Southwire®

ELECTRICAL GRID
RELIABILITY & RESILIENCY
CATALOG







SOUTHWIRE.COM

OUR STORY

Roy Richards, Sr. founded a small construction company in 1937 to erect power poles. Only two and half years later, the company had strung 3,500 miles of cable. In 1950, Mr. Richards went on to start a small, family-owned operation to manufacture electrical wire and cable. Southwire Company opened with only twelve employees, and within the first two years it had shipped 5 million pounds of wire for the transmission and distribution of electricity. Since that time, Southwire has become one of the world's leading manufacturers of wire and cable and an emerging influence in the industrial electrical space. With more than 7,000 employees, the company serves customers in a wide variety of markets across the globe and has introduced many industry-changing innovations like the SCR® continuous casting process, SIM*pull* Solutions® Innovations, and many more.

SOUTHWIRE, THE COMPANY

Southwire Company, LLC is North America's leading manufacturer of electrical wire and cable. Nearly one in two new homes built in the United States contains our wire, and we produce half of the cable used to transmit and distribute electricity throughout the nation. More than half of the world's refined copper passes through one of our SCR® systems, our tools & equipment business continues to grow, and our wire plays a key role in the manufacturing of other products including automotive wiring harnesses.

THE PRODUCTS

To be successful requires products that give you solutions no matter what stage of the project cycle you are in. Our product teams and dedicated resources work together to listen to and work with our customers, creating solutions that deliver unparalleled value through product innovation, safety, and efficiency.

THE SERVICE

Service is more than a word or a phone number; it's a tangible support system that assists you through the entire project cycle. Starting with our own knowledgeable customer service team, to our CableTechSupport™engineering team, whether in the office or in the field, we're there to lend a hand when you need it most.

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INTRODUCTION

Our aging energy infrastructure is seeing stress like never before. A large portion of our electrical transmission and distribution grid was built in the 1950s and 1960s. Many things were different then. The Korean War was raging, rock-n-roll was in its infancy, and John F. Kennedy was just beginning his political career. The population was smaller and the demand on the grid wasn't as high, superstorms were predicted to hit only every century or so, and the Baby Boomer population was just entering the workforce.

A lot has changed since the 1950s and 1960s. The population of the United States has nearly doubled from 160,000,000 to 331,000,000. Superstorms are occurring more frequently and with more severity, and the Baby Boomer population is retiring causing the workforce to drastically reduce. But, one thing hasn't changed, the majority of the same power lines that were installed 60 years ago are still in service today. The problem? These lines were not designed for the requirements of the world today.

These changes are putting a toll on the existing infrastructure. More people means more demand for electricity. As the load increases on an aging power grid, systems often fail leading to blackouts. For a society that depends on electricity, even short blackouts can prove deadly. To increase the reliability of the aging power grid, utilities must reconductor existing lines or install new lines that can carry more electrical load.

As storms increase in frequency and severity, transmission lines are more likely to fail in a significant weather event. Lines from the 1950s and 1960s were not designed for the types of winds and ice that are occurring in the current environment. To increase the resiliency of power lines, many utilities are assessing the feasibility of moving their transmission and distribution lines underground. While this may be an ideal solution against ice and wind, the cost of burying lines is often excessive. An alternative to burying lines is reconductoring existing overhead lines with stronger, more resilient products meant to withstand the storms.

Utilities are also facing the challenge of vandalism. As the price of copper increases, substations are being attacked by copper thieves. According to one study by the Electrical Safety Foundation International, U.S. utilities incur 450,000 minutes of outages and $60 million in losses annually as the result of copper theft. Criminals steal copper wires to sell on the scrap-metal market, often vandalizing substations, transformers, poles, and other equipment. Besides triggering outages and necessitating equipment replacement and repair, these thefts endanger public safety by disrupting power delivery to hospitals and traffic lights.

These challenges can seem daunting, but Southwire is here to help with a variety of products and services designed to help utilities face each challenge head on. The following pages provide an overview of our Electrical System Reliability and Resiliency Solutions.

To learn more about how Southwire can help with your unique situation, contact your local Southwire sale representative today.

STRESS ON THE ELECTRICAL GRID

INCREASING FREQUENCY AND SEVERITY OF WEATHER EVENTS

According to NOAA, since 1980, the U.S. has had 310 weather and climate disasters where the damage has been $1 billion or more, a cumulative cost of $2.12 trillion

AGING INFRASTRUCTURE

In its 2021 infrastructure report card, the American Society of Civil Engineers (ASCE) gave the nation's power grid a C-. The reason? The majority of electric transmission and distribution lines were built in the 1950s and 1960s with an expected lifetime of 50 years.

COPPER THEFT

According to one study by the Electrical Safety Foundation International, U.S. utilities incur 450,000 minutes of outages and $60 million in losses annually as the result of copper theft.

SEVERE WEATHER EVENT SOLUTIONS

INCREASING FREQUENCY AND SEVERITY OF WEATHER EVENTS

According to NOAA, since 1980, the U.S. has had 310 weather and climate disasters where the damage has been $1 billion or more, a cumulative cost of $2.12 trillion.

While the damage caused by hurricanes, tornadoes, ice storms, and fires understandably grabbed headlines, the truth is that storms cause significant damage – especially extended blackouts. That is why it is important to meticulously prepare for storms in advance and respond quickly and effectively after the storm hits.

Speed is everything when it comes to storm response. Though there is some debate about the likelihood of a months-long or even years-long power outage, the worst-case scenarios are certainly troubling. The head of a Congressional advisory board testified in 2015 that an extended and expansive blackout could result in the death of 9 out of 10 Americans as the result of “starvation, disease, and societal collapse.” Even relatively short blackouts are severe, particularly for sick and elderly people who rely on oxygen or live in areas of the country where access to air conditioning can be a matter of life or death.

There is no one magic recipe to help utilities respond swiftly and effectively to storm damage. Hardening and resiliency efforts are instead dictated by geography, economics, and legislative and regulatory demands. That is why Southwire has a variety of options to help you prepare.

SEVERE WEATHER EVENT SOLUTIONS

HOW WE CAN HELP : OUR SERVICES

STORM ACTIVATION TEAM

"Utilities want a long-term, proactive partner capable of doing far more than providing the equipment needed to repair storm damage."

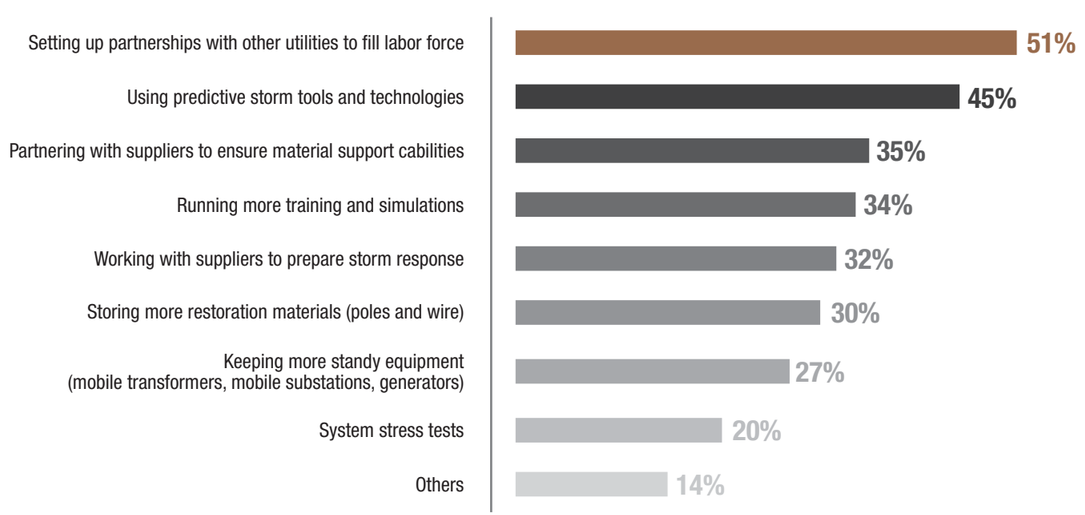
A study conducted in partnership with Utility Dive, asked leading utilities what actions they are taking on the front end of the storm season to increase the speed of post-storm response. As you can see from the results, over 50% of respondents emphasized the need to set up partnerships with other utilities to fill their labor force, but, it's important to remember that a large workforce can do little without adequate supplies. Which is why 35% of respondents mentioned partnerships with suppliers as being important to ensure that they have the materials they need to respond to storm damage fast.

These partnerships with suppliers can be especially advantageous when an equipment supplier is able to respond to specific utility needs within 24 hours by transitioning its regular manufacturing to a storm response mode. The importance of partnerships with suppliers was also shown in the 32% of respondents who mentioned working with suppliers in advance to prepare their storm response.

Utilities need to know that the suppliers they work with have experience, are adept at advanced planning, are flexible, and communicate effectively. Storms are stressful for everyone. Coordinating with suppliers before, during, and after a storm can alleviate some of that stress.

The Southwire Storm Activation Team is the answer. The Storm Activation team works tirelessly year-round with utilities and partners to track and anticipate the impact of extreme weather events. Knowing we are always a few weeks away from our next big challenge, Southwire has the scale and reach to help across the entire country before, during, and after major storm events.

WHAT ACTIONS ARE *YOU* TAKING ON THE FRONT END OF STORM SEASON TO INCREASE THE SPEED OF YOUR POST-STORM RESPONSE?



DEDICATED TEAM

Our Storm team is available 24/7/365 to help in advance of, and during, major storm events.

EXPERIENCE

It takes more than equipment and material alone to address storm damage. Over the years our team has helped provide support during storms across the country and knows how to address their impacts, both large and small.

COMMUNICATION

Without proper communication between utilities, suppliers, customers, and regulators, storm response can be unnecessarily delayed. Proactive and effective communications are an essential part of our preparedness.

DIGITAL STORM ANALYSIS SOLUTION

Our storm analysis solutions helps validate and analyze storm events including hourly storm progression, restoration timings, hardest impacted customers and circuits, cause analysis and validation, etc. by leveraging information from OMS, CIS and GIS for storm analysis and validation.

INNOVATION

Researching and developing innovative products is in our DNA. Hardening systems is a way to proactively address the damage storms can unleash.

To learn more about our storm response, visit
www.southwire.com/services/storm-activation-team

Articles

https://www.tdworld.com/resources/white-papers/whitepaper/20971506/a-proactive-approach-to-storm-preparation
https://www.tdworld.com/substations/article/20970724/storm-response-team-recounts-challenges-from-hurricane-harvey-and-Irma
https://www.tdworld.com/overhead-distribution/article/20960274/southwire-helped-to-restore-power-along-the-gulf-coast
https://www.tdworld.com/overhead-distribution/article/20970492/hurricane-restoration-begins-with-support

SEVERE WEATHER EVENT SOLUTIONS

DIGITAL SOLUTIONS

Southwire offers Grid Resilience Digital Solutions that analyze, support, and validate your current reliability initiatives by leveraging your existing outage and GIS data. A **Findings and Recommendation Analysis** is provided to you to help you identify circuit reliability issues and prioritize equipment replacement and maintenance needs. With an evaluation subscription to our **Grid Resiliency Assessment**, utilities will have the opportunity to access the following user-applications.

Vegetation Optimization

- Identifies Asset at Risk from external factors such as vegetation and weather
- Places a Probability of Failure based on multiple criteria
- Establishes a priority based on probability and impact
- Generates a Work Plan to be executed
- Supports ongoing analysis as improvements are made

Grid Modernization

- Recommends equipment upgrades or replacements based on cost savings, number of failures, and reliability improvements
- As actions are taken, results are measured
- Users configure how they measure replacement criteria such number of failures, minutes of interruption, and causes
- Assets include wire, protection devices, and transformers
- Generates a Work Plan to be executed

Asset Performance Analysis

- Asset health and ranking is established by asset risk & criticality
- Measures the health of your network on an ongoing basis
- System supports O&M and CAPEX budgeting with expected improvements based on actions planned
- Generates a Work Plan for execution by WMS

Reliability Results

- Provides IEEE 1366 reporting with advanced circuit analysis
- Performance indices measured from the circuit to the device
- Analysis provided by organization, time, failure, and cause
- SAIDI, SAIFI, and CMI calculations are embedded throughout modules

Data Integrity & Connectivity Model

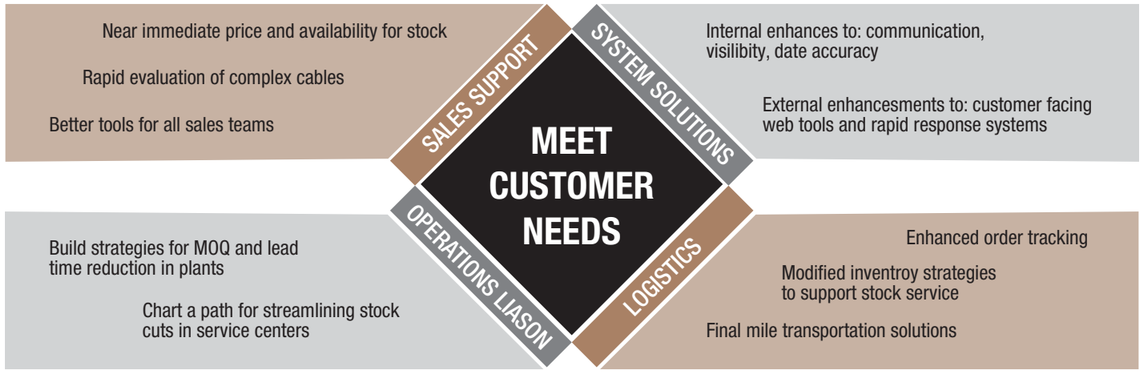
- Ensures data quality & completeness for accurate decision making
- Identifies where data issues need to be corrected at the source level
- Connectivity Model spatially constructs protection zones, and customers affected for accurate impact

For more information, visit **southwire.com** or contact OBI@southwire.com

SOUTHWIRE SPEED™ SERVICES

Need cable quickly? Southwire SPEED™ Services was created for situations like this. Southwire SPEED™ Services has been meeting critical deadlines since 2016. Our concierge customer specialist will work with you and your distributor to meet your needs for an expedited product that comes from one provider. We will support your projects with our expertise as North America's largest wire and cable solution provider.

