ELAND®
CABLES

MEDIUM VOLTAGE CABLES:

An Expert's Guide

INTRODUCTION

Medium voltage cables have long been a crucial component of modern electrical distribution systems. Carrying power from substations to various endpoints such as homes, businesses and industrial facilities, they ensure an efficient, reliable supply of electricity that meets our daily needs.

There's a reason for this surge in demand. Factors such as urbanisation, industrialisation, the expansion of renewable energy sources and the electrification of transportation are all fuelling increased use of MV cables across various sectors.

As they become more frequently specified, understanding the features, functions and applications of medium voltage cables is hugely important. This ebook provides a detailed guide to MV cables, examining them from the inside out to help you navigate their complexities, ensure optimal cable performance and keep downtime to a minimum.

In 2023, the global medium voltage cables market was valued at a staggering $31.86 billion. What's more, forecasts indicate that it will reach over $43.93 billion by 2028 – demonstrating continued growth.[1]

WHAT MAKES A MEDIUM VOLTAGE CABLE?

Most medium voltage cables will follow a typical construction pattern consisting of several key layers: the current-carrying conductor, a layer of insulation and a protective cable sheath.

Depending on the requirements of your project however, there will be wide range of MV cables for you to choose from, each with their own range of additional features and functions.

To help you better understand these various constructions, we've highlighted four examples of commonly specified MV cables – and identified the components you might want to consider when selecting your next MV cable.

1. https://www.researchandmarkets.com/reports/5744265/medium-voltage-cable-global-market-report

N2XS(FL)H

Power distribution cables suitable for internal and external installation – limiting jointing at point of entry to the building where CPR (Construction Products Regulation) compliance is required. Waterblocking layers provide longitudinal and radial watertightness, preventing water propagation along the cable. Manufactured in accordance with IEC 60502-2. Available in a range of voltages including 6/10kV, 8.7/15kV, 12/20kV and 18/30kV.

Common variants:

- Copper conductors: N2XS2Y (MDPE sheath) and N2XSY (PVC/Polyvinyl Chloride) sheath)
- Aluminium conductors: NA2XSH (LSZH sheath), NA2XS2Y (MDPE sheath) and NA2XY (PVC sheath).

Sheath: LSZH (Low Smoke Zero Halogen)

CPR compliant and flame retardant, with low smoke and zero halogen properties to protect human life and sensitive equipment in the event of fire. Suitable for internal or external installation (UV resistant). Traditionally a red sheath.

Radial Waterblocking:

Aluminium tape tightly bonded to the sheath prevents water ingress in the event that the sheath is penetrated i.e. pierced by a rock or sharp implement.

Conductor: Class 2 stranded copper:

Offers the optimal balance of conductivity to size – important for internal installations where space may be severely limited.

Core Configuration:

Single core cable.
Available as three-core cable N2XSEH (without waterblocking).

Insulation: XLPE (cross-linked polyethylene)

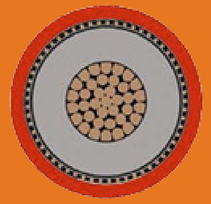
Provides high dielectric strength, thermal stability. Conductor screen and insulation screen applied in triple extrusion process. Supports a maximum conductor operating temperature of +90°C.

Metallic Screen: Copper wires and copper tape

Provide shielding against electromagnetic interference (EMI) and electrical disturbances. Also, to maintain a uniformly divergent electric field and contain the electric field within the cable core. Tape is wound in a counter-helix to the copper wires.

Longitudinal waterblocking:

Swellable tapes and/or powders applied above and below the metallic screen. When exposed to moisture, the swellable tape expands, forming a barrier that prevents water from pulling through the length of the cable.

