

# Railway Main Line Cables

FINLAND



## Linking the Future

As the worldwide leader in the cable industry, Prysmian Group believes in the effective, efficient and sustainable supply of energy and information as a primary driver in the development of communities.

With this in mind, we provide major global organisations in many industries with best-in-class cable solutions, based on state-of-the-art technology.

Through two renowned commercial brands - Prysmian and Draka - based in almost 50 countries, we're constantly close to our customers, enabling them to further develop the world's energy and telecoms infrastructures and achieve sustainable and profitable growth.

For our energy business, we design, produce, distribute and install cables and systems for the transmission and distribution of power at low, medium, high and extra-high voltage.

For telecoms, the Group is a leading manufacturer of all types of copper and fibre cables, systems and accessories for voice, video and data transmission.

Drawing on over 130 years' experience and continuously investing in R&D, we apply excellence, understanding and integrity to everything we do, meeting and exceeding the needs of our customers across all continents - while at the same time shaping the evolution of our industry.







# What links global expertise to the wheels of industry?

High-performing cable solutions to keep the wheels of industry turning

On every continent, in applications that range from rolling stock and vehicles for high-speed trains and urban mass transit lines, to all types of rail transport infrastructure, Prysmian's specialist cable solutions sit at the heart of significant international projects - supporting the work of major customers, with high-performing, durable and safe technology.

As the world leader in cabling, we draw on global expertise and local presence to work in close proximity with our customers in order to deliver product and service solutions built on workability, customized solutions and effective supply chain, that help them drive the wheels of industry and achieve sustainable growth and profitability.

# Railway Main Line Cables

## History of the railways

When George Stephenson's steam locomotive "The Rocket" emerged as the winner of the Rainhill Race in 1829, with an average speed of 12.5 mph = 20 km/h, no one could predict the triumphant progress the railways would make in the almost 200 year period that followed. Within just a few decades, the railway developed into a broadly integrated transport system, which drastically reduced travel times, and made it possible to develop infrastructure - especially in the New World on the continent of North America. The triumph of the railways began with a 330 km railway line, as early as 1830. Over the next fifty years, the industry grew exponentially and reached almost 370,000 km. Nowadays, the railway infrastructure extends to more than 1.1 million km.

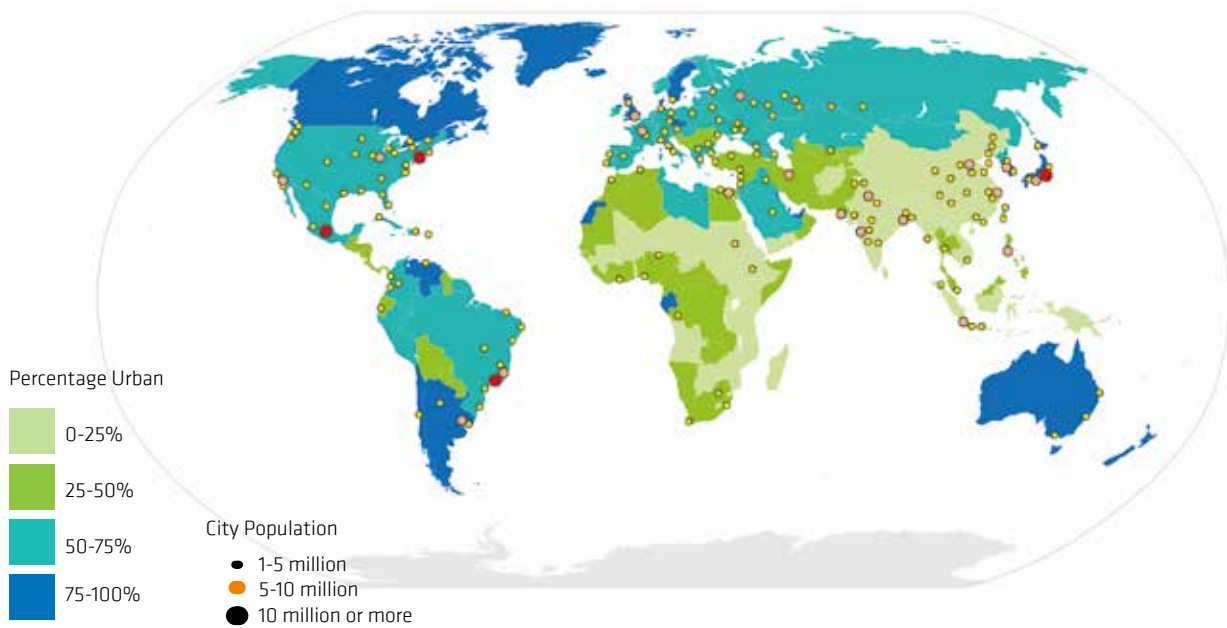
With the advent of civil aviation, the railway lost its role as the main means of transport for middle and long distances, and has long been regarded as outdated, slow and uncomfortable. But in recent years, the railway has experienced a revival. With the introduction of electronic interlocking technology and agreement on a European system for the management and control of railway transport - ERTMS (European Rail Traffic Management System), the rail transport once again plays an important role especially over medium distances. Thanks to a variety of European and other internationally operating system providers in the field of interlocking technology, the ERTMS system, which originated in Europe, has been experiencing an explosive worldwide acceptance over the past few years.

## Urbanisation

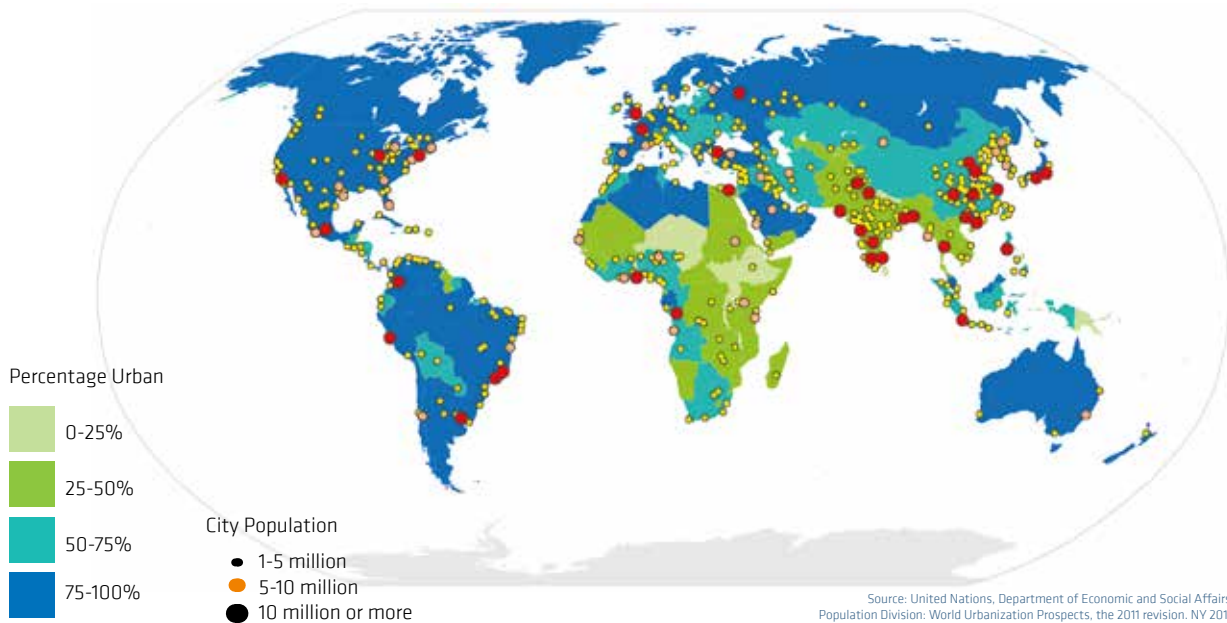
A major challenge for the railways as a means of mass transport, which is also an unparalleled opportunity, is represented by the increasing urbanisation of the world's population. In 2013, approximately 51% of the 7 billion people inhabiting the planet resided in an urban environment. By 2050, not only will the world's population have increased to approximately 9 billion people, but the proportion of people living in cities will have grown to about 70%. Thus, some 6.3 billion inhabitants will reside every day in large cities and be on the move. Car-bound private transport is destined to collapse and a change to rail-based transportation is therefore, without rival.

Tram and metro systems as well as regional trains and light rail vehicles will interconnect the cities into low-emission zones. Megacities are already in planning, such as the Chinese project "Turn The Pearl Delta Into One", in which nine cities with a total of 42 million people are to be merged into a single city. The most modern railway systems will form the backbone of this metropolis. A total of 29 lines with a network of altogether 1500 km will service the region and allow transit times of maximum one hour from one end of town to the other.

## Percentage of urban population and agglomerations by size, class 1980



## Percentage of urban population and agglomerations by size, class 2025



Source: United Nations, Department of Economic and Social Affairs, Population Division: World Urbanization Prospects, the 2011 revision. NY 2012

# Railway Main Line Cables

## Development of technology

The safety requirements for the railway technology are extraordinary and similar to that in aviation or aerospace. With increasing traffic volume in both directions on single track lines, continuous monitoring which provides permanent communication between the train conductor's cab and the railway control center is essential for the railway line safety. The rail vehicles cannot leave their track in case of imminent collision by opposing traffic on the same track.

In Europe, there has been a number of train control technologies that worked well within the country borders, but, led to considerable additional costs in the cross-border traffic. Currently, locomotives have more than one train control system installed, which ensure safe participation in railway traffic in neighboring countries without the need to change the locomotive.

Research aimed at reducing the number of systems and develop a uniform operational management approach for railways across Europe already started in the 80's on behalf of the International Union of Railways (UIC) and the European Rail Research Institute (ERRI). In April 2000, the guidelines for adopting specifications were presented under the name ERTMS - European Rail Traffic Management System.

The ERTMS system mainly consists of the following components:

- ETCS (European Train Control System) is a train control system, which is intended to prevent a train entering an occupied sector, or running at too high speed, using interlocking electronic control systems, with integrated train and trackside elements.
- GSM-R (Global System for Mobile Communications - Railway) is a mobile communications system for railway data and voice communications between moving trains and fixed locations, designed to satisfy the highest safety standards.

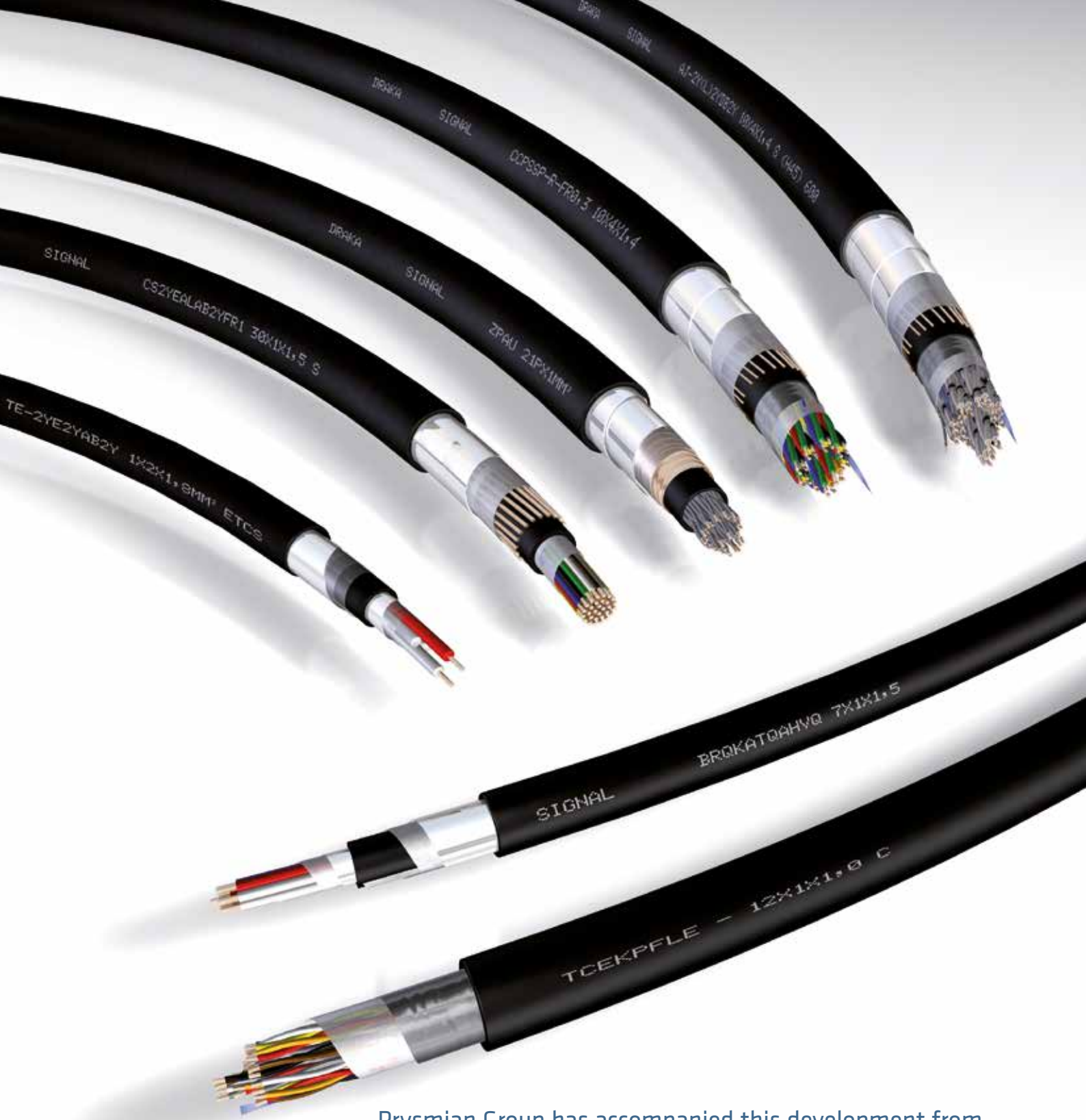
ERTMS was initially developed for intercity trains on routes of Trans-European Networks (TEN), but is gaining worldwide attention and it is being implemented outside Europe as well.

