R3e™ EDITION 29
VOLUME 1

12 TOP ATTRIBUTES TO DESIGN A REINFORCED, RESILIENT, & RELIABLE MV PRIMARY DISTRIBUTION SYSTEM

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1. VOLTAGE RATINGS

The most popular distribution system voltage is 15 kV, followed by 25 and 35 kV. MV cables with a 115-mil insulation thickness can be dual-rated for 5 kV 133% and 8 kV 100%. It is common to see 28 kV circuits in Canada, and the 46 kV sub-transmission line is gaining popularity due to the growing power demand. The heaviest insulated MV cable is the 46 kV 133% rating with a 580-mil wall, which is much thicker than the 69 kV high voltage system with a 354-mil standard thickness.

2. CONDUCTOR SIZES

At Southwire, we manufacture eight standard conductor sizes regularly to satisfy the market needs. For example, 15kV 100% designs can be sized from 2 AWG to 1000 kcmil, but the full range of conductors, including 1250 kcmil and larger, can be customized to deliver the highest required ampacity at 90˚C, which is the normal operating temperature of the conductor. Aluminum conductors in 1/0 AWG and 1000 kcmil are among the most frequently specified sizes in the U.S.

3. CONDUCTOR METALS

Southwire is vertically integrated with multiple rod mill plants, allowing us to produce copper and aluminum rods for drawing and stranding for all cable products. Utilities often specify conductors made of 1350-H16/H26 (¾ hard) aluminum. Aluminum alloy in 8000 series and soft-drawn copper are more prevalent in industrial and commercial applications. Copper conductors are vital when a larger aluminum cable is space-constrained or fails to meet the ampacity demand. For example, 1000 kcmil copper can carry 640 amps of ampacity in the duct, but the equivalent aluminum design will be bigger than 1250 kcmil.

4. STRANDING CLASSIFICATIONS

There are three general stranding types: solid, stranded, and full compact. A solid conductor without interstices yields the best water-blocking. Moisture comes through terminations or splices, allowing water to permeate through the stranded conductor and travel along the circuit length. However, the stranded design is necessary for sizes larger than 1/0 AWG, as it improves flexibility and facilitates bending. Compacting the wire strands reduces the overall conductor diameter, essential to designing the smallest MV feeder cable to fit into an existing congested raceway without undersizing.

WE'VE GOT IT MADE IN AMERICA™

BUILD AMERICA & BUY AMERICA

Southwire's Medium Voltage (MV) products meet the Build America & Buy America (BABA) policy and comply with 49 U.S.C. § 5323(j) regulation. Raw materials from drawing, stranding, extrusion, shielding, and jacketing are made in the U.S.A. Cables are qualified to the most stringent industry standards, including AEIC, CSA, ICEA, and UL. Over 10,000 MV combinations from 5 to 46 kV can be designed to power utility distribution circuits, wind, solar, battery energy storage systems (BESS), and hydropower plants. Scan to access the spec library.

Southwire CABLETECH SUPPORT™ Services

CABLETECHSUPPORT™ SERVICES

Southwire's CableTechSupport™ Services group features certified MV splicers, Professional Engineer (PE) certifications, Ph.D., MBA, and Master of Science degrees in engineering. Over 15,000 technical requests with 100 signed letters are submitted yearly to gain approvals from engineers, inspectors, and Authorities Having Jurisdiction (AHJ). Our whitepapers and online tools help customers select the most Reinforced, Resilient, and Reliable products, including MV cables. Scan the QR code to access our technical library.

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CableTechSupport@southwire.com or visit **Southwire.com**

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5. WATER-BLOCKED CONDUCTORS

The capillary force accelerates the longitudinal water penetration within a stranded conductor (similar to a straw). A hydrophobic and semiconductive strand-fill compound can be pumped into the conductor during the stranding process to block the water. Many utility or renewable MV cables are designed with this moisture-block material made of a crosslinked super absorbent polymer. It absorbs liquid up to 100% of its original volume, preventing water from migrating further.

