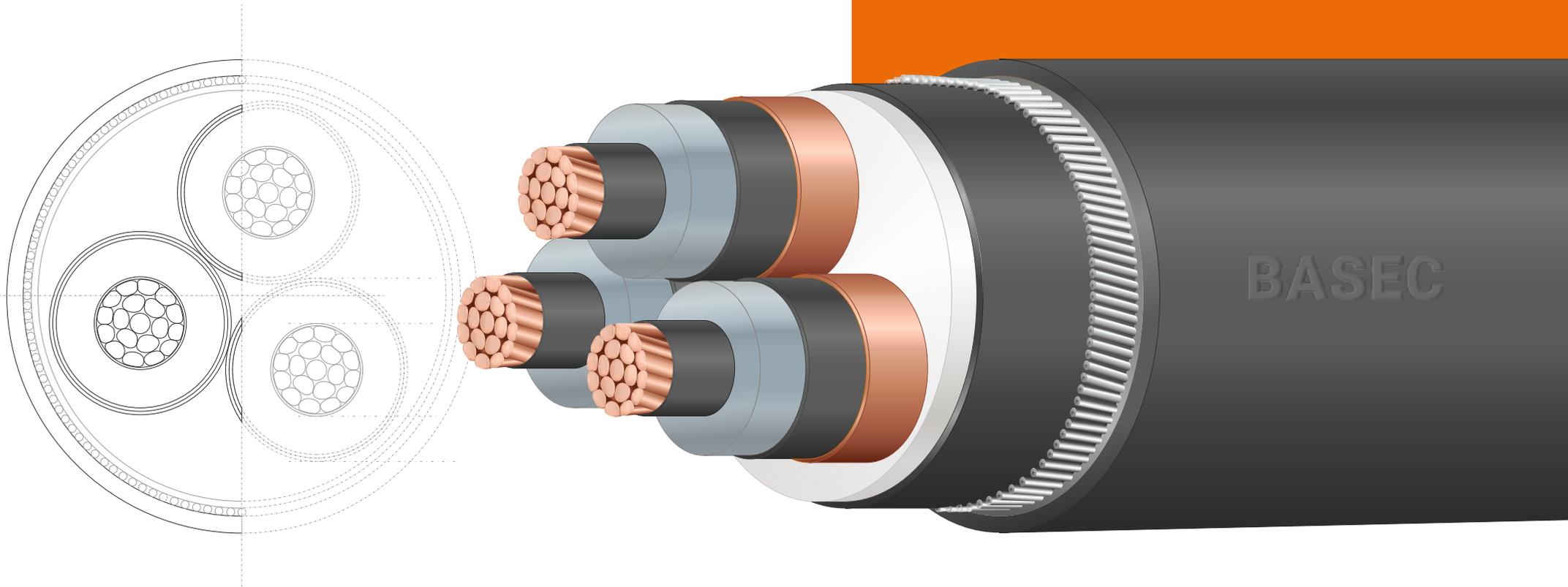


Guide to Medium Voltage Distribution Cable Standards and Power Distribution Network Requirements for Enhanced Performance and Quality Assurance



Contents

1.	Introduction	Page - 2
2.	Background	
3.	Technical Overview of MV Cable Standards	Page - 3
3.1	IEC 60502-2	
3.2	BS 6622	
3.3	BS 7835	
3.4	BS 7870-4.10	
3.5	BS 7870-4.20	
3.6	Comparison of MV Cable Standards	
3.7	Other Specifications	
4.	Enhanced Performance	Page - 7
4.1	Water Protection	
4.2	Shrinkage	
4.3	Insulation Screen	
5.	Quality Assurance	Page - 9
5.1	Type Test	
a)	Third Parties	
b)	Independent Witness	
5.2	Product Approval	Page - 10
a)	BASEC Product Approval	
b)	Factory Audit	
c)	Cable Sample Testing	
d)	Market surveillance	
5.3	Factory Acceptance Test	Page - 12
6.	Current & Future Challenges	Page - 13

Forward

BASEC has been working in partnership with cable manufacturers for over 50 years and has a strong brand and heritage of being the mark of quality and safety. Over the last few years, we have made significant investments to extend our offering to a broader customer group.

Our new medium and low voltage testing laboratory in Dubai, United Arab Emirates, complements the laboratory in Milton Keynes UK and significantly increases our testing capacity and support for manufacturers to achieve a shorter time to market whilst also adding to the robustness and capabilities of the existing testing services and certification schemes.

We continue to expand our international reach to establish BASEC as a worldwide partner delivering services and support through our regional offices of dedicated teams of technical experts and superior customer care. Our goal is to give end users and manufacturers confidence that by using the BASEC mark, they can be assured of guaranteed quality and safety throughout the supply chain.

Our vision is to be the preferred testing and certification partner to the worldwide cable industry. It builds upon other recent investments to add capability, technology, and global reach, to enhance BASEC's service proposition in this technology space and the increasing demands for medium voltage cabling in the renewable energy and power distribution sector.

This guide informs Industry stakeholders of the range of standards and product approval process for MV cables (up to 33kV). The aim is to reach designers, specifiers, contractors, manufacturers, suppliers, operators, and others to highlight some of the specific enhanced performance requirements for MV cables for power distribution and help ease climate change impacts.

Mark Froggatt
BASEC Group Technical Director

Section 1: Introduction

This guide provides an overview of medium voltage (MV) distribution cables and compares British and International standards. It identifies some of the specific requirements of the UK power distribution network for enhanced performance and quality assurance.

The guide aims to inform a range of stakeholders within the industry - designers, specifiers, contractors, manufacturers, suppliers, operators, and others of the product approval process for MV cables (up to 33kV). It also highlights some of the specific enhanced performance requirements for MV cables that can help mitigate climate change impacts.