Another well recognized railway technology is CBTC - Communication Based Train Control system. CBTC systems are commonly used for urban rail traffic such as underground railways, light rail vehicles and trams, in urban areas with short transportation systems.

Both ETCS and CBTC systems are based on the same principles, namely high safety level in highly dense traffic. However, CBTC goes one step further and offers fully automated train operation. The train starts and stops automatically without a driver.

Even though CBTC complies with international standards the systems of each individual developer are not freely replaceable. The implementation of CBTC is highly complex and significantly more expensive than ERTMS on comparable routes. However, CBTC is unbeatable when it comes to achieving the shortest possible intervals between trains, down to 60-90 seconds. During the peak morning and evening periods, thousands of commuters can be comfortably transported and hence the streets can be relieved of congestion.





Prysmian Group has accompanied this development from the outset and today is able to offer a full range of cables for all applications in the railway sector.

Prysmian Group has the experience and the know-how to assist you and your projects worldwide.

Railway projects are unique!



# Railway Main Line Cables



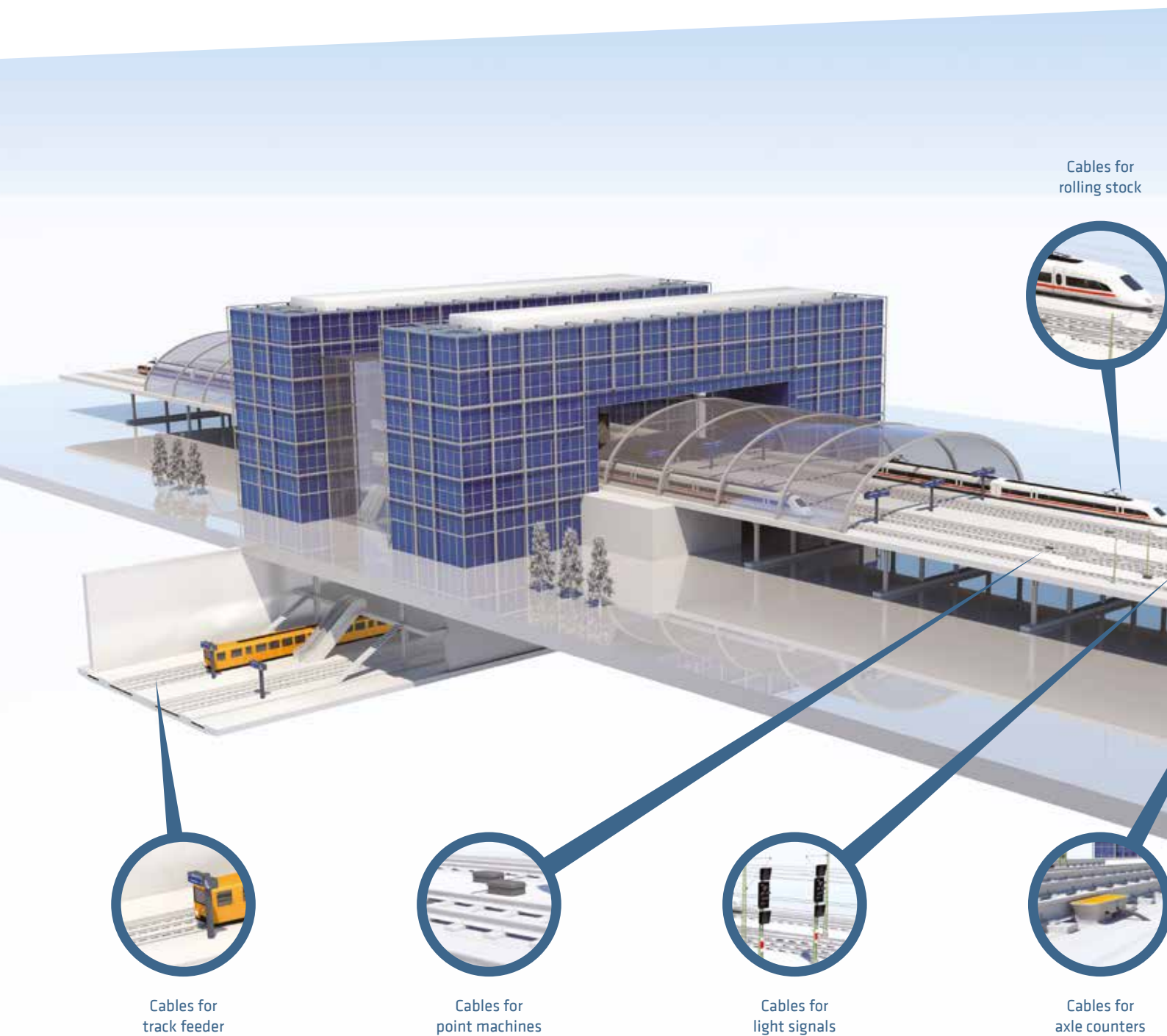


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# Railway Main Line Cables

## Cables for any application





As the leading worldwide supplier, Prysmian Group offers an extensive range of cabling solutions for different railway network applications.

Typical cable applications for main railway lines include:

### **Substations and Transformers**

- HV cables to substations for traction power
- MV cables to transformers for power distribution networks

### **Traction Tower Networks**

- MV cables for AC systems
- MV and LV cables for DC systems

### **Railway Network Systems**

- MV and LV cables to distribute current to control and telecommunication systems, lighting, heating and real estate along the railway.

### **Grounding of Electrical Systems**

- Bare conductors or insulated cables to guarantee the integrity of electrical systems.

### **Overhead Catenary Lines**

- Cables to supply electric power to railway trains and to make them move.

### **Control and Signalling Systems**

- Cables to cover a wide range of control and signalling applications to direct trains and keep trains clear of each other.

### **Mobile Communication Systems (GSM-R)**

- Data and fiber optic cables for railway data and voice communication between moving trains and fixed locations.

Cables for  
catenary



Cables for balises



# Railway Main Line Cables

## Designation codes for cables

### Cable designations used in Finland

Designations in the cross-section:

<b>X</b>	Separating the number of phase cores and the cross-section (mm <sup>2</sup> ).
<b>+</b>	Product having an external conductor for example a centre conductor, messenger or auxiliary phase core.
<b>/</b>	Separating numbers or letters from each other: <ul style="list-style-type: none"><li>- separates the cross-section of the concentric conductor (metallic screen) from the phase core.</li><li>- separates the cross-section of the aluminium and the steel core in overhead conductors.</li></ul>

The most common letters used in domestic products (current product selection):

<b>A</b>	Aluminium or aluminium alloy: <ul style="list-style-type: none"><li>- in the beginning of the type designation means Al conductor.</li><li>- in the middle of the type designation means Al foil laminate.</li><li>- aluminium alloy messenger.</li><li>- aluminium alloy armouring.</li></ul>
	Copper conductor (no A letter in the beginning).
<b>M</b>	Plastic insulation or sheath either as PVC, PE or fire retardant and halogen free thermoplastic compound.
<b>K</b>	Cable.
<b>X</b>	XLPE insulation.
<b>H</b>	Extruded semi-conducting layer below and over the insulation - sheath made of special material or heat resistant sheath.
<b>C</b>	Concentric layer of copper wires: <ul style="list-style-type: none"><li>- metallic screen or uniform copper layer (Cu helically applied tape or Cu foil laminate)</li></ul>
<b>S</b>	Copper braid.
<b>L</b>	Lead sheath.



<b>P</b>	Round steel wire armouring.
<b>J</b>	A conductor or a lead.
<b>O</b>	Control cable.
<b>CHB</b>	Metallic screen having Cu wires, semi-conducting tape layer and Al foil laminate. The cross-section of the metallic screen given in type designation is solely based on the cross-section of Cu wires.
<b>CA</b>	Metallic screen having Cu wires, semi-conducting tape layer and Al foil laminate. The cross-section of the metallic screen given in the type designation is a total cross-section of Cu wires and Al foil laminate combined.
<b>Y</b>	Each phase core having a separate metallic screen.
<b>W</b>	
<b>FR</b>	Fire Resistant cable remaining functional during fire, for example FRHF
<b>T</b>	Heat resistant.
<b>E</b>	Cable having a special feature compared to standard cable, for example a flexible Class 5 conductor.

# Railway Main Line Cables



4rail.net - Stanislav Voronin



# Explanation of symbols



## **Conductor temperature**

Max. conductor temperature °C in continuous operation.



## **Flexible installation**

Due to IEC 60228 class 5 multi-stranded conductor.



## **Smoke density**

Smoke propagation acc. to EN/IEC 61034.



## **Halogen free**

Halogen free acc. to EN/IEC 60754-1 and EN/IEC 50267-1.



## **Acidity**

Corrosivity acc. to EN/IEC 60754-2.



## **Fire retardant**

Flame propagation acc. to EN/IEC 60332-1.  
Bundled and vertical acc. to EN/IEC 60332-3.



## **Screened or armoured**

With either copper, aluminum or steel wire, foil and tape.



## **Fire resistant**

Fire resistant acc. to EN/IEC 60331-1 & 2.



## **UV resistant**

Filling and/or outer sheath suitable for outdoor application.



## **EMC resistant**

Fulfills EMC-directive with 100% dense screen with low coupling impedance.



## **Impact resistant**

Against shocks.



## **Pull resistant**

High tensile stress required to create cable failure.



## **Weather proof**



## **Watertight or proof**

Axial and radial water blocking via water swellable tape or yarn.

# Railway Main Line Cables

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Many more cable types and tailor-made cables are available for your individual application.



## TRACTION POWER NETWORK

### AHXCМК 26/45 (52) kV

#### SCREENED DISTRIBUTION CABLE

##### Application

Single core distribution cable for outdoor installation in pipes, directly in the ground or for ploughing down.

##### Technical data

###### Rated voltage:

- > 26/45 (52) kV

###### Phase induction:

- > In trefoil: 0.37 mH/km
- > Flat: 0.56 mH/km

###### Operating capacitance:

- > 0.22  $\mu$ F/km

###### Thermal short-circuit current:

- > For phase conductor: max. 28.3 kA
- > For metallic screen: max. 6.9 kA

###### Bending radius:

- > Min. 0.76 m

##### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C

##### Standard

- > IEC 60840
- > IEC 60228

##### Construction

###### Conductor:

- > Round aluminium wires
- > Compacted and stranded
- > Nom. diameter 20.3 mm
- > DC resistance at 20°C max. 0.1  $\Omega$ /km

###### Conductor screen:

- > Semi-conductive copolymer compound

###### Insulation:

- > XLPE compound
- > Nom. thickness 9.0 mm

###### Insulation screen:

- > Semi-conductive copolymer compound

###### Wrapping:

- > Semi-conductive creped paper tape

###### Screen:

- > Helix of copper wires
- > Counter helix of copper contact tape

###### Binder tape:

- > PA tape

###### Outer sheath:

- > HDPE compound
- > Black



90°



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard length m	Prysmian article no.
1 x 300/50	51	2,640	500	20022766

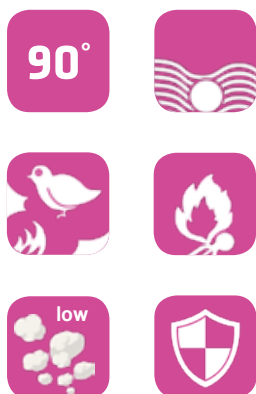


# 1. Electrification of main lines

## RAILWAY NETWORK SYSTEM

### AXCMK-PLUS 0.6/1 kV

#### SCREENED POWER CABLE - CPR CLASS E



#### Application

Halogen free and screened power cable for fixed installation indoors in buildings or outdoors directly in the ground or ploughed down. Can also temporary be installed in water. Not suitable for installations with severe electrical interference.

