FEBRUARY 2009

ELECTRIC UTILITY OPERATIONS

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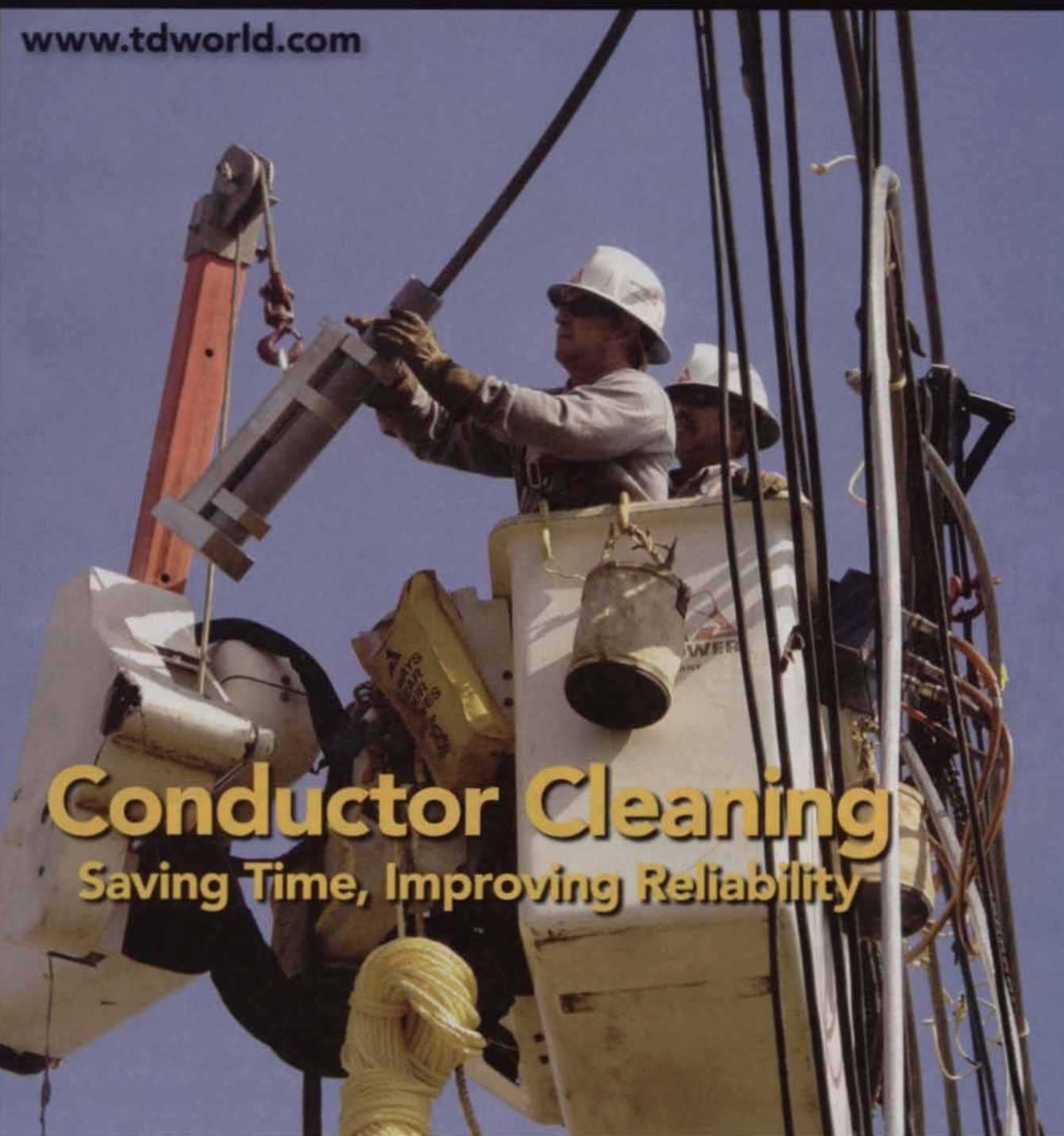


Conductor Cleaning

Saving Time, Improving Reliability

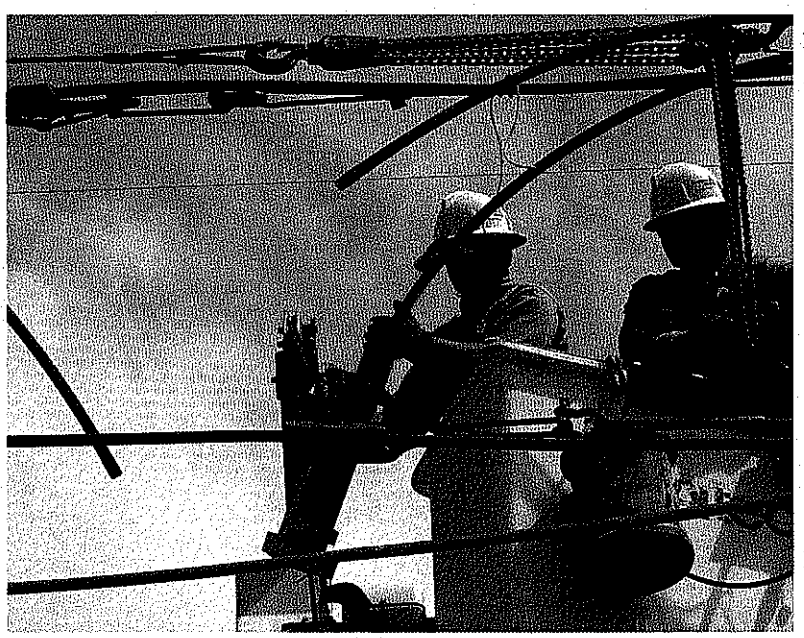
Linemen Curb Outages With EPRI-Developed Tool