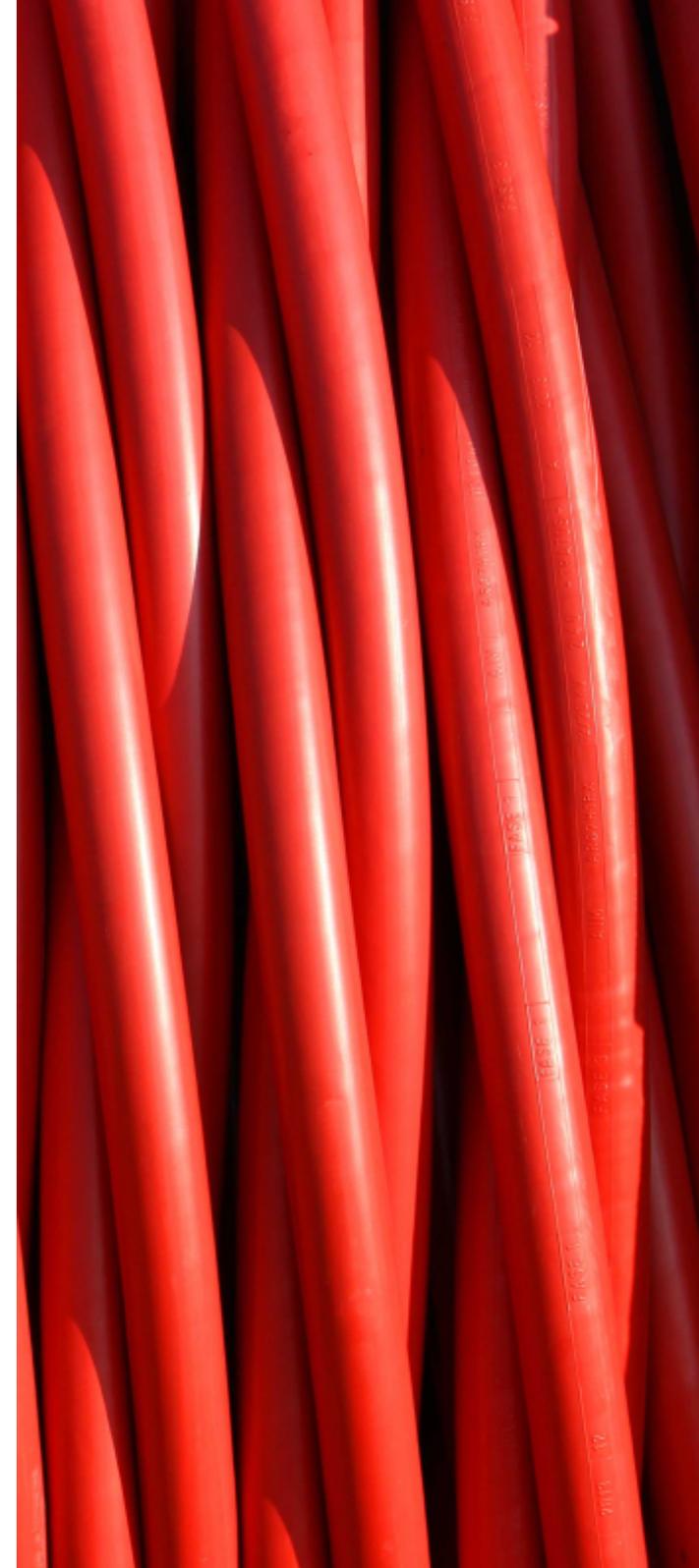
Section 2: Background

The future distribution network faces many challenges as we transition from a traditional network model where power is generated from large-scale fossil fuel generators and distributed to meet predictable consumption behaviour. A new model of dynamic networks needs to accommodate bi-directional power distribution and unpredictable demands and allows consumers to generate their energy from renewable sources such as micro solar, wind, and other local energy generation. The new network model must deal with unpredictable consumption and more significant demand spikes because electric vehicle charging and ground source heat pumps provide heating, hot water, and cooling.

The challenge for the power distribution network is to manage this seismic technology shift whilst maintaining energy security and resilience to climate change effects. These climatic changes result in more extreme weather

events requiring the energy infrastructure to be more resilient and adaptable to these changing conditions and increasingly impacting energy transmission and distribution. More frequent and severe storms are being experienced that result in wind damage due to fallen trees and pylons, increased flooding (urban flash floods), and greater water penetration of cabling infrastructure. Summer months can provide a complete contrast, experiencing progressively hotter temperatures which can affect the performance of cable components and components exposed to the high temperatures for prolonged periods. Cable products must continue to perform under these extreme conditions and withstand weather impacts to continuously transport power and maintain efficient operations.

To mitigate some of the risks of cable failure, there are a variety of stringent tests to assess performance characteristics and measure the suitability for end applications. Weather conditions such as flooding and water penetration tests check that the cable can continue to operate when submerged in water with close inspection of the cable sheathing material to ensure the conductor is protected. This guide provides an overview and comparison of the MV standards. It highlights the unique requirements of distribution network operators (DNOs) and some of the enhanced performance requirements that can help mitigate and reduce the risks of cable failure.



Section 3: Technical Overview of MV cable standards

The testing standards for MV cables have long been established and embedded in the product approval process, which comprises of initial assessment, laboratory testing, factory audit, sample selection, and witness testing.

This section provides a technical overview of the MV standards, British and International, and gives a technical insight and comparison of the scope of each standard.

3.1 IEC 60502-2

IEC 60502-2 is an international standard for MV cables that can be used in generation networks, distribution networks, and some applications in the transmission networks.

The standard specifies different cable constructions, different materials used, and the required testing regimes to ensure that the manufactured cable meets the standard requirements.

It is considered the umbrella for MV cables, as it covers most of the existing MV cables constructions, such as:

- ✓ Five voltage ratings up to 36 kV.
- ✓ Single-core & three core MV cables.
- ✓ Metallic screen to be tape(s)/braid/wires/combination wires and tape(s).
- ✓ Armoured and unarmoured MV cables.
- ✓ Wire and tape armouring types.
- ✓ MV cables with and without lead sheath.
- ✓ MV cables with and without water protection.