#### Technical data

##### Rated voltage:

- > 0,6/1 (1,2) kV

##### Test voltage:

- > 4,000 V AC

##### Bending radius:

- > During installation 12 x D
- > Fixed 8 x D

#### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -20°C
- > Below 0°C exercise caution

#### Standard & Directive & Approval

- > Standard: SFS 4879, IEC 60502-1
- > Standard: HD 603-5D, EN 50575:2014
- > Directive: fulfils RoHS and REACH
- > Approval: CPR class: Eca

#### Construction

##### Conductor:

- > Round aluminium wires
- > Annealed, stranded and compacted
- > 25 mm²: round
- > 50-185 mm²: sector shaped

##### Insulation:

- > XLPE compound
- > UV resistant

##### Core colours:

- > Blue, brown, black, grey

##### Wrapping:

- > Plastic tape

##### Screen:

- > Helix of copper wires
- > Tape binding

##### Outer sheath:

- > Halogen free compound
- > Flame retardant
- > Black

#### Material property

- > Halogen free: IEC 60754
- > Flame retardant: IEC 60332-1

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm²	Outer diameter mm	Weight kg/km	Standard length m	Finnish electric-number
4 x 25/16	26	720	1000	0621800
4 x 50/16	29	1,100	1000	0621802
4 x 95/29	38	1,900	1000	0621804
4 x 150/41	47	2,900	1000	0621806
4 x 185/57	52	3,600	1000	0621807

Conductor cross-section mm²	Bending radius - fixed min. mm	DC resistance of PE-conductor at 20°C max. Ω/km	Current rating at 90°C in free air A	Short circuit current - conductor kA
4 x 25/16	0.22	1.15	105	2.3
4 x 50/16	0.23	1.15	165	4.7
4 x 95/29	0.30	0.641	245	8.9
4 x 150/41	0.37	0.443	320	14.1
4 x 185/57	0.42	0.320	365	17.4

## RAILWAY NETWORK SYSTEM

### AXCMK-HF C-PRo 0.6/1 kV

#### SCREENED POWER CABLE - CPR CLASS C

##### Application

Halogen free and screened power cable for fixed installation indoors in buildings or outdoors. Not suitable for installations with severe electrical interference.

##### Technical data

###### Rated voltage:

- > 0,6/1 (1.2) kV

###### Test voltage:

- > 4,000 V AC

###### Bending radius:

- > During installation 12 x D
- > Fixed 8 x D

##### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -15°C
- > Below 0°C exercise caution

##### Standard & Directive & Approval

###### Standard:

- > SFS 5546
- > EN 50575:2014 +A1:2016
- > IEC 60502-1
- > EN 13501-6

###### Directive:

- > Fulfills RoHS and REACH

###### Approval:

- > CPR class: Cca-s1d1a1

##### Construction

###### Conductor:

- > Round aluminium wires
- > Annealed, stranded and compacted
- > 25 mm<sup>2</sup>: round
- > 50-300 mm<sup>2</sup>: sector shaped

###### Insulation:

- > XLPE compound
- > UV resistant

###### Core colours:

- > Blue, brown, black, grey

###### Wrapping:

- > Plastic tape

###### Screen:

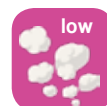
- > Helix of copper wires
- > Tape binding

###### Outer sheath:

- > Halogen free compound
- > Black

##### Material property

- > Halogen free: IEC 60754-1
- > Flame retardant: IEC 60332-1 & 3
- > Smoke density: IEC 60134



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating at 90°C in free air A	Standard length m	Finnish electric-number
4 x 35/16	26	900	130	500 - K12	0601990
4 x 50/16	29	1,200	165	500 - K12	0601991
4 x 70/21	33	1,550	205	500 - K14	0601992
4 x 95/29	38	2,050	245	500 - K16	0601993
4 x 120/41	41	2,500	280	500 - K20	0601984
4 x 150/41	47	3,000	320	500 - K20	0601986
4 x 185/57	52	3,800	365	500 - K22	0601987
4 x 240/72	57	4,850	430	500 - K24	0601988
4 x 300/88	63	5,900	480	500 - K24	0601989

# 1. Electrification of main lines

## RAILWAY NETWORK SYSTEM

### MCMK 0.6/1 kV

#### SCREENED & PVC INSULATED - CPR CLASS E



#### Application

Screened power cable for fixed installation indoors in buildings or outdoors directly in the ground. Also suitable for switchgear and explosive areas. Not suitable for installations with severe electrical interference.

#### Technical data

- > Rated voltage: 0.6/1 (1.2) kV
- > Test voltage: 4,000 V AC
- > Bending radius: during installation 12 x D
- > Bending radius: fixed 8 x D

#### Temperature range

- > Max. conductor temperature: +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -15°C
- > Below 0°C exercise caution

#### Standard & Directive & Approval

##### Standard:

- > SFS 4880
- > HD 603-3F
- > IEC 60502-1

##### Directive:

- > Fulfills RoHS and REACH

##### Approval:

- > CPR class: Eca

#### Construction

##### Conductor:

- > Round annealed copper wires
- > 1.5-6 mm<sup>2</sup>: solid
- > 10-16 mm<sup>2</sup>: stranded

##### Insulation:

- > PVC compound
- > Lead free

##### Core colours:

- > 2-core: blue, brown
- > 3-core: blue, brown, black
- > 4-core: blue, brown, black, grey

##### Filler:

- > Lead free compound

##### Screen:

- > Helix of copper wires
- > Counter helix of tape

##### Outer sheath:

- > PVC compound
- > Lead free
- > Black

#### Material property

- > Flame retardant: IEC 60332-1

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating at 70°C in free air A	Standard length m	Finnish electric-number
2 x 1.5/1.5	12	170	15	1000 - K8	0602122
2 x 2.5/2.5	13	220	20	1000 - K8	0602123
2 x 6/6	17	400	34	500 - K8	0602125
2 x 10/10	20	610	67	500 - K9	0602126
3 x 1.5/1.5	12	190	14	1000 - K8	0602152
3 x 2.5/2.5	13	250	19	1000 - K8	0602153
3 x 6/6	17	470	31	500 - K5	0602155
3 x 10/10	20	710	63	500 - K9	0602156
3 x 16/16	23	1000	85	500 - K11	0602157
4 x 1.5/1.5	13	220	14	1000 - K8	0602172
4 x 2.5/2.5	14	290	19	1000 - K9	0602143
4 x 6/6	19	550	31	500 - K8	0602145
4 x 10/10	22	840	63	500 - K11	0602146
4 x 16/16	25	1,200	85	500 - K11	0602147



## RAILWAY NETWORK SYSTEM

### MCMK-HF C-PRo 0.6/1 kV

#### SCREENED & HALOGEN FREE - CPR CLASS C

##### Application

Halogen free, flame retardant and screened power cable for fixed installation indoors in buildings or outdoors directly in the ground. Also suitable for switchgear and explosive areas. Not suitable for installations with severe electrical interference.

##### Technical data

- > Rated voltage: 0,6/1 (1.2) kV
- > Test voltage: 4,000 V AC
- > Bending radius: fixed 8 x D
- > Bending radius: during installation 12 x D

##### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -15°C
- > Below 0°C exercise caution

##### Standard & Directive & Approval

###### Standard:

- > SFS 5546
- > EN 50575:2014 +A1:2016
- > IEC 60502-1
- > EN 13501-6

###### Directive:

- > Fulfills RoHS and REACH

###### Approval:

- > CPR class: Cca-s1,d1,a1

##### Construction

###### Conductor:

- > Round annealed copper wires
- > 25-35 mm<sup>2</sup>: Round and stranded
- > 50-300 mm<sup>2</sup>: Stranded, compacted and sector shaped

###### Insulation:

- > XLPE
- > UV resistant

###### Core colours:

- > 4-core: brown, black, grey, blue

###### Filler:

- > Halogen free, extruded

###### Screen:

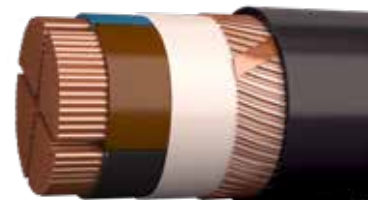
- > Helix of copper wires
- > Counter helix of copper wires

###### Outer sheath:

- > Halogen free compound
- > Black

##### Material property

- > Halogen free: IEC 60754
- > Flame retardant: IEC 60332-1-2
- > Flame retardant: IEC 60332-3
- > Smoke density: IEC 60134



90°



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating at 90°C in free air A	Standard length m	Finnish electric-number
4 x 25/16	24	1,400	135	500 - K11	0602021
4 x 35/16	26	1,800	165	500 - K12	0602023
4 x 50/25	29	2,400	200	500 - K12	0602024
4 x 70/35	33	3,300	250	500 - K14	0602025
4 x 95/50	38	4,500	310	500 - K16	0602026
4 x 120/70	42	5,700	360	500 - K20	0602016
4 x 150/70	47	6,850	410	500 - K20	0602017
4 x 185/95	52	8,650	470	500 - K24	0602018
4 x 240/120	57	11,500	560	500 - K24	0602020
4 x 300/150	63	13,900	640	500 - K26	0602022

# 1. Electrification of main lines

## RAILWAY NETWORK SYSTEM

### AMCMK 0.6/1 kV

#### SCREENED & PVC INSULATION - CPR CLASS E



70°



#### Application

Screened power cable for fixed installation indoors in buildings or outdoors directly in the ground. Also suitable for switchgear and explosive areas. Not suitable for installations with severe electrical interference.

#### Technical data

- > Rated voltage: 0.6/1 (1.2) kV
- > Test voltage: 4,000 V AC
- > Bending radius: fixed 8 x D
- > Bending radius: during installation 12 x D

#### Temperature range

- > Max. conductor temperature: +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -15°C
- > Below 0°C exercise caution

#### Standard & Directive & Approval

##### Standard:

- > SFS 4880
- > HD 603-3F
- > IEC 60502-1

##### Directive:

- > Fulfills RoHS and REACH

##### Approval:

- > CPR class: Eca

#### Construction

##### Conductor:

- > Round aluminium wires
- > 16 mm²: solid
- > 25 mm²: annealed, stranded, compacted and round
- > 35-300 mm²: annealed, stranded, compacted and sector shaped

##### Insulation:

- > PVC compound
- > Lead free

##### Core colours:

- > 3-core: brown, black, grey
- > 4-core: blue, brown, black, grey

##### Filler:

- > Lead free compound

##### Screen:

- > Helix of copper wires
- > Counter helix of copper wires

##### Outer sheath:

- > PVC compound
- > Lead free
- > Black

#### Material property

- > Flame retardant: IEC 60332-1

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm²	Outer diameter mm	Weight kg/km	Current rating at 70°C in free air A	Standard length m	Finnish electric-number
3 x 16/10	20	460	64	1000 - K12	0622157
3 x 25/16	24	680	83	1000 - K14	0622158
3 x 50/16	27	975	125	500 - K12	0622160
3 x 95/29	35	1,750	190	500 - K14	0622162
3 x 150/41	42	2,550	250	500 - K18	0622164
3 x 185/57	46	3,200	285	500 - K20	0622165
3 x 240/72	52	4,050	330	500 - K22	0622166
3 x 300/88	48	5,000	380	500 - K24	0622167
4 x 16/10	22	550	64	1000 - K14	0621854
4 x 25/16	27	820	83	1000 - K16	0621855
4 x 50/16	31	1,250	125	500 - K14	0621860
4 x 95/29	40	2,200	190	500 - K18	0621862
4 x 150/41	48	3,150	250	500 - K20	0621864
4 x 240/72	59	5,050	330	500 - K24	0621866
4 x 300/88	66	6,300	380	500 - K24	0621867

## RAILWAY NETWORK SYSTEM

# AXMK-PLUS 0.6/1 kV

## POWER CABLE - CPR CLASS E

### Application

Halogen free, flame retardant and screened power cable for fixed installation indoors in buildings or outdoors directly in the ground or ploughed down. Not suitable for installations with severe electrical interference.