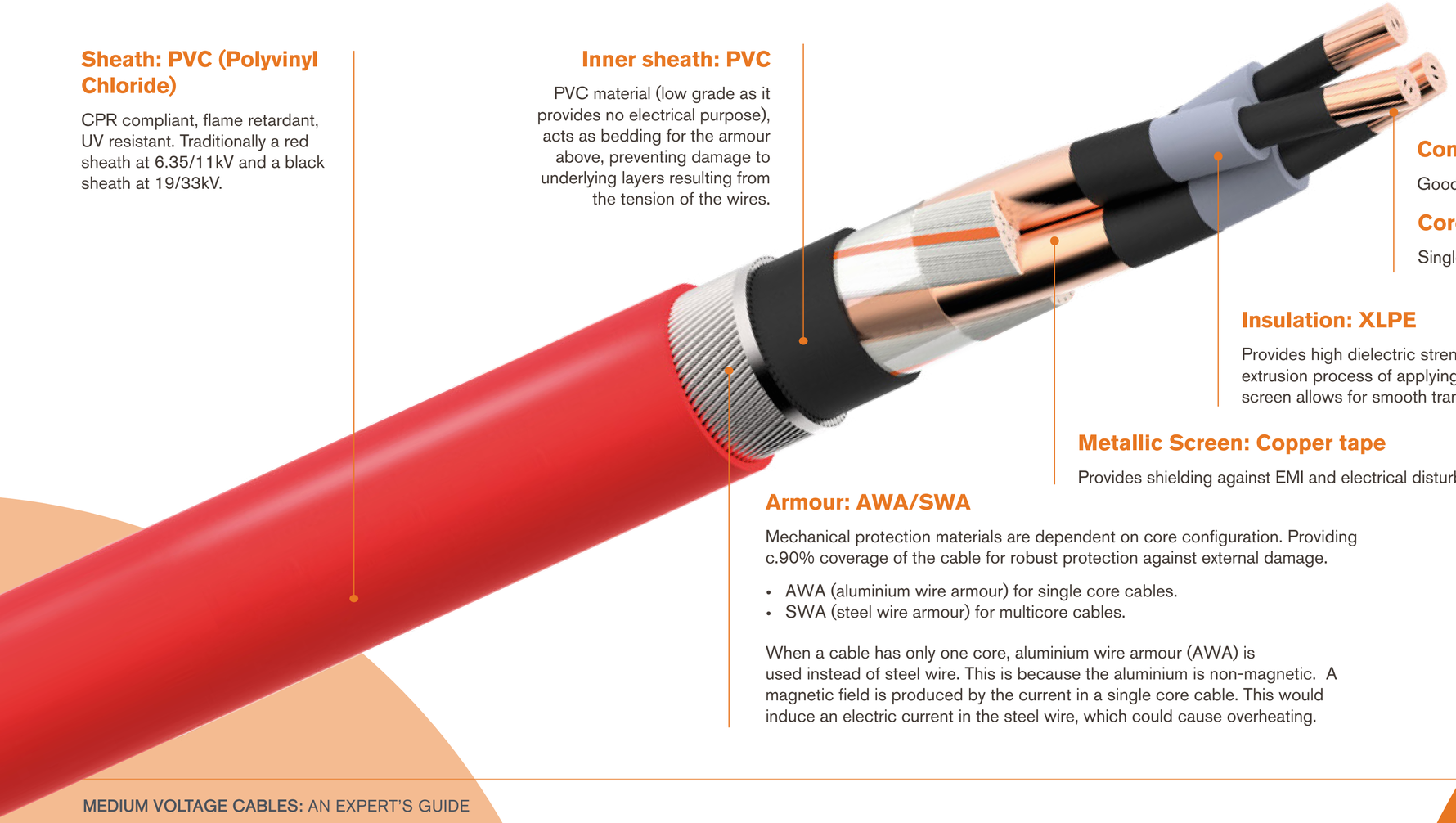


ALL CABLES AVAILABLE WITH SINGLE OR DUAL WATERBLOCKING LAYERS (F) AND (FL) RESPECTIVELY.

