The power for a cleaner energy future and a safer environment is in our hands

Cable Solutions for the Nuclear power industry
CONNECTING THE WORLD. TODAY AND IN THE FUTURE

Prysmian Group is world leader in the energy and telecom cables and systems industry. With 140 years’ experience, the Group is strongly positioned in high-tech markets and offers the widest possible range of products, services, technologies and know-how.

140
YEARS OF EXPERIENCE

25
R&D CENTRES AROUND THE WORLD

We specialise in underground and submarine cables and systems for power transmission and distribution, special cables for applications in many different industries, and medium and low voltage cables for the construction and infrastructure sectors.

For the telecommunications industry, the Group is the world’s largest provider of cutting-edge cables and accessories for voice, video and data transmission, offering a comprehensive range of optical fibres, optical and copper cables and connectivity systems.

We are committed to environmental responsibility in our production processes, the protection of the global environment, and the responsible management of relations with the local communities in which we work.

For us, innovation means meeting the needs of our customers and communities by understanding their business drivers as quickly as they do. To do that, our team of over 900 Research & Development professionals is constantly looking to the future, predicting and identifying emerging trends in each of our industries and sectors. Acting on this intelligence from 25 R&D centres around the world, we’re constantly close to our customers in their own local markets.
Prysmian Group offers three different nuclear cable families, certified by renowned third party laboratories and suitable, respectively, for CST4C068 Nuclear Protocol (EPR Reactor type), for IEEE 323/383 Nuclear Protocol (Westinghouse, GE-Hitachi, Mitsubishi, KEPCO and CANDU Reactor type) and for NP 001-15 (OPB 88/15) Nuclear Protocol (VVER Reactor type).

Our large portfolio of cable products for typical and bespoke applications inside a nuclear power plant includes:

- Low Voltage
- Instrumentation & Control
- Medium Voltage up to 20 kV
- Coaxial
- Ethernet
- Composite and Fibre Optic Cables

Prysmian Group relies on the participation in the construction of the most recent nuclear power stations worldwide and on a long-standing proven experience in successfully delivering projects in partnership with major EPC contractors.

Our goal is to provide our international customers with the best added-value offer, meeting local or national requirements, guaranteeing the support of a competent and multi-role team in proximity and delivering reliable cables with a proven lifetime of at least 60 years in operation for the utmost security of their nuclear power plants, anywhere in the world.

Prysmian Group’s experience and expertise in the development and fine-tuning of proprietary innovative organic polymeric compounds for harsh and safety-related environment is just one of the many areas in which we excel at. Extensive experience about effects of gamma irradiation, irradiation flow rate, combined temperatures and pressures in thermodynamic shocks, extensive researches on degradation of polymers and compounds impacting nuclear cables (thermal and radiation aging) are also among the many.

Three main principles drive the development of nuclear power: security of energy supplies, environmental safety and cost efficiency. These have always been Prysmian Group’s main focus in the development of cables for nuclear power stations. Nuclear power plants consist of various areas that differ by ambient temperature, radiation-related risks and relevance for the overall system security: the Nuclear Island, where reactor and safety systems are located, the Conventional Island, where the turbines that generate electricity are installed, and the Building Block (Balance of Plant or BOP) that comprises of all power plant’s supporting components and auxiliary systems needed to deliver the energy, other than the generating unit. The environmental conditions in the first two operating areas are severe and persistent over time and many of the components that are critical for the safe and efficient operation of a nuclear power plant, including cables, are permanently exposed to such harsh conditions.

Metals are not affected by such exposure, but organic polymeric compounds undergo oxidation, due to the combined action of oxygen, high temperature and gamma radiation. In cables, the deterioration of polymeric layers does not guarantee the consistently high levels of safety and reliability that are required throughout a cable’s operation life cycle, usually 60 years. In order to tackle this technical challenge, Prysmian Group offers the highest standards of reliability and safety, developed over more than 50 years of expertise in designing and manufacturing nuclear cables both in the USA and in Europe and R&D centres specifically dedicated to nuclear cables development.

The Paris Climate Change Conference Agreement resulted into the declaration in favour of the consolidation of efforts of the signatory countries to create a green energy future. When referring to eco-friendly power, solar, wind and hydroelectric are the most widely acknowledged sources and nuclear is usually left out. Nuclear power, instead, is an undeniable component of a green energy mix and can make a significant contribution to achieving sustainable energy goals and enhancing energy security. It is a reliable and predictable source of electricity and supports economic development by providing “clear conditions” that may be forecast up to 60 years in advance. It also offers “low volatility” because the “commodity component” in the cost of energy generated by nuclear power plants is very low, below 3%.

