

DO YOU ALWAYS GET WHAT YOU SEE?

Probably not.
And that's definitely true for cables.



The planet's pathways

LOOKS CAN DECEIVE YOU

Cables might look the same on the outside. But it's the inside that counts. And that can differ enormously. We're all depending on safe and reliable cables, and Prysmian will always stand in the forefront, manufacturing cables living up to all relevant standards. That includes making rigorous tests of all cables before letting them out on the market. It's better to be safe than sorry.

LET'S PUT IT TO THE TEST

The primary criteria for a safe cable is that it must comply with all relevant standards and ensure the same transmission quality throughout its complete life cycle. To ensure this, we make meticulous tests on our cables.

Mechanical tests

Several different tests are executed to make sure a cable can withstand harsh conditions. To be accepted as a safe cable all the tests must be fulfilled in accordance with relevant standards. Tests included:

- Tensile strength
- Elongation
- Ageing
- Pressure
- Cold bend
- Insulation shrinkage
- Durability to vast temperature shifts

Geometrical tests

The measurements and quality of a cable's components have a direct effect on the cables service life. Meticulous measurements are therefore made on:

- Conductor (including the number of wires)
- Insulation
- Outer sheath
- Complete cable

Electrical tests

To make sure a cable can endure and continue to deliver power in accordance to the most stringent regulations it has to withstand severe tests. Among them:

- Resistance of the conductor and insulation in different temperatures
- Voltage tests of both the core and the complete cable
- Water absorption of the insulation
- Long-term endurance to D.C. voltage



COMPLIANCE GUARANTEED

CPR Classification and Fire Performance

CPR – REGULATING FIRE SAFETY

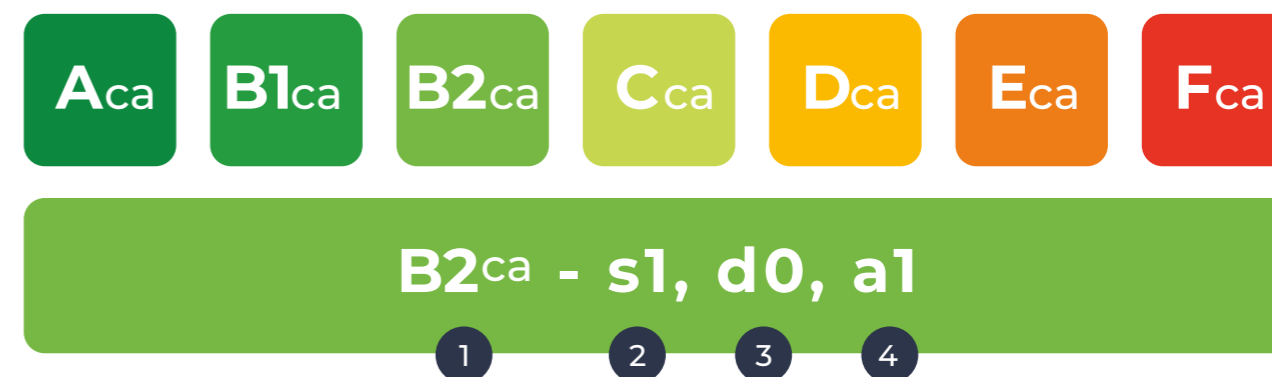
Since 2017, cables for fixed installations in buildings must comply with the Construction Products Regulation (CPR) and be CE marked according to EN 50575. This regulation aims to enhance safety by ensuring cables meet fire resistance standards.

Our cables are fully compliant with European CPR requirements, each with a Declaration of Performance (DoP) and CE marking, confirming compliance with fire resistance regulations set out in the EN 50575 standard.

CLASSIFICATIONS

There are seven fire performance classes based on heat release and flame spread. Additional criteria

for classes B1ca, B2ca, Cca, and Dca include smoke emissions, flame droplets, and acidity.