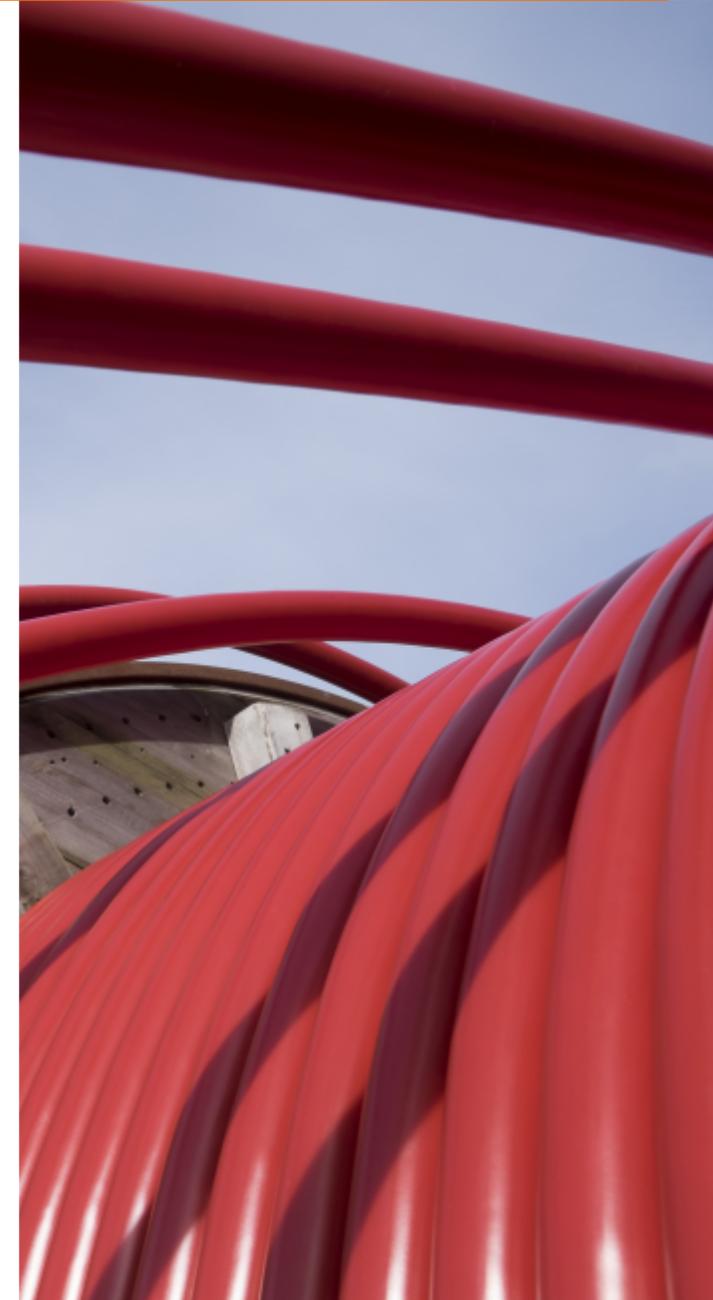
It is worth highlighting that this standard specifies the minimum requirements for MV cables. Still, it is up to the project designer/specifiers/end-users to set higher levels of requirements to meet their specific applications in their projects.

3.2 BS 6622

BS 6622 is a British standard used mainly in the UK, Commonwealth countries, and some worldwide projects.

The standard is similar to the IEC 60502-2 with some limitations in the scope of coverage, as follows:

- ✓ Five voltage ratings up to 36 kV.
- ✓ Single-core & three-core MV cables.
- ✓ Metallic screen to be tape(s)/wires/combination wires and tape(s).
- ✓ Armoured MV cables.
- ✓ Wire armouring type.



There are slight differences in the voltage designations (U_0/U (U_m)), at the end of the insulation level, the value is the same, and the maximum voltage U_m is the same, for more clarification, please refer to table 1:

Voltage designations	
U_0/U (U_m)	
IEC 60502-2	BS 6622
3.6/6 (7.2) kV	3.8/6.6 (7.2) kV
6/10 (12) kV	6.35/11 (12) kV
8.7/15 (17.5) kV	8.7/15 (17.5) kV
12/20 (24) kV	12.7/22 (24) kV
18/30 (36) kV	19/33 (36) kV

Table 1: comparison of voltage designations

3.3 BS 7835

BS 7835 standard is precisely the same as BS 6622 with the only difference: BS 7835 is for Low Smoke Halogen Free (LSHF) MV cables and is used when the cable reaction to fire requires low emission of smoke and corrosive gases.

In light of this special fire performance requirement, additional testing is carried out to measure how the cable reacts to the fire, such as the smoke emission test (BS EN 61034) and corrosive acid gas tests (BS EN 60754) and flame propagation test (BS EN 60332-3-24 Cat C).

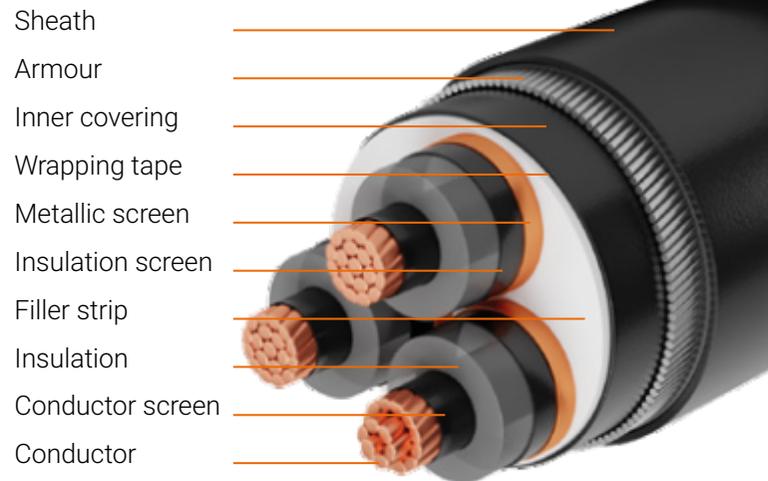


Figure 1: Typical three core MV cable



3.4 BS 7870-4.10

BS 7870-4.10 is a British standard used in the UK's distribution networks.

