



HENDRIX

Where Power Distribution Reliability Begins.



**15 kV Spacer
Cable System**



**69 kV Spacer
Cable System**

Spacer Cable was invented by Bill Hendrix in 1951. It is a messenger supported primary electrical distribution system using covered conductors in close triangular configuration. The system has the mechanical strength to weather severe storms and the electrical strength to prevent temporary faults due to phase to phase or phase to ground contact from tree branches or animals. It is also used in applications where its superior strength and compact configuration are beneficial such as substation exits, long spans, multiple circuit configurations and areas where Right-of-Way is a concern.

Hendrix provides a complete, coordinated Spacer Cable System. Dielectric compatibility, track resistance, surface charging currents, leakage distance, wash characteristics, ultraviolet protection, lightning protection, and numerous other factors are built into the design to insure electrical integrity and long life. Messengers, spacers and brackets work as a system to be self supporting and to provide superior protection from branches, trees and forces that bring down other overhead circuits during storms. Hendrix systems are designed for installation—brackets and installation equipment work together to make installation fast and easy.

Hendrix supports our Spacer Cable Systems with the most experienced engineering staff in the industry. Our custom designs for your projects will be supported by the knowledge gained from over a half century of experience. Selection of applications, system layout and design, training, onsite installation, and project management services are available. We also have a design guide, construction drawings, installation guide, and an installation video for your use. Our systems are backed up with factory stock of system accessories and installation equipment.

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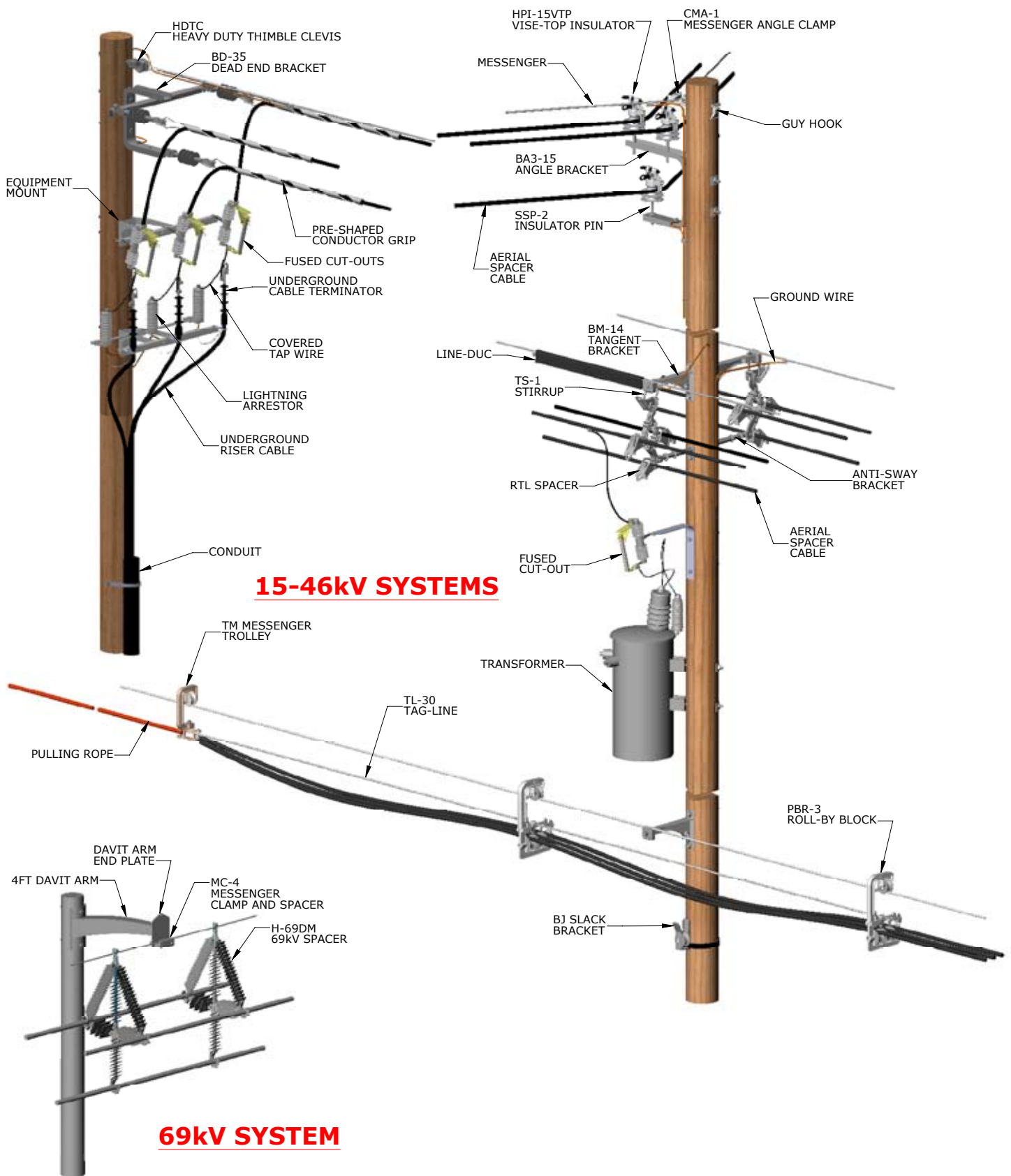
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HENDRIX SPACER CABLE SYSTEMS