Using Southwire SPEED™ Services allows for shorter lead times upon request and express shipment options for stock items to meet deadlines and get your project back on track. With a flexible minimum order quantity, Southwire can also produce short lengths of cable that fit non-standard constructions.



MANUFACTURING SERVICES

- LOWER MINIMUM ORDER QUANTITIES
- REDUCED LEAD TIMES
- CREATIVE SOLUTIONS FOR CUSTOM SPECIFICATIONS
- DEDICATED TEAM SUPPORTING ALL YOUR PROJECTS

STOCK SERVICES

- SAME DAY AND NEXT DAY SHIPPING
- MANAGED EXPEDITED DELIVERY REQUIREMENTS
- CUT-TO-LENGTH SERVICE
- REAL TIME PRICING & AVAILABILITY

PRODUCT CATEGORIES

- UTILITY MV
- SUBSTATION CONTROL SPECIALS
- BARE AL OVERHEAD
- 600V UD SERVICE DROP
- CABLE-IN-CONDUIT (CIC)
- BARE COPPER
- INSTRUMENTATION
- SUBSTATION CONTROL
- STANDARD 600V U&D SERVICE DROP
- COVERED COPPER

For more information visit **southwire.com/services/speed-services**

SEVERE WEATHER EVENT SOLUTIONS

HOW WE CAN HELP : OUR PRODUCTS

Some utilities are opting to go underground when upgrading their transmission and distribution powerlines, but for many underground cabling isn't a cost-effective option. Reconductoring current overhead lines with more weather resistant cables may be the best option.

Whether you choose overhead or underground cables to upgrade your system, Southwire has an option for you.

In addition to our full line of traditional transmission and distribution products, Southwire has several innovative products designed to help withstand the storm.

OVERHEAD TRANSMISSION AND DISTRIBUTION PRODUCTS

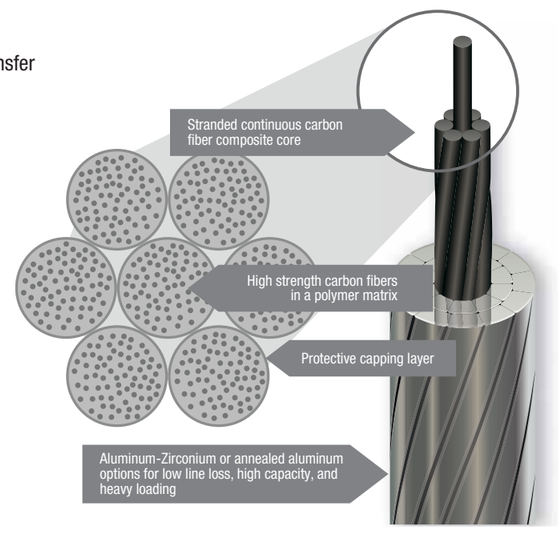
C7® OVERHEAD CONDUCTOR

INNOVATION STARTS AT THE CORE

Southwire is revolutionizing the industry with its innovative C7® overhead conductor. With its unique stranded construction, Southwire's C7® overhead conductor is the most durable, rugged, and reliable composite core conductor on the market - and the only composite core conductor developed by a conductor manufacturer with full knowledge of utility needs and practices.

FEATURES:

- **Minimal Thermal Expansion** – minimal sag increase at high power transfer
- **Stranded Core** – no single point of failure
- **Flexible** – robust, installs like traditional conductor
- **Less Sag** – for lines with clearance or structure limitations
- **Easy Installation** – uses traditional methods and familiar hardware
- **Designs for All Loading Conditions** – light loading to heavy ice loading
- **Trapezoidal Wire (TW) or Round Wire Available**
- **Aluminum-Zirconium (Al-Zr) or O-Temper Aluminum Available**



APPLICATIONS:

New Lines: Reduce new line costs by saving on structures and foundations. Cross challenging terrain or reduce the visual profile in sensitive areas. Build for the future with high capacity, low sag lines.

Reconductoring: Double the capacity of existing ACSR lines. Light conductor weight and low sag allow use of existing structures and ROW, even for lines previously designed with all-aluminum or aluminum alloy (AAC, AAAC, ACAR) conductors.

ADVANTAGES:

Proven Robust Materials
- Matrix materials have been used in demanding environments for over 50 years
- Resists harsh chemicals, high-temperature, and corrosion
- Resistant to abrasion and high-tension fatigue

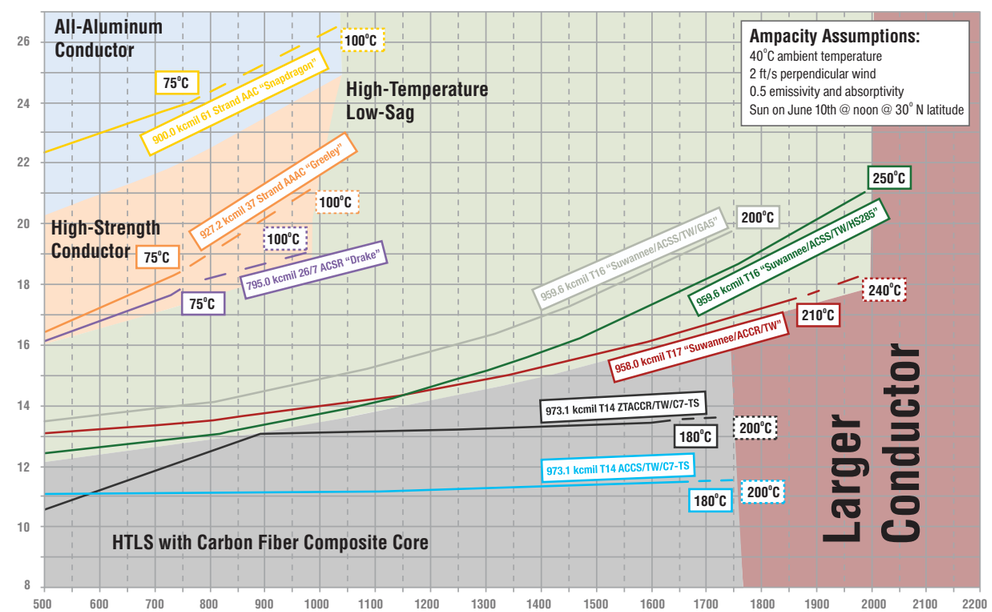
Stranded Core
- Multi-strand, NO single-point of failure like single-rod designs
- More flexible than single-rod core designs
- Increased tolerance for bending

Increase Capacity
- Double the capacity of same-diameter ACSR round-wire conductor
- 180°C continuous, 200/225°C (thermoset/thermoplastic) emergency ratings are material property based
- No losses due to core magnetization

Low Sag
- Minimal sag increase at high temperature
- For lines with clearance or structure limitations
- Reduce land requirements, structure size and height, and foundation costs
- Overcome objections to high-visual-profile lines
- Capacity for future system rating increases without sag increase consideration

Suitable for Extreme Weather Loading
- Al-Zr option bolsters carbon fiber to carry heavy ice and wind loads with low sag

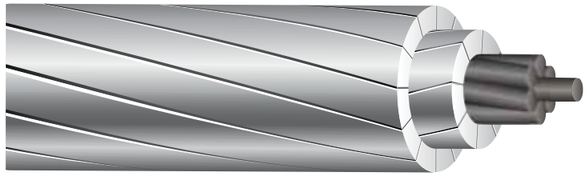
Conventional Installation & Inspection
- Uses standard work practices and traditional hardware
- Same stringing blocks and installation equipment as ACSS



For technical information on our C7® overhead conductor, visit **www.southwire.com/industries/utility/system-hardening**

SEVERE WEATHER EVENT SOLUTIONS

MAXSTORM™ OVERHEAD CONDUCTOR



Designing conductors to withstand heavy ice and wind loads has always been a requirement, but, with extreme weather conditions wreaking havoc across the world, extreme weather conditions are a growing concern for utilities.

In areas such as the extreme north, coastal regions, and water crossings, ice buildup can exceed 1" in thickness. These conditions cause extreme strain on transmission lines resulting in increased sag and tension. To accommodate for the increased sag, transmission towers must be built taller to ensure a safe electrical clearance is maintained between grounded objects and conductors. Taller towers mean higher costs to utilities.

Extreme wind conditions, such as tornadoes and hurricanes, also cause tremendous strain on transmission lines. In recent years, hurricanes, such as Katrina and Maria, have highlighted the humanitarian crises that prolonged power outages can cause and have prompted utilities to put a more intense focus on grid resiliency, which is a combination of storm hardening and better recovery planning.

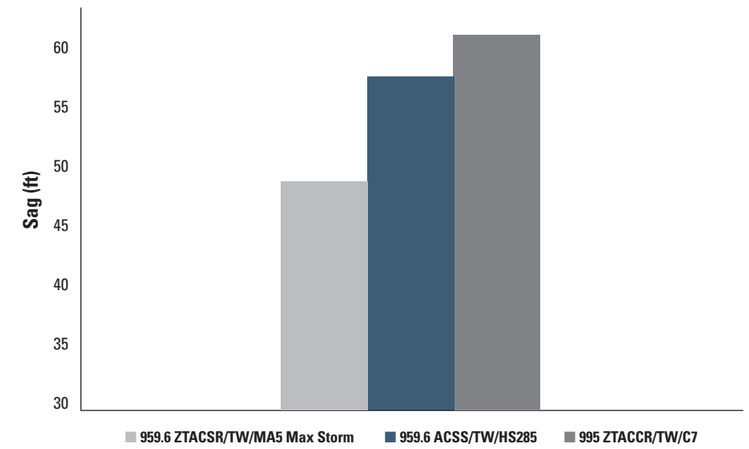
Southwire's MaxStorm overhead conductors are utilities' answer to extreme weather conditions. At half the size of the same capacity ACSR conductors, MaxStorm overhead conductors accumulate less ice buildup, resulting in less sag and less weight on transmission towers. The higher aluminum packing factor reduces the sail area which results in less wind load on transmission lines. Made with high-temperature-tolerant ZTAL aluminum zirconium alloy, an ultra-high strength (UHS) steel core, and mischmetal alloy coating, these conductors are able to withstand higher stringing tensions, extreme heat, and provide the best available corrosion protection. The UHS steel core and strong aluminum alloy result in minimum elongation during extreme load events. This allows for increased electrical clearances and greater safety margins.

BENEFITS:

- **Thermal Ratings:** 210˚C continuous and 240˚C emergency allows for greater capacity than standard ACSR.
- **Smaller Conductor Size:** MaxStorm overhead conductors are half the size of the same capacity ACSR conductors, resulting in less ice buildup, less sag, and less weight on the towers. The higher aluminum packing factor reduces the sail area for reduced wind load
- **Same Repair Hardware as ACSS:** ACSS hardware and fittings are used for the MaxStorm overhead conductor.
- **Reduced Tower Height:** Tower height and cost can be reduced as a result of MaxStorm overhead conductors carrying less ice weight or wind load, having less conductor tension, and less load sag than traditional overhead conductors.

For more information on Southwire MaxStorm overhead conductor, visit
www.southwire.com/industries/utility/system-hardening

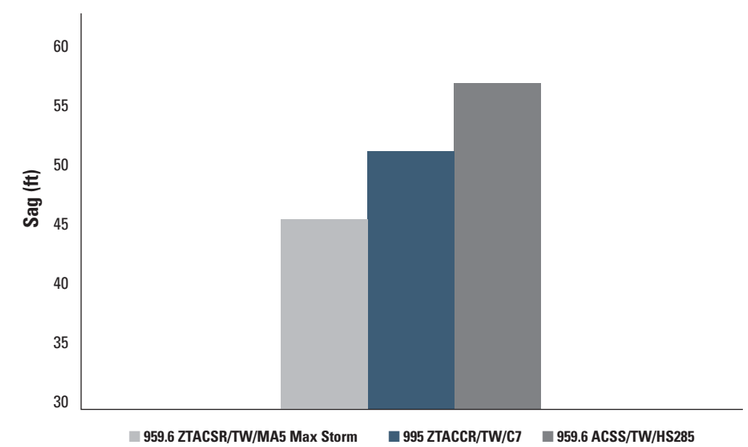
SAG COMPARISON UNDER NESC +2" HEAVY ICE LOAD – 1200 FT SPAN



CALCULATIONS BASED UPON:

- 1200 ft span
- NESC "Heavy" loading district
- 40 °C ambient, 2 ft/sec wind
- 30 deg N lat
- 0.5 emissivity and absorptivity
- June 11, noon
- 2012 NESC
- Southwire Certified Data (where applicable)

BLOW-OUT COMPARISON UNDER 300 MPH WIND LOADS – 800 FT SPAN



CALCULATIONS BASED UPON:

- 800 ft span
- NESC "Light" loading district plus Hurricane wind at 60 °F
- 2012 NESC tension limits plus 80% RBS @ hurricane wind
- Southwire Certified Data (where applicable)

ACSS/HS285® OVERHEAD CONDUCTOR

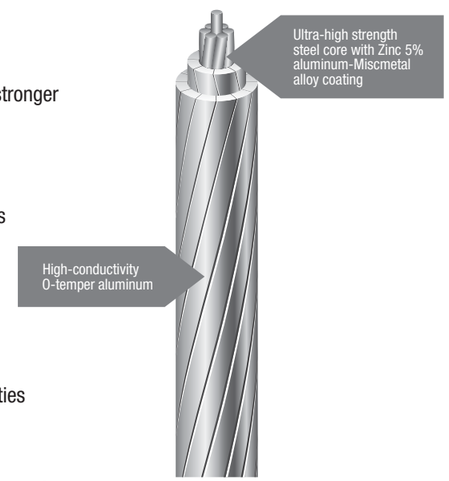
THE INDUSTRY STANDARD THAT'S ANYTHING BUT STANDARD

ACSS/HS285 overhead conductor is the most popular high temperature low sag (HTLS) conductor in use today because of its versatility and strength. The multipurpose conductor is up to 21 percent stronger than standard ACSS, reducing sag while allowing for additional line capacity. Developed at Southwire's D.B. Cofer Technology Center, ACSS/HS285 conductor has been proven in the field for capacity up to 95 percent higher than ACSR, lowering reconductoring costs and, it can be strung tighter to operate with more clearance at higher temperatures. It also allows for easy installation using existing rights of way, structures, and methods.

