

Optimizing Transmission Design

69kV, 115kV and 138kV



Expanding Existing Right-of-Way Capacity ◀

Wildfire Mitigation ◀

Environmental Stewardship ◀

The Hendrix Difference ◀

Hendrix[®]



Meet Your Capacity and Reliability Needs More Quickly

Hendrix Aerial Spacer Cable Systems utilize covered conductor, allowing phase spacing to be much closer together resulting in an extremely compact footprint compared to bare wire. Transmission construction can take decades, and with capacity needs continually increasing, utilities need a solution that works within their existing right-of-way.

Bare Wire Challenges

Despite their widespread use, bare wire systems present numerous challenges and risks. These include momentary outages caused by foliage coming into contact with the wires, permanent outages due to fallen trees, incidents involving animals or birds, lightning strikes, and the extensive space these systems require. As a result, utilities often face lengthy processes to acquire and clear land as the demand for capacity continues to grow. Outages resulting from bare wire systems are becoming increasingly unacceptable as their reduced reliability points to greater maintenance demands and costs for utilities. As a result, utilities will often opt for superior, more reliable alternatives such as covered conductor.

High Voltage Covered Conductor Benefits

A 1990's study by a Northeastern utility showcased covered conductor reliability by determining that outages occurring from bare wire systems could be reduced by as much as 90% by converting to covered conductor systems. The impetus for using covered conductor systems at transmission voltages is much alike to the reasons for using it at distribution voltages. The desire to minimize right-of-way (ROW) width and clearing, adding circuits in an existing ROW, reactive compensation and improved voltage regulation, improved reliability, reduced tree trimming, reduced operations and maintenance expenditures (saving on tree trimming as well as trouble call reduction) and environmental stewardship (protection of flora and fauna and reduced carbon footprint).

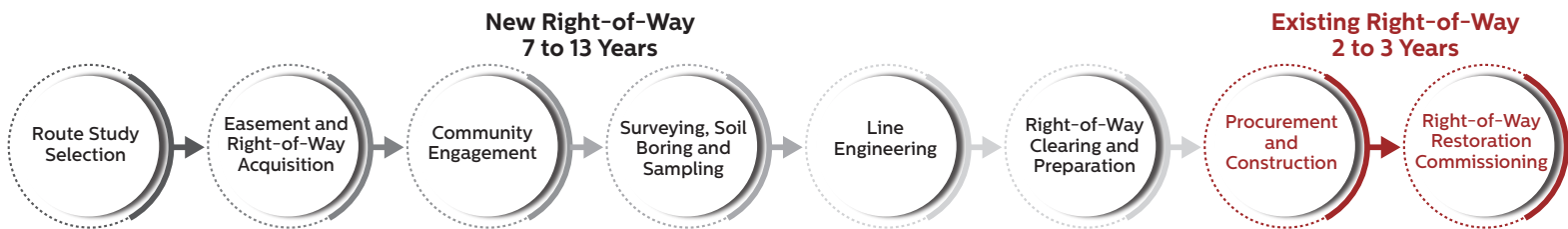


Expanding Existing Right-of-Way Capacity

Establishing new ROW can be a lengthy and arduous challenge. This process includes a feasibility study, acquiring approval for permits, easement purchases, surveys, land clearing, procurement, and finally construction and commissioning. In its entirety, this drawn-out process of acquiring a new ROW can take 7-13 years on average. Transmission systems typically require a much larger ROW than distribution systems, indicating existing distribution ROW would traditionally need to be expanded to support run-of-the-mill transmission infrastructure.

With Hendrix Aerial Spacer Cable the necessary ROW for a transmission line is significantly reduced due to the compact nature of spacer cable systems, allowing for the creation of new transmission lines in existing distribution ROW without the need for additional land acquisition, clearing, etc. This greatly shortens the timeline for the project by avoiding a great deal of the previously mentioned steps needed to begin construction and can fast-track the timeline of the project to 2-3 years.

