser after the completion of testing and inspection to identify degradation. Material samples may also be taken for further lab analysis. Additional electrical testing may be performed as needed throughout the process.

Deliverables

All project participants receive regular update webcasts and a report documenting recloser test results. The non-proprietary results of this work will be incorporated into EPRI's Distribution Systems R&D program, and available to the public for purchase, or otherwise.

Price of Project

The cost of the project is $90,000 per participant. Each funder may send a new 38-kV recloser for testing. This project qualifies for Self-Directed Funding (SDF).

Project Status and Schedule

The project may last for up to three years. The project plans to commence once a funder joins the project and testing for each recloser is planned to be completed within 12 months of receipt by EPRI.

Who Should Join

Electric companies who are planning to or are currently deploying reclosers on their 35-kV systems and would like to better understand their functionality and potential long-term performance.

Contact Information

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Product ID: 3002031159 **Project ID:** 1-120169 **October 2024**

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