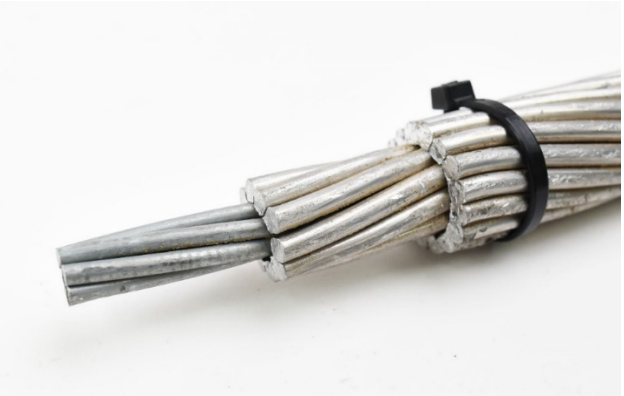
Batch vs. Bobbin Annealed ACSS Conductor Analysis



- Quantify difference between batch annealed and bobbin annealed ACSS conductors
- Compare sag tension models with empirical stress-strain and creep data

Background, Objectives, and New Learnings

Aluminum Conductor Steel Supported (ACSS) conductors have higher normal and emergency operating temperature limits due to the different materials used in their fabrication: annealed aluminum conductive strands and high or ultra-high strength steel core strands with high temperature tolerant anti-corrosion coatings.

There are currently two methods for annealing aluminum strands for ACSS conductors: batch annealing or bobbin annealing. The batch annealed ACSS conductors are stranded with hard drawn (1350-H19) aluminum and then the completed conductor on the reel is placed in a large oven and heated above the annealing temperature for a designated period. The ACSS conductors produced using the bobbin annealing method are stranded with fully annealed aluminum strands. No additional heat treatments are performed once the conductor is stranded.

Manufacturers have claimed additional benefits of batch annealing over bobbin annealing aluminum strands including less sag, better self-dampening, and tighter aluminum stranding. This project aims to evaluate these claims by performing a series of mechanical tests on ACSS conductors of the same geometry, but produced using the two different annealing techniques.

Additionally, the empirically obtained stress-strain and creep data will be compared to PLS-CADD software parameters to better understand possible difference between estimated sag of the two manufacturing processes.

Benefits

By better understanding the effects of the two different annealing methods on the performance of the conductor, utilities are better equipped to specify the conductor to best meet the utilities' needs. Additionally, utilities may utilize the data obtained to refine their tensioning calculations to obtain more accurate conductor sag heights.

Project Approach and Summary

This project will evaluate the same geometry of ACSS conductor produced by two different manufacturers who utilize two different methods to anneal the conductive aluminum strands of the conductor. For this project, we will be using ACSS Squab conductors manufactured by Prysmian and Southwire. Southwire utilizes a batch annealing process and Prysmian utilizes strands annealed aluminum strands.

This project will be evaluating the physical properties of the whole conductor and the individual strands.

The stress-strain tests will be performed on the whole conductor and the core. The stress-strain characteristics of the aluminum will be extrapolated from the data obtained from the core and whole conductor. This information will provide insight on the conductor's elastic and plastic deformation characteristics. Additionally, the ultimate tensile strength of the entire conductor will be obtained.

Creep tests will be performed to project the estimated 10-year creep of the conductor to understand the long-term sag of the conductor.

Sections of each of the conductors will be thermally aged at 250°C to understand the effects of heat on the conductor's strength, stress-strain profile, and electrical resistance.

Vibration studies will be performed (given that at least three funders participate) to verify claims that batch annealing provides better self-dampening.

Deliverables

A report outlining the test procedures, results, comparison of the two conductors, as well as an analysis comparing PLS-CADD models with the empirical data obtained will be published. Periodic meetings with funders will be held to update them on results.

Price of Project

The price for participating in this project is $50,000 per utility. To complete the entire scope of the project, the participation of at least three utilities is required.

Project Status and Schedule

The scheduled duration of this project is 12 months. Initial work on conductor and strand physical properties may commence with at least 1 participating utility. To complete the full scope of the project, the participation of three utilities is required.

Who Should Join

Transmission utilities that have interest in the performance of ACSS overhead transmission conductors.

Contact Information

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

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