Transmission Voltage Covered Conductor Systems Offer Advantages for Reliability, Economics and Ecofriendliness

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Introduction

Aerial covered Conductor systems came about in 1952, starting at 5kV, and rapidly advanced to 15-, 25-, 35-, and 46kV systems. In the early 1990's, at the request of industry leaders, spacer cable was introduced at the 69kV level. This was followed in 2019 by the 115kV spacer cable. The trend seems unstoppable, as covered conductor systems provide numerous technical, economic, and ecofriendly advantages.

System Description

Covered conductor systems consist of the following:

Three heavily covered, but unshielded, phase conductors. The conductors are usually AAC when in a spacer configuration, since there is no tension on the phase conductors, but can be ACSR or AAAC when installed in a self-supported or "Tree Wire" configuration.

The phase conductors are attached to a high strength messenger by spacers, installed every 30 ft. (10m.) along the messenger. The messenger is a high strength, alumoweld (AW) or alumoweld-aluminum (AWA) conductor which has several functions. The first is that the messenger is the mechanical strength member, holding the phase conductors up. The messenger can also be used as a system neutral, is a lightning shield, and provides a mechanical protection function by protecting the phase conductors from any items (leaves, branches, trees) which can fall onto the bundle from above.

The spacers are made of high Density Polyethylene (HDPE), as are the pin or line post insulators used on the angles, to ensure dielectric compatibility with the phase conductors.

Covered Conductor Benefits

Historically, covered conductor systems were used to overcome reliability issues associated with bare wire systems. Temporary outages from foliage contacting bare wire was eventually deemed unacceptable. Permanent outages from tree falls, animal/bird incidents, lightning, as well as "unknown" and "other" were unacceptable, and a 1990's study by Northeast Utilities showed that these outages could be reduced by as much as 90% by converting to covered wire systems.

High Voltage Covered Conductor (HVCC) Benefits

The impetus for using covered conductor systems at transmission voltages is not unsimilar to the reasons for using it at distribution voltages. The desire to minimize ROW width and clearing, adding circuits in an existing ROW, reactive compensation and improved voltage regulation, improved reliability, protection of flora and fauna, reduced tree trimming, reduced O&M expenditures (saving on tree trimming as well as trouble call reduction) and environmental stewardship (protection of flora and fauna and reduced carbon footprint).

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Configurations

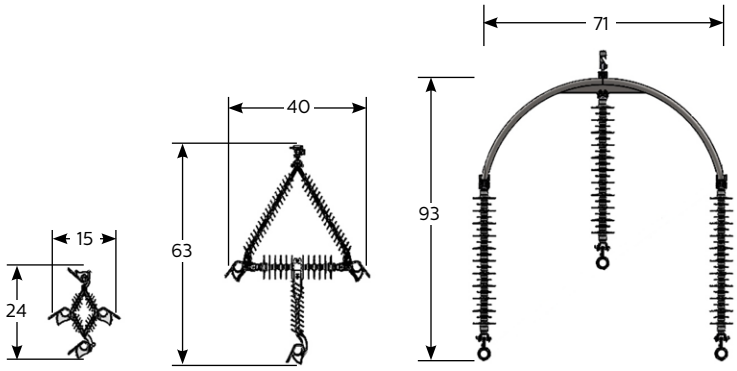
Aerial Covered Conductor Systems can be built in a Spacer Cable configuration (messenger supported) or a Tree Wire configuration (open construction, self-supported). The photo below left shows a 69kV spacer cable system running through Villarica National Park in Chile, with a 25kV spacer cable underbuild. The photo below right shows a 69kV Tree Wire system in Jasper National Park, Canada. It also has a 25kV underbuild, but in a tree wire configuration.

The utilization of covered conductors at transmission voltages also allows the commonplace distribution construction practice of building multiple circuits on a single pole line. The photo below shows a double circuit 69kV spacer cable in Saint John Energy, New Brunswick.

Covered Conductor Migrates to 115kV Voltage Level

Covered Conductor systems at 115kV have been constructed to date using the spacer cable configuration. The photo below left shows a tangent pole, while the photo below right shows the general profile, and the larger 115kV spacer.

The evolution of covered conductor systems to higher voltages has introduced the need for new spacers, more robust mechanical designs to handle the heavier conductors and longer longitudinal spacing of spacers. The spacers used for different voltage classes are shown below for comparison.