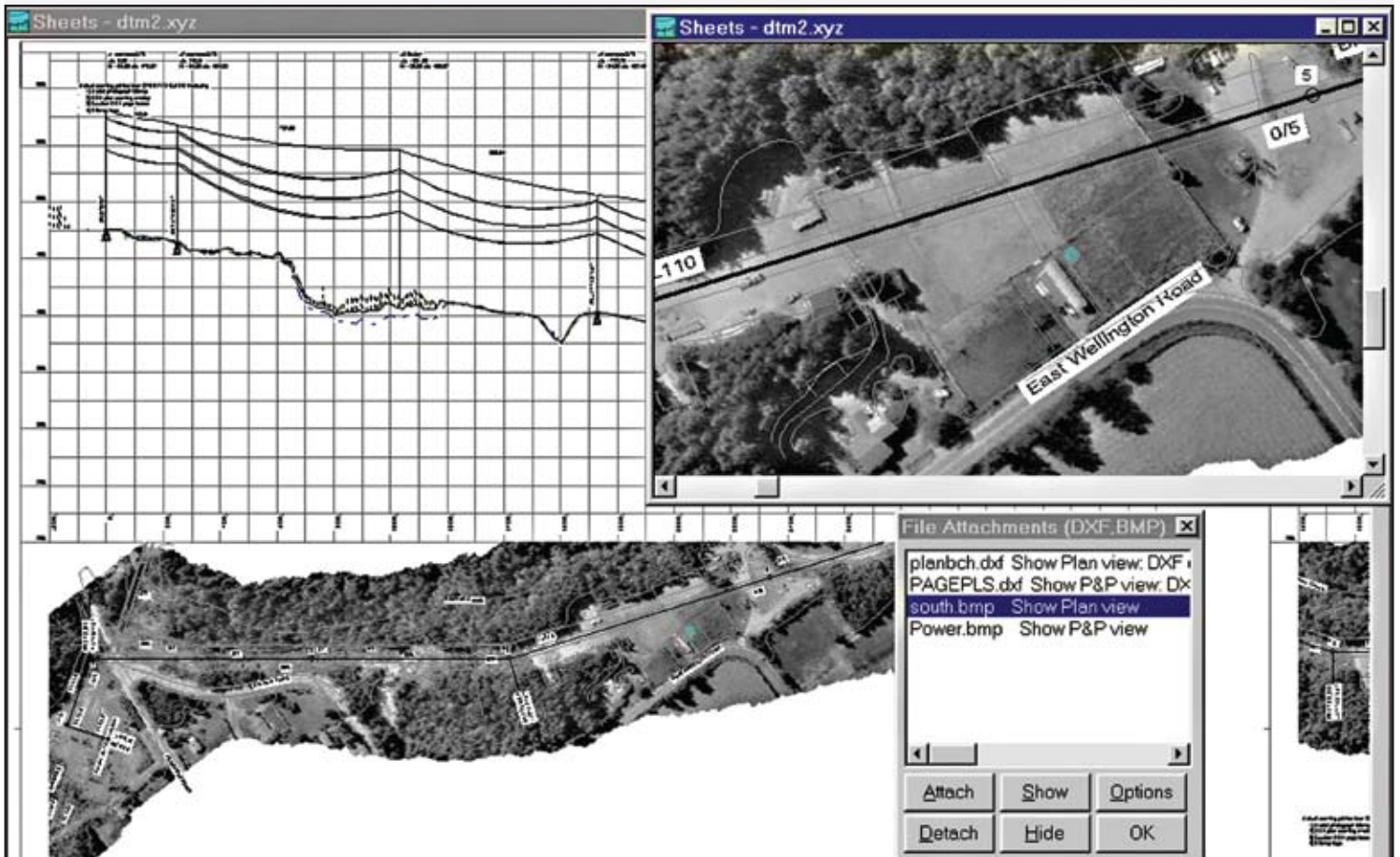


HENDRIX SPACER CABLE SYSTEMS

ENGINEERING AND MANAGEMENT SERVICES

Design, Training, Advisory Services, Project Support

Hendrix has been designing, manufacturing and installing Spacer Cable systems since 1951. Our Engineers are the most experienced in the industry. Whether you need a little support or a lot, we can assist you at a low cost -- and sometimes at no cost.



Design: Send Hendrix a staking sheet with capacity requirements and we will provide you with a complete Spacer Cable System design.

- Job layout
- Sag and Tension
- Guying requirements
- Bill of Material
- Construction drawings
- Ampacity/conductor sizing
- Pole loading calculations
- Grounding and arrester requirements
- Cost Estimates
- Installation equipment requirements

Free Designs for Job Estimating
Detailed Designs: \$125/hr

All fees are waived if the complete system is purchased from Hendrix

Contact Hendrix for free consultation on potential applications, current projects, or installed Spacer Cable Systems



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Training and Advisory Services: We will work with your planners, designers, line crews, or contractors- online, in the classroom, or in the field.

- Standards: Incorporate Spacer Cable into your standards. Our design guide, installation guide, and construction drawings make this process fast, simple and economical.