The standard is used for a particular application in the distribution network, and in a specific region in the UK; it covers a specific range of cable construction and voltage levels:

- ✓ Three voltage ratings 11 kV, 22 kV, and 33 kV.
- ✓ Single-core MV cables.
- ✓ Metallic screen is wires/combination wires and tape(s)
- ✓ Unarmoured MV cables.
- ✓ MV cables with and without water protection.

Specific application and regional coverage have been reflected in the testing, and find the new tests required in BS 7870-4.10, such as:

- ❖ Long duration test: (to test insulation/screen system and ensure that conductor, screen breakdown stress will meet the standard requirement)
- ❖ Cold bend test: (to ensure that the cable will withstand the installation at a very low temperature in the UK).

3.5 BS 7870-4.20

BS 7870-4.20 is very similar to BS 7870-4.10, but it covers three core 11 kV cables only:

- ✓ Voltage rating of 11 kV.
- ✓ Three core MV cables.
- ✓ Metallic screen is wires/combination of wires and tape(s).
- ✓ Unarmoured MV cables.
- ✓ MV cables with and without water protection.

3.6 Comparison of MV Cable Standards

The table provides a brief comparison between the MV cable standards:

	IEC 60502-2	BS 6622	BS 7835	BS 7870-4.10	BS 7870-4.20
Regional coverage	International	British	British	British	British
Voltages ranges	3.6/6 (7.2) kV 6/10 (12) kV 8,7/15 (17.5) kV 12/20 (24) kV 18/30 (36) kV	3.8/6.6 (7.2) kV 6.35/11 (12) kV 8,7/15 (17.5) kV 12.7/22 (24) kV 19/33 (36) kV	3.8/6.6 (7.2) kV 6.35/11 (12) kV 8,7/15 (17.5) kV 12.7/22 (24) kV 19/33 (36) kV	6.35/11 (12) kV 12.7/22 (24) kV 19/33 (36) kV	6.35/11 (12) kV
Number of cores	Single core & Three-core	Single core & Three-core	Single core & Three-core	Single core	Three-core
Conductor	Copper & Aluminium	Copper & Aluminium	Copper & Aluminium	Copper & Aluminium	Copper & Aluminium
Insulation	PVC, XLPE, EPR and HEPR	XLPE, EPR	XLPE, EPR	XLPE, EPR	XLPE, EPR
Screen	Tape(s), Wires Braid Combination W+T	Tape(s) Wires Combination W+T	Tape(s) Wires Combination W+T	Wires Combination W+T	Wires Combination W+T
Un-armoured	Un-armoured	N/A	N/A	Un-armoured	Un-armoured
Armoured	Wire, Tape	Wire	Wire	N/A	N/A
Lead	Lead	N/A	N/A	N/A	N/A
Sheath	PVC, PE Polychloroprene or Chlorosulfonat-ed Polyethylene	PVC MDPE	LSHF	MDPE LSHF	MDPE LSHF

Note: Each standard has a different testing program.

3.7 Other Specifications

Energy Networks Association

The Energy Networks Association (ENA) is the trade association for the DNOs, and its work is underpinned by an online catalogue which contains hundreds of technical documents. These include engineering guidance, reports and recommendations used by the network operators. All engineering documents can be found on the ENA Engineering Document Catalogue, which consists of:

- Technical Specifications (TS) are typically based around/on International (IEC) and British and European (BS EN) standards with additional UK and GB requirements and which cover the cable's design, construction and dimensions. In addition, it covers the testing requirements for single-core cables for use in substations having extruded insulation and rated voltages of 6.35/11 (12) kV and 19/33 (36) kV.
- Engineering Recommendations (EREC) and Reports (ETR & EREP) typically focus on best practice or guidance information; however, the application of EREC documents that support Distribution Code compliance is mandatory.

UK's Distribution Network Operators

There are fourteen licensed regions within the UK where a distribution network operator (DNO) distributes electricity from the transmission grid to homes and businesses. Each DNO has its own MV cable specification that considers the local conditions and performance requirements.