In ACSS conductors, the weight of the wire is taken almost entirely by the steel core. Sag is determined by the low expansion rate of steel, rather than the high expansion rate of aluminum. That allows higher operating temperatures – and more capacity. ACSS can operate continuously at temperatures up to 250°C without loss of strength. For the same conductor size and weight, an ACSS solution can give substantial increases over ACSR without significant changes in structure or line design, sometimes exceeding 100 percent more power than ACSR with the same sag.

STRENGTH COMPARISON OF STEEL CORES

- A typical steel core in a standard ACSR cable has a tensile strength of about 210 ksi
- A traditional "high-strength" core delivers a tensile strength of about 235 ksi
- ACSS/HS285 conductor steel core can stand up to 285 ksi before failure, 21 percent stronger than the usual "high-strength" core, and 36 percent stronger than a standard core



BENEFITS:

- ACSS/HS285® conductor provides higher line capacity and lower reconductoring costs
- Can be strung tighter with less sag, allowing for a 60 to 95% increase in current-carrying capacity
- Proven in the field for immediate and contingency capacity
- Easy installation using the same products and accessories as ACSS
- Simple reconductoring using existing rights of way, no changes to structures and familiar methods
- Increased line design options due to superior strength and improved corrosion properties

APPLICATIONS:

New lines: Reduce new line costs by saving on structure and foundation costs. Build for the future with higher system ratings while maintaining line clearances. Increase your line capacity with lower line losses and a lower cost premium.

Reconductoring: Double the capacity of existing ACSR lines. ACSS/HS285® conductor can be strung tighter for more clearance at higher temperatures. It also allows for easy installation using existing rights of way, structures and methods.

Construction: ACSS is a composite concentric-lay-stranded conductor. Steel strands form the central core of the conductor with one or more layers of 63% minimum average conductivity aluminum 1350-0 wire stranded around it. The steel core carries most or all of the mechanical load of the conductor due to the "0" (fully annealed or soft) temper aluminum. Ultra-high-strength steel core wires are protected from corrosion by Galfan®, zinc-5% aluminum-mischmetal alloy coating.

Learn more about Southwire's ACSS/HS285® Overhead Conductor visit:
www.southwire.com/industries/utility/system-hardening

SEVERE WEATHER EVENT SOLUTIONS

VR2® OVERHEAD CONDUCTOR

Our twisted pair conductor design provides vibration and galloping resistance without the schedule delays associated with bagging problems during installation. VR2 conductor is one of the easiest installing dual-conductor cable constructions on the market.

BENEFITS:

DECREASE LABOR ASSOCIATED WITH BAGGING PROBLEMS

- The patented VR2 conductor design eliminates conductor separation and bagging by limiting relative movement between conductors
- Reduce the labor costs required to bump loops and bags out of installed conductors
- VR2 conductor uses the same installation and mounting hardware as traditional dual-conductor cables

GET THE PERFORMANCE YOU EXPECT, AND MORE

- Available in transmission and distribution sizes with industry-leading lengths to squeeze install costs
- Field studies and computer modeling shows VR2 conductor delivers equal to or better resistance to aeolian vibration and ice galloping than traditional dual-conductor constructions
- Advanced dynamic analysis measured drag force, lift force, moment load, and vortex-shedding frequency at multiple wind angles
- Sag calculations for standard conductors work for VR2 overhead conductor
- VR2 overhead conductor helps you bring your dual-conductor project in on schedule and within budget

CONSTRUCTION:

VR2 conductor is composed of two identical bare conductors twisted together in a figure 8 spiral shape. This spiral shape disrupts the wind forces that cause cable vibration. Torsional and bending characteristics also reduce or eliminate cable galloping due to ice and wind. VR2 overhead conductor is available with multiple conductor types, and in sizes up to dual 1113 kcmil conductors.

APPLICATIONS:

VR2 conductor is designed for overhead applications subject to aeolian vibration and galloping due to wind and ice and can be strung to the maximum allowable tension limits without the need for additional vibration protection

VR2® OVERHEAD CONDUCTOR IN ACTION

KANSAS CO-OP FIGHTS ICE WITH VR2 CONDUCTOR

Pioneer Electric Cooperative in Ulysses, Kansas, knows about ice and the challenges it can bring to electrical transmission and distribution. Ulysses is in a heavy ice-loading zone, and the winds blowing steadily across the plains bring big problems of aeolian vibration and ice galloping. So, Pioneer turned to Southwire's patented VR2® vibration-resistant conductors. Mike Haney of Pioneer Electric recounts, "In a terrible winter storm, we lost 3,800 poles and over a thousand miles of conductors, but no twisted-pair conductors hit the ground."

Traditional twisted-pair conductors can separate and sag apart during installation. "You can spend thousands of dollars in labor jacking out the bagging that occurs," says Haney. "All twisted-pair is not the same," Haney says. "The way VR2 overhead cable is constructed, the conductors stay together during installation making it much easier to handle. That's important." Pioneer has now installed over nine million feet of VR2 conductor, in sizes from twin 4/0 AWG conductors to twin #2 AWG conductors with operating voltages of typically 13.2 kV.

Southwire can deliver VR2 conductor in industry-leading sizes and run lengths. The larger sizes bring VR2 conductors ice galloping and vibration resistant benefits to high capacity grid applications. Longer run lengths squeeze installation costs by reducing multiple-reel handling time. And, VR2 conductor cable can be strung to the maximum allowable tension limits without additional vibration protection.

Non-VR2 cables fall to the weight of ice and force of wind. Photo taken by Ross Riley

Southwire's VR2 conductor holds up against the elements. VR2 conductor shown at the left side of the photo.

Learn more about our VR2 Vibration Resistant Conductor visit:
https://www.southwire.com/industries/utility/system-hardening

SEVERE WEATHER EVENT SOLUTIONS

VR2® OVERHEAD CONDUCTOR IN ACTION

MIDWEST UTILITY

Where the winds blow free across the open spaces of the Midwest, aeolian vibration, ice storms, and ice galloping are serious problems for overhead transmission and distribution lines.

When a large Midwest utility company was looking to utilize a better ice galloping preventative conductor for its electric operations, the company turned to VR2 Vibration Resistant conductor. In the company's installation, VR2 conductor made twisted pair conductor installation easier than the old twisted pair cable design.

Traditional vibration-resistant cable constructions have a history of being temperamental during installation. VR2 conductor solves the problem.

For this utility company, severe ice storms are a fact of life. The company estimated that restoration costs after a major ice storm were approximately $70 million. "We saw anywhere from 1-2 ½ inches of ice on conductors," says a project manager with the company.

For years, the standard preventive measure for aeolian vibration and ice galloping was to install cables made up of two individual stranded conductors twisted together. Southwire's traditional version of this twisted pair construction was called VR or Vibration Resistant cable.

"Ice can add six or seven times the conductor weight to a line, and ice galloping breaks wires and pulls down poles," says the project manager. "Twisted conductors tend to accumulate less ice, because of its design which allows ice to fall off once it starts to accumulate." The problem with traditional twisted pair designs is that during installation, the conductors often separate, forming loops called "bagging." Fixing bagging issues is time consuming and labor-intensive for crews.

Utility crews encountered bagging problems as they were stringing traditional twisted pair cable. They turned to Southwire for technical support on installation techniques. Southwire engineers worked with the crews to improve stringing practices, advising them on factors such as the size of the sheaves being used. Still, the installation modifications did not completely resolve the bagging problem. That is when the company turned to Southwire for a possible change in the twisted pair design.

The utility company installed the VR2 conductors on a .65-mile stretch of 69 kV horizontal post insulator as a side-by-side comparison with traditionally constructed twisted pair conductor on different phases of the three-phase line. The traditional construction continued to exhibit bagging problems. The VR2 conductor went up without a hitch. "The difference was like night and day," says the project manager.

A company travel crew foreman says, "We pull the wire in under tension. The old wire might start to come apart between the reel and the pole, or while it was going down the line. We'd have to put up people in bucket trucks to shake out the loops. The new wire just came in perfectly."

He adds, "You could stand under the pole and listen to the wire moving through the sheaves. With the old wire, you could hear the twists passing through the sheaves at odd intervals. With the new wire, you could hear it clinking through the sheaves very regularly."

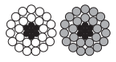
Even after the installation, the VR2 conductor difference is apparent. The foreman says, "With the old wire, even after we shake out the loops, you can drive down the road and see the irregularity in the twist of the conductor. The VR2 conductor is completely regular. This wire is good stuff."

"The company has installed several hundred thousand feet of VR2 conductor so far, in sizes 1/0 and 4/0," says Michael Lowery, sales manager for Southwire. "VR2 conductor is another example of a Southwire innovation with immediate benefits in the field.

Learn more about how Southwire's CableTechSupport™ team can help you with your next project.
www.southwire.com/services/cabletech-support-services

OVERHEAD TRANSMISSION AND DISTRIBUTION CONDUCTORS

SOUTHWIRE® INNOVATIONS



C7®
Overhead Conductor

- Southwire's High Temperature, Low Sag (HTLS) conductor with a carbon fiber composite multi-strand core
- ACCS or ZTACCR constructions
- TP- Thermoplastic 180°C | 225°C
- TS- Thermoset 180°C | 200°C

- Features:
  - Flexibility
  - Thermal stability
  - Excellent corrosion resistance
  - Low CTE

ACSS/HS285®
Overhead Conductor

- Southwire's patented ultra-high strength mischmetal coated steel core

- Features:
  - HTLS when used in ACSS or ACSS/TW
  - High modulus
  - Excellent corrosion resistance

MaxStorm®
Overhead Conductor

- Designed for improved sag under extreme ice and wind loads
- ZTACSR/TW/MAS construction
- TW stranding allows for reduced diameter (i.e. reduced ice and wind loads)
- High temperature capability allows for a smaller conductor OD

- Features:
  - High modulus
  - High resiliency
  - 210°C | 240°C Ratings

VR2® Overhead Conductor

- Two conductors twisted together to an engineered lay length based on conductor size
- Presents a varying profile to the wind to resist galloping and Aeolian vibration
- Available using ACSR, ZTACSR, AAC, or AAAC Conductors

MRC
Motion-Resistant Conductor (oval)

- Strands in the outer layer vary in diameter and shape to create an oval shape
- Presents a varying profile to the wind to resist galloping and Aeolian vibration

SOUTHWIRE® LEGACY PRODUCTS

AAC
All-Aluminum Conductor

- 1350-H19 Aluminum Strands
- 61.2% IACS conductivity
- Excellent corrosion resistance
- Superior conductivity-to-weight ratio

AAAC
All-Aluminum Alloy Conductor

- 6201-T81 Aluminum Alloy Strands
- 52.5% IACS conductivity
- Excellent corrosion resistance
- Excellent strength-to-weight ratio

ACAR
Aluminum Conductor, Aluminum Alloy Reinforced

- 1350-H19 Aluminum Outer Strands
- 61.2% IACS conductivity
- 6201-T81 Aluminum Alloy Inner Strands
- 52.5% IACS conductivity
- Excellent corrosion resistance

ACSR
Aluminum Conductor, Steel Reinforced

- 1350-H19 Aluminum Outer Strands
- 61.2% IACS conductivity
- Coated steel core strands

ACSS
Aluminum Conductor, Steel Supported

- 1350-O Temper Aluminum Outer Strands
- 63% IACS conductivity
- Mischmetal-coated steel core strand
- 250°C continuous operating temperature
- Self-damping

AACSR
Aluminum Alloy Conductor, Steel Reinforced

- 6201-T81 Aluminum Alloy Outer Strands
- 52.5% IACS conductivity
- Coated steel core strands

OPTIONS

Color Key

- C7® Core
- Steel Core
- Al-Zr
- Aluminum Alloy
- Aluminum

Aluminum Alloys

- 1350-H19
- 1350-O Temper
- Aluminum-Zirconium (Al-Zr)
- 6201-T81

Corrosion Protection

- Zinc-Coated (Galvanized)
- Zinc-5% Aluminum-Mischmetal Alloy Coated
- Aluminum-Clad (AW)
- Greased Core and/or Inner Aluminum Layers
- C7® Composite Core

Other Options

- TW
- Non-Specular

SEVERE WEATHER EVENT SOLUTIONS

COVERED AERIAL MEDIUM VOLTAGE (CAMV™) TREE WIRE

Covered Aerial (CAMV™) cable is a single aluminum conductor protected by a layer of track-resistant polyethylene. These non-shielded, covered conductors are handled like bare conductors during installation and operation.