- System Design: Train your engineers how to design a system. Our design guide simplifies the process.
- Construction: Plan the job and demonstrate techniques that will make installation fast and easy. Our video, installation guide, and construction drawings support our onsite field Engineers.

Onsite: \$125/hr plus expenses (including travel time)

Online: \$125/hr

Ask about our first time user discounts

Project Support: We can support you through every phase of the project.

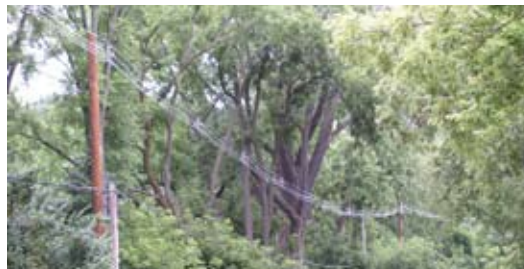
- Project Design and specifications
- Material and installation equipment
- Installation advisory services
- Quality Assurance and final Inspection

\$125/hr plus expenses (including travel time)

An extended one (1) year warranty is available on Spacer Cable Systems that have been final inspected and approved by a Hendrix Field Service Engineer



SOLUTIONS FOR THOSE "IMPOSSIBLE" CIRCUITS



AREAS WITH TREES



GETTING MORE POWER THROUGH EXISTING RIGHT-OF-WAYS



LOW COST SOLUTIONS FOR SUBSTATION EXITS



PRESERVING THE ENVIRONMENT AND PROTECTING WILDLIFE

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11/15/07



HENDRIX SPACER CABLE SYSTEMS

IDEAL FOR AREAS WITH TREES

- Resists storm damage
- Reduces outages
- Improves power quality
- Lowers tree trimming costs
- Improves aesthetics
- Greater public acceptance



