EDITION 22
VOLUME 1

24 TOP CONSIDERATIONS FOR UTILITIES

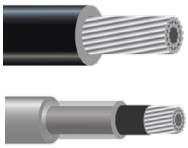
TO DEFEND AGAINST STORMS, MITIGATE WILDFIRES, AND MODERNIZE THE GRID

WRITTEN BY: Dr. Yuhsin Hawig, VP of Applications Engineering | **Casey Spradlin,** Principal Applications Engineer

WE DELIVER POWER…RESPONSIBLY®

This whitepaper outlines top considerations for utilities modernizing the transmission & distribution systems to defend against natural disasters and wildfires. Included in this article are 17 ruggedized cable designs, 4 calculation tools, and 3 services offered by Southwire. Discover our complete solutions by **scanning the QR code**.

COMPLETE SOLUTIONS



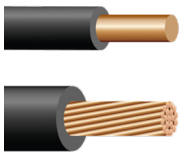
SHIELD BARE WIRES WITH TRACK-RESISTANT COVERING

Tree wires are self-supporting overhead conductors covered with an extruded track, UV, and abrasion-resistant covering that provides protection against momentary contact between phases. Also known as CAMV™ (Covered Aerial MV) cable, it prevents direct shorts and flashovers should tree limbs or other grounded objects contact the conductor. Upgrading bare overhead conductors to CAMV™ products can reduce faults caused by trees and minimize fire ignition in dry areas with dense vegetation. You can review our spec sheets by **scanning the QR code.**

SPEC SHEETS

UPGRADE CONDUCTORS OR UPSIZE MESSENGERS

To reinforce overhead systems against storms, many conductor types can be specified for bare transmission lines, CAMV™ distribution designs, or 600V service drop cables with a messenger. AAC containing 1350-H19, AAAC made of a 6201 alloy, and ACSR are standard options. Greased ACSR or mischmetal ACSR are frequently deployed to hamper steel corrosion in coastal areas. Additionally, ACSS with a higher thermal rating and C7® conductors with high-temperature & low sag are gaining acceptance for long span lengths located in hurricane-prone regions.



PROTECT EXPOSED GROUNDS USING COVERING

Protected Ground Wire (PGW), Covered Line Wire, and Covered Riser Wire are specified for applications where protection from momentary contact with wildlife is needed. Bare copper conductors are covered with either an extruded polyethylene (PE) or a crosslinked polyethylene (XLPE) layer to protect the exposed copper. Because the metallic appearance is concealed by a black covering, it also deters vandalism and copper theft. You can download our spec sheets by **scanning the QR code**.

SPEC SHEETS

DELAY CORROSION USING COPPER

Copper is more corrosion-resistant than aluminum and steel, which are often used on overhead lines. A good practice in coastal areas, where weight is not a major concern, is to utilize hard-drawn copper wire as an overhead distribution conductor. Metallic corrosion can occur both above and underground, and there are methods to delay corrosion below grade, which are challenging to inspect. Replacement of corrosive native soil with an engineered backfill is a great option. Improvement of local drainage is also essential as it diverts water around the exposed wires and lowers concentration of the contaminated water.

FIGHT WILDFIRES BY REPLACING BARE WIRES

The most successful wildfire mitigation solution for high fire risk areas is the conversion of overhead lines to below grade systems. There have been more intense wildfires due to climate change that are difficult to prevent. If undergrounding is not possible due to time, budget, or right-of-way, then bare overhead lines can be upgraded with tree wires to minimize arcing in drought regions. The 3-phase bare conductors can potentially collide with one another during windy conditions, which trigger sparks. Replacing bare wires with CAMV™ cable or covered conductors not only lessens the burden of vegetation management but also reduces the fire risk.