INCREASED RELIABILITY CUTS MAINTENANCE COSTS

Running through a community park or down a tree-lined boulevard, CAMV cable systems can reduce outages compared to bare-wire ACSR installations. CAMV circuits show higher reliability because the conductor cover reduces momentary outages during contact with tree branches. Outages from animal and bird contact also go down. When storms hit, or under accumulations of ice or snow, the covered conductors are partially protected from falling limbs by the high-strength messenger. Lightning-related outages may drop as well, because the grounded messenger wire serves as a shield wire for the system. Higher reliability means you spend less money per pole on maintenance, and your total distribution system life-cycle costs drop.

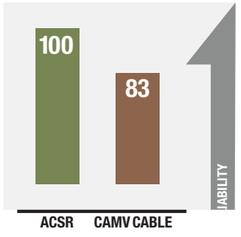
PUT MORE POWER THROUGH EXISTING RIGHTS-OF-WAY

CAMV cable's compact construction lets you put more power down existing rights-of-way. Suspend two CAMV cable configurations back-to-back on a 14" bracket and you can double the circuits–and double your available power going into an area. Wherever clearance is tight, CAMV cable can simplify distribution design while achieving higher reliability.

DRAMATICALLY CUTS VEGETATION MANAGEMENT COSTS

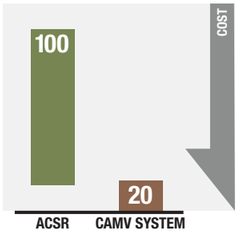
Tree contact is the single largest cause of both momentary outages and sustained customer interruptions in much of the country. Managing vegetation to avoid conductor contact is an expensive, recurring maintenance operation. Outages due to neglected trimming can lead to significant fines, but severe trimming can generate community complaints. CAMV™ systems offer a vegetation management breakthrough. If a tree limb brushes a CAMV cable, the conductor covering has the electrical strength to limit momentary outages. Tighter clearances around your distribution circuits may be allowed in some instances, resulting in less frequent trimming. In many cases, the trimming of trees actually accelerates growth, so reduced trimming can help you stretch out the whole trimming cycle.

10-YEAR MAINTENANCE COST PER POLE



CAMV cable maintenance costs 17% less per pole than on traditional bare wire systems.

10-YEAR RELATIVE VEGETATION MANAGEMENT COSTS



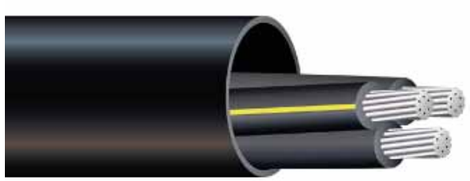
CAMV Systems can shrink vegetation management budgets by up to 80%.

To learn more about Southwire CAMV™ Cables vist:
www.southwire.com/industries/utility/system-hardening

SEVERE WEATHER EVENT SOLUTIONS

UNDERGROUND DISTRIBUTION PRODUCTS

SIM*pull*® CABLE-IN-CONDUIT



INNOVATION: INSIDE AND OUT

Protect the power inside with SIM*pull*® Cable-In-Conduit (CIC). Southwire is the only full product supplier that manufactures both the cable and conduit, providing trusted and tested quality you can depend on. As part of Southwire's SIM*pull* Solutions® Innovations, SIM*pull*® Cable-In-Conduit (CIC) increases job safety, productivity, and profitability and can be customized to meet your specific needs.

BENEFITS:

Protects cable:
- During shipment
- During installation
- During operation

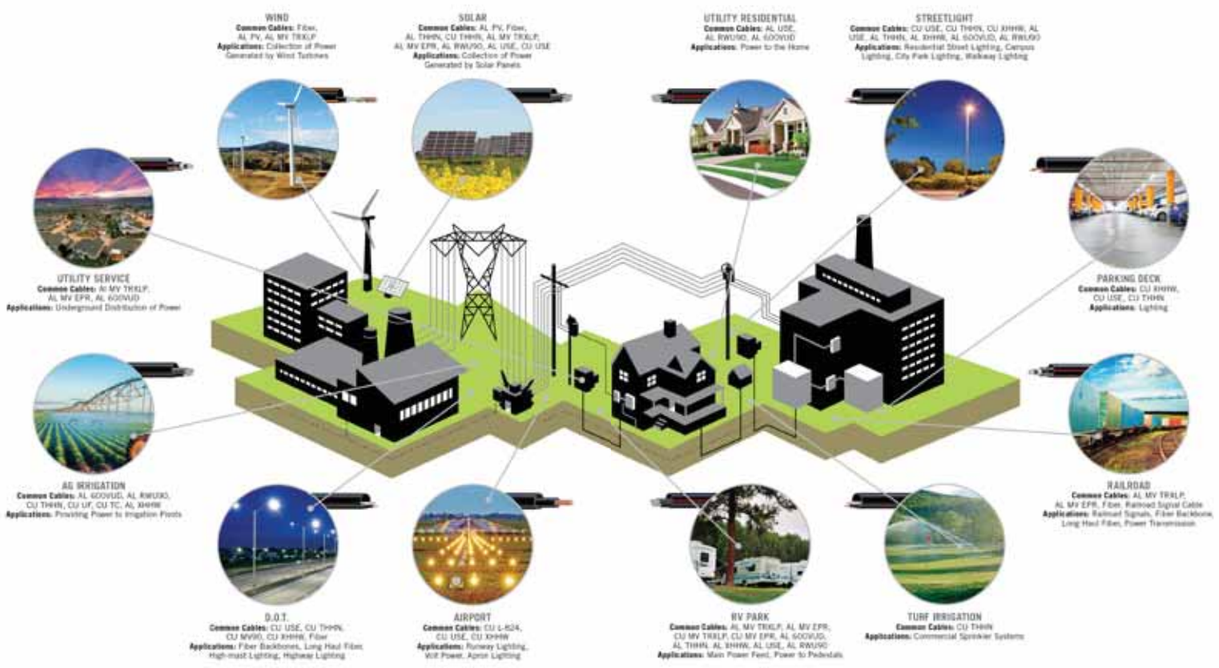
Reduces labor costs by:
- Eliminating separate handling of both pipe and wire
- Eliminating assembly of 20' conduit sections
- Eliminating pulling of wire into duct
- Can eliminate need for special pulling equipment
- Helps reduce freight costs
- Allows for various installation methods which may reduce installation and restoration costs

- Can reduce replacement and upgrade costs
- HDPE conduit is flexible as opposed to rigid PVC pipe
- Available in various colors or stripes
- Available in continuous lengths

Check our our Top 10 Advantages of HDPE and 20 Reasons to Switch to CIC white papers.
www.southwire.com/services/cabletech-support-services

SIZE	REEL DIMENSIONS (INCHES)		FOOTAGE	TRUCKLOAD 45 FOOT FLATBED	
	FLANE	WIDTH		Reels	FEET
3/4	50	37	2500	20	50,000
1	54	37	1500	20	30,000
1	54	37	2500	20	50,000
1 - 1/4	66	47	2500	16	40,000
1 - 1/4	90	47	6000	14	72,000
1 - 1/2	66	47	1500	16	24,000
1 - 1/2	72	47	2500	14	35,000
2	78	47	1500	14	21,000
2	90	47	3000	10	30,000
2 - 1/2	83	47	1000	12	12,000
2 - 1/2	102	47	2500	10	25,000
3	96	47	1000	10	10,000

APPLICATIONS:



SEVERE WEATHER EVENT SOLUTIONS

SIM*pull*® CABLE-IN-CONDUIT IN ACTION

GOING UNDERGROUND HELPS COLUMBIA BASIN ELECTRIC COOPERATIVE BEAT EXTREME WEATHER, ICE STORMS

The Pacific Northwest's highly variable weather – 90 feet of snow in the mountains, 30 inches of rain in the valleys and 100-degree temperatures in the high desert plains – wreak havoc on utility systems. Fog, ice, and other severe weather can knock out overhead service to rural customers for weeks. Columbia Basin Electric Operations Manager Brian Kollman's solution? Installing SIM*pull*® Cable-In-Conduit in areas most vulnerable to extreme ice conditions, reducing maintenance costs and unplanned outages.

Exposure to extreme ice, wind, and heat can damage overhead conductors and lead to eventual power failure – often when homeowners, business, and other utility customers need it most.

Columbia Basin Electric replaced about 20 miles of overhead conductor with SIM*pull*® Cable-In-Conduit. The buried underground conduit protects the cable from damage during transit, handling, installation, and weather extremes.

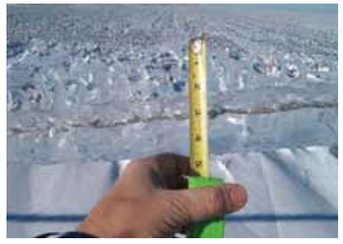
While installing CIC costs more upfront, long-term savings add up quickly. "With about 18 poles per mile of line, it takes a significant amount of time to check overhead," Kollman said. Underground, on the other hand, may have a switching cabinet every half to one mile."

CIC also provides cost savings over the traditional methods of installing underground conductor into a PVC pipe system. "With CIC, we lay the cable directly in the ditch," Kollman said. "If there's ever a failure, we have space inside the conduit to pull a new conductor through."

More than 60 percent of Columbia Basin Electric Co-op members now prefer CIC over installing their own underground cable and conduit separately.

Ice forming on Overhead Conductor

Southwire Company's SIM*pull*® Cable-In-Conduit



Represents approximately 5" of ice accumulation on a section of overhead conductor. Overhead conductors are typically not designed to handle this amount of ice. This usually results in downed lines and power outages when utility customers need the power the most.

Learn more about our SIM*pull*® Cable-In-Conduit by visiting
www.southwire.com/industries/utility/system-hardening

Articles:
http://www.southwireblog.com/simpull-cable-in-conduit-usage-and-code-compliance-faqs/
https://plasticpipe.org/pdf/cable-conduit-power.pdf
http://www.southwireblog.com/cic-wins-plastic-pipe-institutes-poy-award/
https://solarbuildermag.com/news/flexible-cable-conduit-solar-farm-missouri/
https://ucononline.com/magazine/2018/february-2018-vol-73-no-2/business/installing-15-miles-of-power-cable-in-dry-texas-soil
https://www.utilityproducts.com/tools-supplies/article/16020599/power-line-construction-overhead-power-line-replacement-project-earns-top-industry-award

AGING INFRASTRUCTURE

AGING INFRASTRUCTURE

In its 2021 infrastructure report card, the American Society of Civil Engineers (ASCE) gave the nation's power grid a C-. The reason? The majority of electric transmission and distribution lines were built in the 1950s and 1960s with an expected lifetime of 50 years. Improving the resilience of the power grid will require significant equipment upgrades and replacements, though the ASCE estimates the investment shortfall in the electricity system at $177 billion.

Having the sort of up-to-date grid equipment that ensures resilience and reliability is critical.

AGING INFRASTRUCTURE SOLUTIONS

HOW WE CAN HELP : OUR SERVICES

CABLETECHSUPPORT™ SERVICES

As a leading manufacturer of wire and cable for the transmission and distribution of electricity for over 70 years, Southwire understands the complexities of an aging power grid. As the thought-leaders in the industry, our elite team of engineers has developed a plethora of innovative wire and cable solutions to help address a number of challenges utilities are experiencing today.

With over 460 patents, several industry accredited manuals (the Overhead Conductor Manual and the Power Cable Manual to name a few), installation guides, and field calculators, our team of elite engineers has developed the products and tools utilities have come to rely on.

When you are ready to upgrade your system, our engineers will be ready to assist. Whether on the phone or standing by your side in the field, we are there for you.

PLANNING

We can help ensure your projects stay on track, on budget, and meet industry regulations by assisting with project planning processes.

RESOURCING

Choosing the right wire and cable is critical to the success of your project. Our team of experts will collaborate with you to ensure the cable or conductor you source will meet the rigors of the application.

INSTALLATION

Often questions arise once materials are onsite. We can help ensure that our innovative solutions are installed properly according to industry best practices. This includes working onsite alongside engineers during the installation process to support the success of your most critical projects.

OPERATIONS

Our products are based on strong engineering principles and backed by years of research and testing. If you have a problem with wire and cable, let us know, and we will troubleshoot it for you – even if it's not our product.

SOUTHWIRE CABLETECHSUPPORT™ SERVICES ARE HERE TO HELP YOU AT EVERY STAGE OF YOUR PROJECT

PROJECT PLANNING AND RESOURCING

- **Pre-planning Calls** to Discuss Timelines, Unique Challenges, Extended Warranty Options, and Southwire SPEED™ Services
- **Wire & Cable Specification Review** to Validate System Requirements & Cable / Conductor Performance
- **Codes & Standard Confirmation**: NEC/NFPA, UL/CSA, IEEE, ASTM, ICEA, AEIC, NEMA, NESC
- **Electrical Modeling** for System Designs (Ampacity, Voltage Drop, Short Circuit, & Southwire Mobile and PC-based Calculator Apps)
- Wire & Cable **Product Selections** (Conductor Sizing, Insulation, Shielding, Jacket, Ratings)
- **Cable / Conductor Pulling Calculations** & Route Reviews
- **Sag/Tension Modeling,** Sag Charts, and Stringing Tables
- Conductor **Testing** including Stress-Strain, Ultimate Strength, and Creep. Hardware Tensile Strength Testing

CABLE INSTALLATION AND OPERATIONS

- **SIM*pull*™ Pulling Head** Installation Support at Job Sites
- Supervised **Cable / Conductor Pulling On-Site**; Rigging Recommendations for Complex Pulls; Cable Damage Evaluations
- **Jacket Repair Procedure** and Chemical Exposure Verifications, Operational Concerns, & Certified Test Reports (CTR or COA) (available upon request)
- **Nitrogen Purging** On-Site to Dry Out Wet Cables
- **Cable Preparations** and Check-List for Installing Terminations & Splices
- **Field Testing** Procedure Reviews and Southwire SPEED™ Cable Replacement Recommendations

PRODUCT TRAINING

- Wire & Cable 101 **Trainings** On-Site, Webinars, Southwire Solutions University (SSU™) or Continued Education Seminars
- Vertical Market Product Training: **Infrastructure & Data Centers (Residential & Commercial)**
- Vertical Market Product Training: **Oil & Gas, Petrochem, Hazardous Locations**
- Vertical Market Product Training: **Utility & Renewable (PV & Windfarm)**
- Vertical Market Product Training: **Transit & Transportation**
- Vertical Market Product Training: **Factory Power & Automation & OEM**

For more information, visit
www.southwire.com/services/cabletech-support-services

HIGH VOLTAGE INSTALLATION SERVICES

Southwire's High Voltage Installation Team is a highly skilled and factory-certified team of installation technicians available to help you with cable pulling, splicing, terminating, sheath bonding, and grounding. Whether it is a new installation or a high-pressure fluid-filled cable replacement, we're with you every step of the way with responsive service, unmatched engineering support, and onsite project management for your turnkey HV project – a commitment that has resulted in zero cable failures with over seven-million feet of HV cable installed.