Southern Company's line crews save time and increase efficiency by using a new tool to clean transmission conductors.

By **Alan Holloman**, *Southern Company*

A tornado obliterated six transmission towers and ripped apart three 500-kV lines last March in Cartersville, Georgia. By using a new conductor cleaning tool developed by the Electrical Power Research Institute (EPRI; Palo Alto, California), Southern Company (Atlanta, Georgia) line crews were able to restore the first line in eight days and get the rest of the system up in three weeks. The new cleaning process enabled the line crews to complete more than 80 conductor cleanings in two weeks and save more than 32 hours.

On this kind of restoration project, linemen normally would wire brush the conductors, install the sleeve and put the conductor back in the air. However, this method is not preferred by the conductor manufacturers, because it can lead to termination failures.



Southern Company became one of seven utilities to participate in a research project to solve an ongoing problem with conductor failures.

Over the past few years, vendors have advised linemen to unstrand the wires of the conductor, wire brush each strand and then restrand them after each strand is clean. Some of the conductors, however, have up to 54 strands. The 500-kV lines in Cartersville had three subconductors per conductor. To clean each conductor strand prior to installing the sleeve could take up to 30 minutes per subconductor.

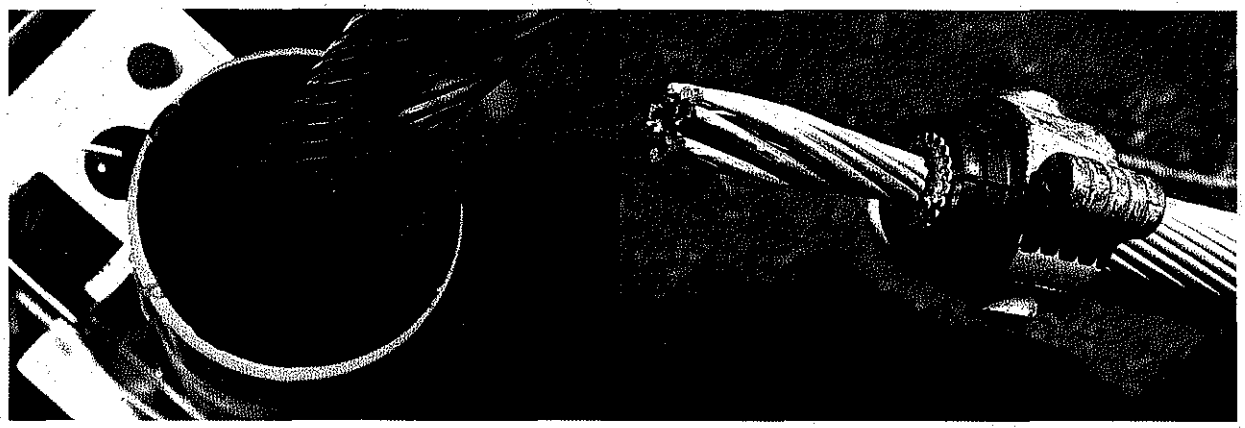
Also, when linemen try to clean each of the strands in an aluminum conductor manually, it is challenging, if not impossible, for them to put them back correctly after the cleaning. And if the strands are not laid in place correctly, the linemen will struggle to get the sleeve on the conductor.

For that reason, Southern Company searched for a way to clean the conductors without taking every strand apart. When EPRI invited the utility to participate in a research project on conductor cleaning, the utility decided to jump on board to try to solve an ongoing problem with conductor failures.

Research Process

Southern Company first became interested in this research project through its involvement in EPRI. The company participates in working groups, which are always looking at ways to better maintain the transmission system. The working groups' primary function is to come up with research projects that eliminate the issues.

When the issue of conductor failures came up, Southern Company knew it was a big deal and would be a good project to fund. The line personnel serve as advisors for EPRI and have online and face-to-face meetings at the different research facilities. As such, they were very involved in the implementation and development of the conductor cleaning tool.



Not only does the new conductor cleaning tool shave hours off the time it takes to restore high-voltage transmission lines, it also reduces the number of conductor failures and increases reliability.