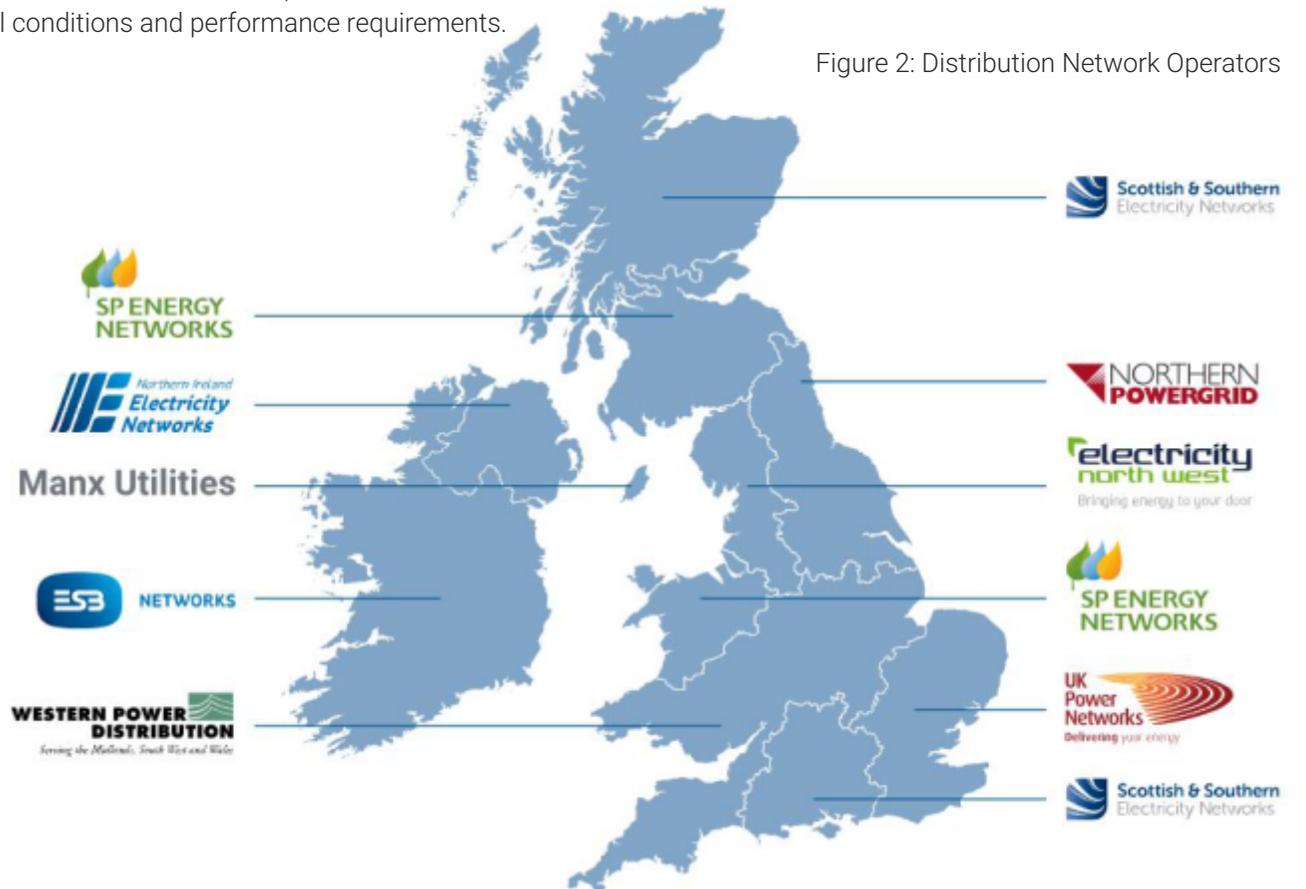


Figure 2: Distribution Network Operators

Source: <https://www.energynetworks.org/operating-the-networks/whos-my-network-operator>

Section 4: Enhanced Performance

This section highlights some of the special requirements of the power distribution network in the United Kingdom and some key measures to prevent cable failures.

4.1 Water protection

The main objective of water blocking in power cables is to prevent entry and migration of water through the cable. If there is any water introduced into installation areas during the fitting, it can cause premature cable failure. There are two ways that the water may ingress a power cable:

- Radial water ingress - The water enters the cable by permeating through the cable's protection sheath. Once the water has entered the cable, it travels longitudinally through it.
- Longitudinal water ingress - The water enters the cable through ineffective end-capping or poorly made joints or terminations (especially if jointing pits, or the like, are flooded).

Metallic layers such as the conductor and metallic screen will always have gaps where the water ingre:

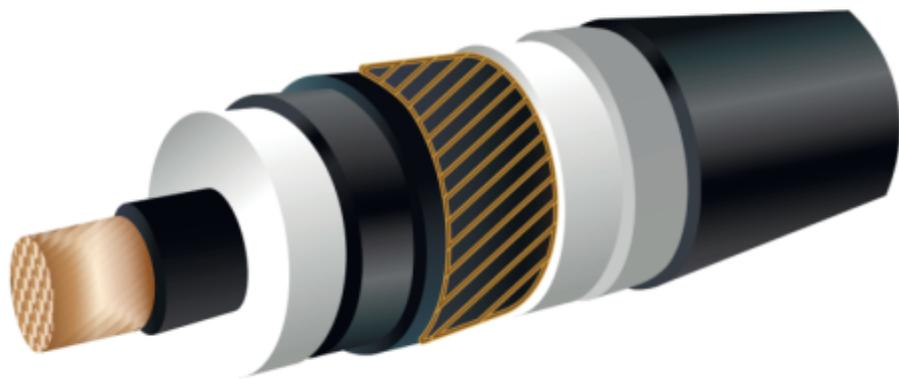


Figure 3: Single core MV cable

A way to block the water ingress and propagation into the power cable is to use swelling materials, such as gels, that can swell with water existence and block the water ingress and propagation.

There are different ways to block the ingress of water through the conductor by using one or more of the following:

- ✓ Swelling powder
- ✓ Swelling yarn
- ✓ Swelling tape/s

Regarding the metallic screen, the most common way is to use swelling tape(s) around the metallic screen; it can be under only or under and above the metallic screen.

It is crucial to mention that when selecting the material type of swelling tape it is essential not to interrupt the electrical connection, i.e. any tape under the metallic screen should be semi-conductive.

4.2 Shrinkage

Shrinkage occurs when the material (insulation/sheath) of a cable pulls back from a termination connector or cable splice. If the shrinkage occurs on the sheath of a cable, it exposes the cable's inner layers to dirt and/or moisture. If shrinkage occurs in the insulation, an excessive amount of copper/aluminium conductor can be exposed and increase the risk of a short circuit, arcing, or electric shock, which will allow water into the cable.

Polymers vary in their susceptibility to shrinkage due to their chemical structure. One of the essential factors is the thermal expansion coefficient, as usually, during the cable operation, the conductor will be heated, and all layers will be subjected to temperature increase. i.e., a higher thermal expansion coefficient means a more significant volumetric change during temperature changes, which will lead to more considerable shrinkage.

The shrinkage test aims to evaluate the susceptibility of a cable's insulation/sheath to shrink with exposure to elevated temperature, which is the case during the regular operation.

In the many DNOs' specifications, the maximum shrinkage percentage has been set to lower values than the permitted values in BS 7870-4 series. In other words, the requirements for shrinkage in DNOs' specifications make the pass criteria more restricted for better safety measures and enhanced performance requirements.

The following table compares the acceptance criteria for shrinkage of insulation and sheath within BS 7870-4 series and the enhanced performance specification.

	BS 7870-4	Enhanced Performance
Insulation (Max.)	4%	2%
MDPE Sheath (Max.)	4%	2%
LSHF Sheath (Max.)	4%	2%

4.3 Insulation screen

The insulation screen is a semi-conducting screen and it should be extruded over the cable insulation. The extrusion process for conductor screen, insulation, and insulation screen should be done simultaneously using a continuous single pass triple extrusion.

An insulation screen is a gradual transition from an insulating medium to a conductive medium, its resistivity is a crucial factor to be checked, and it shall not exceed 500 $\Omega \cdot m$ at 90 $^{\circ}C$.