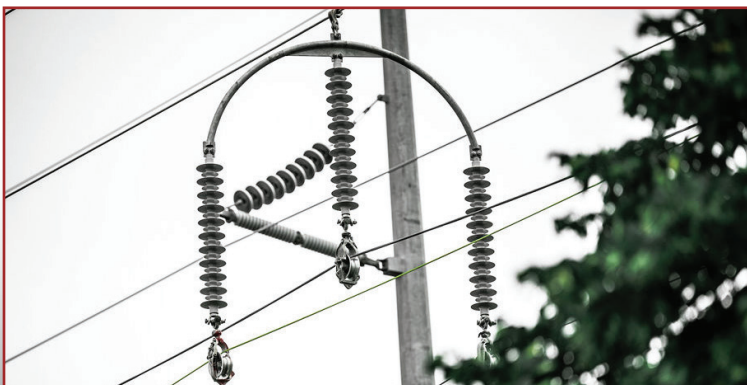
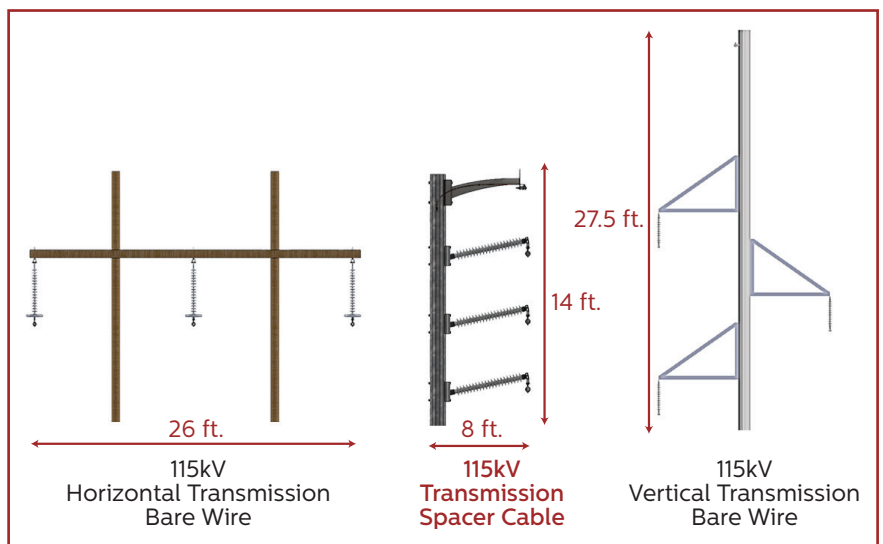
New Versus Existing ROW Project Timeline



Horizontal and Vertical Reductions

The illustration on the right emphasizes the key advantages of spacer cable in ROW reduction.

Hendrix Spacer Cable also provides considerable reductions in pole height when compared to vertical bare wire constructions, this is due to the use of covered conductor in spacer cable systems.



Aerial Spacer Cable System Objectives

- Avoid land acquisition and permitting processes (New ROW 7-13 years vs existing ROW 2-3 years)
- Increase reliability and safety within budget
- Add capacity in existing right-of-way
- Reduce total cost of ownership by more than 50%
- Realize revenue sooner



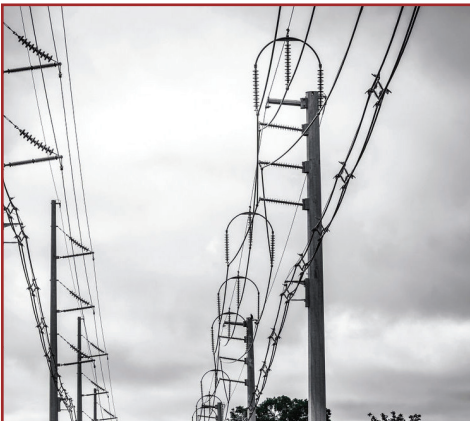
Wildfire Mitigation

Various innovative protective relaying schemes are designed to prevent ignitions from fallen wires. Through frequency or sequence impedance analysis, relays detect faults and act to de-energize the falling line before it reaches the ground. This typically occurs in just over a second. Unfortunately, a bare conductor, in contact with any object, can create an arc that can ignite vegetation. This could be a tree, the ground, wildlife, or another bare conductor. Covered conductors are protected with insulating layers that will prevent arcing in these situations and greatly reduce the risk of the system causing an ignition.



Environmental Stewardship

Due to the compact nature of Hendrix Spacer Cable Systems, more trees are left undisturbed when establishing system ROW. This leads to increased carbon capture, as the remaining trees continue to absorb carbon dioxide and produce oxygen. The abundance of trees means carbon pollution is reduced and overall air quality is improved, benefiting human health. Trees also provide habitats for wildlife, but as human expansion encroaches on natural areas, animals are forced to coexist with power lines. Spacer Cable helps preserve wildlife habitats and offers a more visible bundle, allowing birds to adjust their flight and avoid collisions.





69kV, 115kV and 138kV Solutions

The first aerial covered conductor line was installed in 1951 in Massachusetts. More than 70 years later, there are aerial covered conductor lines in all 50 states and U.S. territories, on all seven continents, and in more than 75 countries.

The RTL-69DM-01 and RTL-115-XXX are three phase Spacers used in Hendrix Aerial Spacer Cable designed for 69kV, 115kV and 138kV transmission voltages. Mounted on a messenger wire, the spacers will support and isolate the phase conductors. The 69kV spacer is designed in a diamond configuration, while the 115kV and 138kV includes a metal suspension clamp that fastens on the messenger and is a pivot point to allow the spacer to hang vertically.

Hendrix Spacer Insulators are molded using a proprietary gray track resistant and UV resistant high density polyethylene material.

One-Price, All-Inclusive Aerial Cable System

Hendrix Overhead Solutions now provides a single-cost solution for any overhead transmission challenge.