1 CPR CLASSIFICATION
Fire Performance Class

2 SMOKE PRODUCTION (EN 61034-2)
s1 Low smoke emission
s1a s1 with > 80 % emission
s1b s1 with > 60 % > 80 % emission
s2 Medium smoke emission
s3 None of the above

3 FLAME DROPLETS (EN 50399)
d0 No flammable drops/particles
d1 10 sec. flammable drops/particles
d2 None of the above

4 ACIDITY (EN 60754-2)
a1 Low acidity < 2.5 µS/mm, pH > 4.3
a2 Acidity < 10 µS/mm, pH > 4.3
a3 None of the above



TESTS FOR MEDIUM VOLTAGE CABLES

MV cables, like all cables, are tested against standards and customer specifications. The tests can be divided into 3 major groups, as piece, consignment and type tests.

Piece tests:

All manufactured lengths must be tested by: voltage tests, partial discharge tests and electrical resistance measurements on the conductor and screening. Cables that pass these tests can be put into service without unexpected failures (breakdowns).

Delivery inspection:

We carry these tests out on 10% of the finished products. They prove that they are made up of the structural elements required by the standards and that their dimensions and physical properties meet the requirements of the standards. A dimensional mismatch does not cause an immediate usability problem, but an inadequate result of the HOT-SET test or surface mismatch of the internal semiconductor may cause an immediate or early failure (breakdown!).

Type tests are tests carried out periodically (every 5 years) to demonstrate that the cable meets the relevant standards in all its characteristics. If there is a change in the materials used or in the relevant technological instructions, the tests must be repeated. Our most commonly used standards are VDE, IEC and various customer specifications.

Why do we do these tests and why is it important for the end user?

Not checking your cables can lead to premature or immediate failures. Partial discharge can be caused by a number of factors, including manufacturing defects and environmental factors. Partial discharge can be measured by a variety of methods including electrical, acoustic and optical. The most common method is electrical measurement, which uses sensors to detect the current flowing through the insulation during a partial discharge event.

This test can help end-users improve the safety of electrical equipment by detecting and fixing problems before they cause a malfunction. By reducing the number of failures, the reliability of electrical equipment is improved. The safety of the transmission network is enhanced if there are no unexpected failures that could result in risks to human life or property damage.

What happens / could happen if a cable fails the test?

If a product has not passed the test required by the standard, we will record a NCR (NON-CONFORMING REPORT) for it. We then send the defective product back to the factory, where our people will locate and remove the defect we have identified. Once the fault location is found, we retest the cable.

What would happen if a cable was installed that did not pass this test?

POSSIBLE NEGATIVE EFFECTS

The use of an inappropriate cable can not only disrupt the power supply, but can also pose very serious risks and a huge financial cost for the investor.

In almost all cases, a faulty cable will make a “chirping” sound, which will be detected as an electrical discharge and then a short circuit. In addition, there have been a fair number of cases where the fault has caused such a power conduction that a spill has occurred. This has led to serious consequences such as fire or explosion.

“The unrolling of the cables is carried out by workers assigned to the MV area of the final inspection under the direct supervision and guidance of the measurement supervisors. If the preparatory workers notice any anomalies, defects, shortcomings or damage during the unpacking or transport of the cable, they shall inform the measuring supervisor, who shall examine the anomaly and decide on the further fate of the cable.”

— quality specialist, Prysmian

Prysmian Kistelek is now a stage 2 TÜV Rheinland Partner Testing Laboratory.

We are proud to successfully have fulfilled the rigorous stipulations set by the international certification body TÜV Rheinland to become its accepted Partner Testing Laboratory in Kistelek. We are authorised to make thorough and internationally approved performance CPR tests for cables exposed to heat and fire without the supervision of TÜV Rheinland's experts. We will continue our close collaboration with TÜV Rheinland to make sure only safe cables are installed in European homes and other constructions.