REDUCED OUTAGES

- Messenger provides a high strength physical shield against falling branches and trees
- Cable covering reduces outages from phase to phase or phase to ground contacts—temporary tree contact does not cause outages
- Wildlife outages are minimized by cable covering
- Ideal for minimizing storm related outages



IMPROVED POWER QUALITY

Cable covering eliminates flickers and other momentary outages



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REDUCED TREE TRIMMING COSTS

- Compact configuration reduces the amount of area to be trimmed
- Flexibility to put the spacer cable bundle on either side of the pole allows you to avoid vegetation
- Ability to withstand temporary contact with branches allows you to extend tree trimming cycles
- Ability to withstand temporary contact with branches allows you to leave overhanging branches thus inhibiting regrowth and minimizing the amount of cutting

Cost savings of 50%-80% have been achieved

GREATER PUBLIC ACCEPTANCE

Improved aesthetics and the ability to leave the local vegetation in a more natural state has been shown to greatly increase public acceptance of new construction and maintenance activities.

Reduced tree trimming leaves a visually pleasing tree profile and allows the spacer cable system to blend into the vegetation

Lack of trenching activities associated with underground cable eliminates the visual “pathway” and the vegetation die off that occurs due to root damage




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HENDRIX SPACER CABLE SYSTEMS



PRESERVING THE ENVIRONMENT AND PROTECTING WILDLIFE

- Eliminates causes of wildlife electrocution
- Minimizes bird collision hazards
- Allows designers to avoid environmentally sensitive areas
- Minimizes the need for vegetation removal and trimming - provides CO₂ offsets
- Improves aesthetics



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HENDRIX SPACER CABLE SYSTEMS

Spacer Cable conductors are designed with a covering that limits the charge on the outside of the cable. Birds, squirrels, and other animals getting between the phase conductors or between the phase conductors and ground will not be subjected to lethal power levels. Additionally, in areas where the covering must be removed (taps) the system is designed to insure adequate distance between the conductor opening and ground points or other conductor openings.

Spacer Cable allows variable span length. Poles can be placed in the least disruptive areas when designing circuits through wetlands, over rivers, or in other environmentally sensitive areas. There is no need for the right-of-way clearing and trenching associated with underground cable or the disruptions normally associated with conventional bare wire systems.

Vegetation trimming can be greatly minimized since the cable can withstand temporary contact with branches or other ground points. System compactness, flexibility in location, and reduced clearance requirements, significantly reduce the amount of trimming needed and can extend the trim cycles.

Less vegetation removal and reduced clearances keeps foliage in a more natural state. The Spacer Cable system blends into the vegetation and is visually less intrusive than other systems.



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SPACER CABLE SYSTEMS

SOLUTIONS FOR THOSE “IMPOSSIBLE” JOBS ON YOUR ELECTRICAL DISTRIBUTION SYSTEM

Span lengths of up to 1600 feet have been achieved using Hendrix Spacer Cable. Crossing highways, rivers, gorges, wetlands, and other environmentally sensitive areas does not present a problem for the most versatile electrical distribution system on the market today.

- The high strength messenger supports the system and enables long spans
- Shorter poles may be needed because conductor sag is less than bare wire
- Covered conductors and spacers eliminate phase separation concerns
- System strength minimizes the potential for downed conductors in critical areas like road crossings or circuits over water.



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Upgrading circuits in **alleyways** can pose significant problems when using conventional open wire systems. Trenching or directional boring for underground circuits is often too expensive.

The compact configuration and versatility of Spacer Cable make it the ideal solution for reconductoring alleyways. The NESC allows reduced clearances between heavily covered conductors and buildings or other structures when required by local conditions.



Road widening projects present right-of-way challenges when relocating distribution circuits.

The compact configuration and the ability to build the spacer cable circuit on either side of the pole can eliminate these concerns.



Backlot bare wire service in older neighborhoods presents a public relations challenge--power quality deteriorates as back yard plantings interfere with the distribution lines and trimming is restricted by the residents for aesthetic reasons and access concerns.

Spacer Cable addresses all of these issues since it can withstand temporary contact with branches without "flickers" or outages. Aesthetics and access are improved since trimming can be less extensive and less frequent.