BS 6622 XLPE AWA/SWA PVC

Armoured PVC power distribution cables offering mechanical protection for direct burial applications. Available in voltages 3.8/6.6kV, 6.35/11kV, 8.7/15kV, 12.7/22kV and 19/33kV. Suitable for internal and external installations. Manufactured to British Standard BS 6622.

Common variants:
- BS 7835 – LSZH (Low Smoke Zero Halogen) inner sheath (bedding) and outer sheath.
- Both cables are available with aluminium conductors under the relevant standards.



Sheath: PVC (Polyvinyl Chloride)

CPR compliant, flame retardant, UV resistant. Traditionally a red sheath at 6.35/11kV and a black sheath at 19/33kV.

Inner sheath: PVC

PVC material (low grade as it provides no electrical purpose), acts as bedding for the armour above, preventing damage to underlying layers resulting from the tension of the wires.

Conductor: Class 2 stranded copper

Good conductivity in accordance with EN 60228.

Core configuration:

Single core or three-core multicore variants.

Insulation: XLPE

Provides high dielectric strength and thermal stability. The triple extrusion process of applying conductor screen and insulation screen allows for smooth transition across the component layers.

Metallic Screen: Copper tape

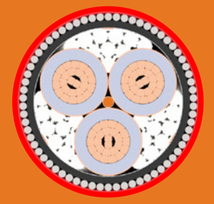
Provides shielding against EMI and electrical disturbances.

Armour: AWA/SWA

Mechanical protection materials are dependent on core configuration. Providing c.90% coverage of the cable for robust protection against external damage.

- AWA (aluminium wire armour) for single core cables.
- SWA (steel wire armour) for multicore cables.

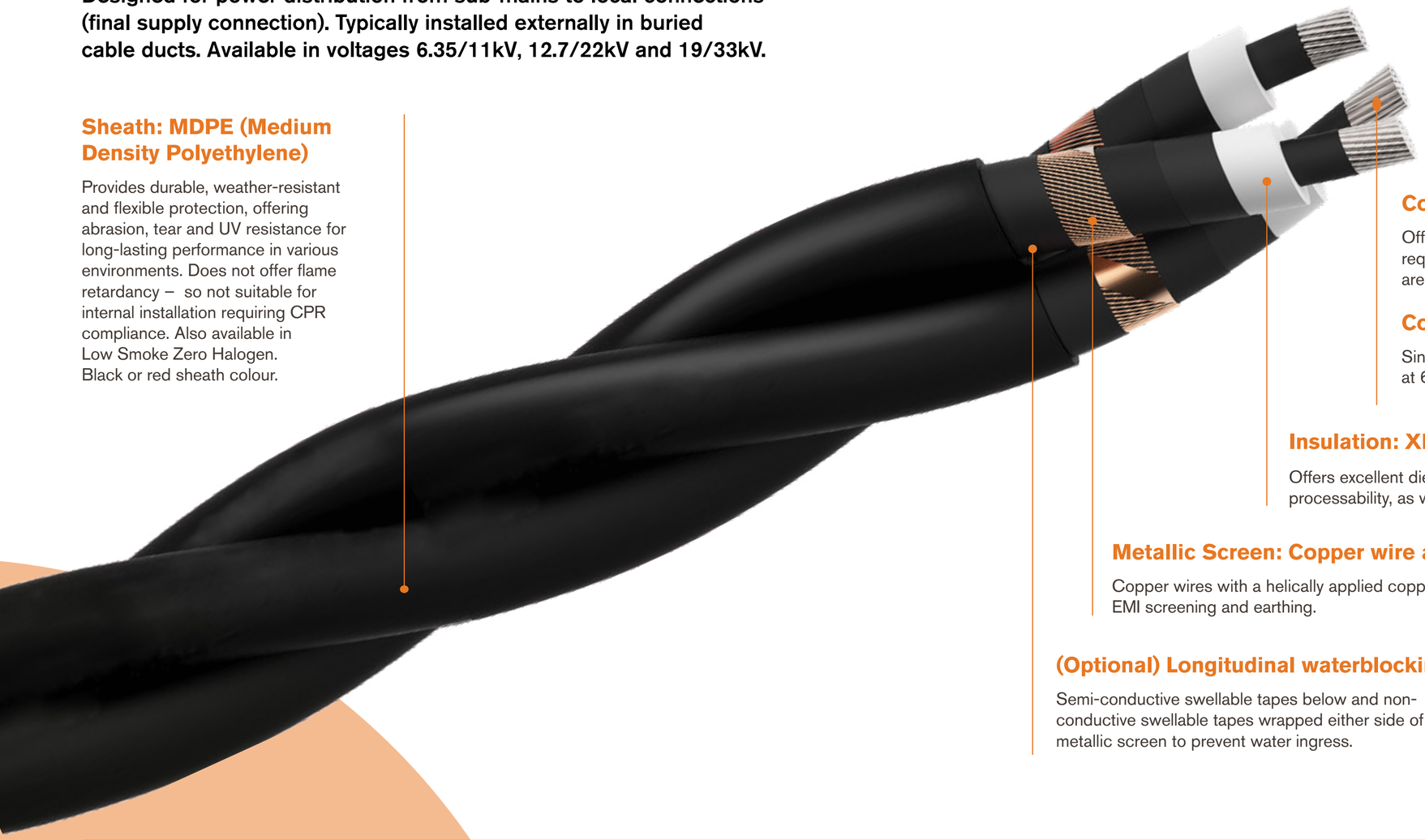
When a cable has only one core, aluminium wire armour (AWA) is used instead of steel wire. This is because the aluminium is non-magnetic. A magnetic field is produced by the current in a single core cable. This would induce an electric current in the steel wire, which could cause overheating.