What we offer

New technologies, urbanization and increase in population intensify the demand for electricity. We build higher and higher buildings, new schools, hospitals, sport arenas, electric vehicles... Every construction – whether it is a building or a bridge, a machine or an underground railway – need electricity. And cables. Lots of it. However, cables poor in quality can become a lethal threat, causing fires and toxic smoke to spread. Whatever we put in our walls, it better be safe.

At Prysmian we are determined only to deliver cables that comply with, or exceed all relevant standards on all markets in which we make business.

But that is not enough. We want all cables to be as safe as they can possibly be. That is why we have established our test laboratory in Kistelek in close co-operation with the TÜV Rheinland certification body. Here we are able to perform CPR tests on cables to make sure they comply with applicable standards. The tests are all in accordance with several international certifications and closely related to the CPR categories stipulating the cable requirements for fixed installations.

TÜV Rheinland

– a world leading testing service provider

TÜV, stands for Technischer Überwachungsverein (Technical Inspection Association). It is an independent organisation known worldwide for tests, inspections and certification of products. Their certifications ensure that the tested products and solutions comply with set safety standards and quality benchmarks based on international regulations.

You can rest assured that any product or service with a TÜV Rheinland certification has been thoroughly tested in inspected and is fit to be used in accordance with recommended practises.



OUR LAB FACILITIES IN KISTELEK



Cable performance tests

In case of a fire, it is crucial that cables do not become too hot or rapidly spread the fire. Cables used in for example fire alarms, emergency exit lightings and ventilation fans must continue to function. Equally important is low toxic gas emission and smoke density in order to facilitate the evacuation process. During tests it rapidly becomes apparent which cables are up for the task and which are not.

Vertical flame spread of bunched wires (EN50399 or IEC 60332-3)

Cables that aren't fire resistant will quickly spread the fire inside the walls. Several times fire patrols have been convinced they have put the fire out but all of a sudden it starts burning higher up in a building.

1

In this test we use a unique high-level technology that can fulfil any requests requirements. A certain number of cables are installed on a standard metal ladder, which is positioned in a vertical position inside a special chamber. By using a 20.5 kW burner we measure how much heat and smoke the cable emits during a specific timespan. In addition, we check if there are any hot pieces falling off the cable and if they, in that case, continue to burn. At the end of the test the flame spread is measured, from the ignition place to the uppermost point of burned cable.

Vertical flame spread of a single wire (IEC 60332-1)

The purpose of this test is the same as the above. In this case we mount a 60 cm long cable sample vertically in an extraction chamber. The cable is exposed to fire with a 1 kW burner for 1-8 minutes, depending on the cable diameter. The fire is then put out and the burned section of the cable is measured.

2

Smoke density (IEC 61034)

According to researches, the main cause of deaths in fires (70%), is the inhalation of toxic smoke and gas emission.

3

In this test we use a 9 m² hermetically sealed off metal chamber. Inside a cable sample is placed above a metal bowl into which an alcoholic solution is filled. After closing the chamber, the solution is ignited. Through a window of the chamber, an optical monitoring system observe the density of the smoke for 40 minutes to check the visibility level.

PH and conductivity measurement (IEC 60754)

Cables that emit acid gases are, of course, a threat to people's lives. The gases typically come with the dark smoke and in addition to its lethality the acid gases make all electronic equipment malfunction.

4

All non-metallic parts of the cable (sheath, core insulation etc.) are tested individually. One gram of the element is placed in a ceramic container, which is put in an oven with a closed tube system. Synthetic air is blown into the system and slowly heated to 800°C. The gases created from the sample are passed through a glass bottle of distilled water in which the gas is dissolved. After 45 minutes of heating, the solution is tested for conductivity and pH level.

WORKABILITY

Ensuring Seamless Installation and Performance

In today's fast-paced world, efficient and reliable cable performance is essential across various industries, from telecommunications to energy distribution. Beyond technical specifications, a key factor to consider is **workability**. This refers to cable stripability, handling and surface quality and it plays a critical role in ensuring seamless installation. Here, the **Prysmian Workability Index (PWI)** offers a clear and practical rating system to help you make informed decisions.