Reconductoring: Spacer Cable circuits can often be built under an existing energized circuit, saving time and money while providing continual service. The original circuit can be left in service or a double Spacer Cable circuit can be installed.



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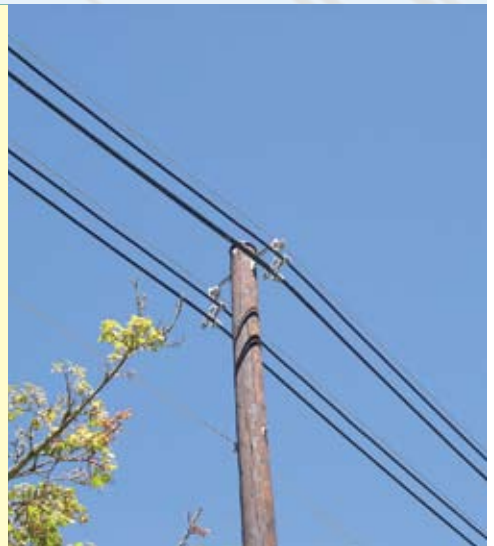
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SPACER CABLE SYSTEMS

Multiple Circuits
Under Builds
Over Builds
Less Voltage Drop

GETTING MORE POWER THROUGH YOUR
EXISTING RIGHT-OF-WAY

System strength and close phase spacing facilitates putting multiple circuits on a single pole. Up to eight three phase circuits have been successfully installed. Multiple circuits greatly increase the amount of power that can be delivered through a right of way corridor thereby satisfying demands for more power and eliminating public resistance to new or wider right of way.



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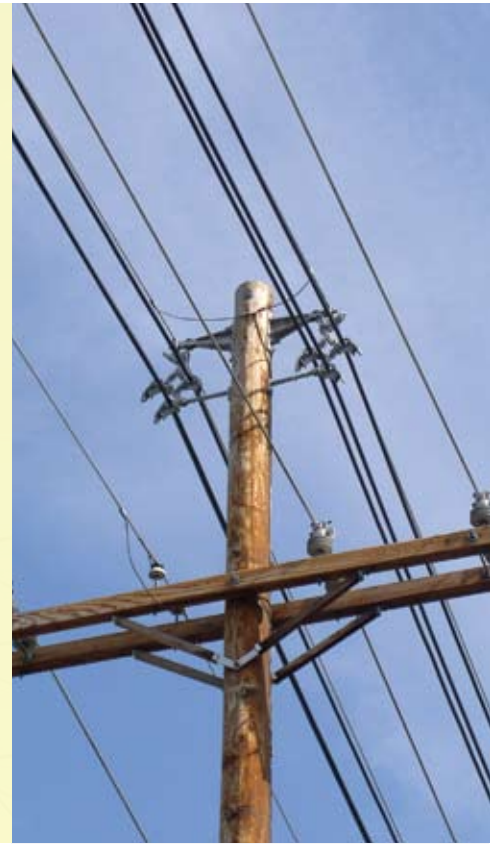
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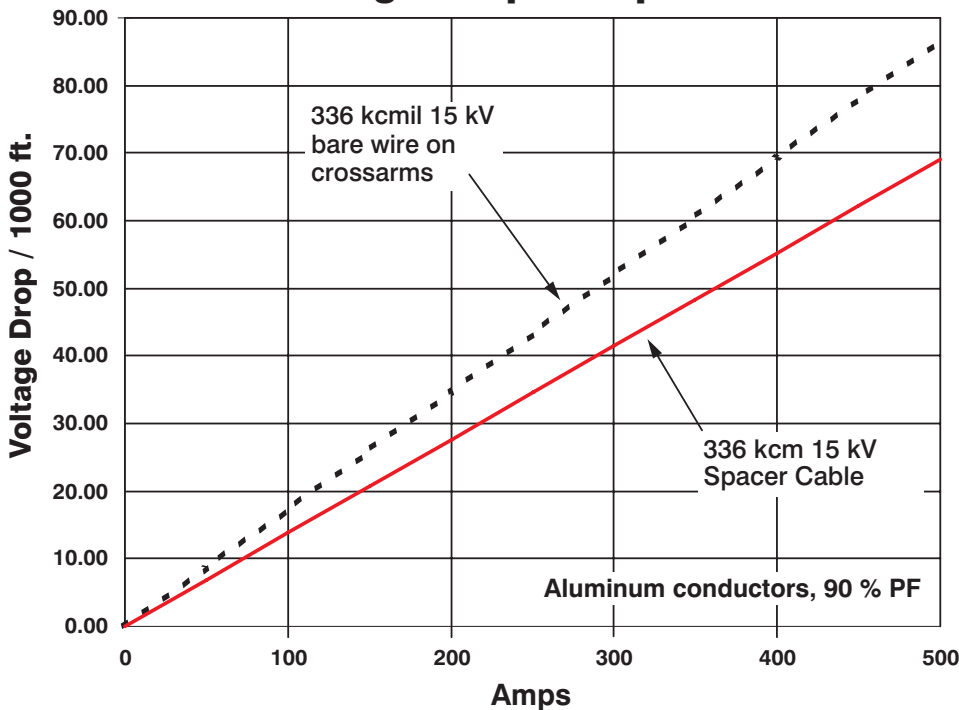
HENDRIX SPACER CABLE SYSTEMS