25-46kV Distribution | **69kV Sub-Transmission** | **115kV Transmission**

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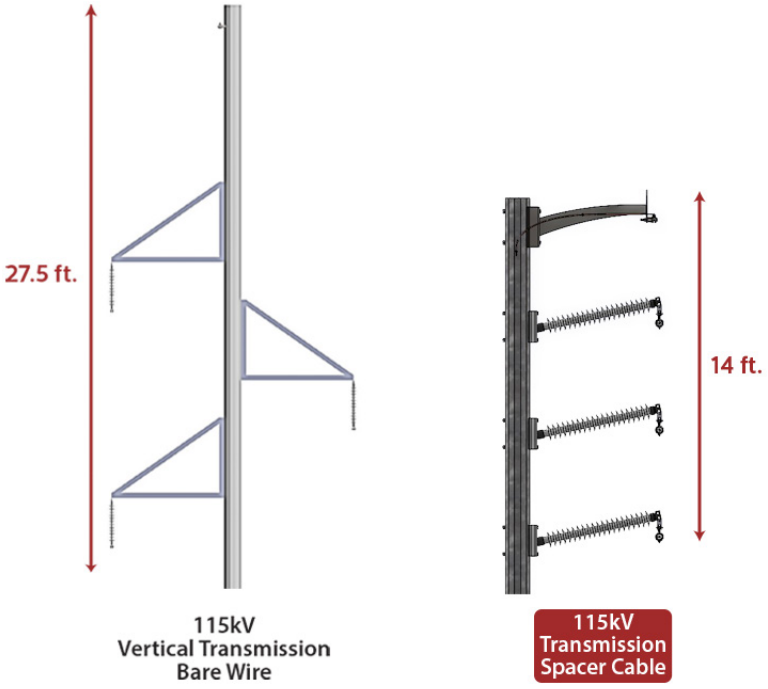
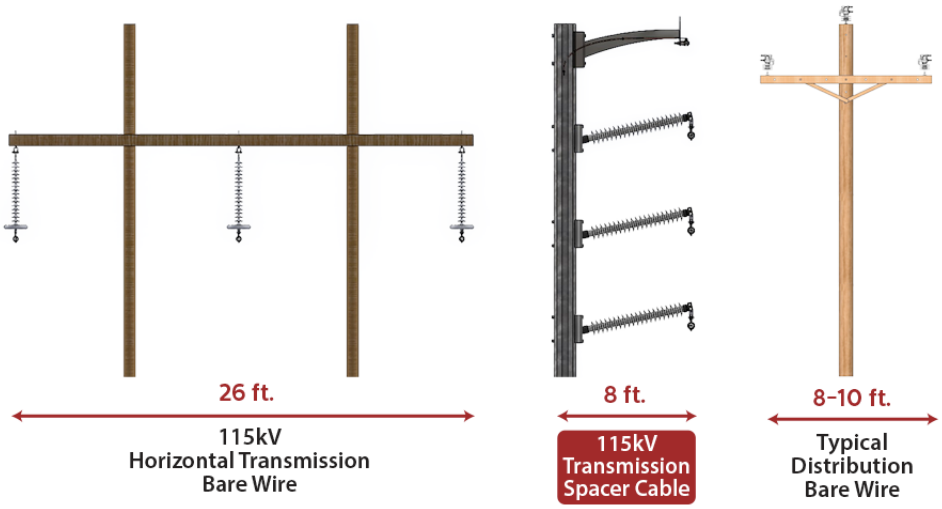
For vertical construction, the below diagram illustrates that spacer cable at 115kV can reduce pole height by 13.5 ft (4.1 m). This reduction in profile can allow higher voltage lines in areas previously limited to distribution (or sub-transmission) voltages.



If we look at horizontal construction, spacer cable reduces the profile by a full 18 feet, and starts to take on a profile similar in size to distribution class construction. This reduction in height and width has enormous ramifications for tree trimming, danger tree removal, and ensuring that the power line fits harmoniously with the surroundings, while at the same time minimizing disruption to the flora and fauna.

The migration of covered conductor technology to transmission voltages will continue unabated. The need for reliable power, construction of transmission lines in heretofore untrodden locales (getting power back from new wind and solar facilities to population centers), petitioning regulators for new ROWs, negotiating ROW parameters, arriving at consensus regarding how much land/resources are justified for a new line are all challenges which will have the opportunity to be reduced with the consideration of covered conductor construction.

If we look at horizontal construction, spacer cable reduces the profile significantly.



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