And, with our maintenance service agreement, you can ensure your HV system will continue to run at peak performance for years to come.

SOUTHWIRE UNDERGROUND TRANSMISSION CABLE SYSTEMS™ ARE BACKED BY SOUTHWIRE PEOPLE

INSTALLATION TECHNICIANS	Highly skilled and factory certified installation technicians
SERVICES	Splicing and terminating services
REPAIRS	Emergency and repair services
TOOLS AND EQUIPMENT	Complete cable installation tools and equipments
ACCESSORIES	Complete accessory installation tools
QUALITY CONTROL	Installation quality control documentation

To learn more about our HV Installation Services, visit
www.southwire.com/services/high-voltage-underground-transmission

AGING INFRASTRUCTURE SOLUTIONS

HOW WE CAN HELP : OUR PRODUCTS

Whether you are reconductoring old lines or you're are increasing capacity with new lines, you want quality cables that are reliable and resilient, and you want them from a manufacturer you can trust. From traditional transmission and distribution products to Southwire's innovative solutions, Southwire has the products you need for your electrical grid upgrade.

OVERHEAD RECONDUCTORING AND UPGRADING SOLUTIONS

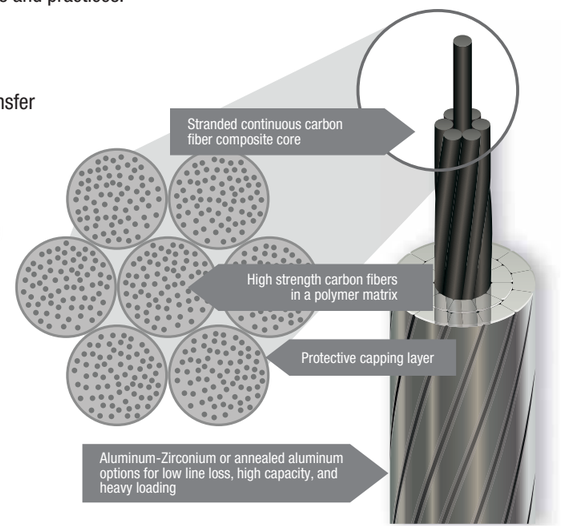
C7® OVERHEAD CONDUCTOR

INNOVATION STARTS AT THE CORE

Southwire is revolutionizing the industry with its innovative C7® overhead conductor. With its unique stranded construction, Southwire's C7® overhead conductor is the most durable, rugged, and reliable composite core conductor on the market - and the only composite core conductor developed by a conductor manufacturer with full knowledge of utility needs and practices.

FEATURES:

- **Minimal Thermal Expansion** – minimal sag increase at high power transfer
- **Stranded Core** – no single point of failure
- **Flexible** – robust, installs like traditional conductor
- **Less Sag** – for lines with clearance or structure limitations
- **Easy Installation** – uses traditional methods and familiar hardware
- **Designs for All Loading Conditions** – light loading to heavy ice loading
- **Trapezoidal Wire (TW) or Round Wire Available**
- **Aluminum-Zirconium (Al-Zr) or O-Temper Aluminum Available**



APPLICATIONS:

New Lines: Reduce new line costs by saving on structures and foundations. Cross challenging terrain or reduce the visual profile in sensitive areas. Build for the future with high capacity, low sag lines.

Reconductoring: Double the capacity of existing ACSR lines. Light conductor weight and low sag allow use of existing structures and ROW, even for lines previously designed with all-aluminum or aluminum alloy (AAC, AAAC, ACAR) conductors.

ADVANTAGES:

Proven Robust Materials
- Matrix materials have been used in demanding environments for over 50 years
- Resists harsh chemicals, high-temperature, and corrosion
- Resistant to abrasion and high-tension fatigue

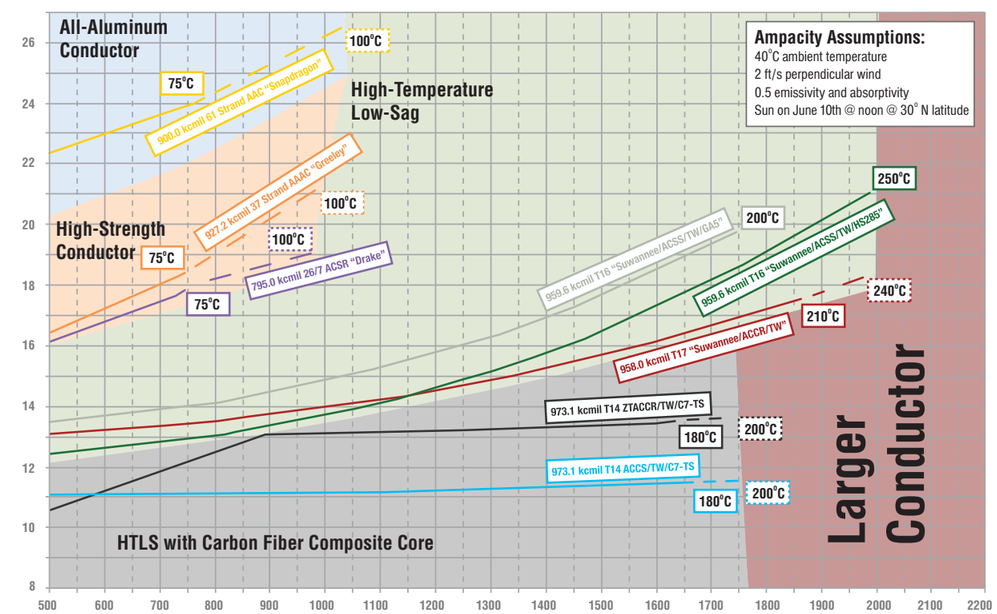
Stranded Core
- Multi-strand, NO single-point of failure like single-rod designs
- More flexible than single-rod core designs
- Increased tolerance for bending

Increase Capacity
- Double the capacity of same-diameter ACSR round-wire conductor
- 180°C continuous, 200/225°C (thermoset/thermoplastic) emergency ratings are material property based
- No losses due to core magnetization

Low Sag
- Minimal sag increase at high temperature
- For lines with clearance or structure limitations
- Reduce land requirements, structure size and height, and foundation costs
- Overcome objections to high-visual-profile lines
- Capacity for future system rating increases without sag increase consideration

Suitable for Extreme Weather Loading
- Al-Zr option bolsters carbon fiber to carry heavy ice and wind loads with low sag

Conventional Installation & Inspection
- Uses standard work practices and traditional hardware
- Same stringing blocks and installation equipment as ACSS



C7® OVERHEAD CONDUCTOR IN ACTION

RECONDUCTORING C7® OVERHEAD CONDUCTOR SOLVES EROSION ISSUE

A utility in the U.S. was planning to reconductor an existing 138 kV transmission line in a residential area to address encroaching erosion at a nearby river. To prevent issues related to riverbank erosion near a structure, the utility was planning to move the structure further inland. The move would increase the river crossing span by approximately 550 feet, to 1,840 feet. The existing conductor was 795.0 kcmil 26/7 ACSR "Drake".

The conductor solution was required to maintain existing clearances (design considerations limited sag to 40 feet) while also maintaining existing ampacity and tensions. The design considered NESC "Heavy" loading with an additional Extreme Ice/Wind load.

C7® overhead conductor was pinpointed early on for its high-temperature, low sag properties and its corrosion resistance. The proposed solution utilized a 7-strand thermoset core with trapezoidal-shaped annealed aluminum strands. Due to its high conductivity and high temperature rating, the C7® overhead conductor solution, 477.0 kcmil Type 23 Capitol Reef/ACCS/TW/C7-TS, required 40% less aluminum to maintain the existing rating. The high strength of the carbon fiber composite core also allowed for a 16% smaller core to be used.

Using the C7® overhead conductor solution, the sag in the 1,840-ft span decreased by 66% compared to the existing Drake. Conductor weight also decreased by 53%.

CONDUCTOR TYPE	SIZE kcmil	STRANDING / TYPE NO.	OUTSIDE DIAMETER in	WEIGHT lbs	RBS lbs	EVALUATION RESULTS					
						MAX TENSION		LOADED WEIGHT lb/ft	COND. TEMP. °C	CURRENT A	FINAL SAG ft
						lb	%RBS				
ACSR*	795.0	26/7	1.108	1.093	31,500	12,480	40%	2.963	100	994	98.01
ACCS/TW/ C7-TS	477.0	23	0.818	0.511	29,100	12,027	41%	2.128	180	1049	33.59

*Sag-tension results assume movement of the structure and use of existing Drake.

For technical information on our C7® Overhead Conductor, visit
www.southwire.com/industries/utility/system-hardening

Articles:
https://www.tdworld.com/overhead-transmission/article/20964350/high-capacity-meets-low-sag

AGING INFRASTRUCTURE SOLUTIONS

ACSS/HS285® OVERHEAD CONDUCTOR

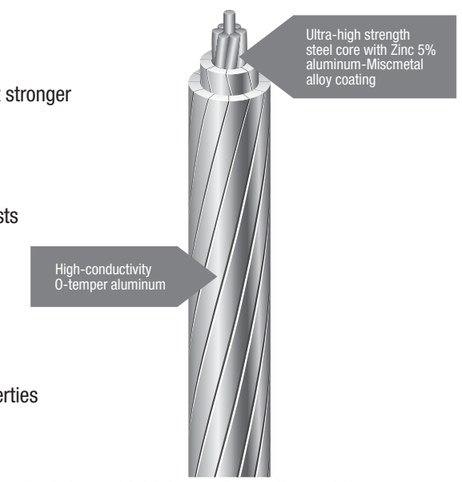
THE INDUSTRY STANDARD THAT'S ANYTHING BUT STANDARD

ACSS/HS285 overhead conductor is the most popular high temperature low sag (HTLS) conductor in use today because of its versatility and strength. The multipurpose conductor is up to 21 percent stronger than standard ACSS, reducing sag while allowing for additional line capacity. Developed at Southwire's D.B. Cofer Technology Center, ACSS/HS285 conductor has been proven in the field for capacity up to 95 percent higher than ACSR, lowering reconductoring costs and, it can be strung tighter to operate with more clearance at higher temperatures. It also allows for easy installation using existing rights of way, structures, and methods.

In ACSS conductors, the weight of the wire is taken almost entirely by the steel core. Sag is determined by the low expansion rate of steel, rather than the high expansion rate of aluminum. That allows higher operating temperatures – and more capacity. ACSS can operate continuously at temperatures up to 250°C without loss of strength. For the same conductor size and weight, an ACSS solution can give substantial increases over ACSR without significant changes in structure or line design, sometimes exceeding 100 percent more power than ACSR with the same sag.

STRENGTH COMPARISON OF STEEL CORES

- A typical steel core in a standard ACSR cable has a tensile strength of about 210 ksi
- A traditional "high-strength" core delivers a tensile strength of about 235 ksi
- ACSS/HS285 conductor steel core can stand up to 285 ksi before failure, 21 percent stronger than the usual "high-strength" core, and 36 percent stronger than a standard core



BENEFITS:

- ACSS/HS285® conductor provides higher line capacity and lower reconductoring costs
- Can be strung tighter with less sag, allowing for a 60 to 95% increase in current-carrying capacity
- Proven in the field for immediate and contingency capacity
- Easy installation using the same products and accessories as ACSS
- Simple reconductoring using existing rights of way, no changes to structures and familiar methods
- Increased line design options due to superior strength and improved corrosion properties

APPLICATIONS:

New lines: Reduce new line costs by saving on structure and foundation costs. Build for the future with higher system ratings while maintaining line clearances. Increase your line capacity with lower line losses and a lower cost premium.

Reconductoring: Double the capacity of existing ACSR lines. ACSS/HS285® conductor can be strung tighter for more clearance at higher temperatures. It also allows for easy installation using existing rights of way, structures and methods.

Construction: ACSS is a composite concentric-lay-stranded conductor. Steel strands form the central core of the conductor with one or more layers of 63% minimum average conductivity aluminum 1350-0 wire stranded around it. The steel core carries most or all of the mechanical load of the conductor due to the "0" (fully annealed or soft) temper aluminum. Ultra-high-strength steel core wires are protected from corrosion by Galfan®, zinc-5% aluminum-mischmetal alloy coating.