The Prysmian Workability Index (PWI): A Clear Rating System

The PWI is calculated by adding up the scores for each of the three factors. A higher PWI score indicates a higher quality cable that is easier to work with and is less likely to cause problems during installation.

STRIPABILITY (S)

Score 1-3 Points

Stripability refers to how easily you peel off a cable, leaving the conductor clean and undamaged. This is important for proper installation and maintenance to avoid harming the wire.

HANDLING (H)

Score 1-3 Points

This refers to how easy the cable is to work with during installation. Flexibility, weight, and bend radius determine how easily installers can position and route the cable without encountering physical constraints or undue effort.

FRICITION (F)

Score 1-3 Points

Friction refers to the outer texture. A smoother surface reduces friction, making it easier to pull the cable through narrow conduits without snagging or damage.

THE GREENER, THE BETTER - RECOGNISE THE HIGHEST PWI BY THE COLOUR



BASIC

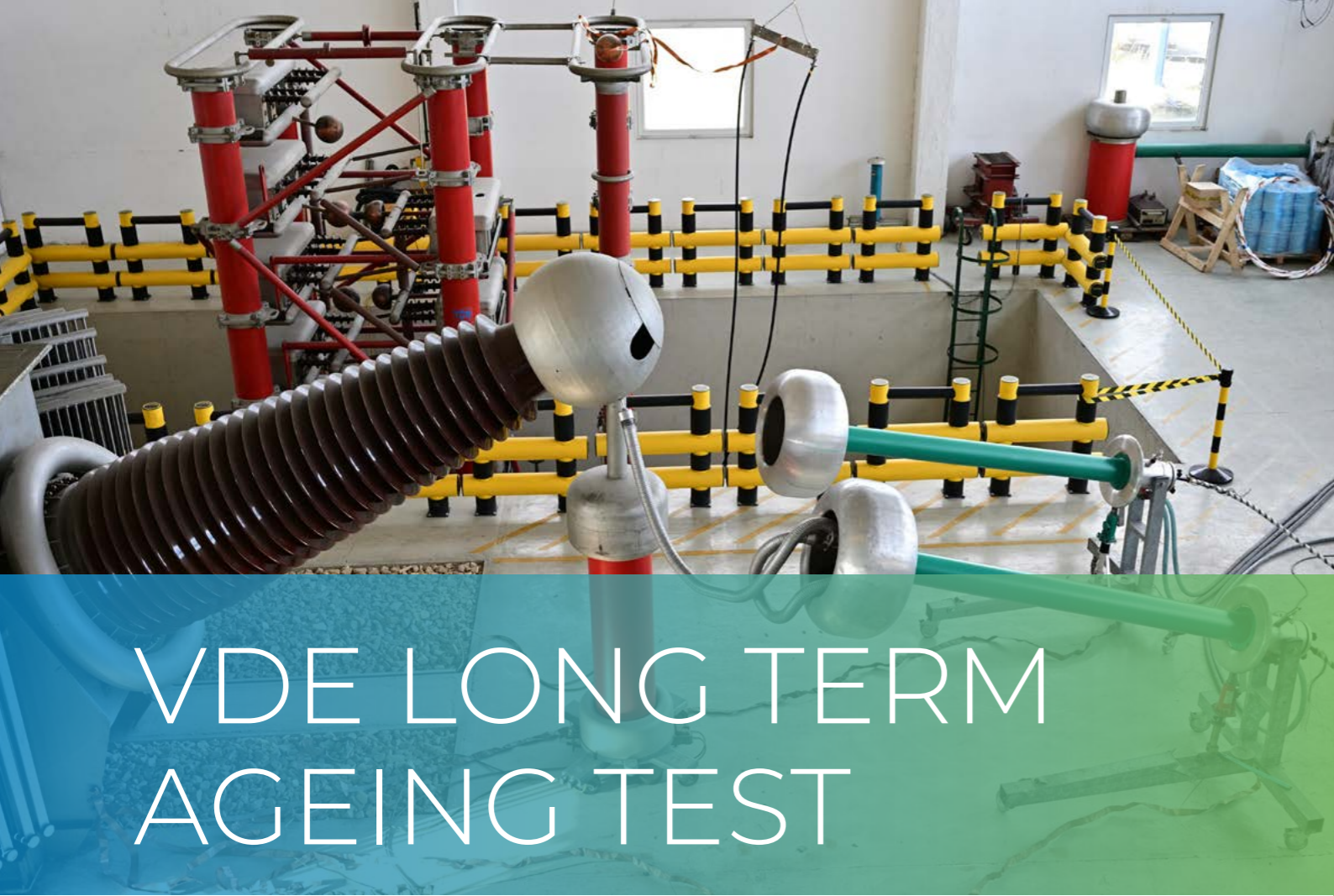
Fundamental workability for simpler applications.