The compact Spacer Cable configuration and reduced sag often make it possible to over or under build existing circuits without changing out the poles.

The strength of Spacer Cable allows easy transmission line under builds without the need for intermediate poles.



Voltage Drop Comparison



The close spacing of the individual phase conductors results in lower total line impedance and reduced voltage drop.

On long runs the voltage improvement can eliminate the need for capacitors or other expensive voltage improvement equipment. Spacer Cable also can reduce the need for large conductors on very long, voltage limited feeders.

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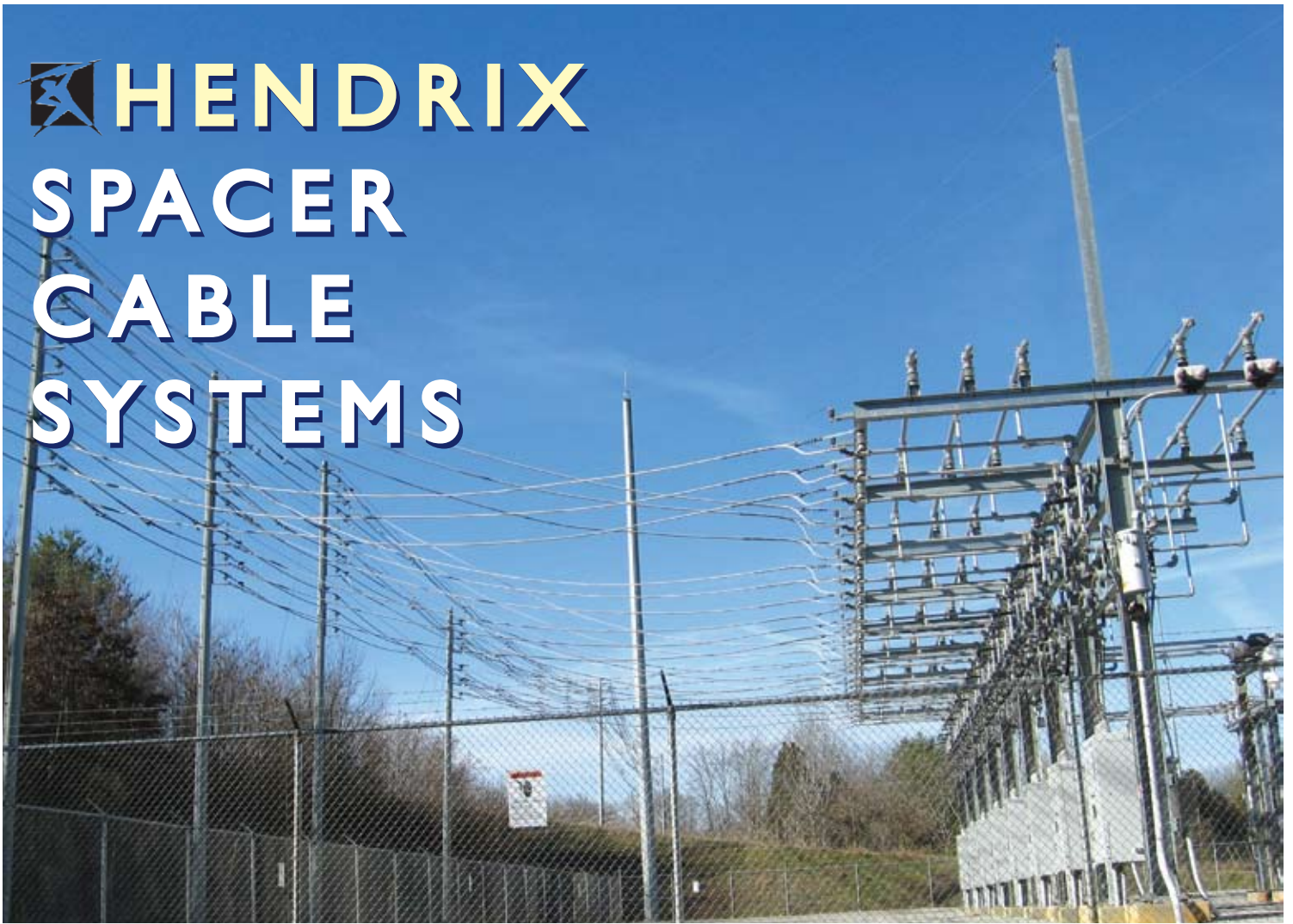
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SPACER CABLE SYSTEMS