### Technical data

#### Rated voltage:

- > Rated voltage: 0,6/1 (1.2) kV

#### Test voltage:

- > Test voltage: 4,000 V AC

#### Bending radius:

- > Fixed 8 x D
- > During installation 12 x D

#### Pulling force:

- > With grip: max. 15 N/mm<sup>2</sup>
- > With eye: max. 50 N/mm<sup>2</sup>

### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -20°C
- > Below 0°C exercise caution

### Standard & Directive & Approval

#### Standard:

- > SFS 4879, HD 603-5D
- > IEC 60502-1

#### Directive:

- > Fulfills RoHS and REACH

#### Approval:

- > CPR class: Eca

### Construction

#### Conductor:

- > Round aluminium wires
- > Annealed and compacted
- > 16-25 mm<sup>2</sup>: stranded
- > 35-300 mm<sup>2</sup>: sector shaped

#### Insulation:

- > XLPE compound
- > Halogen free

#### Core colours:

- > 4-core: yellow/green, brown, black, grey

#### Wrapping:

- > Plastic tape

#### Rip cord:

- > Kevlar

#### Outer sheath:

- > Halogen free compound
- > UV resistant
- > Black

### Material property

- > Halogen free: IEC 60754
- > Flame retardant: IEC 60332-1-2



90°



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating at 90°C in free air A	Standard length m	Finnish electric-number
4 x 16/10	18.79	350	75	500 - K11	0601829
4 x 25/16	22.5	500	105	500 - K11	0601830
4 x 35/16	22.54	630	130	500 - K12	0601831
4 x 50/16	26.09	820	165	500 - K12	0601832
4 x 70/21	29.90	1,130	205	500 - K14	0601833
4 x 95/29	33.56	1,450	245	500 - K16	0601834
4 x 120/41	37.40	1,850	280	500 - K18	0601835
4 x 150/41	41.38	2,250	320	500 - K20	0601836
4 x 185/57	46.38	2,800	365	500 - K22	0601837
4 x 240/72	52.08	3,600	430	500 - K24	0601838
4 X 300/88	57.95	4,500	480	500 - K24	0601839

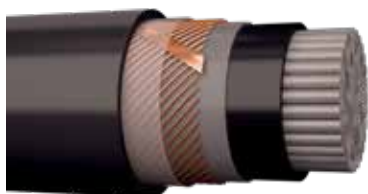


# 1. Electrification of main lines

## RAILWAY NETWORK SYSTEM

### AXCMK-PLUS 3 kV

#### SCREENED & HALOGEN FREE



70°



#### Application

Single core screened power cable for fixed installation indoors or outdoors directly in the ground.

#### Technical data

##### Rated voltage:

- > 1.8/3 kV

##### Bending radius:

- > Fixed 10 x D
- > During installation 15 x D

##### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -15°C
- > Below 0°C exercise caution

##### Standard

- > IEC 60228
- > IEC 60502-1

#### Construction

##### Conductor:

- > Round aluminium wires
- > Stranded and compacted

##### Insulation:

- > XLPE compound
- > Halogen free
- > Black

##### Core colour:

- > 1-core: black

##### Screen:

- > Helix of copper wires
- > Tape binding

##### Outer sheath:

- > PE compound
- > Flame retardant
- > Black

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	DC resistance at +20°C Ω/km	Standard length m
1 x 300/50	32	1,700	0,100	500
1 x 500/50	39	2,300	0.0605	500
1 x 630/50	43	2,800	0,0469	500

## RAILWAY NETWORK SYSTEM

### XCMKE-LSZH 0.6/1 kV

#### FLEXIBLE & INSULATED POWER CABLE

##### Application

Flame retardant and halogen free screened multi-stranded power cable for fixed installation indoors or outdoors.

##### Technical data

Rated voltage:

- > 0,6/1 kV

Test voltage:

- > 4,000 V

Bending radius:

- > During installation 12 x D
- > Fixed 8 x D

Pulling force:

- > Max. 50 N/mm<sup>2</sup>

##### Temperature range

- > Max. conductor temperature: +90°C
- > Short circuit temperature: +250°C
- > Lowest temp. at installation: -15°C

##### Standard & Directive & Approval

Standard:

- > IEC 60502-1

Directive:

- > Fulfills RoHS & REACH

Approval:

- > CPR class: Upon request

##### Construction

Conductor:

- > Round copper wires
- > Multi-stranded
- > Acc. to IEC 60228 class 5.

Insulation:

- > XLPE compound
- > Black

Screen:

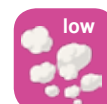
- > Helix of copper wires
- > Tape binding

Sheath:

- > Halogen free compound
- > Black

##### Material property

- > Flame retardant: IEC 60332-1-2
- > Halogen free: IEC 60754
- > Smoke density: IEC 61034



Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	DC resistance at 20°C Ω/km	Standard length m
1 x 150/35	28	1900	0.129	500
1 x 300/50	36	3500	0.0641	500

# 1. Electrification of main lines

## GROUNDING

### HK

#### STRANDED ANNEALED COPPER CONDUCTOR



##### Application

Bare copper conductor for grounding of metal parts for different railway network systems.

##### Technical data

###### Bending radius:

- > During installation: 15 x D
- > Fixed: 10 x D

###### Pulling force:

- > Using eye or grip: max. 50 N/mm<sup>2</sup>

##### Standard & Directive

###### Standard:

- > IEC 60228

###### Directive:

- > Fulfills RoHs

##### Construction

###### Conductor:

- > Round copper wires
- > Annealed
- > Stranded
- > Acc. to IEC 60228 class 2.

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard length m	Finnish electric-number
1 x 50	9	430	1000 - K7	0105350
1 x 70	11	610	1000 - K9	0105370
1 x 95	13	850	1000 - K11	0105395
1 x 120	15	1,100	500 - K11	0105397
1 x 150	16	1,312	500 - K11	0105014

## GROUNDING

### KK

## STRANDED HARD COPPER CONDUCTOR

#### Application

Bare copper conductor for grounding of metal parts for different railway network systems.

#### Technical data

##### Bending radius:

- > During installation: 15 x D
- > Fixed: 10 x D

#### Standard

- > IEC 60228

#### Construction

##### Conductor:

- > Round copper wires
- > Hard drawn
- > Right handed 'Z' stranded
- > Acc. to IEC 60228 class 2.



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section nom. mm <sup>2</sup>	No. of wires x diameter of wires	Outer diameter nom. mm	Weight kg/km	Standard length m
1 x 25	7 x 2.1	6.3	218	1500 - K9
1 x 35	7 x 2.5	7.5	310	2000 - K10
1 x 50	7 x 3.0	9.0	446	500 -K7
1 x 70	19 x 2.1	10.5	596	750 - K9

Conductor cross-section nom. mm <sup>2</sup>	Rated tensile strength kN	Final modulus of electricity GPa	Coefficient of linear expansion /°C	DC resistance at 20°C Ω/km
1 x 25	9.72	118	16.9 x 10 <sup>-6</sup>	0.746
1 x 35	13.77	113	17.0 x 10 <sup>-6</sup>	0.5267
1 x 50	19.84	113	17.0 x 10 <sup>-6</sup>	0.366
1 x 70	26.38	105	17.0 x 10 <sup>-6</sup>	0.276



# 1. Electrification of main lines

## GROUNDING

### MK-HF C-PRo 450/750 V

#### INSULATED & HALOGEN FREE COPPER WIRE



70°



low



#### Application

Halogen free and flame retardant wire for grounding of metal parts of different railway network systems.

#### Technical data

Rated voltage:

- > 450/750 V

Test voltage:

- > 2,500 V

Bending radius:

- > During installation 8 x D
- > Fixed: 3 x D

Pulling force:

- > Max. 50 N/mm<sup>2</sup>

#### Temperature range

- > Max. conductor temperature: +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -25°C
- > Below 0°C exercise caution

#### Standard & Directive & Approval

Standard:

- > EN 50525-3-31

Directive:

- > Fulfills RoHS & REACH

Approval:

- > CPR class: Cca-s1d1a1

#### Construction

Conductor:

- > Round copper wires
- > Stranded
- > Acc. to IEC 60228 class 2.

Insulation:

- > Halogen free compound
- > Yellow/green

#### Material property

- > Flame retardant: IEC 60332-1-2 and IEC 60332-3
- > Halogen free: IEC 60754
- > Smoke density: IEC 61034

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard length m	Finnish electric-number
1 G 6	5	70	500 - PK	0403395
1 G 16	8	180	500 - K6	0406216
1 G 25	10	280	500 - K6	0406227
1 G 35	11	370	500 - K6	0406237
1 G 50	12	510	500 - K6	0406240
1 G 70	14	700	500 - K7	0406245
1 G 95	16	960	500 - K8	0406247
1 G 120	18	1,300	500 - K9	0406249

## GROUNDING

### MKEM-HF C-PRo 450/750 V

#### INSULATED & HALOGEN FREE FLEXIBLE COPPER WIRE

##### Application

Flame retardant and halogen free multi-stranded wire, e.g. for grounding of metal parts from different systems of railway networks.

##### Technical data

Rated voltage:

- > 450/750 V

Test voltage:

- > 2500 V

Bending radius:

- > During installation 8 x D
- > Final installation: 3 x D

Pulling force:

- > Max. 50 N/mm<sup>2</sup>

##### Temperature range

- > Max. conductor temperature: +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -25°C

##### Standard & Directive & Approval

Standard:

- > EN 50525-3-31

Directive:

- > Fulfills RoHS & REACH

Approval:

- > CPR class: Cca-s1,d1,a1

##### Construction

Conductor:

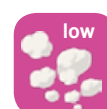
- > Round copper wires
- > Multi-stranded
- > Acc. to IEC 60228 class 5.

Insulation:

- > Halogen free compound
- > Yellow/green or black

##### Material property

- > Flame retardant: IEC 60332-1-2 & 3
- > Halogen free: IEC 60754-1
- > Smoke density: IEC 61034



Content is subject to changes acc. to current product development and or any changes to standards.

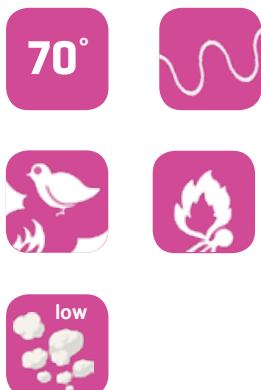
Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating in free air A	Standard length m	Finnish electric-number
1 G 6	5	65	31	100	0406253
1 G 10	7	110	41	100	0406263
1 G 16	8	170	55	100	0406269
1 G 25	10	260	72	500 - K6M	0406280
1 G 35	11	350	88	500 - K6M	0406284
1 G 50	13	500	105	500 - K6M	0406287
1 G 70	15	700	133	300 - K6M	0406290
1 G 95	18	910	159	1000 - K11	0406294
1 G 120	19	1,200	182	800 - K11	0406296
1 X 6 BK	5	65	31	100	0406255
1 X 10 BK	7	110	41	100	0406264
1 X 16 BK	8	170	55	100	0406270
1 X 25 BK	10	260	72	500 - K6M	0406281
1 X 35 BK	11	350	88	500 - K6M	0406285
1 X 50 BK	13	500	105	500 - K6M	0406288
1 X 70 BK	15	700	133	300 - K6M	0406291
1 X 95 BK	18	910	159	1000 - K11	0406295
1 X 120 BK	19	1,200	182	800 - K11	0406297

# 1. Electrification of main lines

## GROUNDING

### MMKEM-LSZH 0.6/1 kV

#### FLEXIBLE & INSULATED POWER CABLE



##### Application

Flame retardant and halogen free multi-stranded power cable for grounding of metal parts from different systems of railway networks.

##### Technical data

###### Rated voltage:

- > 0,6/1 kV

###### Test voltage:

- > 4,000 V

###### Bending radius:

- > During installation 8 x D
- > Fixed 3 x D

###### Pulling force:

- > Max. 50 N/mm<sup>2</sup>

##### Temperature range

- > Max. conductor temperature: +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -15°C

##### Standard & Directive & Approval

###### Standard:

- > IEC 60502-1
- > EN 50363 (insulation & sheath)

###### Directive:

- > Fulfills RoHS & REACH

###### Approval:

- > CPR class: Upon request

##### Construction

###### Conductor:

- > Round copper wires
- > Multi-stranded
- > Acc. to IEC 60228 class 5.

###### Insulation:

- > Halogen free compound
- > Type TI6
- > Black

###### Sheath:

- > Halogen free compound
- > Type TM7
- > Black

##### Material property

- > Flame retardant: IEC 60332-1-2
- > Halogen free: IEC 60754
- > Smoke density: IEC 61034

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	DC resistance at 20°C Ω/km	Standard length m
1 x 150	25	1,600	0.129	500
1 x 300	34	3,200	0.0641	500







# 1. Electrification of main lines

## ACCESSORY

### FORMFIT MULTI-CONNECTOR

#### 12-36 kV SEPARABLE WITH TEST POINT



##### Application

Watertight separable connector suitable for connecting polymer up to 36 kV cables to transformers, switchgear units, motors etc. Available as a straight FMCE-400, elbow FMCE-400 or tee FMCT-400 connector. For indoor and outdoor application of:

- > Single core cables
- > PE, XLPE and ERP insulation
- > CU or AL conductor
- > Semi-conducting screen
- > Screen of metal, wire or tape
- > Insulation voltage up to 36 kV
- > From 25-240 (300) mm<sup>2</sup>
- > For continuous 400 A rms
- > Overload 600 A rms
- > Interface B

##### Installation features

- > No need for special tools
- > No need for heating, taping or filling
- > Vertical, angled or inverted position
- > No min. distance between phases
- > Immediate energizing possible
- > Individual clamping by steel brace

##### Construction

- > Contact pin assembly
- > Semi-conducting inner screen
- > Semi-conducting outer jacket
- > Insulating body of moulded EPDM
- > Test point electrically protected by cap
- > Adapter of EPDM moulding
- > Locking brace of stainless steel
- > Earthing cover of moulded EPDM
- > Earthing eye

##### Standard

- > VDE 0278-C 33-051, CC 33-001
- > HD 629-1 og IEC 60502-4
- > Cenelec EN 50180, EN 50181

##### Delivery

- > Supplied as a kit of 3 single connectors containing all components.