STANDARD

Balanced performance and workability for a wide range of applications.

PRO

Superior workability with effortless handling, stripability, and performance for demanding applications.



VDE LONG TERM AGEING TEST



What is this test?

The system of requirements described in the MSZ HD 620 S3 2023 standard, which is identical to the VDE 0276-620 standard. This is a never-ending continuous test that shows the consistent quality of our production or certain quality fluctuations. In most of Europe, medium-voltage cables can only be sold with a satisfactory test result. The test result gives an indication of the life expectancy of the cable. It is in the vital interest of all electricity suppliers to ensure that cables operate for as long as possible without unexpected failure.

Description of the study:

2 pieces of samples are taken every second month - 1 for one year of aging, and 1 for 2 years of aging. The type preferred by the VDE institute is Al 150 mm², approximately in 20 m length.

These are to be rolled out on a plastic core with a diameter of approx. 60 cm and then kept under water at 50±5 °C degrees for 500 hours (conditioning).

This is followed by the ageing phase which is 40±5 °C under water at 36±3 kV for one sample for 1 year, net 8750 hours, and for the other sample for 2 years, net 17500 hours.

The net time means that if the water temperature is not within the specified limits, that time is not included in the ageing time.

Samples must not lose contact with water for more than 24 hours for 1 occurrence and for more than 120 hours during the total ageing period.

When the ageing period expires the sample shall be subjected to an alternating voltage step-through procedure.

The electrical engineer is responsible for managing the preparation of samples and supervising and documenting the subsequent procedures.

He/she must also carry out the staggered knock-overs. At least once a year, several samples shall be run through at the same time in the presence of the VDE auditor.

In the event of an unsatisfactory result, we would risk losing our VDE mark-use licence.



RECYCLED POLYETHYLENE

Why are we using recycled polyethylene?

- ✓ Sustainable
- ✓ Resource efficient
- ✓ Reduces the environmental impact

How many type of tests are we performing related to PE?

We, Quality Inspector Specialists, do a lot of tests to ensure quality:

- Carbon black content test: Without the right amount of carbon black, UV radiation can degrade the outer sheath of the cable which leads to surface cracking or loss of insulation properties.
- Stress cracking test: With this test we can assess the durability and resistance of a material to cracking under stress. We can identify potential weaknesses in the material exposed to environmental or mechanical stress.
- Tensile strength and elongation test: We can predict how the material will perform under real-world stresses, ensuring safety, durability, and reliability.
- Melt Flow Rate (MFR): It helps us determine how easily the material can be processed during manufacturing methods like extrusion.
- Hardness – Shore-D: If the value is very high, the material is very stiff/rigid and if the value is low, the material is very elastic.
- Density: we have to make sure that the material has the right density.
- Bulk density: We need the bulk density so that we know how much material can be filled into the silo or other packaging unit.

How often do we perform these tests?

We test every incoming material. Then we test polyethylene every week in a form of granules.

If we want to produce quality, we need to make sure we use quality raw materials.