Circuit Materials and System Supporting Hardware

- Hendrix Covered Conductor
- Hendrix System Supporting Hardware
- Hendrix System Spacers
- Messenger, Grips & Insulators
- System Pole by Pole Cut & Kit
- Hendrix Installation Equipment

Hendrix Provided Design or Design Support and Review

- Pre Design On-Site Walk Down
- Circuit Design
- BOM & Pole Report
- Standard Construction Drawings
- Alcoa Sag & Tension
- Pole Loading Calculations and Guying Recommendations

Field Support and Final Inspection

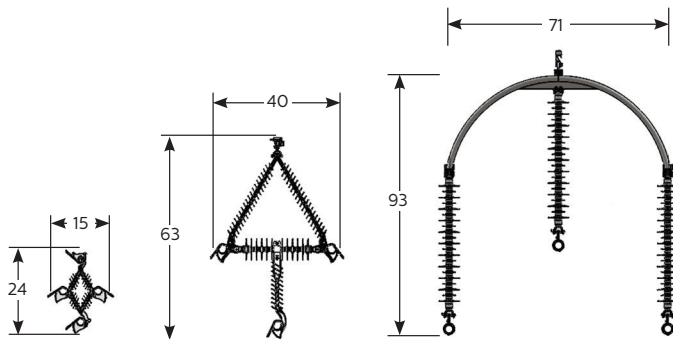
- Installation Equipment List Review
- Validation of Client Construction/ Installation Plan and Equipment
- Install Training
- On-site Installation Support
- Final Circuit Inspection with Pole by Pole "As Built" Photo Capture

The Hendrix Difference

Hendrix offers a complete solution, or a customized subset of products and services that solves the problem a customer faces.

Our goal is to maximize system circuit reliability and installation efficiency. We offer a complete solution, or any customized subset of products and services that achieves this goal.

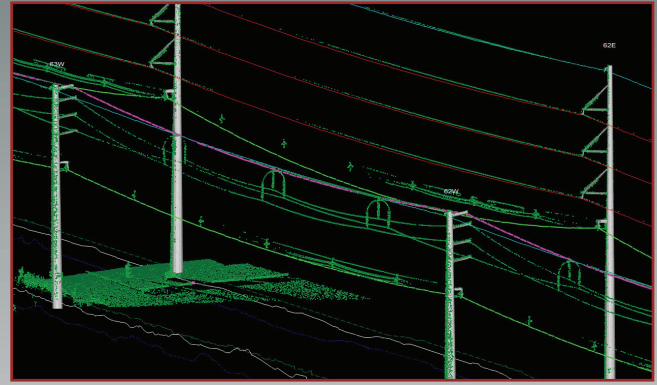
- Increased Reliability
- Improved SAIDI and SAIFI Indices
- Withstands Harsh Environments
- Multiple Circuits on a Single Pole
- Improved Voltage Reduction by 20%
- Unlimited Span Lengths



25-46kV
Distribution

69kV
Sub-Transmission

115kV and 138kV
Transmission



When you have the pressure to perform in emergencies or the need to keep the power flowing, you want a team with the experience, the expertise, and the empathy to find the right solution.

We will go the extra mile to ensure your system performs as intended, even after installation is complete.

69kV Hendrix Aerial Spacer Cable Systems

Part Number	Overall Dimensions (in)			Phase Spacing (in)				Minimum Leakage Distance (in)	Maximum Messenger Size (in)	Maximum System Voltage (kV)	Short Circuit Rating (kA)	Weight (lbs)
	Height	Width	Depth	AN	AC	BC	BN					
RTL-69DM-01	65.25	43.5	5	36.25	34.25	30	56.25	80	1.0	69	30*	21.4

*Calculated value for short circuit rating

115kV Hendrix Aerial Spacer Cable Systems

Part Number	Overall Dimensions (in)			Phase Spacing (in)				Minimum Leakage Distance (in)	Maximum Messenger Size (in)	Critical Impulse Flashover (kV)*		Power Frequency Flashover (kV)*		Weight (lbs)
	Height	Width	Depth	AB	AC	AN	BN			Positive	Negative	Dry	Wet	
RTL-115-XXX	92.7	78.1	7.7	45	71.3	88	64.5	109	1.0	763	753	468	407	87

*All testing performed line to ground on a spacer insulator with bare wire

138kV Hendrix Aerial Spacer Cable Systems

Part Number	Overall Dimensions (in)			Phase Spacing (in)				Minimum Leakage Distance (in)	Maximum Messenger Size (in)	Critical Impulse Flashover (kV)*		Power Frequency Flashover (kV)*		Weight (lbs)
	Height	Width	Depth	AB	AC	AN	BN			Positive	Negative	Dry	Wet	
RTL-138-XXX	92.7	78.1	7.7	45	71.3	88	64.5	109	1.0	763	753	468	407	87

*All testing performed line to ground on a spacer insulator with bare wire



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