Content is subject to changes acc. to current product development and or any changes to standards.

Diameter over insulation		Kit reference	Conductor size in mm (for guidance only)			
Min.	Max.		12 kV	17 kV	24 kV	36 kV
18.5	20.5	FMCE-400-Z	70	50	35	
19.9	21.9	FMCE-400-A	95	70	50	
21.4	2.5	FMCE-400-B	120	95	70	25
22.9	25.1	FMCE-400-C	150	120	95	35
24.4	26.6	FMCE-400-D	185	150	120	50
26.0	28.3	FMCE-400-E	240	185	150	70
27.8	30.4	FMCE-400-F	300	240	185	95
29.8	32.7	FMCE-400-G		300	240	120
31.8	35.3	FMCE-400-H			300	185
34.1	38.3	FMCE-400-J				240

## ACCESSORY

# ELASCON TEE CONNECTOR

## 12-36 kV SEPARABLE WITH MECHANICAL CONTACT

### Application

Watertight connector type MSCT/EC-630-C suitable for connecting polymer MV cables to transformers, switchgear units, motors etc. For indoor and outdoor application of:

- > Single core cables
- > PE, XLPE and ERP insulation
- > CU or AL conductor solid or stranded
- > Semi-conducting screen
- > Screen of metal, wire or tape
- > Insulation voltage up to 18/30 (36) kV
- > Conductor size: 25 - 300 mm<sup>2</sup>
- > For continuous 630 A rms
- > Overload 900 A rms

### Installation features

- > No need for special tools
- > No need for heating, taping or filling
- > Vertical, angled or inverted position
- > No min. distance between phases
- > Immediate energizing possible

### Standard

- > HD 629.1 S2
- > IEC 60502-4 NF C 33-051 - NF C 33-001
- > IEC 61238-1 class A - mechanical contact

### Construction

- > Mechanical conductor contact
- > M16 clamping screw
- > Semi-conducting inner screen
- > Semi-conducting outer envelope
- > Insulating body mould EPDM
- > Test point electrically protected by cap
- > Insulating plug epoxy component
- > Cap of moulded semi-conducting EPDM
- > Earthing eye
- > Moulded high permittivity reducer

### Standard

- > Cenelec HD 629.1 S2
- > IEC 60502-4 - NF C33-051 - NF C 33-001.
- > Cenelec EN 50180, EN 50181
- > IEC 61238-1 class A, HN 68-S-91

### Versions available

- > Elascron is available in version for 250, 400 and 630 continuous A rms.

### Delivery

- > Supplied as a kit of 3 single connectors containing all components.



Content is subject to changes acc. to current product development and or any changes to standards.

Voltage kV	Diameter over insulation		Conductor size in mm <sup>2</sup> (for guidance only)		Prysmian order no.
	Min.	Max.			
12	13.0	22.3	25	120	MSCEA/EC-630-C-12-rA-25/120
12	16.1	26.3	95	240	MSCEA/EC-630-C-12-rB-95/240
12	22.7	33.0	185	300	MSCEA/EC-630-C-12-rC-185/300
17	13.0	22.3	70	70	MSCEA/EC-630-C-17-rA-25/70
17	16.1	26.3	120	120	MSCEA/EC-630-C-17-rB-35/120
17	20.2	30.8	240	240	MSCEA/EC-630-C-17-rC-95/240
17	25.6	35.3	300	300	MSCEA/EC-630-C-17-rE-185/300
24	16.1	26.3	185	150	MSCEA/EC-630-C-24-rB-25/150
24	16.1	26.3	185	195	MSCEA/EC-630-C-24-rB-70/185
24	20.2	30.8	240	240	MSCEA/EC-630-C-24-rC-95/240
24	22.7	33.0	240	240	MSCEA/EC-630-C-24-rD-95/240
24	25.6	35.3	300	300	MSCEA/EC-630-C-24-rE-185/300
36	20.2	30.8	95	95	MSCEA/EC-630-C-36-rC-25/95
36	22.7	33.1	120	120	MSCEA/EC-630-C-36-rD-35/120
36	25.6	35.3	240	240	MSCEA/EC-630-C-36-rE-70/240
36	30.5	40.6	150	300	MSCEA/EC-630-C-36-rF-150/300

# 1. Electrification of main lines

## ACCESSORY

### SIXTY-SPEED JOINT 72.5 kV

#### ALL-IN-ONE FACTORY TESTED COLD SHRINK EPR



#### Description

- > Factory pre-assembled
- > Factory pre-tested
- > Cold-shrink EPR joint
- > All-in-one design
- > Integrated link-devices
- > Integrated elastic outer sheath
- > Sectionalized version
- > Non-sectionalized version
- > Self-ejecting technology
- > Shear bolts mechanical connector
- > Tool free solution
- > LEAN product - few components

#### Application

- > Joint for single-core extruded cables (XLPE or EPR)
- > Copper or aluminium conductor
- > Copper wire screen or aluminium laminated sheath
- > Cable sizes from 120 mm<sup>2</sup> (240 kcmil) up to 1000 mm<sup>2</sup> (2000 kcmil)
- > Voltage: 36/69 (72.5 kV) (IEC)
- > Voltage: 39.8/69 kV (BIL 350 kV crest) (IEEE)
- > Suitable for buried installations also in presence of water table (1 m water-proof)

#### Installation features

- > Easy to install: No special tools are required (tool-free solution).
- > Quick assembling: Designed for reducing installation time. Main components are already expanded and placed in the correct position. Joint sealing simply done by removing supports from the outer sheath.
- > Self-ejecting supports: No special skill required for the installation.
- > 100% factory tested: Submitted to electrical test and partial discharges measurements before shipping.
- > 2 years shelf-life.

#### Additional options

- > Metallic casing as additional mechanical protection.
- > Coffin-box filled with resin as additional water protection suitable for concentric cross-bonding cable.
- > Heat-shrinkable outer protection instead of the integrated elastic outer sheath.

#### Qualification

- > Qualified in accordance to IEC 60840 and IEEE-404.
- > Short circuit tested (up to 40 kA/0.5 sec.)

Content is subject to changes acc. to current product development and or any changes to standards.

Product references	Rated voltage kV	Sixty-Speed model	Cross-section range mm <sup>2</sup>	Insulation range mm	Max. outer diameter mm
CSJ(-X) 1072	72.5 kV	1	120 - 240	39.0 - 53.0	77.0
CSJ(-X) 1072	72.5 kV	2	300 - 1000	52.0 - 71.0	89.0

## ACCESSORY

# COLDFIT TERMINATION 72.5 kV

## FACTORY EXPANDED WITH MODULAR DESIGN

### Application

Factory-expanded cold shrink silicone termination designed with factory-assembled moisture sealing components. Modular design allows for different creepage distances. Suitable for outdoor installation subject to severe climatic conditions. Installation without use of special tools.

- > Single core extruded cables (XLPE or EPR)
- > With CU or AL conductor
- > With wire screen or aminated sheath
- > Conductor size from 150-1,200 mm<sup>2</sup>

### Technical data

- > Rated voltage: 36/69 (72.5) kV
- > Terminal body creepage: 2,100 mm
- > Modular creepage: 600 mm
- > Total creepage distance: 2,700 mm
- > Acc. to IEC 60815

### Installation features

- > Easy to install - not tools needed
- > Quick assemble - LEAN few items
- > Extractable support - on plastic carrier
- > Vertical or angled position
- > Shear bolts mechanical connector
- > Excellent anti-tracking and hydrophobic
- > 100% factory tested
- > 2 year shelf-life

### Construction

#### Insulation body:

- > Cold shrink element
- > Silicone rubber
- > Expanded into a spiral support

#### Stress cone:

- > Designed to ensure voltage control
- > Suitable for all cables
- > Semi-conducting silicone rubber

#### Sealing tube:

- > Upper and lower (conductor/earth)
- > Cold shrink silicone rubber
- > Expanded into a spiral support

#### Tape:

- > High permittivity tape
- > Sealing mastic and silicone tape
- > Ensures watertightness

#### Conductor lug:

- > Suitable for copper or aluminium

### Standard

- > IEC 60840 / IEEE 404



Content is subject to changes acc. to current product development and or any changes to standards.

Rated voltage kV	Model type	Cross section mm <sup>2</sup>	Insulation thickness mm	Outer diameter mm	A mm	B mm	C mm	D mm	F creepage m
72.5 kV	1	150 - 500	33.5 - 48.8	57.0	750	146	186	1,000	> 2.25
72.5 kV	2	500 - 1,200	42.8 - 66.0	74.0	750	156	196	1,000	> 2.25



# 1. Electrification of main lines

## ACCESSORY

### ECOSPEED JOINT 24-36 kV

#### STRAIGHT THROUGH JOINT, COLD SHRINK



##### Application

Suitable for jointing of polymeric insulated cables of different specifications, for example as transition joint between extruded and paper insulated cables. Joint can be laid underground in tunnels, on horizontal racks or directly buried.

##### Cable types

- > Single core polymeric insulation
- > Insulation voltage up to 36 kV (Um)
- > Copper or aluminium conductor
- > Conductor sizes 50 to 630 mm<sup>2</sup>
- > Tape, wire or polylam metallic screen
- > Non-armoured
- > Semi-conducting screen

##### Selection guide

Select in the table below, the kit model corresponding to the insulation voltage Um (up to 24 kV or 36 kV), the diameter over insulation and over outer sheath.

Specify insulation voltage Um for 24 or 36 kV.

Select the screen continuity device according to the type of metallic screen of cable. T1 for polylam screen, T2 for tape screen and T3 for wire screen.

##### Construction

- > Three layers sleeve
- > Two layers sheath
- > Copper mesh
- > High permittivity tape
- > PVC tape
- > Sealing mastic tape
- > Embossed copper tape
- > PVC strip
- > Identification label

##### Standard

- > Fulfills IEC 60502-4
- > Fulfills CENELEC HD 629-1-2

##### Installation characteristics

- > All-in-one compact design
- > Factory expanded onto a support
- > No special skills or experience required
- > Easy assembling
- > No special tools or heating needed
- > Wide cables size range
- > Immediate energizing after jointing
- > Great flexibility
- > Suitable for compact insulated cables

Content is subject to changes acc. to current product development and or any changes to standards.

Rated voltage kV	Elaspeed model	Min. outer insulation diameter mm	Max. outer sheath diameter incl. screen mm	Conductor size range (for guidance only)
24 kV	Ecospeed 151556	19	40	50 - 240
24 kV	Ecospeed 162662	24	44	95 - 240
36 kV	Ecospeed 151656-0	23	40	50 - 120
36 kV	Ecospeed 202070-1	28	55	95 - 240
36 kV	Ecospeed 202070-3	34	55	300 - 630
36 kV	Ecospeed 252580-4	36	62	500 - 630

## ACCESSORY

# ELASPEED JOINT 12-36 kV

## STRAIGHT THROUGH JOINT, ELASTIC

### Application

For jointing of 1- or 3 core polymeric insulated cables of different specifications, conductor sizes, round or sector shaped. Joint has injected outer protection and integrated electrode. Suitable for jointing cables laid underground, in tunnels, on horizontal racks or aerial. Can be directly buried (after curing of resin). Supplied as a kit containing all the necessary components except the ferrules (supplied on request).

Elaspeed™ utilize cold shrink technology which doesn't require any special tools or torches for installation. The EPR rubber insulation is manufactured on a vertical extruder to ensure complete concentricity to the tightest tolerance possible.

### Cable types

- > 1- or 3-core polymeric insulation
- > Copper or aluminium conductor
- > Metallic screen of tape or wire
- > Semi-conducting screen (extruded/taped)
- > Insulation voltage up to 36 kV (Um)
- > Conductor sizes from 25-500 mm<sup>2</sup>
- > Non-armoured or armoured.