INTERNATIONAL STANDARDS, CERTIFICATIONS AND PROTOCOLS

- Low Voltage, Instrumentation & Control, Medium Voltage up to 20 kV, Coaxial, Ethernet, Composite and Fibre Optic Cables.

EXTENDED PROJECT TRACK RECORD

Our large portfolio of cable products for typical and bespoke applications inside a nuclear power plant includes:

- Prysmian Group relies on the participation in the construction of the most recent nuclear power stations worldwide and on a long-standing proven experience in successfully delivering projects in partnership with major EPC contractors.

GLOBAL EXCELLENCE, LOCAL REACH

Our goal is to provide our international customers with the best added-value offer, meeting local or national requirements, guaranteeing the support of a competent and multi-role team in proximity and delivering reliable cables with a proven lifetime of at least 60 years in operation for the utmost security of their nuclear power plants, anywhere in the world.

MATERIALS INNOVATION, EXPERIENCE AND EXPERTISE

Prysmian Group’s experience and expertise in the development and fine-tuning of proprietary innovative organic polymeric compounds for harsh and safety-related environment is just one of the many areas in which we excel at. Extensive experience about effects of gamma irradiation, irradiation flow rate, combined temperatures and pressures in thermodynamic shocks, extensive researches on degradation of polymers and compounds impacting nuclear cables (thermal and radiation aging) are also among the many.
Product Families at a glance

1. 1E Safety Class (IEEE) or K1/K2 (CST) or HF-FRHF NP 001-15 cables inside Reactor containment
2. 1E Safety Class cables for Nuclear Containment Sealing
3. 1E Non Safety Class (IEEE) or K3 (CST) or LS-FRLS NP 001-15 cables for Turbine Island and auxiliary Safety Systems
4. K2 (CST) Coaxial Cables for measuring neutronic chain reaction & core temperature
5. K1/K2 (CST) Composite Cables for Control Rod Systems
6. K1/K2 (CST) or HF-FRHF NP 001-15 cables for polar cranes inside reactor containment
7. K1/K2/K3 (CST) or HF-FRHF-LS-FRLS NP 001-15 Thermocouple cables
8. 1E Non Safety Class (IEEE) or K3 (CST) or LS-FRLS NP 001-15 LV, I&C, Coaxial Ethernet, Optical Fiber cables for Control Room, Electrical Cabinets
9. 1E Safety/Non Safety Class (IEEE) or K1/K2/K3 (CST) or FRHF-FRLS NP 001-15 Fire Resistant Cables
## Product Mapping

| PRYSMIAN BRAND | CABLE FAMILY | CABLE BRAND | DESIGNATED FOR REACTOR TYPE | NUCLEAR SAFETY CLASS | NUCLEAR APPLICATION | NUCLEAR STANDARD | DESCRIPTION | CROSS-SECTION | CONDUCTOR | CONDUCTOR MATERIAL | VOLTAGE | INSULATION | SCREEN | OUTER JACKET | CABLE COLOR SHEATH |
|----------------|--------------|-------------|-----------------------------|----------------------|---------------------|-------------------|--------------|---------------|------------|-----------|------------------|---------|-----------|--------|-------------|------------------|
| GENERAL CABLE  | ULTROL 60+   | AP1000-ABWR-APAR-CANDU-AP14000 | CLASS 1E TC-EB          | LV Power             | IEEE 1323/IEEE 1383 (1994/2003) | 3x-4x Conductor with Y/S Dual Shield | 8 AWG (0.36 mm²) and 9 AWG (0.54 mm²) solid alloy | ASTM B8 Class B | CU         | 600V FR-XLPE | XLPO Black |
| GENERAL CABLE  | ULTROL 60+   | AP1000-ABWR-APAR-CANDU-AP14000 | CLASS SS / SAFETY-RELATED | Thermocouple Extension | IEEE 1323/IEEE 1383 (1994/2003) | 1-24 Pairs Individually Shielded Overall Shielded | 18 AWG (0.52 mm²) solid alloy | ASTM B8 Class B | CU         | 600V FR-XLPE | XLPO Black |
| GENERAL CABLE  | ULTROL 60+   | AP1000-ABWR-APAR-CANDU-AP14000 | CLASS 1E TC-EB          | Instrumentation      | IEEE 1323/IEEE 1383 (1994/2003) | 2-19 Pairs Individually Shielded Overall Shielded | 18 AWG (0.52 mm²) solid alloy | ASTM B8 Class B | CU         | 600V FR-XLPE | XLPO Black |
| GENERAL CABLE  | ULTROL 60+   | AP1000-ABWR-APAR-CANDU-AP14000 | CLASS 1E TC-EB          | Medium Voltage       | IEEE 1323/IEEE 1383 (1994/2003) | Single Conductor Shielded | 6 AWG (0.36 mm²) and 9 AWG (0.54 mm²) solid alloy | ASTM B8 Class B | CU         | 600V FR-XLPE | XLPO Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13B) K2LSOH (PK28B) K3LSOH (PK38B) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1x-5x Conductor Dual Shield | 1.5 mm²-800 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Blue |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 2x-8x Conductor Dual Shield | 16 mm²-800 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Green |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK15C) K2LSOH (PK25C) K3LSOH (PK35C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 2-19x Conductor Dual Shield | 0.34 mm²-10 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13P) K2LSOH (PK23P) K3LSOH (PK33P) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1P-24P Conductor Dual Shield | 0.35 mm²-1.5mm² | IEC 60228 Class 1-5 | 0.6/1.2kV XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Gray |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1x Conductor Dual Shield | 1.0 mm²-2.5 mm | Silver Cu-Tinned Cu | 50 D 75 Q 112 D XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Green |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K2LSOH (PK22C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1x Conductor Dual Shield | 1.5 mm²-240 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV EPR | Cross-Linked Polyolefin Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1x Conductor Dual Shield | 1.5 mm²-240 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV EPR | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 3x Conductor Dual Shield | 95 mm²-500 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV EPR | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 2x-57x Conductor Dual Shield | 1 mm²-6 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV XLPE | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Black |
| PRYSMIAN       | AFUMEX TECHN | EPR - ATMEA | K1LSOH (PK13C) K2LSOH (PK23C) K3LSOH (PK33C) | LV Power             | IEEE 1323/ IEEE 1383 (1994/2003) | 1P-40P Conductor Dual Shield | 0.5 mm²-1.0 mm² | IEC 60228 Class 1-5 | 0.6/1.2kV EPR | Copper Braid Individual Screen & General Screen | Cross-Linked Polyolefin Black |