Southern Company became one of seven utilities to participate in the research project. In addition to Southern Company, American Transmission Co., Tennessee Valley Authority, Public Service Electric & Gas Co., Oncor Electric Delivery, CenterPoint Energy and East Kentucky Power Cooperative helped to develop the conductor cleaner.

By participating in the project, Southern Company hoped to end up with an effective, time-efficient and less costly strategy to make a termination. If the tool did not perform well in the test, Southern Company was prepared to go back to its old method of wire brushing. The tool, however, did meet Southern Company's goals and expectations.

Cutting Down on Conductor Failures

The tool, which is now being manufactured by EDM International (Fort Collins, Colorado), helps utilities clean high-voltage conductors in a shorter period of time. Now linemen can clean the conductors in one to six minutes without risking damage to the individual strands in a line.

Over the last few years, the manufacturers have emphasized their recommendations for cleaning, because so many utility companies reported conductor sleeve or termination failures. Utilities are experiencing sleeves that run hotter and even fail due to poor cleaning of the conductors, overall poor installation procedures, the need to deliver more electricity down the existing lines, and age of the conductor sleeves.

Southern Company transmission line crews in Georgia experience about 10 to 12 sleeve failures per year. If this number is multiplied by the number of U.S. utilities and circuit miles, it turns into more of a significant problem.

By cleaning the conductors properly, utilities can cut down on about half of the failures, which in turn will make the bulk power system more efficient and reliable. As the demand for electricity increases, line crews are running more lines and trying to pump more electricity through those lines. The better condition the sleeves are in, the more reliable the system will be.

Additionally, line crews are building newer lines that are designed to run at much higher temperatures; therefore, linemen need to do a better job of making sure termination points are properly installed. This tool will increase the reliability of the new conductor sleeves now being installed on new lines.

Clean to the Core

When Southern Company transmission linemen used the old method of cleaning conductors, they only cleaned the oxidation on the outside of the conductors. As a result of oxidation on the internal strands, some of the sleeves would fail prematurely, causing a line outage.

By using the specialized tool developed by EPRI, linemen are making certain that each individual strand is free of any contaminants or oxidants. A detergent-like solution enables users to thoroughly clean the conductors so the strands can operate in synergy when they are compressed. This method helps the conductor to have higher conductive properties, be less likely to heat up and not as apt to cause a conductor-sleeve failure.

Linemen cut the conductor off, trim it back and then place the conductor inside the cleaning solution within a PVC pipe. The solution is agitated by a motor that runs off a small battery. The linemen then set a timer. The duration of the cleaning depends upon the age and condition of the conductors. While new conductors can be cleaned down to the core in as little as one minute, others may take three to six minutes.

Rather than extensively trimming the conductors, the linemen often peel back one layer at a time to see how clean the conductors are following a cleaning. If the conductors are not clean enough, then the linemen set the timer for a few more minutes. Once the linemen are satisfied with the cleanliness of the conductor, they wipe down the conductor with a clean cloth, install the termination and put the conductor back into the air.

Safety Precautions

Line work can be a hazardous job, and although the conductor cleaning process saves time in the field, it does carry some safety hazards. As with any other chemical, the solvent used in the cleaning process needs to be disposed of properly. The neutralizing agent that goes into the solvent is considered a manageable waste, but it needs to be properly disposed.

Southern Company is working through its environmental hygiene organization to dispose of the solution based on the recommendations from the Environmental Protection Agency.

Linemen also need to make sure that they don't swallow the solvent or are exposed to it for an extended period of time. For protection, linemen wear gloves and long-sleeved shirts.

Buy-In From the Field

When Southern Company tested the conductor cleaning tool, linemen were hesitant to switch from the wire brushing method. When the transmission specialist explained to them that the manufacturer's recommendations were to take every individual strand, wire brush it and put it back together, they all had a common response: "That would take a long time."

The linemen then asked what would happen if they bent the strands and could not get them back in correctly. They understood that this tool could help them end up with a good termination. When they started cleaning the conductors and peeling back the strands, they could not believe that the tool did such a good job of cleaning. Once they understood why Southern Company was testing the new tool and considering changing conductor cleaning practices, it made a lot more sense to them.

Putting Into Practice

On the restoration project following the tornado, about 16 to 18 linemen tested the tool and used it in the field. By working together and trying out a new way of cleaning conductors, the linemen were able to get the job done quickly.

Southern Company now has one of the tools on hand and plans to order more when they are commercially available. In the meantime, the utility is using the tool both on the ground and in the air on a bucket truck.

When the utility gets more of these tools, it plans to train all the linemen on the process of making conductor sleeves and terminations. The wire brushing procedure will be completely eliminated, and linemen will be expected to use the conductor tool to make terminations.

The trainers at Southern Company's training facility will help the linemen understand how the tool works and how to maintain it. The utility also will create a training program with both classroom and hands-on components, and then certify its crews and linemen to use the tool.

By testing the conductor cleaning tool, Southern Company discovered a new way to clean conductors without sacrificing reliability. The new tool not only helped the utility crews save time during the tornado-restoration project, but it also will help the company improve the quality of its compression connectors from this point forward. TDW

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