LOW COST SOLUTIONS FOR SUBSTATION EXITS

Detailed cost estimates have shown
Spacer Cable to be 40-50% less costly than
Underground Cable

- Allows direct connection to the substation bus
- Eliminates cost and disruptions associated with trenching for installing underground circuits
- Eliminates the need for riser poles and stress relief when transitioning to overhead systems outside of the substation
- Eliminates soil heating problems -- no need for heat absorbing sands
- Eliminates ampacity derating of underground circuits in ducts



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ELECTRICAL CLEARANCE AND RELIABILITY ISSUES COMMON WITH BARE WIRE AT SUBSTATIONS ARE ADDRESSED WITH HENDRIX SPACER CABLE SYSTEMS



- Reduced spacing between conductors and reduced clearance requirements allow efficient use of limited space in substations
- The ability to put multiple circuits on a pole reduces right of way requirements at substation exits and along the distribution line where multiple circuits are required
- The cable covering and the superior mechanical strength of the Hendrix Spacer Cable System provide increased reliability on the critical feeder circuits at substation exits

Substation exits using Hendrix Spacer Cable Systems can often be completed at a lower cost than the bare wire alternative

- Less poles and hardware
- Reduced right of way requirements

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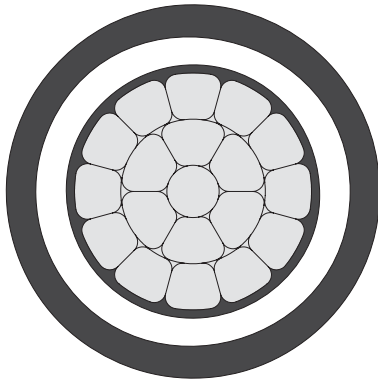
69kV Transmission Spacer Cable System

Description:

The Hendrix 69kV Transmission Spacer Cable System was developed to provide solutions to utility and industrial problems such as limitations on right of way, tree trimming and electrical clearance to buildings and structures. This unique system utilizes a messenger and polyethylene spacers to support heavily covered conductors in a close, triangular configuration. Like lower voltage Hendrix Spacer Cable Systems, 69kV systems have the mechanical strength to weather severe storms and the electrical strength to prevent faults due to phase to ground or phase to phase contact. All 69kV spacer cable circuits are custom-designed by Hendrix to meet customer requirements.