THE STEP SURGE VOLTAGE BREAKDOWN TEST

The step surge voltage breakdown test is a special test that shows us the breakdown strength of the cables under test.

It is a periodic test to prove the quality of cables made either with new insulation materials or on a new production line, or the reliability of our production with conventional materials on old machines.

Most Austrian utilities periodically require the test to be carried out, reassuring themselves that new cables entering their network will operate for decades without any unexpected failure.

The test must be carried out in accordance with the instructions and requirements drawn up by a professor at the Graz University of Technology.

This test is always carried out by an electrical engineer, but in case of Austrian deliveires, the presence of the professor who developed the test is also required.

Brief description of the test:

It must be carried out on five 20 m long samples.

The initial voltage is 150 kV for a 10 kV cable and 350 kV for a 20-30 kV cable.

At each voltage step, 5 negative wave voltage pulses shall be applied to the sample and then the voltage shall be increased in 50kV steps until a breakdown occurs. The result of the test is satisfactory if all five samples pass the voltage steps of 400 kV for 10 kV cables, 600 kV for 20 kV cables and 800 kV for 30 kV cables. This requirement implies a breakdown strength of approximately 160 kV/mm.

For comparison, the operational stress of medium voltage cables is 2-4 kV/mm.

In case of unsatisfactory results, even if only one sample does not meet the required level, the test can be repeated on a sample from the same drum. If this result is good, the test is successful.

If unsatisfactory, or if several sample results are below the requirement, the whole consignment is rejected.



COMPARISON TESTS

In our case study we tested 37 different cable samples from nine cable manufacturers (including Prysmian) to see how well they live up to minimum standards set to make sure safe usage of electricity in our buildings.

All Prysmian cables passed the test, while all other manufactures had cables that did not. In the chart below you can see what kind of deviations we experienced during the tests.

Producer	Cable	Test	Standard	Deviations	
A	1-AYKY-J 4x16 RE	Sheath min:	1.43 mm	1.32 – 1.42 mm	Inner covering is not continuous
	1-AYKY-J 4x16 RE	Sheath min:	1.60 mm	1.55 – 1.70 mm	
B	1-AYKY-J 4x25 SE	Tensile strength:	100 – 130 MPa	77 – 80 MPa	
		Conductor resistance max:	1.20 Ohm/km	+3 to +5%	
C	H05VV-F 3x1,5	Conductor resistance max:	13.30 Ohm/km	+1.8 to +2.2%	
		Insulation thickness min:	0.7 mm	-27% (average: -5%)	
	NYM-J 3x1,5	Conductor resistance max:	12.10 Ohm/km	+3.1 to +4.7%	
		Insulation thickness min:	0.6 mm	Average: -6.5%	
		Sheath min:	1.4 mm	-24% (average: -32%)	
E-AYY-J 4x240 SM	Conductor resistance max:	0.125 Ohm/km	+10 – 11%		
D	YKY 1x70 RMC	Sheath min:	1.43 mm	1.13 mm	
	YKY zo 5x25 RMC	Conductor resistance max:	0.727 Ohm/km	+2.5 to +5.2%	
E	YKY zo 5x25 RMC	Insulation thickness min:	0.98 mm	0.26 – 1.17 mm	Uneven insulation
		Sheath min:	1.43 mm	1.37 mm	
F	YKY 1x120 RM	Conductor resistance max:	1.20 Ohm/km	+7%	
	YKY zo 5x50 SM	Sheath min:	1.69 mm	1.62 mm	
	YKY 4x50 SM	Conductor resistance max:	0.387 Ohm/km	+2%	
		Conductor resistance max:	0.524 Ohm/km	+3%	
	YKY 4x35 SM	Sheath min:	1.43 mm	1.13 mm	
YKY 4x240 SM	Sheath min:	2.37 mm	2.20 mm		
G	YKY 1x120 RM	Conductor resistance max:	0.153 Ohm/km	+7%	
		Insulation thickness min:	1.34 mm	1.15 mm	
	YKY zo 5x25 RMC	Insulation thickness min:	0.98 mm	0.86 – 0.94 mm	Uneven insulation
H	YKY zo 3x35 RMC	Insulation thickness min:	0.98 mm	0.91 mm	
	YKY 4x35 SM	Sheath min:	1.43 mm	1.27 mm	
		Conductor resistance max:	0.524 Ohm/km	+1%	
	YKY 4x120 SM	Sheath min:	1.94 mm	1.16 mm	
YKY 4x240 SM	Conductor resistance max:	0.0754 Ohm/km	+2%		
	YKY 1x240 RMC	Conductor resistance max:	0.0754 Ohm/km	+2%	