There are two types of insulation screen:

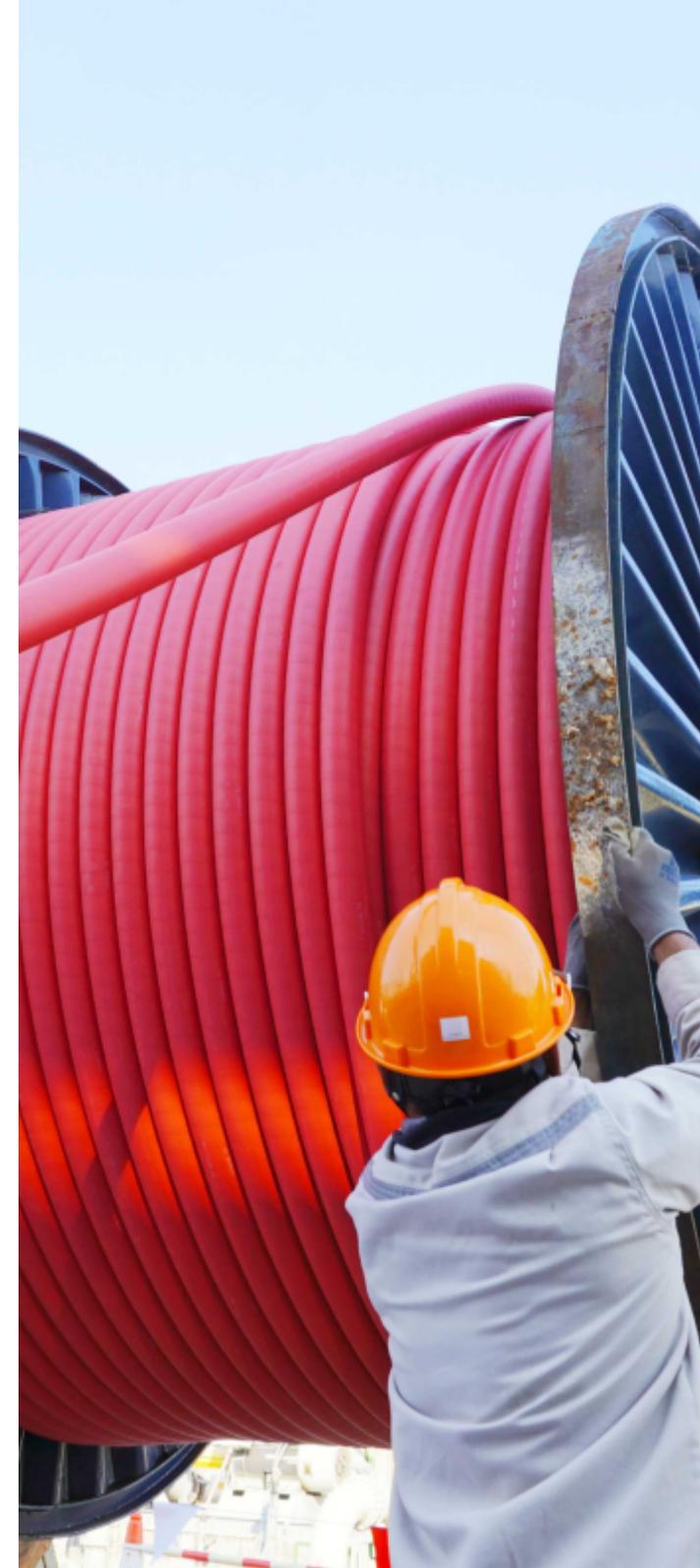
- ✓ Bonded type
- ✓ Strippable type

During the cable installation, there is a need to connect it with a joint or termination, and in both cases, a qualified joiner should prepare the cable for this connection, which requires complete removal of the semi-conducting insulation screen, with no adhering remains.

For most medium voltage cables, the insulation screen is a strippable type to make the preparation and connection easy and fast, while for high-voltage cables, the insulation screen is always a bonded type.

Regarding the strippable insulation screen, the standard specifies a range for the force to remove the insulation screen to be not less than 8 N and not more than 45 N (8 N – 45 N), based upon a 10 mm strip width.

Most DNOs specifications specify a different range for minimum and maximum removal force for the insulation screen, making this range more restricted as the standard range is wide. Other ranges have been introduced include 12 N - 20 N and 10 N to 30 N.



Section 5: Quality Assurance

The quality assurance process is vital to ensure the specification and production of compliant cables to perform efficiently over prolonged periods, demonstrating resistance to harsh conditions to safeguard the energy distribution network.

The cable quality assurance process involves different levels of checks and testing of different performance characteristics of the cables, such as electrical, mechanical, material, fire and chemical. These varying levels of quality assurance are as follows:

5.1 Type Testing

Type Tests provide a snapshot in time of the cable's compliance to the standard. Their purpose is to verify if the materials and construction of the tested cable sample are compliant with a certain standard or specification.

The manufacturer is the one selecting and supplying the sample for testing. The lack of random and impartial sample selection opens the door to the 'golden sample' practice. A golden sample is manufactured for the sole purpose of passing the testing and meeting specifications and is not representative of the actual range of production.

a) Third-Party

Third-party testing means testing performed by a third-party accredited laboratory or certification body. A third-party body can issue an official 'Type Test Certificate' or a 'Type Test Report' that the manufacturer uses based on the type test results. The Type Test Report will typically include the testing details for all tests performed in compliance with a specific standard and whether they passed or failed.

It is important to note that a Type Test is performed only once, and there is no 'validity period' for the Type Test report or Type Test certificate. This means that it does not reflect a continuous assessment of the cable quality production and does not consider or reflect the changes over time in manufacturing processes or raw materials used. Therefore, any Type Test report/certificate more than one year old should be considered with care and request the manufacturer to provide additional evidence of the cable production quality.

b) Independent Witness

Independent witness testing usually requires an independent representative to be the test witness at the manufacturer's test laboratory. The representative is typically technical personnel trained on the standards and competent to have conducted many hundreds of tests themselves, to have the experience and know-how of knowing what to look for.



