Methodology for Estimating the Life of Power Line Conductor-Connector Systems Operating at High Temperatures (MELCOT)

www.ornl.gov

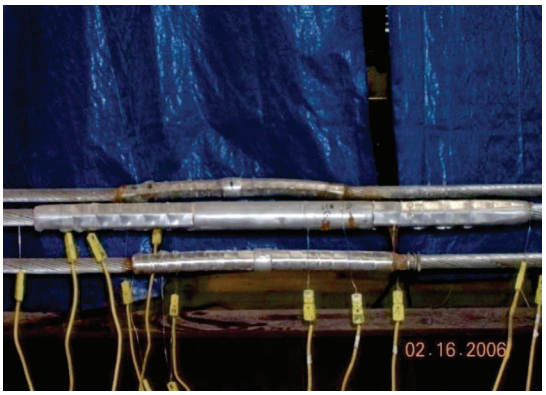
Due to increases in power demand, existing overhead power transmission lines in the United States often operate at temperatures higher than those for which they were designed. This has led to accelerated aging and degradation of splice connectors and increases in the chances for power outages, including the large-scale blackouts, which constitute one of the greatest threats to homeland security. Presently, aerial inspection and pre-matured replacement are the typical ways to ensure the health of these connectors. An efficient and low-cost way to predict the health of these connectors can improve the reliability and resiliency of the grid, and may move their maintenance from a time-based to a more cost-effective condition-based schedule.

The Oak Ridge National Laboratory (ORNL) Methodology for Estimating the Life of Power Line Conductor-Connector Systems Operating at High Temperatures (MELCOT) integrates analytical and experimental protocols, along with a software package and material property database, for evaluating, accurately and cost-effectively, the performance of conductor-connector systems under various operating conditions and for predicting their effective service life.

The MELCOT R&D efforts produced the material mechanistic modeling, structural verification tests, and thermal-cycling aging experiments and simulations; assembled the relevant data sets; and developed a coherent methodology that, taken together, enable them to evaluate the integrity and durability of conductor-connector system of the power grid.

The key benefits of developing the effective lifetime prediction models are

- Optimization of existing power grids,
- Prevention of conductor system damage,
- Effective rerouting of the power grid system during an emergency,
- Accelerated decision-making processes,
- Reduced maintenance cost and outages, and
- Reduced overall power consumption due to improved reliability and efficiency in the power delivery infrastructure.



High-voltage splice connectors embedded with thermocouples.

The MELCOT methodology provides an accurate and economical way to evaluate the performance of a conductor-connector system under various operating conditions and to predict the effective lives of such systems. For example, the governing equations developed by the MELCOT System can be used directly by power grid system operators to predict the integrity and durability of splice connectors to ensure the safe and reliable operation of the electric power grid. Furthermore, the methodology provides details of the crimped-type splice connector forming mechanism, including the optimal design configuration of conductor-connector systems for a target service temperature range. By providing a better understanding of the behavior of the conductor-connector systems, MELCOT enables manufacturers to develop more durable and reliable power line connectors.

Contact

Jy-An John Wang
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6069
(865) 574-2274
wangja@ornl.gov

October 2014

ORNL 2014-G01191/chj