### Construction

- > Conductor ferrule, crimped
- > Joint body, extruded EPR
- > Removable carrier, pre-loaded
- > Core screen, copper
- > Outer protection, watertight

### Installation features

- > No need for special tools or heating.
- > Injection of resin with disposable injection device can be supplied directly in the kit - in this case, letter "F" to be added at the end of kit reference.
- > Energizing of cable 30 minutes after injecting.
- > Polymerisation of synthetic resins at ambient temp. +5°C to +45°C

### Standard

- > C 33 001 - DIN 57 278
- > IEEE 404 - IEC 60502-4
- > ENEL DJ 4853 - C 33 050-AI
- > CENELEC HD 629-1



Content is subject to changes acc. to current product development and or any changes to standards.

Rated voltage kV	1 core cable			3 core cable		
	Max. OD sheath mm	Max. conductor size mm <sup>2</sup>	Kit reference name	Max. OD sheath mm	Max. conductor size mm <sup>2</sup>	Kit reference name
12	38	95 - 150	EPJM - 1C-12 E	19.0	95 - 150	RTMJ - 3C-12 E
12	49	195 - 300	EPJM - 1C-12 F	23.1	185 - 300	RTMJ - 3C-12 F
12	50	240 - 400	EPJM - 1C-12 H	24.4	240 - 400	RTMJ - 3C-12 H
12	57	300 - 500	EPJM - 1C-12 IP	27.8	300 - 500	RTMJ - 3C-12 IP
17.5	34	70 - 120	EPJM - 1C-17 E	19.0	70 - 120	RTMJ - 3C-17 E
17.5	44	150 - 240	EPJM - 1C-17 F	23.1	150 - 240	RTMJ - 3C-17 F
17.5	46	195 - 300	EPJM - 1C-17 H	24.4	185 - 300	RTMJ - 3C-17 H
17.5	52	240 - 500	EPJM - 1C-17 IP	27.8	240 - 500	RTMJ - 3C-17 IP
24	39	50 - 95	EPJM - 1C-24 E	19.0	50 - 95	RTMJ - 3C-24 E
24	48	95 - 240	EPJM - 1C-24 F	23.1	95 - 240	RTMJ - 3C-24 F
24	50	120 - 300	EPJM - 1C-24 H	24.4	120 - 300	RTMJ - 3C-24 H
24	57	195 - 400	EPJM - 1C-24 IP	27.8	185 - 400	RTMJ - 3C-24 IP
36	50	50 - 150	EPJM - 1C-36 H	24.4	50 - 150	RTMJ - 3C-36 H
36	57	95 - 300	EPJM - 1C-36 IP	27.8	95 - 300	RTMJ - 3C-36 IP
36	67	195 - 630	EPJM - 1C-36 I			



## CATENARY CONTACT WIRE

### TRL

### PURE COPPER CONDUCTOR

#### Application

Copper wire for power transmission to electric railway lines. Suitable as catenary wire for AC and DC systems.

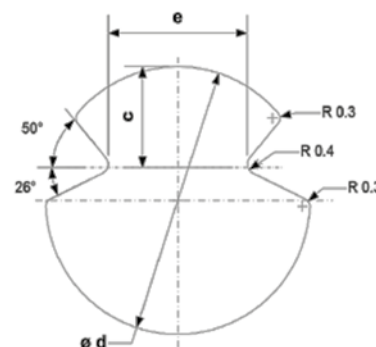
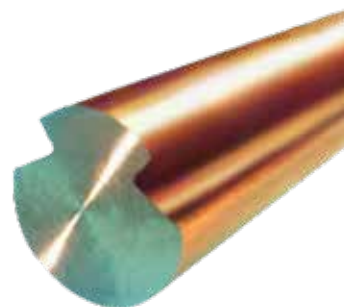
#### Standard

- > EN 50149 type A

#### Construction

##### Conductor:

- > Single strand
- > Pure copper - ETP
- > Hard drawn
- > Grooved
- > Identification marks acc. to EN 50149



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Conductor diameter mm	Weight kg/km	Standard length m	Prysmian article no.
80	10.6	710		0104008
100	12.0	890		0104010
120	13.2	1,067		

Conductor cross-section mm <sup>2</sup>	Rated tensile strength (RTS) kN	Coefficient of linear expansion /°C	Final modulus of elasticity GPa	Thermal oxide resistance kA
80	28.4	17 x 10 <sup>-6</sup>	120	12
100	35.5	17.0 x 10 <sup>-6</sup>	120	15
120	42.0	17.0 x 10 <sup>-6</sup>	120	

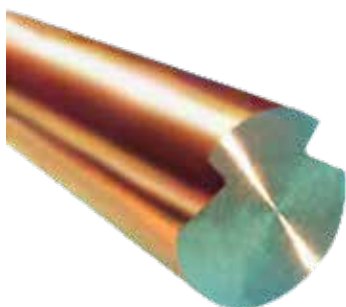


## 2. Overhead catenary lines

### CATENARY CONTACT WIRE

## TRL CuAg

### COPPER-SILVER ALLOYED CONDUCTOR



#### Application

Copper-silver alloyed wire for power transmission to electric railway lines. Suitable as catenary wire for AC and DC systems.

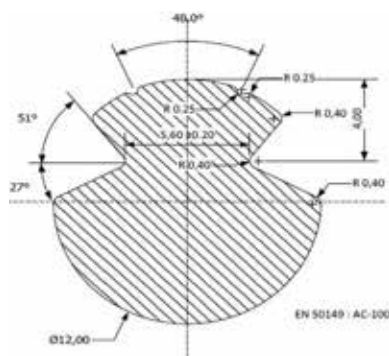
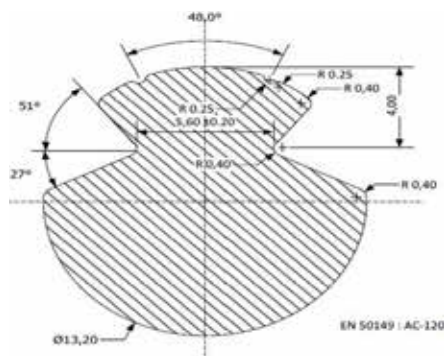
#### Standard

- > EN 50149

#### Construction

##### Conductor:

- > Single strand
- > Silver alloyed copper
- > Hard drawn
- > Grooved
- > Identification marks acc. to EN 50149



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard length m	Prysmian EAN no.
80				
100	12.0	980		
120	13.2	1,067		

Conductor cross-section mm <sup>2</sup>	Rated tensile strength (RTS) kN	Coefficient of linear expansion /°C	Final modulus of elasticity GPa	DC resistance at 20°C Ω/km
80				
100	36.0	17 x 10 <sup>-6</sup>	120	0.183
120	42.0	17 x 10 <sup>-6</sup>	120	0.153

## CATENARY WIRE & DROPPER

### KK Bz-II 10 mm<sup>2</sup> or 50 mm<sup>2</sup>

#### STRANDED BRONZE ALLOYED COPPER CONDUCTOR

##### Application

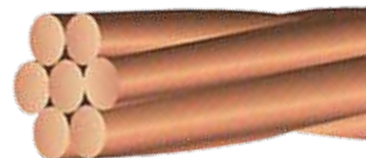
Stranded bronze alloyed 1,35 or 3,0 mm copper wire concentrically stranded acc. to DIN 48201 part 2.

KK Bz-II 10 mm<sup>2</sup> suitable as dropper wire and KK Bz-II 50 mm<sup>2</sup> suitable as catenary wire in railway applications.

##### Construction

###### Conductor:

- > Round
- > Bronze alloyed copper wires
- > Hard drawn
- > Nom. diameter 1.35 or 3.0 mm
- > Outer layer "Z" stranded
- > Acc. to IEC 60228 class 2.



##### Technical data

###### Tensile strength:

- > Min. 618 N/mm<sup>2</sup>

###### Resistivity:

- > Max.: 27.78 n Ω m

##### Standard

- > DIN 48201 part 2.
- > DIN 48200 part 2. Bz-II



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard length m	Prysmian EAN no.
10 (7 x 1.35)	4.1	90		
50 (7 x 3.0)	9.0	446		

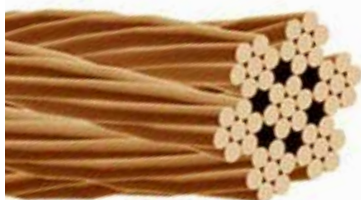
Conductor cross-section mm <sup>2</sup>	Rated tensile strength (RTS) kN	Coefficient of linear expansion /°C	Final modulus of elasticity GPa	DC resistance at 20°C Ω/km
10 (7 x 1.35)	5.88	17 x 10 <sup>-6</sup>	113	2.8
50 (7 x 3.0)	28.58	17 x 10 <sup>-6</sup>	113	0.569

## 2. Overhead catenary lines

### DROPPER

## KKM Bz-II 10 mm<sup>2</sup>

### MULTI-STRANDED COPPER ALLOYED CONDUCTOR



#### Application

Stranded bronze alloyed 0.5 mm copper wire concentrically bundled acc. to DIN 48201 part 2.

KKM Bz-II 10 mm<sup>2</sup> is suitable as dropper wire railway applications.

#### Technical data

##### Tensile strength:

- > Min. 618 N/mm<sup>2</sup>

##### Resistivity:

- > Max.: 27.78 n Ω m

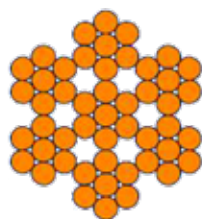
#### Standard

- > DIN 48201 part 2.
- > DIN 48200 part 2. Bz-II

#### Construction

##### Conductor:

- > Round
- > Multi-stranded
- > Bronze alloyed copper wires
- > Hard drawn
- > Nom. diameter 0.5 mm
- > Bunched sub-conductor 7 x 0.5 mm
- > Outer layer "S" stranded



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Sub-conductor diameter nom. mm	Weight kg/km	Standard length m
10 (7 x 7 x 0.5)	4.5	1.37	89	

Conductor cross-section mm <sup>2</sup>	Rated tensile strength (RTS) kN	Coefficient of linear expansion /°C	Final modulus of elasticity GPa	DC resistance at 20°C Ω/km
10 (7 x 7 x 0.5)	589			2.98

## RETURN WIRE

### AAC

#### STRANDED ALUMINIUM CONDUCTOR

##### Application

Cable for energy transmission designed with concentric layers. Suitable for fixed installation as return wire for railway application outdoors.

##### Technical data

###### Bending radius:

- > During installation: min. 0.2 m
- > Fixed: min. 0.14 m

###### Conductor initial modulus:

- > 41,000 N/mm<sup>2</sup>

###### Resistor module:

- > 60,000 N/mm<sup>2</sup>

##### Temperature range

- > Max. conductor temperature: +80°C
- > Short circuit temperature: +160°C

##### Standard & Directive

###### Standard:

- > EN 50182
- > IEC 61089
- > SFS 5701

###### Directive:

- > Fulfills REACH and RoHS

##### Construction

###### Conductor:

- > Round
- > Aluminium wires 4.42 mm
- > Stranded
- > Acc. to EN 50182
- > Outer layer "Z" stranded



80°

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Number of wires	Outer diameter mm	Weight kg/km	Standard length m	Prysmian article no.
107	7	13.3	294	2100 - G13	0120250

Conductor cross-section mm <sup>2</sup>	Rated tensile strength (RTS) kN	Coefficient of linear expansion /°C	Thermal oxide resistance kA	DC resistance at 20°C Ω/km
107	17.2	23 x 10 <sup>-6</sup>	9.6	0.267

## 2. Overhead catenary lines

### RETURN WIRE

## ACSR

### STEEL REINFORCED ALUMINIUM CONDUCTOR



80°

#### Application

Cable for energy transmission designed with concentric layers of aluminium wires and inside of galvanized and fat enclosed steel wires. Suitable for fixed installation as return wire for railway application outdoors.