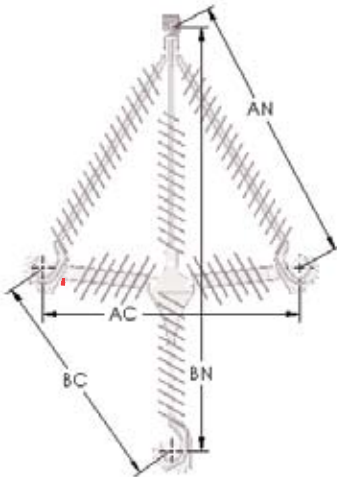


Conductors:

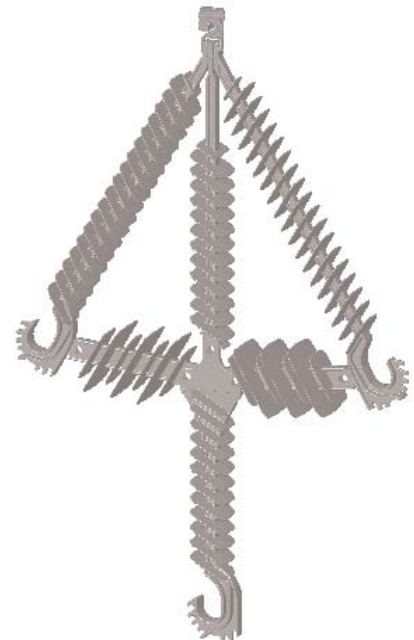


- .020" black, semi-conducting conductor shield
- .250" natural low density polyethylene for high dielectric strength and strippability
- .250" outer layer of proprietary, black or gray, high density polyethylene for resistance to tracking, abrasion and ultraviolet degradation
- Compact stranded 1350-H19 All Aluminum Conductors
- Hendrix will provide a design to meet a utility's electrical load requirements

Spacers:



- Supports conductors and maintains phase spacing
- Proprietary, gray, track resistant, high density polyethylene
- Provides high strength and flexibility under dynamic loading
- Ultraviolet resistance has been proven for 30 years
- Track resistant compound does not support current flow on the surface
- Long leakage distance and self washing shed design allow operation even with contamination
- Highly resistant to shock, impact and rifle fire
- Spacers are installed at 30 foot intervals



Catalog Number	Dimension (inches)				Minimum Leakage Distance (in)	Max. Messenger Diameter (in)	Max. Conductor Diameter (in)	Short Circuit Rating (kA)*	Weight (lbs)
	BN	AN	BC	AC					
H-69DM	56 ³ / ₈	36 ¹ / ₄	30	34 ¹ / ₄	80	.750	2.25	30	13.3

*Contact Hendrix if project requires a higher rating.

continued

69kV Transmission Spacer Cable System

Benefits:

The 69kV spacer cable system is a further extension of Hendrix' many years of experience and expertise (since 1951) in the design and manufacture of spacer cable systems. Developed in 1995, the 69kV system has been installed and tested in the field and laboratory. The operating and test results have been excellent, and they confirm the viability of the system and its components. Ideal for utility and industrial projects, the system offers the following benefits:

- Compact design provides solutions in congested areas
- Reduced Right of Way costs
- Reduced tree trimming costs
- Reduced outage repair costs, lost revenue, customer complaints
- Reduced electrical clearance requirements to buildings and structures
- Improved service reliability in heavily treed and contaminated areas
- Unique spacer design provides high system short circuit rating
- Close, triangular configuration minimizes voltage drop
- Easy to install using Hendrix installation equipment and "Roll-By" method



The application of spacer cable on 69kV circuits requires close attention to circuit design and installation. Accordingly, Hendrix engineers work closely with each prospective customer at the project planning stage and at every stage of the design/build process in order to assure a thoroughly satisfactory result.

At no charge, Hendrix application engineers provide recommended circuit designs, bills of material and cost estimates at the project planning and design stages. Also at no charge, Hendrix customer service engineers furnish jobsite training and advisory services prior to and during installation of the system.

On page 1-7 of this catalog, Hendrix design and installation services are described more fully. Please contact your Hendrix sales representative to request engineering assistance on 69kV projects.