ARMOURING CAN PROTECT AGAINST MECHANICAL DAMAGE WHEN BURIED DIRECT IN THE GROUND.

BS 7870-4.10 TRIPLEX

Designed for power distribution from sub-mains to local connections (final supply connection). Typically installed externally in buried cable ducts. Available in voltages 6.35/11kV, 12.7/22kV and 19/33kV.



Sheath: MDPE (Medium Density Polyethylene)

Provides durable, weather-resistant and flexible protection, offering abrasion, tear and UV resistance for long-lasting performance in various environments. Does not offer flame retardancy – so not suitable for internal installation requiring CPR compliance. Also available in Low Smoke Zero Halogen. Black or red sheath colour.

Conductor: Class 2 Aluminium

Offers a lightweight alternative to a copper conductor, but requires a compromise on increased conductor cross-sectional area to achieve the same current carrying capacity.

Core configuration:

Single core triplex formation (3x1 formation) commonly supplied at 6.35/11kv. Single core supplied at 12.7/22kV and 19/33kV.

Insulation: XLPE

Offers excellent dielectric properties and good processability, as well as a temperature rating of +90°C.

Metallic Screen: Copper wire and copper tape:

Copper wires with a helically applied copper equalising tape for EMI screening and earthing.

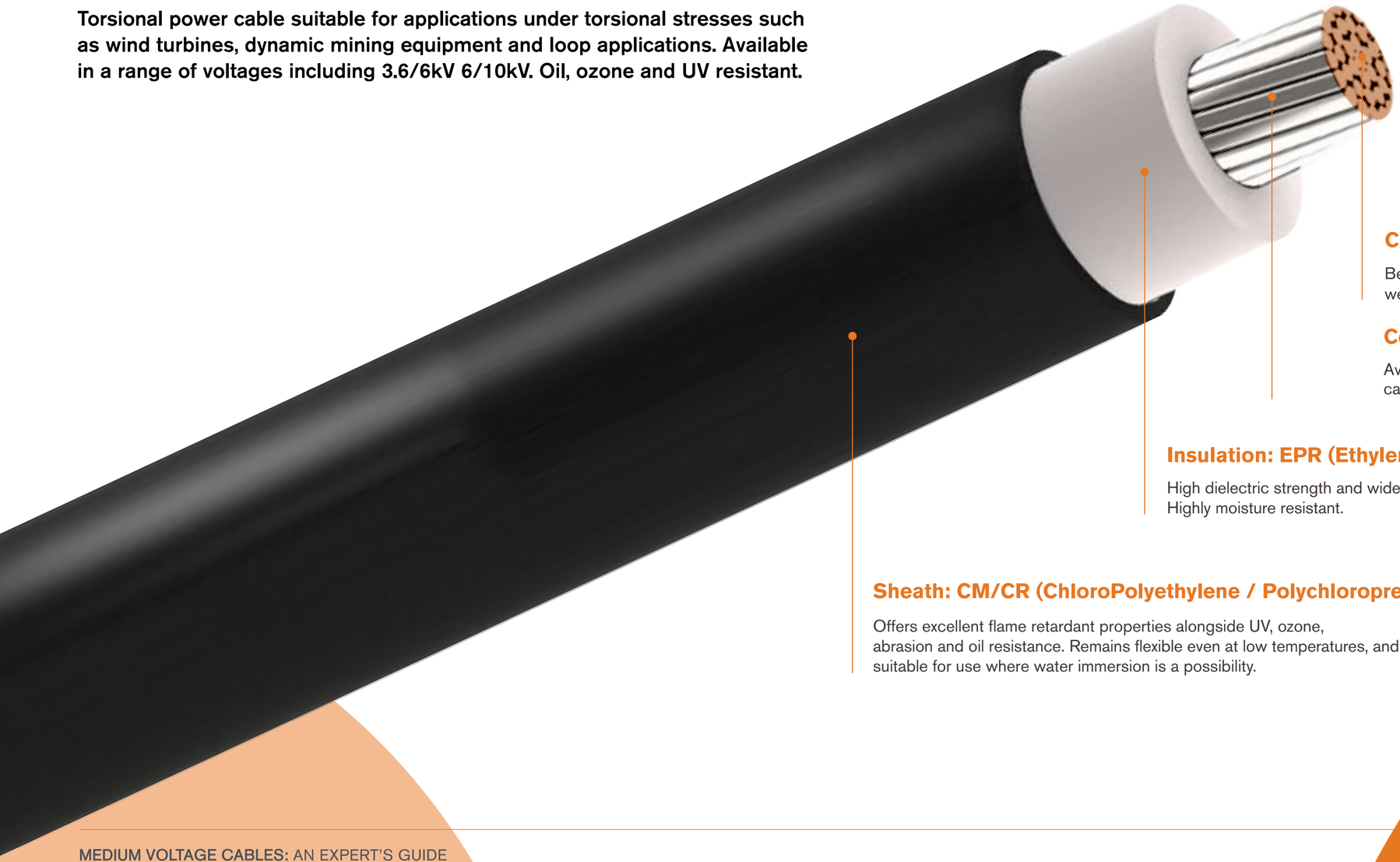
(Optional) Longitudinal waterblocking:

Semi-conductive swellable tapes below and non-conductive swellable tapes wrapped either side of the metallic screen to prevent water ingress.

TRIPLEX FORMATION IS QUICKER TO INSTALL COMPARED TO 3x SINGLE CORE CABLES FOR THREE-PHASE POWER

NTSCGEWÖW CABLE

Torsional power cable suitable for applications under torsional stresses such as wind turbines, dynamic mining equipment and loop applications. Available in a range of voltages including 3.6/6kV 6/10kV. Oil, ozone and UV resistant.



Conductor: Class 2 Tinned Copper

Benefits include anti corrosion properties, making these cables well suited for environments where corrosion can be problematic.