Learn more about Southwire's ACSS/HS285® Overhead Conductor visit:
www.southwire.com/industries/utility/system-hardening

AGING INFRASTRUCTURE SOLUTIONS

ACSS/HS285® CONDUCTOR IN ACTION

CENTERPOINT ENERGY HIGH-CAPACITY TIE LINE USES LOW-SAG TECHNOLOGY

When Houston-based CenterPoint Energy needed to upgrade a tie line between two major generating stations, their choice was a product from Southwire that delivers high-temperature, low sag capacity rivaling composite-core designs — without the cost. The wire CenterPoint chose puts an ultra-high strength steel core inside an ACSS/TW conductor architecture.

CenterPoint's challenge was to bring more power to the greater Houston area. They needed increased transmission capacity between a nuclear plant near Bay City, Texas and a generating facility in Rosenberg, Texas. The solution was an $80 million, 60- mile, two-circuit 345kV transmission line. The question was how to implement the circuits.

CenterPoint analyzed 60 different design combinations factoring in distance between structures, land-use impacts, construction issues, and total installed costs. Circuit options included: two conductors using ACSR (aluminum conductor, steel reinforced); three conductors using standard ACSS/TW (aluminum conductor, steel-supported, trapezoidal wires); and two conductors using HS285 ultra-high-strength ACSS/TW high-temperature, low-sag cable design.

CenterPoint found that the HS285 ACSS/TW conductors would give 55 percent more capacity than the ACSR conductors with a project cost premium of only about four percent. That made the decision clear. Forty miles of the line will use new structures to carry two 1433.6 kcmil ACSS/ TW HS285 conductors.

Chuck Bennett, Manager of Transmission Engineering for CenterPoint, says, "We would have used ACSS/HS285 conductor for the entire project, but testing time and early product availability didn't quite meet schedule requirements for the first phases. For the same scheduling reasons, we originally designed our new structures for the reduced sag of standard ACSS/TW.

Reduced tower height saved several hundreds of thousands of dollars over the ACSR option, but even then, we didn't make full use of ACSS/HS285 conductor economies. ACSS/HS285 conductors will reduce maximum sag by yet another three to four feet."

The ACSS/HS285 conductor is an enhanced version of Southwire's ACSS/TW. Like standard ACSS/TW, ACSS/HS285 conductor is rated for continuous operation at 250°C. An ultra-high strength steel core puts HS285 conductor's sag performance on a par with composite cores "…at a reasonable cost, not 10 to 30 times the price," according to Bennett.

The ultra-high-strength steel core material borrows heavily from existing steel technology to develop high tensile strength without loss of elongation, ductility, or stress corrosion properties. The ACSS/HS285 conductor core is protected by a Galfan coating that contains 95 percent zinc and about five percent aluminum, with a small addition of rare earth elements, primarily cerium and lanthanum. The Galfan coating protects the steel core at operating temperatures that would shorten the life of traditional galvanizing. "The advanced steel core in ACSS/HS285 conductor lets us get more strength with tested and known technology," says Mark Lancaster, manager of overhead transmission engineering. "The higher strength of HS285 ACSS/TW lets us pull the cable tighter at installation. That helps sag performance and allows shorter, less expensive support structures."

In addition to cost advantages, another advantage of HS285 conductor over composite conductors is that it uses the same installation techniques as standard ACSS. ACSS/HS285 conductor is commercially available with lead times in line with conventional ACSR conductors.

Bennett says, "We have a long history with the ACSS/TW cable architecture. We have been using ACSS/TW since 2000 and have installed over 3,000 miles of it." CenterPoint sees ACSS/HS285 conductors as an economical solution for increasing capacity needs. The additional mechanical strength will also meet new needs. The 2007 National Electrical Safety Code will require higher mechanical loading design criteria, and the Texas PUC may be considering higher hurricane storm-loading criteria.

"This is a good option to have in our toolbox," says Bennett.

ACSS/HS285® CONDUCTOR IN ACTION

WESTERN AREA POWER ADMINISTRATION HIGH-TEMPERATURE, LOW-SAG CONDUCTORS EASE ECOLOGICALLY SENSITIVE LINE UPGRADE

When the Western Area Power Administration (Western) wanted to upgrade the ampacity of a 230kV transmission line near the lower Colorado River, they knew the existing ACSR conductors were approaching the end of their life span. Conductor selection became a design challenge.

The Davis-Mead line is part of the Parker-Davis Project, which includes 1,541 circuit-miles of high-voltage transmission lines in Arizona, southern Nevada, and California. Power generated from the Parker-Davis Project is marketed to customers in Nevada, Arizona, and California. "The existing 61 miles of 230 kV line had a capacity of 170 MVA.

Growing demands on the grid were requiring more power down that route. The goal was a rating of 450 MVA, a 164% increase in capacity," says Allen Turner, electrical engineer, Western Area Power Administration, Design Group.

About 50 miles of the line cross arid desert land near Lake Mohave in southern Nevada. This land is managed by the federal government and is home to several protected species of animals – including mountain goats and desert tortoises. This fragile area is slow to recover from construction disturbances, so great care would have to be taken to not disrupt the ecosystem.

Western wanted to use existing sites and structures if possible, to hold down project costs. In addition, adding access roads to accommodate new tower sites or to bring heavy construction equipment to existing sites might have detrimental effects to the mountain goat or tortoise population that would trigger a lengthy environmental review. "Besides the obvious budget benefits, using existing sites and structures could shorten the project by two to three years," Turner says. The design challenge was to find a conductor that gave the needed capacity gains while minimizing structural work.

The team modeled portions of the line in PLS-CADD using existng drawings and carried out sag and tension studies. The rated steady-state capacity of the existing ACSR conductor was 170 MVA at an operating temperature of 176˚F (80˚C), with an assumption of a four foot-per-second ambient wind.

The design team looked at several conductor options for the line, both with and without tower modifications. Only two delivered the required increase in capacity without significant tower modifications: Southwire "Rook" ACSS/TW HS285 conductor and 3M "Drake" ACCR. Southwire ACSS/TW (Aluminum Conductor Steel Supported, Trapezoidal Wire) HS285 conductor uses an engineered ultra-high-strength steel core to support the entire conductor, thus controlling sag by the core's lower rate of thermal expansion. The 3M ACCR (Aluminum Conductor Composite-core Reinforced) has a core made from aluminum oxide fibers embedded in high-purity aluminum. While the two conductors had similar ampacity ratings, the Western design team's choice for the majority of the line work was Southwire's "Rook" ACSS/TW HS285 conductor based on the comparative expense of the two conductor options.

The Western design team had selected ACSS/HS285 conductor for the reconductor project. Southwire's preconstruction support began immediately. Southwire hosted the Western team to observe the conductor manufacturing process and held a preconstruction training session on-site. Total installed cost for the project came in around $5.7 million—within the budget set for the project.

The reconductored line using ACSS/HS285 conductor has a steady-state rating of 450 MVA at an operating temperature of 270˚F (132˚C), again with an assumption of a four foot-per-second ambient wind. The line can also handle a 30-minute overload of 500 MVA at an operating temperature of 305˚F (152˚C), thus achieving Western's goals while saving significant time and budget dollars in this ecologically sensitive line upgrade.

ACSS/HS285® CONDUCTOR IN ACTION

N1/OTRA DANMARK ULTRA-HIGH-STRENGTH STEEL UPGRADES DANISH GRID

On Denmark's Jutland peninsula, near Arhus, the second-largest city in Denmark and a major seaport, power needs for homes and industry are growing just as quickly as in the U.S. But building new towers to carry larger, heavier conductors can push upgrade budgets past the breaking point. The Danish utility operator N1 found an alternative. They have reconductored existing towers using ACSS/HS285® conductor.

N1's ACSS/HS285 conductor project is a double-circuit 170kV line stretching 22.5 miles (36 km) between the cities of Trige and Tange. The line was built in 1963, using ACSR (aluminum conductor, steel reinforced) conductors. By 2005, the original 980-amp capacity just wasn't sufficient. N1's goal was to develop a capacity of 1,500 amp down the same right-of-way. The problem was finding a cost-effective approach to the expansion.

N1 worked with Otra Danmark and Delpro A/S, supplier of overhead conductors, cables, transformers, and switch gear to the Danish utility market. Otra also contributed engineering services that helped make the upgrade both successful and cost-effective.

N1 and Otra spent a year considering several approaches to the problem, including conductors manufactured in Europe. They reviewed environmental impact, installation costs, and operating economy. In the end, the only alternative that met the needs of price and performance was ACSS/HS285 conductor which required no structural modifications to the existing towers.

N1 and Otra then took another full year testing and confirming the performance of the new design. "Otra helped N1 with technical assistance in sag, tension, and tower strength calculations," says Merete Neilsen, Manager of Power and Networks for Otra.

N1's Trige-to-Tange upgrade used a total of 137.5 miles (220 km) of 954 kcmil Cardinal HS285/ACSS/TW conductor with the HS285® steel core. "Southwire has years of experience with the ACSS/TW conductor architecture," says Neilsen. "That was an important factor in making the choice." Mark Lancaster, manager of overhead transmission engineering, adds, "Southwire also brought specialized conductor engineering expertise to the project, to design a steel core, high-temperature low-sag conductor with specifications tailored to the application." In meeting the application requirements, the ACSS architecture was a "must have" to control sag due to thermal elongation under a 1,500 A load. The ACSS/HS285 conductor core was needed to handle the weight of the conductor spans and expected ice loads. Ice loads can be heavy in Denmark. One incident reported 1.15 inches (29.2 mm) of conductor ice at 23° F (-5.2°C).

N1's project is the first installation of the ultra-high-strength ACSS/HS285 conductor in Europe. The ACSS/TW architecture in general is relatively new to Europe. Conductors there more commonly use ACSR or AAAC (all aluminum alloy conductor) designs.

The ACSS/HS285 conductor installs just like other steel-core ACSS/TW conductors, but because of the relative unfamiliarity of the ACSS/TW design, a team from Southwire conducted a pre-installation conference for the contracting crew doing the job.

The Southwire team inspected the site, trained installers, and consulted with Otra engineers. "This project is the first of its kind in Denmark and this type of upgrading is only carried out in a few places in Europe," Neilsen says. "We're pleased with the results," Lancaster adds. "We're expecting to see growth in the use of ACSS/TW conductors in Europe as grid operators continue to confront the cost of upgrade projects."

Learn more about how our CableTechSupport(TM) team can help you on your next project.
Visit **www.southwire.com/industries/utility/system-hardening**

AGING INFRASTRUCTURE SOLUTIONS

STRATEGIC UNDERGROUNDING

HIGH VOLTAGE UNDERGROUND TRANSMISSION

SERVICES

Engineering, Project Management, Installation, and Testing

- Feasibility studies and conceptual engineering
- Detailed underground system design
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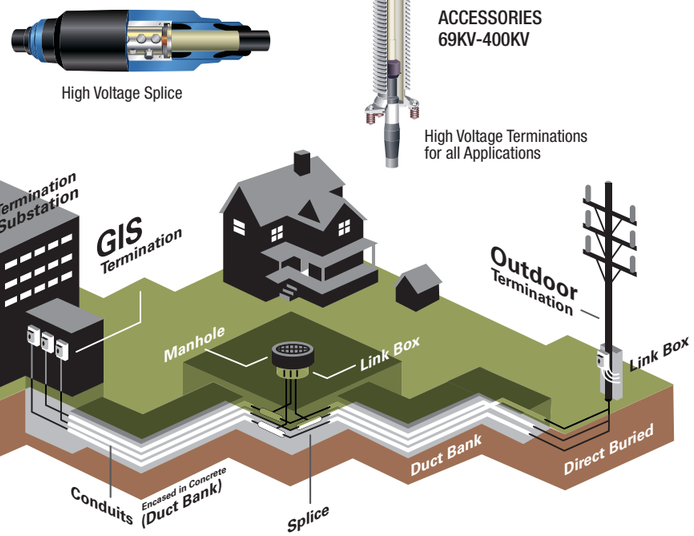
- Cable pulling
- Splicing and terminating services
- Sheath bonding and grounding
- Commissioning, testing
- AC Resonant and PD testing
- Construction Management
- Full turnkey projects including civil works
- Maintenance
- Fault location
- Emergency and repair services



CABLES
69KV-500KV

Copper or Aluminum Segmental Conductor with a Welded Corrugated Sheath

Copper or Aluminum Conductor with a Welded Corrugated Sheath

Copper Conductor with Copper Shield Wires and a Copper Laminate Sheath

Aluminum Conductor with Aluminum Shield Wires and an Aluminum Laminate Sheath

Contact a Southwire representative for other cable constructions

UNDERGROUND. OVERACHIEVING.

Southwire provides high-voltage underground transmission solutions from end to end. We offer a full spectrum of Underground Transmission cable products, installation services, tools, and equipment to meet your specific needs. And we're with you every step of the way with responsive service, unmatched engineering support, and onsite project management—a commitment that has resulted in zero cable failures with over seven million feet of HV cable installed.

BENEFITS:

- Complete line of cables from 69 kV through 500 kV
- A North American exclusive supplier of Kabeldon and nkt cables' line of high-voltage accessories for 69 kV to 500 kV
- Fast service response during times of crisis
- Customer support services include a wide range of engineering, installation, project management, and testing
- Over seven million feet of underground transmission cable installed for customers across North America
- Zero cable failures of installed underground transmission cable to date

Copper or Aluminum Segmental Conductor with a Welded Corrugated Sheath

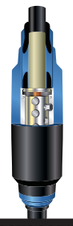
Copper or Aluminum Conductor with a Welded Corrugated Aluminum Sheath

Copper Conductor with Copper Shield Wires and a Copper Laminate Sheath

Aluminum Laminate sheath also available.