5.2 Product Approval

Product Approvals are certificates given by third-party testing and certification bodies and state if a cable range 'continuously' conforms to the necessary standards as part of an ongoing certification scheme. This is achieved by building on the Type Test and adding a combination of:

- a) Factory audits: qualified personnel make regular, independent and documented physical visits to the manufacturer's factories. In most accredited bodies schemes, the audit is conducted once per year.
- b) Cable sample testing: the technical determination of the specifications and characteristics of the cable according to a standard or specific requirement. As part of the ongoing certification and continuous assessment and sampling of the cable quality production.

The ongoing certification scheme drives manufacturers to be consistently compliant with high levels of quality across their systems and production methods. If the product is compliant with the cable testing, factory audits, and ongoing cable sample testing, the accredited body can issue a license or certificate that allows the manufacturer to display the mark of conformity on the cable.

The scheme assures the specifier or end-user that the product and the manufacturing processes have been assessed and have adequate control structure to maintain quality and standards throughout production consistently.

BASEC Product Approval

The BASEC Product Approval is an ongoing certification scheme designed to improve the quality and safety of wires and cables within the local and global markets through in-

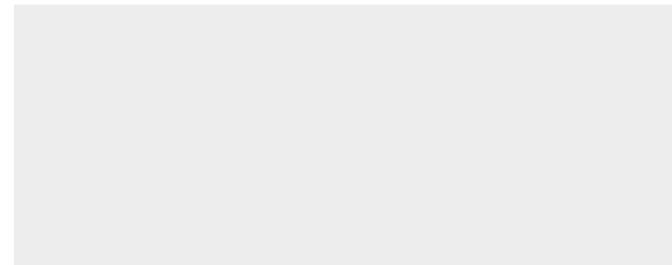
the year over a three-year validity period. It promotes conformity with local, national and international standards and helps differentiate product quality, compliance and reliability through its endorsement.

BASEC assesses the management systems and thoroughly tests the manufactured cables to make sure they conform to BASEC's requirements and national and international standards. In order to obtain the BASEC Product Approval, the manufacturer must consistently demonstrate that:

- The manufacturing facilities comply with the BASEC's Product Certification Requirements (PCR), which set out a series of procedures and processes intended to ensure consistent product quality. BASEC assesses this during regular Factory Audits.
- The cables are manufactured to comply with cable standards. BASEC assess with comprehensive cable testing at BASEC's testing laboratory in Milton Keynes, UK.

a) Factory Audits

As part of the BASEC Product Approval scheme, BASEC auditors will conduct independent factory audits three times per year for the life of the certificate. For example, the BASEC Product Approval will require a minimum of 9 factory audits over the 3-year life of the cable certificate. The visits are three per year, two scheduled and one unannounced.



The number of audits is higher than most other third parties, as BASEC aims to comprehensively assess and monitor the quality of all the manufacturing processes and cables.

The scope of the audits is to verify the manufacturer's production processes, controls, production equipment, staff, raw materials, test equipment and procedures, test results, handling and packaging of cable products comply with BASEC's requirements.

As part of the routine surveillance during the factory audits, the BASEC auditor selects multiple samples for testing. Any non-conformity of the factory's management system or the tested products against requirements is followed up.

The BASEC auditors are technical experts highly specialised in cables. BASEC is the only testing and certification body that specialises in cables only.

b) Cable Sample Testing

During the audits, BASEC's expert auditors identify and select the cable samples to be shipped to BASEC's laboratory in Milton Keynes, UK or Dubai, UAE, for testing and assessment. This process ensures that the cables are selected randomly by someone objective and neutral and therefore prevents the malpractice of producing and testing ad hoc golden samples.

In one year, the BASEC scheme includes collecting numerous samples from each approved range on cross-sections of all sizes of cables. The total number of samples depends on the size, volumes and complexity of the manufacturer's production processes and the risk category and can vary the number of cable samples tested each year.

The rigorous testing comprises all the fields that determine the cable quality and performance: chemical, electrical, fire, material and mechanical.

If the assessments are successful, BASEC issues two certificates with a three-year validity:

- If the factory audit results are compliant, BASEC will issue a general PCR management system certificate granting the quality of the management system and manufacturing processes.
- If the samples' testing results are compliant, BASEC will issue an accredited Product Approval certificate for the range of cables tested with a specific design and materials.

It is impossible to obtain a Product Approval certificate without successfully passing the audits and testing verifications. If the audits or testing do not comply with requirements, then the manufacturer has a time-limited period to rectify before revoking certification. This ongoing audit and product surveillance ensure a high-quality product.

For cables under BASEC's Medium Voltage scheme, samples of cable from each certificate (related to a particular cable design standard) are tested annually for mechanical properties and performance concerning fire for Low Smoke Zero Halogen (LSZH) cables. Sequential Type Testing, this is carried out every five years.



To ensure that approved materials are used, BASEC carries out material fingerprinting, using thermogravimetric analysis (TGA) and Fourier Transform Infrared (FTIR) analysis:

- TGA is a thermal investigation tool which enables the BASEC team of in-house chemists to assess the physical changes in polymer material masses and identify chemical decomposition patterns.
- FTIR analysis works by scanning the samples being assessed with infrared light to map, fingerprint and quantify the chemical properties of said sample.

This analytical assessment ensures that the materials which are used to meet the type test requirements are used in the continuous manufacture of the cables over the lifetime of the approval and that no substitute materials are used without first undergoing the type test process, as the use of different polymers/compounds is known to affect the overall cable performance.

c) Market Surveillance

BASEC undertake continuous, independent market surveillance throughout the supply chain, including assessing cable stockists, wholesalers, and distributors. Samples of cables are sourced independent of the manufacturer at the point of sale.

Any sample failure is awarded a number of 'deviation points.' The manufacturer will have a points limit that must not exceed to maintain product approval. Any test failures must be followed up with corrective actions reviewed at the audit and any preventative actions.