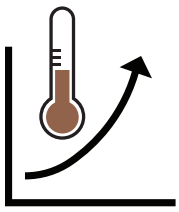
Southwire®

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

EDITION 22
VOLUME 1

24 TOP CONSIDERATIONS FOR UTILITIES

TO DEFEND AGAINST STORMS, MITIGATE WILDFIRES, AND MODERNIZE THE GRID



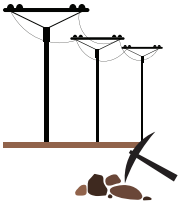
CHOOSE XLPE TO BOOST THERMAL STABILITY

When considering dielectric materials for overhead or underground circuits, there are two designs that can impact the long-term performance due to a conductor's thermal rating. The standard option is a thermoplastic Polyethylene (PE or LLDPE) covering/insulation, while the premium grade is a thermoset or Crosslinked Polyethylene (XLPE). Replacing PE with XLPE raises the cable's normal operating temperature from 75°C to 90°C, emergency overload from 95°C to 130°C, and short circuit from 150°C to 250°C. A thermoset insulation will not soften or melt easily in comparison to a non-crosslinked material.

SELECT HDPE TO WITHSTAND ABUSIVE USAGE

If a more robust cable is desired, then a High-Density Polyethylene (HDPE) material should be selected instead of the common Linear Low-Density Polyethylene (LLDPE). HDPE's excellent abrasion resistance protects cables from abusive tree limb contact or other grounded contact and can also minimize damage during shipment, handling, and installation. HDPE's superior durability compared to LLDPE can protect cables from wildlife attack and mechanical impact from backfill. You can download the whitepaper on HDPE by **scanning the QR code here.**

WHITEPAPER ON HDPE

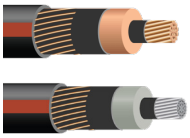


UNDERGROUNDING TO PREVENT OUTAGES

With the increasing frequency of natural disasters including hurricanes, tornadoes, wildfires, and winter storms, electric utilities have proactively transitioned overhead lines to underground circuits to boost reliability. Approximately 80% of power outages occur in distribution systems. For example, 15kV distribution conductors made of ACSR can be direct-buried by converting to a 15kV primary aluminum MV cable with a TRXLPE insulation, concentric neutrals, and an overall LLDPE jacket, which has become the preferred method for the upgrading of old lines overhead or underground and installation of new systems.

WATER-BLOCK TO DEFEND AGAINST MOISTURE

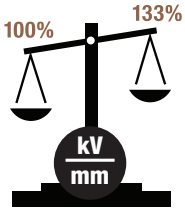
Water intrusion is one of the primary causes of cable system failures. Moisture accelerates the dielectric breakdown of insulation and triggers metallic corrosion. Corrosion-resistant designs such as solid conductors over stranded wires and copper tinning over uncoated counterparts have proven to be effective. A strand fill compound to water-block the conductor is frequently specified for underground MV cables. Water-swellabe powder can be applied over shielding wires, under the jacket, to absorb and retain moisture, which hinders the water penetration between the layers of jacketing and shielding wires along the installed cable.



SPECIFY EPR OR TRXLP FOR UNIQUE APPLICATIONS

MV cables rated 15-46 kV can be insulated with either EPR or TRXLPE depending on project requirements. EPR is a heavily-filled synthetic rubber formulation exhibiting excellent thermal stability, lower temperature flexibility, increased flexibility at low temperatures, and improved flame retardancy compared to the unfilled TRXLPE. Both designs can achieve the minimum 40-year service life and deliver excellent performance. However, installations in colder climates or locations requiring a UL optional flame rating can benefit from pairing EPR with a different shielding and jacket. You can access our whitepaper on EPR by **scanning the QR code.**

WHITEPAPER ON EPR



LOWER ELECTRICAL STRESS USING 133% INSULATION

The cable insulation level is dictated by how fast the protective equipment can de-energize the circuit in case of a fault. If a fault can be cleared within 60 seconds, then 100% insulation is sufficient. However, if a fault will sustain beyond 1 minute, but less than 1 hour, then 133% design is required. A 25kV 1/0 AWG cable insulated with a 133% wall yields a 15% reduction in electrical stress at the conductor shield and insulation interface compared to one with only 100% insulation. A thicker insulation is recommended for systems prone to electrical surges, and lowering electrical stress by using a heavier insulation can extend cable life.

