Utility Products
The Resource for Power, Telecom and CATV Product Solutions ®

A New Trend in Transmission

Why Utilities are Making the Switch to Fiberglass Crossarms on Their H-frame Transmission Structures

By Amber Reed

H-frame transmission structures are common fixtures in nearly every skyline, from cities to rural areas, transferring electrical energy from power plants to utility companies' substations for disbursement out to customers. Many of the H-frame structures in the US are 40-50 years old and are in need of replacement. Building new H-frames is expensive, so utility companies looking to update their existing infrastructure are choosing to retrofit these structures rather than replace as a way to better manage costs and increase their structures' service life.

As utilities are conducting these H-frame retrofit projects, they are exploring new materials for key components such as crossarms, braces and deadend assemblies.

The Material Challenge

Crossarms are one of the most important components at the top of a H-frame transmission structure. Although traditionally constructed in wood, crossarms are also made of steel and fiberglass. The challenge with wood, like other biodegradable materials, is that it is susceptible to contamination and deterioration. Steel is an electrical conductor in any condition, so it does not have any insulation resistance.

Fiberglass products, including crossarms, offer utility companies an alternative to wood and steel.

"Because of their superior qualities over wood and steel, fiberglass crossarms and braces are ideally suited to H-frame transmission structures," said Riley George, PUPI® regional sales manager. "They are easy to handle and install, and they are constructed of engineered materials that means their strength is consistent and stays that way over time. In addition, they do not rot, which means long, maintenance-free service life, and they are excellent electrical insulators."

Consistent Strength

Fiberglass transmission crossarms and braces are constructed of pultruded composite material that delivers more consistent strength with less weight—the result is a material that is up to six times stronger than wood while less than half the weight of steel. Other benefits of fiberglass products that are manufactured under such carefully controlled conditions are that they are free from the natural variations found in wood and their characteristics do not change over time.

Long Service Life, Maintenance Free

Fiberglass products also offer a longer life span than wood products. While wood crossarms can last anywhere from 10 to 30 years, depending on the climate, high-quality fiberglass assemblies have a life expectancy of at least 60 years. An additional reason that contributes to their long service life is that fiberglass crossarms do not rot, dry out, split or shrink from the effects of weather, UV radiation, insects or woodpeckers. In addition, these types of crossarms are built to withstand heavy wind loads and impacts.

Another feature of fiberglass crossarms that contributes to these products' longevity in the field is that they never rust or need re-coating.

Insulating Properties

Unlike steel transmission structures, fiberglass crossarms and braces have excellent insulating properties—in fact, they are often used with steel and concrete poles to prevent unintended grounding. The fiberglass pultrusion produces a smooth, non-porous surface that resists contamination and will not absorb water, making fiberglass a better insulator than wood.

Choosing Fiberglass

According to George, many utility companies have been using fiberglass crossarms and components in their overhead distribution lines for more than 25 years, but when it comes to updating their transmission lines, these companies can be

more cautious to make a material change.

"Fiberglass doesn't have the same awareness in the transmission industry yet," George said. "Most transmission engineers have been working with wood or steel products for decades, and many of them are hesitant to try a product that they are not as familiar with.

"However, more and more utility companies are becoming comfortable with fiberglass products and are making the switch. Once they do, they are pleased with the results."

Sho-ME Power Electric Cooperative in Marshfield, Missouri, is currently working to retrofit 500 miles of 161 kV H-frame structures that bring power from the Associated Electric Coop (AECI) in Springfield, Missouri, to its 148 substations. According to Wade Drossel, transmission design engineer for Sho-ME Power, the company's H-frame poles are structurally sound, but the wood crossarms rot out quickly because of water contamination and prolonged sunlight exposure. Replacing the wood crossarms with new wood crossarms has been a big challenge for the company.

"In the last 40 years, the quality of wood readily available for crossarm construction has steadily deteriorated," Drossel said. "This situation led us to start looking for alternative solutions to wood. Our goal is to find a long-term, non-wood replacement for the crossarms."

Although familiar with fiberglass products, Drossel didn't have any experience with them prior to beginning Sho-ME Power's retrofit project. Their decision to switch to PUPI® fiberglass crossarms was based on the need for a long-term replacement to wood.

"The strength and longevity of the fiberglass products, as well as comparable labor rates to install them, justify the cost," Drossel said. "And the integrity of the fiberglass crossarms over time will outlast any wood product available, while their lightweight composition make them a better choice than steel."

The Knoxville Utilities Board in Knoxville, Tennessee, has a similar need. The company is in the process of updating their 114 69-kV transmission lines that distribute power purchased from the Tennessee Valley Authority and deliver it to their 68 substations. Zane Howard, an electrical engineer with the company, said the wood crossarms on their H-frame structures, which were built in the late 1950s, need to be replaced because of rotting from rain and UV rays, as well as damage from woodpeckers.

Like Drossel, Howard wanted to find a longer-lasting alternative to wood with the strength needed to meet the strict codes set by the National Electrical Safety Code.

"Our system uses bundled conductors, which means we have multiple conductors per phase," Howard said. "The crossarms we use need to be able to handle the weight of the lines without the weight of steel."

The Knoxville Utilities Board, which uses PUPI® fiberglass products in their 13 kV distribution lines, made the decision to try fiberglass crossarms in their transmission structures based on their positive experience with the material.

"We were looking to build transmission structures that will last a long time—longer than wood, which has a lot of variance and deteriorates over time," Howard said. "Fiberglass offers us uniform and predictable strength in any weather condition. These type of crossarms are strong, insulated products that are easy to install and look nice on the poles. We have been very pleased with the performance of the fiberglass assemblies in our distribution lines, and we anticipate having the same results in our transmission structures."

Sid McDonald, manager of Operations and Engineering at High Plains Power in Riverton, Wyoming, was looking to replace the wood crossarms on the company's H-frame structures with a product that can withstand the natural elements of the region, but with some 100 miles of transmission lines to retrofit, he was also looking for an alternative that could be installed quickly, easily and cost effectively.

"Our lines are more than 65 years old," said McDonald, whose company buys power from Tri-State out of Denver, Colorado. "As we retrofit them, we need to be able to maintain reliable service to our customers. This means that we need a crossarm product that our crews can mount to our existing poles without a lot of extras parts or would require special tools or equipment to install."

The reduced labor costs associated with installing fiberglass vs. wood or steel products appealed to McDonald as well as Drossel.

"Our wooden crossarms have worked well, but with this retrofit project it is time for us to move these structures into this century," McDonald said. "Because each fiberglass crossarm is made of the same material, by the same process and has the same treatment as every other fiberglass piece, this material gives us consistency throughout our entire network."

"We have had no failures to date," said McDonald, whose company is also installing PUPI® H-frame fiberglass products on its retrofitted transmission structures. "These crossarms are built bull strong and handle the weight of the lines and the weather conditions really well. I have seen poles fall, and the PUPI® fiberglass crossarms are still intact."

George offers these final thoughts: "Fiberglass crossarms have specific properties that make them a good choice for use with transmission lines. Based on our customers' successes to date, we will continue to recommend fiberglass crossarms as a cost-effective alternative to wood and steel in H-frame transmission structure construction and maintenance." UP

About the author: Amber Reed is with Signature Style PR + Marketing, Huntersville, North Carolina. GEOTEK Inc. is the manufacturer of PUPI fiberglass products, Stewartville, Minnesota.