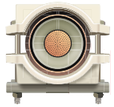
Aluminum Conductor with Aluminum Shield Wires and an Aluminum Laminate Sheath

CABLES : 69 KV – 500 KV

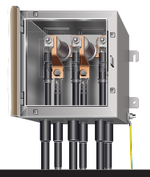


High-Voltage Splice

High-Voltage Terminations for All Applications



Aluminum Cable Clamps



Link Boxes for an Array of Sheath-grounding Arrangements

ACCESSORIES

ENGINEERING:

- Support feasibility studies and conceptual engineering
- Detailed underground system design
- Pulling calculations
- Ampacity studies

INSTALLATION:

- Team of highly skilled and factory-certified installation technicians
- Cable pulling
- Splicing and terminating
- Sheath bonding and grounding

PROJECT MANAGEMENT:

- Construction management
- Full turnkey projects, including civil works
- Maintenance
- Emergency and repair services

TESTING:

- Commission and Maintenance testing services
- AC resonant and PD testing
- Fault locating

SERVICES

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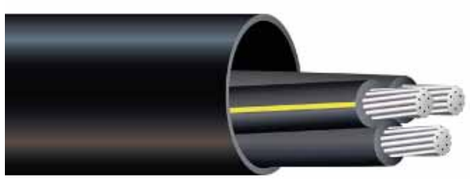
AGING INFRASTRUCTURE SOLUTIONS

UNDERGROUND DISTRIBUTION PRODUCTS

SIM*pull*® CABLE-IN-CONDUIT



INNOVATION: INSIDE AND OUT

Protect the power inside with SIM*pull*® Cable-In-Conduit (CIC). Southwire is the only full product supplier that manufactures both the cable and conduit, providing trusted and tested quality you can depend on. As part of Southwire's SIM*pull* Solutions® Innovations product and service suite, SIM*pull*® Cable-In-Conduit (CIC) increases job safety, productivity, and profitability and can be customized to meet your specific needs.

BENEFITS:

Protects cable:
- During shipment
- During installation
- During operation

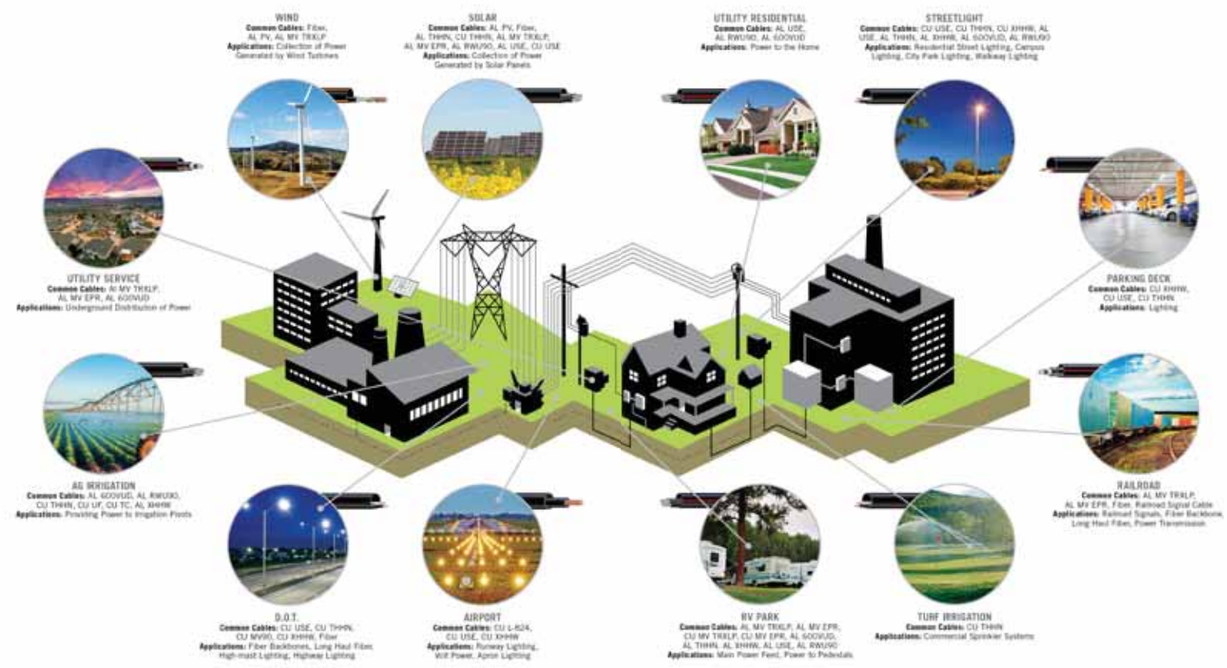
Reduces labor costs by:
- Eliminating separate handling of both pipe and wire
- Eliminating assembly of 20' conduit sections
- Eliminating pulling of wire into duct
- Can eliminate need for special pulling equipment
- Helps reduce freight costs
- Allows for various installation methods which may reduce installation and restoration costs

- Can reduce replacement and upgrade costs
- HDPE conduit is flexible as opposed to rigid PVC pipe
- Available in various colors or stripes
- Available in continuous lengths

Check our our Top 10 Advantages of HDPE and 20 Reasons to Switch to CIC white papers.
www.southwire.com/services/cabletech-support-services

SIZE	REEL DIMENSIONS (INCHES)		FOOTAGE	TRUCKLOAD 45 FOOT FLATBED	
	FLANE	WIDTH		Reels	FEET
3/4	50	37	2500	20	50,000
1	54	37	1500	20	30,000
1	54	37	2500	20	50,000
1 - 1/4	66	47	2500	16	40,000
1 - 1/4	90	47	6000	14	72,000
1 - 1/2	66	47	1500	16	24,000
1 - 1/2	72	47	2500	14	35,000
2	78	47	1500	14	21,000
2	90	47	3000	10	30,000
2 - 1/2	83	47	1000	12	12,000
2 - 1/2	102	47	2500	10	25,000
3	96	47	1000	10	10,000

APPLICATIONS



COPPER THEFT

COPPER THEFT

An estimated 95 percent of utilities have been hit by copper theft in recent years. A recent industry survey of 618 U.S. utility companies revealed more than 18,400 incidents in one year alone among that sample group.

People looking for quick cash are lured by a lucrative scrap metal market, the ease at which copper can be accessed and stolen, and the fact that such crime has historically yielded few convictions and relatively light sentences. In other words, in the eyes of the perpetrator, copper theft is a low-risk, high-reward endeavor. But for the affected utility — and the tax-paying public — the consequences of copper theft are immeasurable.

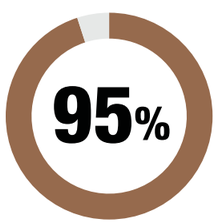
Cut wires and tampered equipment pose a tremendous safety hazard: according to industry estimates, one person is injured each week and three people die each month as a result of these incidents. Additionally, power outages that stem from copper theft can cause a range of downstream safety risks, from disabled traffic lights and pedestrian signals to disruption of critical equipment at the local hospital.

In terms of infrastructure damage, the cost of replacing copper wire is nothing compared to the expense of fixing vandalized substations, transformers, utility poles, fencing, and other equipment. The loss of a few feet of stolen wire is a mere fraction of the total repair bill — not to mention the lost revenue from resulting power outages.

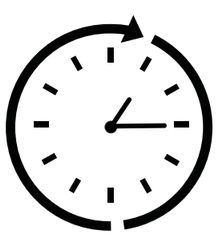
Copper theft is estimated to cost the U.S. power industry $60+ million annually. Taxpayers shoulder much of this burden in rate increases.

The issue of copper theft has the ears of lawmakers nationwide. Most states have enacted legislation, or have bills pending, to mitigate the problem by regulating scrap metal sales and criminalizing the sale of stolen copper. In 2013, a bill was introduced in Congress to make copper theft a federal crime. While these efforts have some merit, they are not airtight solutions.

For one thing, a creative thief can find ways to forge IDs and other information to pose as a legitimate seller. Moreover, most of the legislation puts a heavy burden on scrap yards and recyclers, who may be required to hold onto loads of material during a waiting period before the product can be sold. These facility owners are the utility's best partners in prosecuting criminals.



OF UTILITIES HAVE BEEN HIT BY COPPER THEFT IN RECENT YEARS



456,210

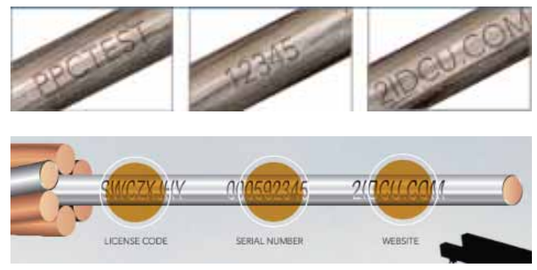
ESTIMATED MINUTES OF POWER OUTAGE EXPERIENCED BY U.S. UTILITIES EACH YEAR AS A RESULT OF COPPER THEFT

COPPER THEFT SOLUTIONS

HOW WE CAN HELP: OUR PRODUCTS

PROOF POSITIVE® COPPER PRODUCTS

Proof Positive® products, available in copper, covered copper, and copper-clad steel, are the only traceable copper theft solution on the market. Made from utility-grade copper, the product looks and behaves like any other copper conductor except for a unique feature: each foot of cable is imprinted with TraceID™ codes that provide a unique "fingerprint" for proving ownership. These TraceID codes are entered on a secure, online database that is available to all users, from law enforcement to recyclers, 24 hours a day, 7 days a week. The database is updated in real time and provides current, accurate ownership data of each foot of cable.



Proof Positive® Copper

Proof Positive® Copper-Clad Steel

Proof Positive® Covered Copper

HOW IT WORKS

Proof Positive wire is readily identifiable by a tin-coated strand that is "candy striped" into the product. The center strand contains TraceID codes consisting of unique license codes and serial numbers. On the solid (single-strand) products, the entirety of the conductor is tinned, and the TraceID codes are etched along the length of the conductor.

As the wire is sold, the dealer enters the codes into an online database accessible to recyclers and law enforcement. These codes document your utility as the rightful owner of the product.

The process is quick and done for every subsequent re-sale. No additional equipment is needed to read the ID codes.

The tinned outer and center strands distinguish Proof Positive products from other stranded copper and copper-clad wiring. The solid (single-strand) products are completely tin-coated. This alerts recyclers (and any would-be thieves who are in the know) that this is traceable material. If the recycler encounters someone trying to sell the product, he or she can run a quick database check at www.2IDCU.com to verify that the person attempting to sell the copper is truly the rightful owner

The database displays the chain of ownership for the length of wire in question, all in real time. The recycler doesn't have to endure the hassles of holding product during a waiting period. Law enforcement can take appropriate action without delay.

Over time, as potential thieves become aware that copper wire can be traced, they'll move on and leave your infrastructure intact.

COMPARE PROOF POSITIVE® CABLES TO OTHER DETERRENT PRODUCTS

METHOD	WEAKNESSES
SPRAY PAINTING	No true proof of ownership; anyone can spray paint the wire
MICRODOTS	Only visible with a UV light and magnifying glass; difficult for the recycler to detect, and not a deterrent to criminals Wiring may only be marked in a single area, so it can easily bo overlooked Must be registered by the end user to enable tracing; may still be registered to the previous owner May be removed through burning or long-term exposure
COPPER-CLAD STEEL	Looks like solid copper, so it's not a theft-deterrent. Once cut, the damage is done.
CAMERAS/MOTION DETECTION	Too dependent on proper camera position, resolution, lighting, and other subtleties High initial cost and diminished lifetime when used in substations Not necessarily a threat deterrent; can be damaged or covered up by perpetrators Impractical for monitoring utility poles
FENCING	Expensive Can be damaged to get to the wire, leaving operations exposed and causing additional repairs Doesn't prevent access to utility poles; impractical for large geographic areas

PROOF POSITIVE® COPPER IN ACTION

GEORGIA POWER

As part of our process for testing our Proof Positive® cable prototype, Southwire asked Georgia Power to install a sample of Proof Positive® Copper in a theft-prone substation just outside metropolitan Atlanta. After we demonstrated the prototype product and web-based tracking system to recycling companies in the area, Georgia Power installed several ground wire samples of the 4/0-7 Proof Positive Copper.

Only one week into the test, all of the new grounding conductor had been cut out. Two weeks later, on two separate occasions, individuals tried to sell the stolen copper to a recycler. Because the copper could be positively traced to Georgia Power by the recycler on the spot, law enforcement was able to successfully apprehend three people in conjunction with the substation vandalism and theft.

The power of Proof Positive cable was reinforced again to Georgia Power. The utility has a close relationship with Schnitzer Steel; the two companies share information to help combat copper theft in the Atlanta area. When a couple of people showed up at a Schnitzer scrap yard with 44 pounds of copper wire to sell, the scale operator immediately identified the distinct tinned outer strand of the material as traceable Proof Positive wire. The scale operator immediately called Schnitzer security. Police arrived at the scrap yard within minutes and detained both suspects. The positive identification provided by Proof Positive's TraceID™ codes established the proof of ownership police needed to arrest the suspects and charge them with theft by receiving, a felony crime.

GEORGIA TRANSMISSION CORPORATION

Georgia Transmission Corporation (GTC) builds and maintains high-voltage systems for 39 of the Georgia's 42 electric co-ops, which means it has responsibility for overseeing more than 3,000 miles of transmission lines and over 600 substations. After thieves stole standard copper grounding wire from GTC's Hagen Creek substation, the company decided to use 4/0-19 Proof Positive Copper for the repair.

One week later, the same substation was hit again — only this time the thieves weren't aware they had a traceable copper. Deputies responding to the alarm at the substation chased two suspects into the woods, and with a little help from their K-9 unit, successfully sniffed out and arrested the suspects, who had 40 feet of Proof Positive Copper in their vehicle.