THE WORLD LEADER IN ENERGY AND TELECOMS CABLE SYSTEMS

We provide high-quality cable solutions with advanced technology for lasting growth and profits. Our commitment to excellence and innovation ensures sustainable profitability. Additionally, we prioritize being a trusted partner and our values guide our actions. Prysmian, the global leader in the energy and telecom cables sector, scored 100 points in the 2023 Dow Jones Sustainability World Index in the environmental areas of Emissions, Resource Efficiency and Circularity, Waste and Water, reaffirming its focus and attention on these topics.

Quality pays off in the long run.

New technologies, urbanization and the increase in population intensifies the demand for electricity. We build higher and higher buildings, new schools, hospitals, sport arenas... And cables. Lots of cables.

With this in mind there are choices to be made. It might be tempting to buy low quality cables and save a buck or two. But that would be a very irresponsible decision, even lethal. Plus, at the end of the day cheap cables might not be the ones that will save you the most money. Play it safe, and smart – choose cables that live up to set standards while continuing to deliver, year after year. Choose Prysmian.

SETTING NEW STANDARDS WITH E PATH

An invaluable business growth opportunity fueled by sustainability.

E Path

Eco-Pathways

Eco-Cable

Prysmian proudly introduces E Path, a pioneering eco-labeling system tailored specifically for the cable industry. This innovative approach, built upon EU-ecolabel standards, sets a new benchmark for sustainability in cable manufacturing.



E Path

E Path uses measurable and known assessment criteria to summarize the contribution that cables can provide, in terms of climate change effect, paving the way for the cable industry to be included into eco or green labelling systems. Sustainability

is not just a goal, it's our commitment at Prysmian. We embed sustainability into every strand of our operations, striving not just for excellence but for sustainable excellence. It's who we are, it's what we do.

With sustainability rooted in our DNA each cable family has to pass a rating process based on the following criteria:



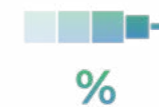
CARBON FOOTPRINT

Aimed at defining climate change impacts deriving from cables life cycle



NO TOXIC SUBSTANCES

Absence of CMR or toxic/hazardous to environment substances in the cable



PERFORMANCE EFFICIENCY

The higher the efficiency of the transmission, the more sustainable the performance



RECYCLING INPUT RATE

Presence of recycled materials in cable, both purchased and reused



ENVIRONMENTAL BENEFITS

Low carbon products (including cables used for green energy sources), CPR compliant products



RECYCLABILITY/ CIRCULARITY

Presence of potentially recyclable material, possibility to reclaim/recover



PRYSMIAN

Prysmian MKM Kft.
Phone: +36 1 382 2222
infocables-hu@prysmian.com



prysmian.hu

© All rights reserved by Prysmian 2024-02 | Version 3.

Technical data, dimensions and weights are subject to change. All sizes and values without tolerances are reference values. Specifications are for product as supplied by Prysmian: any modification or alteration afterwards of product may give different result. The information contained within this document must not be copied, reprinted or reproduced in any form, either wholly or in part, without the written consent of Prysmian. The information is believed to be correct at the time of issue. Prysmian reserves the right to amend this specification without prior notice. This specification is not contractually valid unless specifically authorised by Prysmian.

Follow us