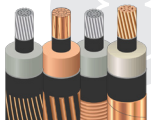
6. CONDUCTOR SHIELD TYPES

Two different grades of carbon black can be sourced to produce a semiconductive shielding compound for Tree-Retardant Crosslinked Polyethylene (TR-XLPE) insulation. The conventional conductor shield contains a standard furnace-based carbon black specified for most TR-XLPE MV cables. A super-smooth grade is composed of acetylene-based carbon black, featuring fewer impurities and smaller defects per surface area. This premium class is often selected to power critical circuits such as airports, data centers, hospitals, and military facilities.

7. INSULATION MATERIALS

MV cables are manufactured on a continuous vulcanization (CV) line equipped with a true-triple-extrusion head. The insulation system is a peroxide-based formulation cured under dry nitrogen. Ethylene Propylene Rubber (EPR) is a heavily-filled synthetic rubber with excellent thermal stability and lower temperature flexibility than the unfilled TR-XLPE. Six insulation design combinations including TR-XLPE, leaded EPR (EAM), and non-lead EPR (EAM) in either 100% or 133% insulation levels are available.

8. SHIELDING DESIGNS

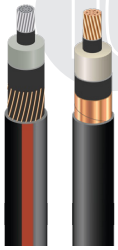


Copper shielding can be designed as concentric neutrals (CN), longitudinally-corrugated tape shields (LCT), helically-applied tape shields (TS), and flat-strap neutrals (FSN). Utility and renewable customers commonly specify concentric neutrals with ratings from Full, 1/3, 1/6, and 1/9 down to 1/12. TS and LCT provide 100% coverage and increase mechanical strength. When greater flexibility is needed, an LCT may be selected over TS. FSNs are indispensable designs as they are often deployed as Paper-Insulated Lead Cable (PILC) replacements in small steel pipes.

9. WATER-BLOCKING FEATURES

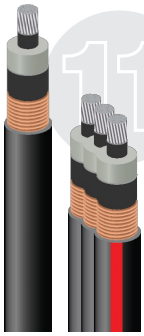
Two supplementary longitudinal water-blocking components can be added to MV cables besides the strand-filled conductors mentioned earlier. Firstly, water-blocking powder can be applied over the neutrals and under the jacket (HI-DRI-PLUS). Secondly, a laminated water-swellable tape (WST), which is required for HV/EHV cables, can also be incorporated into MV cables as a design upgrade. If there is a jacket puncture, water intrusion can be impeded effectively by the water-swellable powder or tape.

10. JACKET OPTIONS



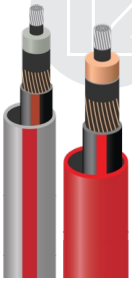
Ten different jacketing materials can be selected for MV, including LLDPE, patented PowerGlide® LLDPE, semiconductive LLDPE, XLPE, HDPE, PP, PVC, SIM*pull*® PVC, CPE, and LSZH. The most commonly specified jacket is a thermoplastic LLDPE featuring the lowest brittleness temperature for cold weather installations. The thermoset or crosslinked XLPE is the most popular MV design for renewable power generation. This allows the conductors to operate at a temperature higher than the traditional utility cables and is marked for UL MV-105.

11. CABLING CONFIGURATIONS



Southwire can offer single conductor (1/C), 3 conductor (3/C) parallel, or triplexed assemblies to simplify material handling. A single reel of 3/C parallel is much easier to install than three separate reels of 1/C. For example, customers can power the 3-phase distribution line using a paralleled 3/C 1/0 AWG 15 kV 100% cable.

12. INSTALLATION METHODS



MV cables can be directly buried in the ground, pulled into a conduit, or pre-assembled into an all-in-one cable-in-conduit system (CIC). Direct burial is the most economical solution in the short term, but adding a protective pipe prevents cable damage and reduces the overall lifecycle cost, including operation and maintenance. CIC also enhances jobsite safety and efficiency while reducing labor costs.

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