#### Temperature range

- > Max. conductor temperature: +80°C
- > Short circuit temperature: +160°C

#### Standard

- > EN 50182
- > IEC 61089
- > SFS 5701

#### Construction

##### Conductor:

- > Round
- > Outer cores of aluminium wires
- > Inner core of steel wires
- > Stranded
- > Acc. to IEC 60228 class 2.
- > Outer layer right handed "Z"

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm²	Number of AL wires	Number of steel wires	Outer diameter mm	Weight kg/km	Standard length m	Prysmian EAN no.
39.5 (34/6)	6	1	8.04	137	2500	6410001202022
67.1 (42/25)	12	7	10.6	310	2500	6410001202282
62.4 (54/9)	6	1	10.1	216	2200	6410001202053
99.3 (85/14)	6	1	12.8	344	2000	6410001202091
142 (89/52)	6	7	15.4	654	2500	6410001202132
177 (152/25)	26	7	17.3	613	2500	6410001202152
281 (242/39)	26	7	21.3	976	2500	6410001202183
344 (305/39)	54	7	24.1	1,151	2200	6410001202213
454.5 (402/52)	54	7	27.7	1,520	2300	6410001054072
637 (565/72)	54	19	32.9	2,123	1400	6410001202244

Conductor cross-section mm²	39.5	67.1	62.4	99.3	142	177	281	344	454.5	637
Rated tensile strength min. kN	12.2	13.52	17.11	24.13	33.37	54.8	84.9	96.8	123.75	174
Coefficient of linear expansion /°C	19.2x10 <sup>-6</sup>	15.6x10 <sup>-6</sup>	19.2x10 <sup>-6</sup>	19.2x10 <sup>-6</sup>	15.6x10 <sup>-6</sup>	19.2x10 <sup>-6</sup>	19.2x10 <sup>-6</sup>	19.3x10 <sup>-6</sup>	19.3x10 <sup>-6</sup>	19.3x10 <sup>-6</sup>
Final modulus of elasticity GPa	78	102	78	78	102	76	76	67	68	63
DC resistance at 20°C Ω/km	0.848	0.682	0.536	0.337	0.323	0.190	0.120	0.0949	0.0719	0.0512
Short circuit current max kA	3.7	5.4	5.8	9.2	11.4	16.5	26.1	32.5	43.7	60.1

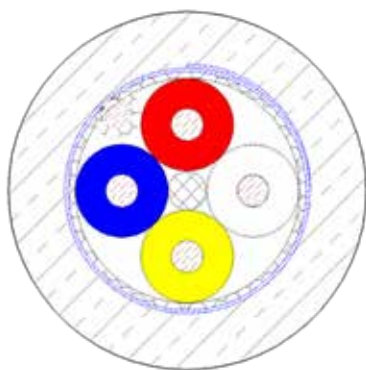




## BALISE

## MOHBU-VR

### JELLY FILLED, WATERTIGHT & PE SHEATH



#### Application

Signalling cable for railway applications for transmission of high frequent signals through symmetric circuits. Suitable for installation in train lines, laying directly in the ground or ducts. The cable is longitudinally watertight.

#### Technical data

##### Design:

- > 1 x 4 x 0.9 + 0.9

##### Bending radius:

- > Admissible min: 10 x D

##### Resistance:

- > Conductor:  $\leq 56 \Omega/\text{km}$
- > Insulation:  $\geq 5 \text{ G}\Omega\text{km}$

##### Mutual capacitance at 800-1000 Hz:

- >  $\leq 45 \text{ nF/km}$

##### Capacitance:

- > Between pair and screen: 100 pF/km

##### Capacitance unbalance at pF/300 m:

- >  $k_1: \leq 400 \text{ pF/km}$
- >  $e_{a/2}: \leq 800 \text{ pF/500 m}$

##### Impedance:

- > At 1 MHz:  $130 \Omega \pm 15\%$

##### Attenuation:

- > At 0.8 KHz:  $\leq 0.65 \text{ dB/km}$
- > At 1 MHz:  $\leq 12 \text{ dB/km}$

##### Near-end-crosstalk-attenuation at 1 MHz:

- > For all cables:  $\geq 60 \text{ dB/km}$
- > Average  $\geq 63 \text{ dB/km}$

##### Dielectric strength at 50 Hz:

- > Core/core: 2,500 V rms
- > Core/screen: 2,500 V rms

#### Temperature range

- > During installation: - 10°C to + 60°C
- > In operations: - 40°C to + 60°C

#### Construction

##### Conductor:

- > Solid copper
- > Soft annealed
- > Diameter 0.9 mm

##### Insulation:

- > PE

##### Twisting:

- > Four cores stranded into quad

##### Filling:

- > Petro jelly filling

##### Wrapping:

- > One or more layers of swellable tape

##### Moisture barrier sheath:

- > Laminate of aluminium tape 0.2 mm
- > Coated one side with copolymer
- > Metal side facing inward
- > Bonded with outer sheath
- > Longitudinal watertight

##### Drain wire:

- > Tinned copper wire 0.9 mm

##### Outer sheath:

- > PE material
- > Black

Content is subject to changes acc. to current product development and or any changes to standards.

No. of pairs	Outer diameter mm	Weight kg/km	Standard length m	Drum size mm	Transport weight kg	Prysmian article no.
1	10.8	120	2000	K10	340	60028728

## BALISE

### A-2Y(L)2YB2Y

#### STAR QUAD STRANDED & STEEL TAPE ARMoured

##### Application

For railway safety equipment, used for train detection according to ETCS (European Train Control System) technology. Maximum installation distance up to 2000 meters.

##### Technical data

###### Design:

- > n x 4 x 1.4 (1.53 mm)

###### Bending radius:

- > During installation:  $\geq 10 \times D$
- > Fixed:  $\geq 7.5 \times D$

###### Resistance per 1.4 or 1.53 mm:

- > Conductor:  $\leq 23.4$  or  $19.8 \Omega/\text{km}$
- > Insulation:  $\leq 10 \text{ G}\Omega\text{km}$

###### Mutual capacitance per 1.4 or 1.53 mm:

- >  $\leq 52$  or  $43 \text{ nF/km}$

###### Capacitance unbalance per 1.4 or 1.53 mm:

- >  $k_1 \leq 650$  or  $240 \text{ pF/500 m}$
- >  $e_{av} \leq 1,300$  or  $650 \text{ pF/500 m}$

###### Impedance:

- > At 8 kHz:  $147 \Omega \pm 15 \%$
- > At 200-600 kHz:  $120 \Omega \pm 10 \%$

###### Attenuation per 1.4 or 1.53 mm:

- > At 8.8 kHz:  $\leq 2$  or  $0.8 \text{ dB/km}$
- > At 280 kHz:  $\leq 5$  or  $3 \text{ dB/km}$
- > At 560 kHz:  $\leq 7$  or  $4.2 \text{ dB/km}$
- > At 1,800 kHz:  $\leq \text{N/A}$  or  $8 \text{ dB/km}$

###### Near-end-crosstalk-attenuation at 1 MHz:

- > For 1.4 mm:  $\geq 55 \text{ dB/km}$
- > For 1.53 mm:  $\geq 60 \text{ dB/km}$

###### Test voltage at 50 Hz:

- > Core/core: 2,500 V rms
- > Core/screen: 2,500 V rms

##### Temperature range

- > During installation:  $-10^\circ\text{C}$  to  $+60^\circ\text{C}$
- > In operations:  $-40^\circ\text{C}$  to  $+60^\circ\text{C}$

##### Construction

###### Conductor:

- > Solid copper
- > Soft annealed
- > Diameter 1.4 or 1.53 mm

###### Insulation:

- > PE (2Y)

###### Quad colouring:

- > Natural
- > Black ring marking

###### Twisting:

- > Star quads
- > Concentric layers

###### Moisture barrier sheath:

- > Laminate of aluminium tape 0.15 mm
- > Coated with copolymer on one side
- > Bonded to inner sheath

###### Inner sheath:

- > PE
- > Black

###### Armouring:

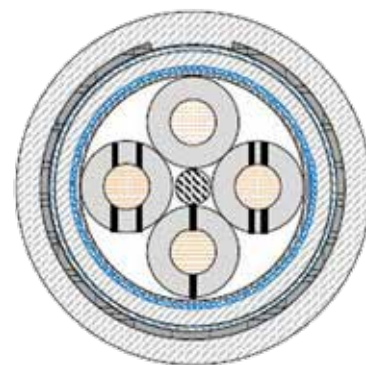
- > Galvanized steel tape
- > One layer 0.2 mm
- > Helically applied

###### Outer sheath:

- > PE
- > Black

##### Material property

- > Smoke density: EN 60134



60°

low



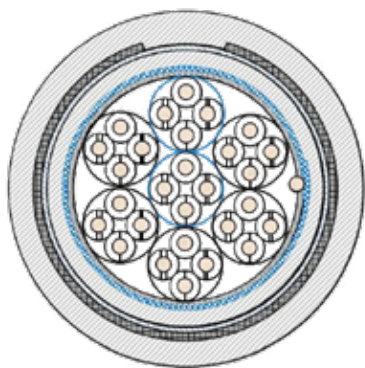
Content is subject to changes acc. to current product development and or any changes to standards.

Conductor diameter mm	No. of quads	Outer diameter mm	Weight kg/km	Standard length m	Prysmian EAN no.
1.4	1	14	260	2000	
1.53	1	18	350	2000	

## AXLE COUNTER

### A-2Y(L)2YB2Y

#### STAR QUAD STRANDED & STEEL TAPE ARMoured



60°



#### Application

Signalling cable for railway applications for transmission of low frequent signals through symmetric circuits. Suitable for laying directly into the ground or in ducts. The cable is protected with a moisture barrier and steel tape armouring. PE insulation and sheath is halogen free.

#### Technical data

##### Design:

- > n x 4 x 0.9 + 0.9 S (H45)

##### Bending radius:

- > During installation:  $\geq 20 \times D$
- > Fixed:  $\geq 15 \times D$

##### Resistance:

- > Conductor:  $\leq 56.6 \Omega/\text{km}$
- > Insulation:  $\geq 10 \text{ G}\Omega \times \text{km}$

##### Mutual capacitance at 800 Hz:

- >  $\leq 45 \text{ nF/km}$

##### Capacitance unbalance at 800 Hz:

- >  $k_1 \leq 650 \text{ pF/500 m}$
- >  $k_{9-12}$  adjcent quad:  $\leq 500 \text{ pF/500 m}$
- >  $k_{9-12}$  opposite quad:  $\leq 150 \text{ pF/500 m}$
- >  $e_{\text{avg}} \leq 1,300 \text{ pF/500 m}$

##### Attenuation:

- > At 90 kHz:  $\leq 3.3 \text{ dB/km}$

##### Far-end-crosstalk-attenuation at 90 kHz:

- > At 100%:  $\geq 58 \text{ dB/km}$

##### Test voltage at 50 Hz:

- > Core/core: 2,500 V rms
- > Core/screen: 2,500 V rms

##### Temperature range

- > During installation:  $-10^\circ\text{C}$  to  $+60^\circ\text{C}$
- > In operations:  $-40^\circ\text{C}$  to  $+60^\circ\text{C}$

#### Construction

##### Conductor:

- > Solid copper
- > Soft annealed
- > Diameter 0.9 or 1.4 mm

##### Insulation:

- > PE (2Y)

##### Quad colouring:

- > Natural with black ring marking
- > Per layer marked with blue tape

##### Twisting:

- > Star quads
- > Concentric layers

##### Wrapping:

- > Non-hygroscopic plastic tape

##### Drain wire:

- > Solid tinned copper 0.9 mm

##### Moisture barrier sheath:

- > Laminate of aluminium tape 0.15 mm
- > Coated with copolymer on one side
- > Bonded to inner sheath

##### Inner sheath:

- > PE (2)
- > Black

##### Armouring:

- > Galvanized steel tape
- > One layer 0.2 mm
- > Helically applied

##### Outer sheath:

- > PE (2Y)
- > Black

#### Material property

- > Halogen free: IEC 60754-1

Content is subject to changes acc. to current product development and or any changes to standards.

No. of quads	Outer diameter mm	Weight kg/km	Standard length m	Tensile strength kN	Fire load MJ/m
1 x	12	190	1000	230	6
5 x	19	470	1000	710	10
10 x	24	750	1000	1,360	13

### SIGNALLING & CONTROL

## MCMOE-PE 450/750 V

### SCREENED & PE SHEATED

#### Application

PE insulated and sheated control cable with concentric copper conductor especially for railway application.

#### Technical data

Rated voltage:

- > 450/750 V

Test voltage:

- > 2,500 V

Pulling force:

- > Max. 50 N/mm<sup>2</sup>

#### Temperature range

- > In operations: max. +70°C
- > Short circuit temperature: +130°C

#### Standard & Directive

Standard:

- > SFS 3713
- > IEC 502
- > IEC 60228
- > IEC 60502-1

Directive:

- > Fulfills RoHS

#### Construction

Conductor:

- > Round
- > Solid annealed copper wires
- > Acc. to IEC 60228 class 1.

Insulation:

- > PE, extruded acc. to IEC 502
- > Black
- > White numbering

Filling:

- > Extruded covering/separation sheath

Screen:

- > Helix of copper wires
- > Counter helix of copper wires

Outer sheath:

- > Extruded PE
- > Type ST<sub>3</sub>
- > Acc. to IEC 60502-1
- > Black



70°



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Max. resistance of conductor Ω/km	Max. resistance of screen Ω/km
12 x 1.5	20	440	21.1	3.08
19 x 1.5	22	580	21.1	3.08
27 x 1.5	25	770	21.1	3.08
37 x 1.5	28	1,000	21.1	2.6
48 x 1.5	32	1,300	21.1	2.6
61 x 1.5	35	1,600	21.1	2.6
12 x 2.5	23	630	7.41	3.08
27 x 2.5	31	1,200	7.41	2.6
37 x 2.5	34	1,550	7.41	2.6



## CONTROL

### MCMO 450/750 V

#### FLAME RETARDANT & SCREENED



70°



#### Application

Cable for control, measuring and signal circuits of electrical equipment. Suitable for fixed surface and flush-mounted installations indoors and outdoors as well as for direct burial in the ground. The concentric copper conductor forms a good electromechanical protection and a moderate protection against electrical interference.