Using the serial number on the recovered wire, GTC's lead investigator was able to prove ownership of the stolen copper. The defendants were both charged with felony criminal damage to property, theft by taking and criminal trespass.

To learn more about our Proof Positive® family of products visit:
www.southwire.com/industries/utility/system-hardening or 2idcu.com

Articles:
www.southwireblog.com/proof-positive-cable-designed-to-help-stop-copper-theft/
www.amm.com/Magazine/2667924/Departments/Southwires-Proof-Positive-technology-uses-laser-etched-serial-numbers-and-a-web-based-system-to.html

INNOVATING AND PROTECTING THE FUTURE

For over 70 years, Southwire has been manufacturing products to help support the electrical power grid. And, while there have been some changes, like renewable energy, the grid is basically the same as it was 100 years ago. But that is rapidly changing, *the grid of our future will be drastically different than the grid of our past.*

Utilities are under increased pressure from regulators to prioritize grid resilience. For decades, utilities have worked under what is known as the cost-of-service ratemaking model, in which they earn a regulated return based on the capital assets they construct and put into operation.

Today, though, at least 19 states, including New York, Massachusetts and Illinois, have explored what's known as performance-based ratemaking.

Instead of allowing utilities to earn a modest return on capital invested, state public utilities commissions (PUCs) are looking to determine rates of return based on how well utilities achieve specific performance metrics. Top among the metrics being considered are system reliability, outage management, and customer service and satisfaction — all factors that will significantly affect the grid of the future and the overall success of utilities.

It is no surprise that a recent customer satisfaction survey conducted by J.D. Power found that the utility companies that ranked highest were the ones that delivered consistent reliability.

Thanks to a combination of public policy, technology price declines, and customer demand, the grid is fundamentally shifting. Quickly disappearing are the days when electrons were generated at large coal and gas power plants and sent long distances to meet demand.

The grid is rapidly becoming a cleaner and more distributed network. Distributed energy resources (DERs), such as rooftop solar and battery storage, are being adopted at accelerating rates across the U.S. and around the world. With a larger amount of two-way power flows and intermittent generation closer to load, utilities have to pay more attention than ever to hardening their distribution grids.

An increasingly distributed grid, with larger and larger numbers of DERs closer to load, has also shifted utility product needs. Many utilities have begun to shift their focus from transmission to strengthening the distribution grid. More utilities are also looking closer at burying grid infrastructure to protect it from harsh weather.

SOUTHWIRE OFFERS THE COMPLETE SOLUTION

No matter what you need, Southwire is here with a variety of products and services to help improve the reliability and resiliency of the electrical grid. From traditional transmission and distribution lines of yesterday, to the renewable energy of today, to the DERs of *the future Southwire is here to help you* with all your wire and cable product and service needs.

Contact your local Southwire Sales Representative today to learn more.

WIRE AND CABLE SOLUTIONS

SUPPORTING THE COMPLETE POWER SUPPLY CHAIN


1. Bare Transmission & Distribution Conductors (AAC, AAAC, ACAR, ACSR, ACSS, ACSS/HS285®)


2. Bare Transmission & Distribution TW Conductors (AAC/TW, ACSR/TW, ACSS/TW, ACSS/TW/HS285®)


3.C^{z}® Transmission Conductor With Celstran® CFR-TPR (ACCR/TW/C^{z}®, ACCS/TW/C^{z}®)


4. Motion-Resistant Oval Conductor (MRC)


5. VR^{z}® – Vibration Resistant Conductors (AAC/VR^{z}®, ACSR/VR^{z}®, TACSR/VR^{z}®)


6. Bare Copper Conductors

7.Proof Positive® Conductors (Copper, Copperclad)


8. Transformer Riser Wire


9. Protected Ground Wire

10. Tie Wire


11. Covered Aerial MV™ & Tree Wire


12. Covered Line Wire


13. 600V Multiplex Service Drop

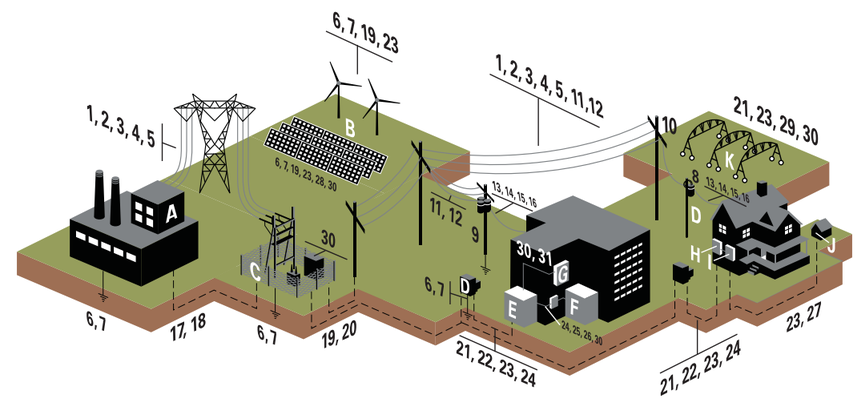

14. 600V SquirrelShield® Service Drop


15. 600V Reverse Twist Secondary (RTS)


16. 600V Parallel Aerial Cable (PAC)

PLACEMENT DIAGRAM

A. Generation Plant
B. Renewables (Solar & Wind)
C. Substation
D. Distribution Transformer
E. Service Equipment
F. Machinery
G. Cable Tray
H. Meter
I. Panel Board
J. Well Pump
K. Agriculture




17. 69kV – 345kV High Voltage Underground*


18. 15kV – 46kV Primary Underground* (TRXLP or EPR)


19. DensFlex® Medium Voltage (Parallel or Triplex)


20. 600V Secondary Underground (Standard, Hi-Score, SureSeal®)


21. 600V PowerGlide® Secondary Underground


22. SIMpull® Cable-In-Conduit (Cable Options: MV, 600V, Fiber)


23. RHH/RHW-2/USE-2 (Triple Rated)


24. XHHW-2


25. THWN-2


26. UF-B


27. 2kV Photovoltaic (PV) Wire


28. Proof Positive® Span Cable

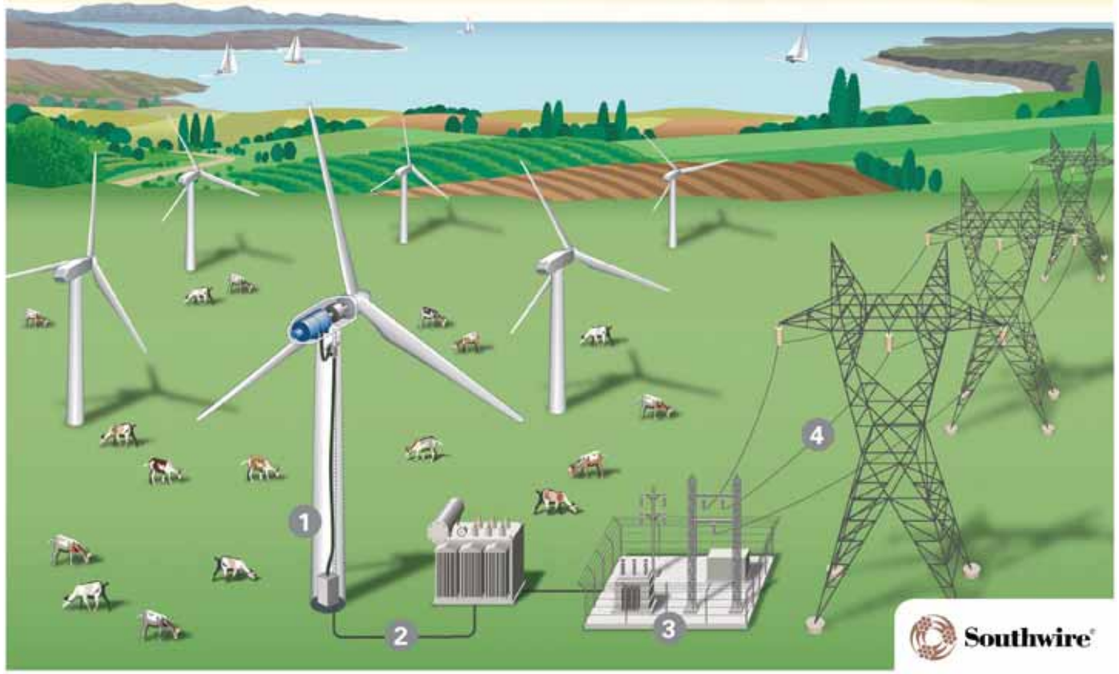

29. Unshielded Control Cable


30. Shielded Control Cable
* Various constructions options available

ADDITIONAL RESOURCES

THINK RENEWABLE ENERGY. THINK SOUTHWIRE.

As a leading manufacturer in the wire and cable industry, Southwire offers a wide spectrum of cable product to meet your wind farm needs. Our products and services are based on a foundation of innovation, providing customers quality product and world-class service. You can count on Southwire to provide solutions for your renewable wire and cable needs.



1 WIND TOWER CABLE 2 MEDIUM VOLTAGE CABLE 3 SUBSTATION CABLE 4 OVERHEAD TRANSMISSION CABLE

1 WIND TOWER CABLE

- DLO
- WTTC
- AL RHH/RHW

2 MEDIUM VOLTAGE CABLE

- 35 kV TRXLPE MV XLPE JACKET

3 SUBSTATION CABLE

- INSTRUMENTATION CABLE
- SHIELDED CONTROL CABLE
- UNSHIELDED CONTROL CABLE

4 OVERHEAD TRANSMISSION CABLE

- ACSR
- ACSS
- C7™ (CARBON COMPOSITE CORE)

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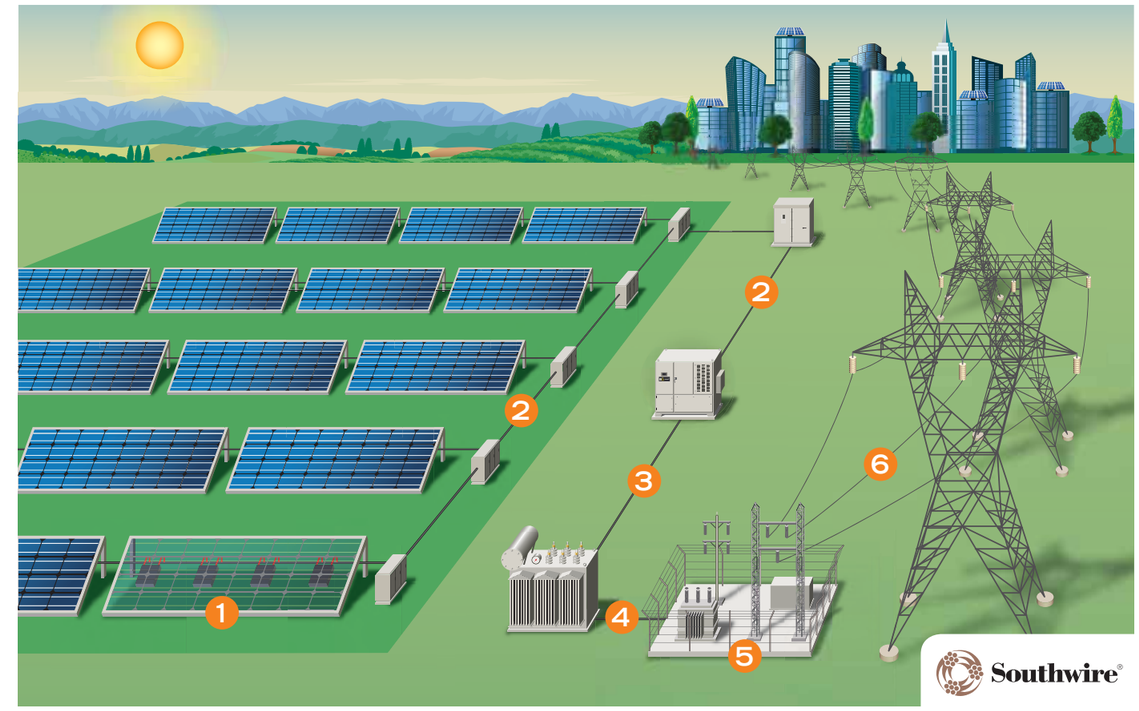

1 SOLAR ARRAY CABLE 2 COLLECTION CABLE 3 POWER EQUIPMENT CABLE 4 MEDIUM VOLTAGE CABLE 5 SUBSTATION CABLE 6 OVERHEAD TRANSMISSION CABLE

1 SOLAR ARRAY CABLE

- CU PV (PHOTOVOLTAIC) WIRE
- RPVU90
- DUAL LAYER PV (PHOTOVOLTAIC) WIRE

2 COLLECTION CABLE

- AL PV (PHOTOVOLTAIC) WIRE
- SIM*pull*® CABLE-IN-CONDUIT (CIC)
- RWU90

3 POWER EQUIPMENT CABLE

- DLO
- RHH/RHW-2/USE-2

4 MEDIUM VOLTAGE CABLE

- 35 kV TRXLPE MV XLPE JACKET
- COVERED AERIAL MV™ (CAMV) CABLE

5 SUBSTATION CABLE

- INSTRUMENTATION CABLE
- JUMPER CABLE
- PROOF POSITIVE® COPPER
- SHIELDED CONTROL CABLE
- UNSHIELDED CONTROL CABLE

6 OVERHEAD TRANSMISSION CABLE

- ACSR
- ACSS
- C7™ (CARBON COMPOSITE CORE)

Learn more about our renewable energy products at **www.southwire.com/industries/power-generation**

ADDITIONAL RESOURCES

APPS

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