Core configuration:

Available in single and three-core variants, with three-core cables including a full-sized earth core.

Insulation: EPR (Ethylene Propylene Rubber)

High dielectric strength and wide thermal range.
Highly moisture resistant.

Sheath: CM/CR (ChloroPolyethylene / Polychloroprene)

Offers excellent flame retardant properties alongside UV, ozone, abrasion and oil resistance. Remains flexible even at low temperatures, and is suitable for use where water immersion is a possibility.

DYNAMIC EQUIPMENT LIKE MOTORS AND ROTORS CAN FACE TORSIONAL STRESSES ACROSS VERTICAL AND HORIZONTAL PLANES

MV CABLE ACCESSORIES

When installing a cable network, the accessories that join, connect and terminate the cables are not optional extras; they're essential components to consider. Calibration to closely match cables and accessories is a key part of facilitating efficient and reliable electrical connections and minimising future maintenance.

HERE ARE A FEW CABLE ACCESSORIES YOU MIGHT COME ACROSS WHEN WORKING WITH MEDIUM VOLTAGE (AND INDEED ANY) CABLES:

CABLE JOINTS:

Used to connect two lengths of cable together. These joints must maintain the electrical integrity of the cable and provide mechanical strength.

TERMINATIONS:

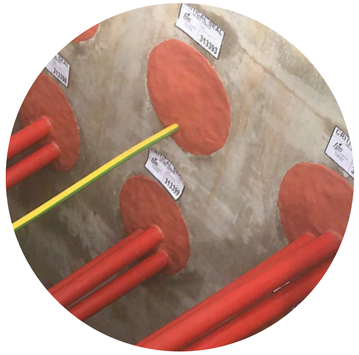
Used to connect MV cables to electrical equipment, such as transformers or switchgear. Terminations must provide a secure connection while maintaining the electrical properties of the cable.

CABLE GLANDS:

Used to secure the cable to equipment or enclosures, providing strain relief and protection against environmental factors such as dust and moisture.

CABLE CLEATS:

Used to support and secure MV cables, preventing movement and ensuring they are correctly positioned.



CABLE MARKERS:

Used for the identification and labelling of MV cables, ensuring easy identification during installation, maintenance and repairs.

WHAT KINDS OF PROJECTS ARE MV CABLES USED FOR?

Thanks to their versatility and reliability, MV cables are used for grid power distribution and equipment power across a diverse range of industries and sectors – here are a few examples.

By the end of 2023, clean renewable power accounted for 43% of global installed power capacity – the largest increase in green capacity to date, mostly due to a significant growth in solar and wind power usage.[2]

Driven by changes in global policy, this shift towards renewable power has meant an unprecedented demand for MV cables. With changes to the underlying grid infrastructure already well under way, the 11kV segment now holds the largest market share.[3]

The growing adoption of electric vehicles (EVs) will continue to drive the expansion of the MV market in the years ahead, connecting commercial and industrial scale banks of chargepoints into grids and to substations.

From the network that supports domestic installations, to the high-powered fast-charge networks being installed across Europe, the e-Mobility industry is dependent on a strong Medium Voltage grid.

Digitalisation and the ever-growing data centre industry sees Medium Voltage cables run from substations into transformers. Where they're run direct into the buildings themselves, LSZH sheathing is always specified. These mission-critical always-on installations are power intensive - something that will increase as AI evolves, requiring more space and more power to process.

MV cables power both infrastructure (site power, lighting, extraction systems) and heavy-duty static and dynamic equipment all operating in challenging conditions. For dynamic equipment, the conductors are often Class 5 flexible stranded copper, to aid movement and flexibility, with abrasion resistant Rubber sheathing for trailing and reeling cables.

Electrification projects require trackside and overhead line power systems on our railways.

Trackside cables to traction substations for Network Rail in the UK are rated at 19/33kV (for AC feed) or 25/44kV (for DC feed). With no space restrictions, cables with aluminium conductors are commonly used to dissuade theft, which can cause disruption and line closures.