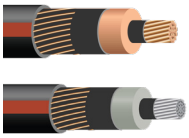
Southwire®

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

EDITION 22
VOLUME 1

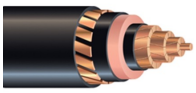
24 TOP CONSIDERATIONS FOR UTILITIES

TO DEFEND AGAINST STORMS, MITIGATE WILDFIRES, AND MODERNIZE THE GRID



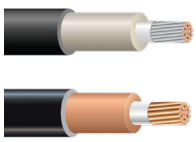
WITHSTAND SHORT CIRCUIT USING MORE NEUTRALS

The outer insulation shielding for many primary MV cables contain “one-third” neutrals relative to phase conductor size when used for a 3-phase supply, or "full-size" neutrals for a single-phase system. With modern rapid-switching equipment at substations, available short circuit current and duration are reduced compared to decades ago. Using a reduced possibly neutral rating ranging from 1/4, 1/6, to 1/12 saves material cost upfront but can pose significant risk due to an insufficient short circuit capacity. Southwire offers calculations to custom design cables with a reduced neutral to match any system requirements.



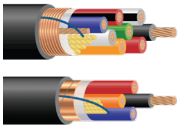
REDUCE DIAMETER VIA COMPACT STRANDS & FLAT STRAPS

PILC (Paper-Insulated Lead Cable) replacements typically require retrofitting new cables into an existing old conduit system with smaller size conduits than currently used. In order to reduce overall cable diameter and maximize flexibility utilities are using a full compact copper conductor insulated with the flexible EPR/EAM system shielded with flat strap neutrals with a ruggedized HDPE or PP jacket that have proven to be successful. A triplexed design with reduced insulation and/or jacket thickness helps to further lower the overall diameter to fit into a small conduit. HDPE or PP jackets also feature an improved oil resistance compared to LLDPE, which is critical if the cable will be subjected to oil residue leaked from old PILC cable.



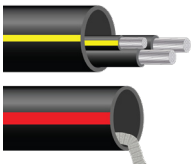
USE LSZH TO BOLSTER SAFETY

Heavy-duty network cables rated 600V, 1kV, or 2kV are often installed in vaults or manholes located below congested downtown streets and are operated to meet peak power demand. They are designed to withstand high temperatures, moisture ingress, and chemical exposure and are flame-retardant and inherently abrasion-resistant. Insulation material options include leaded or lead-free EPR/EAM, Chlorinated Polyethylene (CPE), and Low Smoke Zero Halogen (LSZH). LSZH is ideal for use in establishments where reduced smoke and low acid emissions are desired for public health and safety.



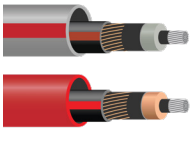
INCORPORATE SHIELDING TO DEFEND EMF

For substations containing a variety of extra high-voltage equipment, significant sources of electromagnetic interference (EMI) are present. Shielded control and power cables are specified in transmission substations to mitigate EMI. The EMI shielding efficiency depends on electrical conductivity, cable coverage, and shielding thickness. Doubling the number of helically applied copper tape shield with a greater thickness and a higher percentage of overlap will improve shielding effectiveness compared to a thinner and single-wrapped tape shield.



ADD CONDUIT TO IMPROVE SAFETY

Many methods can be deployed to install cables underground, including the use of PVC pipes or HDPE conduit, installation of concrete duct banks, or direct burying cables in earth. While direct burial is cheaper upfront, cables are susceptible to backfill damage and accidental dig-ins. Using conduit creates a durable barrier both electrically and physically to protect cables from mechanical forces and avoid electrocution. Pulling cable in conduit improves safety compared to direct burial as the protective plastic pipe can prolong cable life and lower replacement costs and frequencies.