**NOTE:** The table above provides a brief overview of the PRYSMIAN Group’s nuclear cables, including their specifications and applications. For detailed information, please refer to the PRYSMIAN NUCLEAR CABLES manual or contact PRYSMIAN directly.
AFUMEX TECNUC

The historical brand of Prysmian Group developed in the Group’s excellence centre for nuclear cables in France and identifying the whole family of cables for nuclear power plants. Originally designed for RCC-E Nuclear Protocol and addressed to Nuclear power plants by AREVA/Framatome/EDF, AFUMEX TECNUC has extended its reach to VVER Reactors and the relevant P 001-15 NP 001-15 Nuclear Protocol according to safety class HF Class 3. Thermodynamic performances of AFUMEX TECNUC have been verified and approved respectively by EDF SEPTEN labs for the RCC-E Nuclear Protocol and by the AREVA/Framatome laboratory for P 001-15 NP 001-15 Nuclear Protocol safety Class HF class 3 (60 years life-time big leaks 150 °C).

ULTROL 60+

The well-known General Cable US legacy brand name and the latest evolution of the ULTROL cable family, serving the US nuclear market for more than 40 years. ULTROL 60+ cables have been designed in compliance with Nuclear Protocol IEEE 323/383 ver. 1974/2003, pursuant to all US Nuclear Regulatory Commission recommendations and to the environmental protocol of reactors installation designed by Westinghouse, GE-Hitachi, Mitsubishi and KEPCO. Cables are approved and certified both for 1E Class and 1E Non-Class Safety Level, by independent IEEE-related certification bodies.

SIENOPYR KO / SIENOPYR XA

The brand name identifies products developed by Prysmian Group’s excellence centre located in Germany. The cables have been originally developed in cooperation with AREVA/Framatome to serve Germany’s domestic nuclear market. Subsequently, the application of the cable family has been extended to the VVER Nuclear Protocol P 001-15 NP 001-15 for safety category FRHF- HF Class 2 & 3, following extensive test sessions at the Chemistry and Radio Chemistry AREVA/Framatome labs of Erlagen. SIENOPYR KO identifies Fire-Resistant cables 60 years life-time big leaks 215 °C. SIENOPYR XA is the KO equivalent version without fire resistance performances.

SAFENUC

The latest Prysmian Group’s cable family released, offering a viable, reliable and proven technical solution for nuclear environment safety classified as type 1E Non-Class, K3 Class and, above all, HF- FRHF class 4 and LS FRLS class 2-3-4 in compliance with Nuclear Protocol P 001-15 NP 001-15 (VVER Reactors). SAFENUC cables use special compounds developed internally by Prysmian Group and offer local production sourcing opportunities while complying with the strict requisites of reliability and performance imposed by the safety requirements of the relevant zone of installation.