2 https://www.smartenergydecisions.com/research/2024/04/10/renewable-capacity-statistics-2024
3 https://www.researchandmarkets.com/reports/5744265/medium-voltage-cable-global-market-report

COMMON CHALLENGES MV CABLE INSTALLATIONS

RESEARCH INTO UNDERGROUND MV CABLE FAULTS HIGHLIGHTS THE CRUCIAL NATURE OF PROPER INSTALLATION METHODS.

72%

OF CABLE FAILURES CAN BE ATTRIBUTED TO POOR CABLE JOINTS[4]

22%

TO IMPROPER CABLE INSULATION[5]

6%

TO FAULTY TERMINATIONS[6]

To help make installation a breeze, here are some of the key installation pitfalls that are worth looking out for – and our top tips on how to tackle them.

CONFINED SPACES

MV installations can often occur in tight underground spaces with limited room. To minimise twisting, kinking and over-bending during handling and installation, use the proper cable handling techniques and never exceed the stated minimum bending radius. Carefully calculate sidewall pressures to navigate bends in the cable route.

In the event of exceeding the stated restrictions, ensure additional testing is conducted to identify any compromise to the cable and contact your cable supplier for further recommendations and assistance.

ADDING NEW CABLES TO AN EXISTING INSTALLATION

When integrating new cables into an established system, consideration of compatibility, load distribution and potential impacts on overall performance is key.

Effectively managing additional cable length begins with preventing tangling or interference – and deploying the appropriate cable jointing accessories to maintain system integrity and performance. It's also important to consider heat dissipation, spacing and potential signal interference with nearby control or data cables.

Additionally, best practice dictates removing old, redundant cables before installing new ones to avoid potential issues.

ENVIRONMENTAL AND WATER DAMAGE

Moisture ingress and environmental damage can compromise cable insulation and lead to electrical faults or failures.

Prevent this by selecting a high quality, rigorously tested MV cable that offers adequate protection. Depending on the specific nature of your project, layers and additives that provide moisture, UV, ozone or chemical protection may be required.

4-5 and 6 https://www.researchgate.net/figure/MV-underground-cable-failure-statistics_tbl1_224122960

UNLOCK MV CABLING SUCCESS WITH ELAND CABLES

As global demand continues to surge, selecting the correct Medium Voltage cable – matching their features, functions and applications – is ever-more important for operational efficiency and reliability.

Our team of MV experts are on hand to provide support in specification or to discuss your project. Let us help you to achieve your MV project goals.

At Eland Cables, we understand the challenges involved in selecting the right MV cable for your project. Our blend of high-performance, high-quality products, technical expertise, sustainable credentials and tailored logistical solutions sets us apart from others.

With technical support from experts who help shape national and international cable standards, coupled with industry experience that understands the demands and challenges of your site, our team offers comprehensive and personalised support tailored to your specific needs. Whether you're facing challenges in your MV cable installation or seeking solutions to issues with existing MV projects, we're here to help you achieve your goals.

At Eland Cables, we're proud to be leading the charge for sustainability within the cable sector. We can provide carbon emissions documentation and LCAs for all our cables, and we're actively seeking to reduce carbon emissions across our supply chain. Our cables are transported by our own fleet of sustainably-fuelled HGVs, ensuring faster and greener delivery across Europe.

And when it comes to quality and safety assurance, our credentials speak for themselves. Our industry-leading testing laboratory is certified with IECEE CBTL and ISO/IEC 17025 accreditations – and all our MV cables hold the BSI Cable Verification Kitemark having been subject to intensive assessment. Powered by our unique Cable Lab, we drive product innovation and uphold rigorous testing procedures to maintain the highest levels of consistency and compliance.

Looking for the perfect cable partner for your next MV project? Get in touch with Eland Cables today. Our team of experts will be happy to assist you.

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