ADOPT CIC TO SAVE TIME & LABOR

Adopting an all-in-one Cable-in-Conduit (CIC) system not only saves labor and shortens installation time, but also can help prevent field injuries and is a proven solution to mitigate wildfires. Medium voltage and 600V cables can be preassembled in HDPE conduit at the factory. The long continuous CIC length provided on a standard reel can be installed with fewer or no joints which are labor-intensive to build. CIC can be deployed via Horizontal Directional Drilling (HDD), plowing, or trenching. HDD minimizes the construction impact with less interruptions to residential areas or busy commercial districts.

Southwire®

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

EDITION 22
VOLUME 1

24 TOP CONSIDERATIONS FOR UTILITIES

TO DEFEND AGAINST STORMS, MITIGATE WILDFIRES, AND MODERNIZE THE GRID

OPTIMIZE SAG & TENSION VIA SAG10® SOFTWARE

Southwire's SAG10® software is recognized as the industry's benchmark for overhead conductors' sag-tension modeling based on the Alcoa Graphic method. It combines 70 years of conductor data, customer feedback, and field expertise into one powerful tool. Over 500 utilities and consultants rely on Southwire & SAG10® software to design overhead systems. Learn more by **scanning the QR code.**

LEARN MORE SAG10®

RUN VOLTAGE DROP TO SIZE CONDUCTORS

Do you need to calculate the voltage drop for a specific circuit length or size conductors to meet the voltage drop limit of 3% per NFPA 70® NEC®? Southwire's calculator tool includes copper & aluminum options, commercial & residential applications, 60, 75, or 90°C ratings, and single vs. 3-phase systems. Installation methods feature overhead lines, direct burial, and steel vs. non-steel conduit. You can access our free calculator by **scanning the QR code.**

USE CALCULATOR

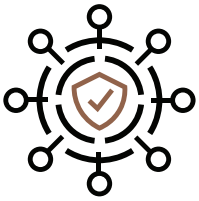
MODEL AMPACITY TO AVOID OVERHEATING

Recently, more copper conductors instead of aluminum have been specified due to the high ampacity required for infrastructure expansions, such as EV and data centers, to meet the growing power demand. Using general ampacity data from a code book might not be sufficient. Southwire offers comprehensive ampacity studies to verify the maximum current-carrying capacity for cables under complex installations and unique environmental conditions. Factors such as burial depth, cable layout, heat sources, and soil thermal resistivity play a critical role in ampacity.

CALCULATE PULLS TO PREVENT DAMAGE

Southwire's online calculators are free of charge for any user. We recommend conducting cable pull calculations in advance to evaluate the routings, coefficient of friction (CoF) for different jacket materials, pull distance, number of bends, and the angle of each bend. You can **scan the QR code** to access the SIM*pull*® calculator for 600V or medium voltage cables.

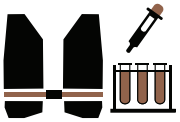
SIMPULL CALCULATOR



ASSESS GRID RESILIENCY DIGITALLY

Southwire offers Digital Grid Resiliency Assessments identifying areas for improvement by leveraging your outage and GIS data. This program locates problematic circuits at the device level and prioritizes maintenance actions. It also provides recommendations with expected benefits and cost justifications. Assets are scored by an overall equipment ranking based on health and network criticality. You can learn more by **scanning the QR code.**

DIGITAL GRID RESILIENCY ASSESSMENTS



REJUVENATE CABLE TO EXTEND LIFE

Aging dielectric cables with growing water trees can be restored close to their original state by utilizing the one of the world's only cable rejuvenation services. Our patented rejuvenation technology injects silicone fluid into cables via the conductors. Then, the liquid migrates out to the conductor shield and insulation. This process raises the breakdown strength of the insulation, extends service life, and boosts reliability of old circuits without costly replacement. Learn more about this innovative process by **scanning the QR code.**

LEARN MORE

CONTACT CABLETECHSUPPORT™ SERVICES

Southwire's CableTechSupport™ services, Re3™ mission statement signifies our commitment to Respond, Rectify, & Restore with Reinforced, Resilient, & Reliable solutions. We have published many whitepapers to help utilities and other industries in North, Central, & South America to plan the most challenging projects. You can access these articles online by **scanning the QR code.**

VIEW WHITEPAPERS

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

Southwire®