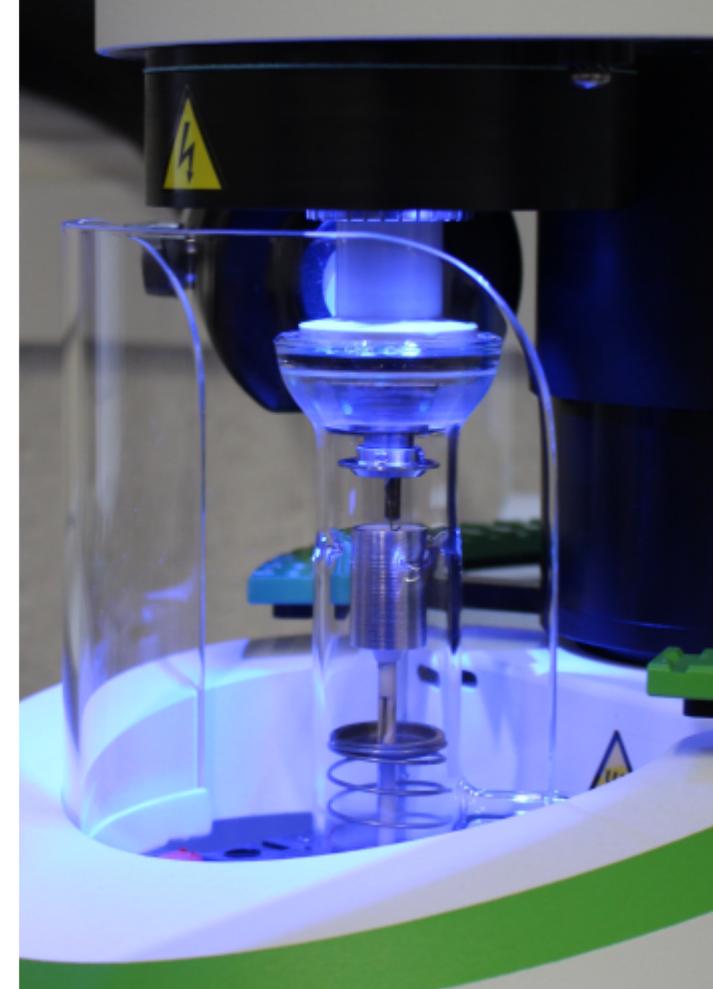
Through this process of regular surveillance, we can quickly identify any potential problems that may arise in the production, thereby minimising the risk of poor quality and substandard cables entering the market.

5.3 Factory Acceptance Test

Factory Acceptance Testing (FAT) is used to ensure that, before the product is dispatched to the site/project, there is no manufacturing, build quality, or performance issues with the specific cable batch based upon the approved documentation, such as:

- Cable drawings, material data sheets and technical specifications.
- Testing method statement and batch test reports.

It is important to note that FAT does not replace the TT or PA as it will be for limited scope and all test equipment is under complete control of the manufacturer, which will not give the necessary independence and required credibility to the test result. The FAT can provide clients with an additional opportunity to verify the quality by conducting some functional pre-test test items and reviewing routine tests and sample tests from batch productions.



Section 6: Current & Future Challenges

The DNO's are facing considerable current and future challenges, which directly impacts the cable approval process and quality assurance. Some of the specific challenges include:

6.1 Material quality:

The uncertainty around future supply chains due to many factors (i.e. availability, logistics, costs, and so on) may significantly impact the quality of the cable. The variability of source materials and compounds that make up the cable can significantly impact the cable performance. As part of the product approval process requires ongoing factory audits and rigorous testing to ensure that the factory's quality management systems and controls are maintained throughout production to guarantee the quality and consistency of the cable product manufactured.

6.2 Production quality

Over time, a cable's manufacturing process and production quality system will inevitably undergo some changes. These modifications could include changes to a cable's construction, the need to withstand higher stress, the introduction or substitution of materials (additives/plasticisers), changes in manufacturing processes, and any other changes which directly impact the original design.

Once the design of the cable product has been confirmed, production will begin. The settings used for each process will have an impact on the quality of the cable product. Here are two examples of what could occur if the wrong settings are used for these processes:

- Incorrect setup of extrusion, tip, die and temperature profile will lead to the extruded thickness not meeting the requirements specified in the design. The extruded layer may not exhibit the required mechanical performance, such as tensile strength and elongation.
- The manufacturer has a critical role in the quality assurance stage when routine and sample tests are conducted. This is to ensure that all testing equipment is correctly calibrated, as testing set up incorrectly will affect the final cable quality and, hence, its performance. If the input wire diameter, applied tension, and compaction ratio are set up incorrectly during the stranding process, this will lead to the product weight and DC resistance not meeting the requirements specified in the design.

6.3 Connections

There is an ever-increasing demand for connections to private networks that can use locally generated power, such as solar or wind, rather than import power from the local network. The demand could be an individual building, a single consumer with several buildings, or a range of users located close to each other. This could take the form of power generation located on-site and connected to the building's electrical system on the customer side of the consumption meter (termed behind the meter). Alternatively, a private wire connection could be employed, which involves installing a cable from a generation source directly to the point of power consumption.





About BASEC

BASEC is the expert in cable certification, testing and the awarding of triple standard accredited management systems approvals: ISO 9001 for quality, ISO 14001 for the environment and ISO 45001 for health & safety. Established in 1971, BASEC works in partnership with cable manufacturers worldwide and their end-users as the preferred testing and certification provider.

To evidence the highest levels of quality and safety, BASEC delivers certification to industry recognised standards and specifications, including International IEC, European EN, British BS and local requirements. BASEC offers a range of services from full certification of single or full product ranges to one-off and type testing of LV, MV and speciality cable products.

We are recognised in the UK via UKAS NB 2661 & Europe via INAB NB 2851 for accredited CPR fire testing. BASEC supports you across all major sectors, including construction & electrical installation, utilities, transportation: rail, power distribution, renewable energy: solar, nuclear, oil, gas and petrochemical, fire and security and infrastructure.

BASEC continues to invest in increased regional presence and laboratory equipment to support the industry faster and better.

When quality matters, choose BASEC as your trusted partner.

British Approvals Service for Cables (BASEC)

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SCAN ME