#### Technical data

##### Rated voltage:

- > 450/750 V

##### Pulling force:

- > Max. 50 N/mm<sup>2</sup>

##### Test voltage:

- > 2,500 V

##### Capacitance at 20°C:

- > Between 2 adjacent cores: 130-160 nF/km
- > To earth for 1 core: 200-280 nF/km

#### Temperature range

- > In operations: max. +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -15°C

#### Standard & Directive & Approval

##### Standard:

- > SFS 3713
- > HD 62751: 4-D
- > IEC 60228

##### Directive:

- > Fulfills RoHS

##### Approval:

- > CPR class: Eca

#### Construction

##### Conductor:

- > Round copper wires
- > Annealed and solid
- > Acc. to IEC 60228 class 1.

##### Insulation:

- > Lead free compound
- > Black
- > White numbering

##### Filling:

- > Lead free compound

##### Screen:

- > Helix of copper wires
- > Counter helix of copper wires or tape
- > Min. cross-section area 6 mm<sup>2</sup>

##### Outer sheath:

- > PVC compound
- > Lead free
- > Black

#### Material property

- > Flame retardant: IEC 60332-1

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating in free air A	Standard delivery m	Finnish electric-number
7 x 1.5	14	310	13	500 - K8	0601901
12 x 1.5	18	480	11	400 - K8	0601902
19 x 1.5	21	650	9	500 - K11	0601903
27 x 1.5	24	860	8	500 - K11	0601904
37 x 1.5	27	1,200	7	400 - K11	0601905
7 x 2.5	17	450	16	500 - K8	0601921
12 x 2.5	21	670	13	500 - K11	0601922
19 x 2.5	24	930	11	500 - K11	0601923
27 x 2.5	28	1,300	10	500 - K12	0601924

## CONTROL

### MCCMO-HF C-PRo 450/750 V

#### EMC SCREENED & FLAME RETARDANT

##### Application

EMC shielded control cable with copper conductors. Halogen free, flame retardant and self-extinguishing in the event of fire. For fixed installation, indoors, outdoors, in pipes or ground. Suitable for switchgear and potentially explosive areas. The copper screen has 100% coverage and meets EMC Directive with appropriate installation.

##### Technical data

Rated voltage:

- > 450/750 V

Test voltage:

- > 2,500 V

Bending radius::

- > During installation: 10 x D
- > Fixed: 8 x D

##### Temperature range

- > In operations: max. +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -15°C

##### Standard & Directive

Standard:

- > HD 627 7B2

Directive:

- > Fulfills RoHS and REACH

Approval:

- > CPR class: Cca-s1d1a1

##### Conductor:

- > Round copper wires
- > Annealed and solid
- > Acc. to IEC 60228 class 1.

##### Insulation:

- > Halogen free compound
- > White
- > Black numbering

##### Filling:

- > Halogen free

##### Screen:

- > Helix of copper wires
- > Counter helix of copper wires or tape
- > Min. cross-section area 6 mm<sup>2</sup>

##### Outer sheath:

- > Halogen free compound
- > Black

##### Material property

- > Halogen free: IEC 60754-1
- > Flame retardant: IEC 60332-1 & 3
- > Smoke density: IEC 60134



70°



Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Standard delivery m	Finnish electric-number
7 x 1.5	15	340	500 - K8	0602092
12 x 1.5	18	500	500 - K9	0602093
19 x 1.5	21	630	500 - K9	0602094
7 x 2.5	17	470	500 - K8	0602097
12 x 2.5	21	700	500 - K11	0602098

## CONTROL

# MKMO-HF C-PRo 450/750 V

## LOW SMOKE & HALOGEN FREE



### Application

Cable for the control, measuring and signal circuits of electrical equipment for fixed surface and flush-mounted installations. Suitable for indoors and outdoors installation especially in places where the cable is exposed to vibration. Not suitable for installation directly in the ground, vibrated concrete or exposed to electrical interference

### Technical data

#### Rated voltage:

- > 450/750 V

#### Pulling force:

- > Max. 50 N/mm<sup>2</sup>

#### Test voltage:

- > 2,500 V

#### Max. DC resistance at 20°C:

- > 12 Ω/km

#### Capacitance at 20°C:

- > Between 2 adjacent cores: 120-150 nF/km

### Temperature range

- > In operations: max. +70°C
- > Short circuit temperature: +160°C
- > Lowest temp. at installation: -20°C

### Standard & Directive & Approval

#### Standard:

- > EN 50363 and SFS 3714
- > IEC 60332-1-2
- > IEC 61034
- > EN 50267

#### Directive:

- > Fulfills REACH and RoHS

#### Approval:

- > CPR class: Cca-s1,d1,a1

### Construction

#### Conductor:

- > Round copper wires
- > Annealed and stranded
- > Acc. to IEC 60228 class 2.

#### Insulation:

- > Halogen free compound
- > Black

#### Core colouring/markings:

- > Acc. to EN 50334
- > 7-core(S): Yellow/green, white numbering
- > 12-37 core: White numbering

#### Wrapping:

- > Plastic tape

#### Outer sheath:

- > Halogen free compound
- > White

### Material property

- > Halogen free: IEC 60754-1
- > Smoke density: IEC 61034

Content is subject to changes acc. to current product development and or any changes to standards.

Conductor cross-section mm <sup>2</sup>	Outer diameter mm	Weight kg/km	Current rating in free air A	Standard delivery m	Finnish electric-number
7 G 1.5 (S)	13	240	13	500 - K8	0413030
12 x 1.5	16	370	11	500 - K8	0413028
7 G 2.5 (S)	15	330	16	500 - K8	0413033
12 x 2.5	19	520	13	500 - K8	0413029





## ALONG THE TRACK

### FZOMVDMU-SD

#### OUTDOOR & ARMoured STRANDED LOOSE TUBE



70°



#### Application

Applications include outdoor data communication connections, telecom trunk lines, telecom access net connections and CATV trunk lines. The intended installation method for this cable is for direct burial under general conditions or with risk of severe rodent attack.

#### Technical data

##### Tensile strength:

- > Max. installation: 5 kN
- > Max. operation: 3.4 kN

##### Crush:

- > 6,000 N, 100 mm, max 15 min.
- > 2,000 N, 25 mm, max 15 min.

##### Impact:

- > 40 J, 3 impacts, R=300 mm

##### Repeated bending:

- > 30 reverse bends, R = 300 mm

##### Torsion:

- > 100 N,  $\pm 180^\circ$ , 10 cycles

##### Repeated bending:

- > R=20 x D, 100 N, 35 cycles

##### Cable bend:

- > R=20 x D, 4 turns, 3 cycles

##### Bending radius:

- > Loaded: 15 x D
- > Unloaded: 20 x D

##### Water penetration:

- > Sample=3 m, water column = 1 m
- > No water leakage after 24 hours

#### Temperature range

- > Storage: - 40°C to + 60°C
- > Installation: - 30°C to + 60°C
- > Operation: - 40°C to + 70°C

#### Construction

##### Central strength member CSM:

- > Glass reinforced plastic rod - FRP
- > Plastic oversheating when needed

##### Fibre colour code:

- > 1 blue, 2 white, 3 yellow, 4 green
- > 5 grey, 6 orange, 7 brown, 8 aqua
- > 9 black, 10 violet, 11 pink, 12 red.

##### Loose tube:

- > Thermoplastic material
- > Watertight compound
- > 12 fibers in each

##### Filler:

- > Thermoplastic rods, when needed

##### Stranding:

- > Loose tubes and fillers
- > SZ stranded around CSM

##### Water blocking:

- > Longitudinal watertight
- > Water swellable elements
- > Dry core

##### Rip cord:

- > 2 rip cords

##### Inner sheath:

- > PE, 1.0 mm

##### Peripheral reinforcement:

- > Aramid yarns

##### Rip cord:

- > 2 rip cords

##### Armouring:

- > Corrugated steel tape with overlap
- > Both sides copolymer coated

##### Outer sheath:

- > HDPE 1.5 mm
- > Black

#### Standard

- > IEC 60794-3-10

Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	No tubes x no. fibres	Loose tube diameter mm	CSM diameter m	CMS overshoot diameter m	Cable diameter m	Cable weight kg/km	Prysmian article no.
24	2 x 12	2.8	3.0	-	15.6	220	60022748
48	4 x 12	2.8	3.0	-	15.6	220	60022749
96	8 x 12	2.8	3.0	4.8	17.4	270	60022750
192	6 x 12 + 10 x 12	2.8	3.0	-	21.2	375	60022747



## ALONG THE TRACK

# FLEXTUBE FY2RMRMU-FT

## OUTDOOR MICRO-MODULE & REINFORCED

### Application

Dielectric optical cable designed for outdoor installation in duct by pulling, jetting or floating technics in areas with rodent presence. Mainly used for distribution and access network. The Flextube® design provides easier storage and faster installation. Finger access to the fibres -no specific tools to open the cable.

### Technical data

#### Crush:

- > 400 daN per 100 mm

#### Impact:

- > 30 Nm, 3 impacts, R=300 mm

#### Torsion:

- > 1 m, ± 180°C

#### Cable bend:

- > R=10 x D

#### Bending radius:

- > Fixed: 10 x D
- > Flexible: 20 x D

#### Water penetration:

- > Sample=3 m, water column = 1 m
- > No water leakage after 24 hours

### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 5°C to + 40°C
- > Operation: - 40°C to + 70°C

### Construction

#### Micro-module:

- > Thin wall tubing
- > Filled with suitable compound
- > 12 single-mode optical fibres

#### Fibre colour code:

- > 1 blue, 2 white, 3 yellow, 4 green
- > 5 grey, 6 orange, 7 brown, 8 aqua
- > 9 black, 10 violet, 11 pink, 12 red.

#### Tube colour code:

- > Same as for fibres -repeating
- > Black ring marks

#### Water blocking:

- > Water swellable elements
- > Dry core

#### Reinforcement:

- > Dielectric yarns

#### Strength member:

- > Glass fibre reinforced plastic material
- > Embedded in the outer sheath

#### Rip cord:

- > 1 rip cord

#### Outer sheath:

- > HDPE
- > Black

#### Peripheral reinforcement:

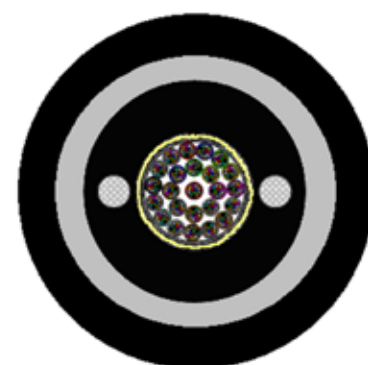
- > Glass yarns

#### Rip cord:

- > 2 rip cords

#### Outer sheath:

- > HDPE
- > Black



70°



Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	No tubes x no. fibres	Module diameter mm	Cable diameter mm	Cable weight kg/km	Max. tension daN	Prysmain article no.
24	2 x 12	1.3	11.7	110	350	60049773
48	4 x 12	1.3	11.7	110	350	60049774
96	8 x 12	1.3	15.4	175	500	60049775
192	16 x 12	1.3	17.1	220	600	60049776
288	24 x 12	1.3	18.0	245	620	60049777

## ALONG THE TRACK

### FTMVDMSU

#### UNIVERSAL, ARMoured & WATERTIGHT



#### Application

Universal distribution or mini-break-out cable for indoor and outdoor application in LAN and WAN backbones, central office interconnections and backbones in data centres. Suitable for installation in ducts, on trays and directly buried. Designed with double sheathing where the outer one is both UV stabilised, water and moisture resistant. Between the two sheaths there is a steel tape armouring making the cable rodent proof.

#### Technical data

##### Impact:

- > 20 Nm

##### Crush:

- > 3,000 N / 100 mm

##### Torsion:

- > 5 cycles  $\pm$  1 turn

##### Kink:

- > No kink at bending radius 12 x D

##### Bending radius:

- > For stranded fibres: min. 20 mm
- > For MaxCap-BB-Omx fibres: min. 7.5 mm
- > For BendBright XS fibres: min. 7.5 mm

#### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 20°C to + 70°C
- > Operation: - 20°C to + 70°C

#### Material property

- > Flame retardant: IEC 60332-1-2
- > Acidity: IEC 60754-2
- > Smoke density: IEC 61034

#### Construction

##### Fibre:

- > 2-24 tight buffered fibres
- > 900  $\mu$ m  $\pm$  50  $\mu$ m

##### Fibre colour code:

- > 1 red, 2 green, 3 blue, 4 yellow, 5 white
- > 6 grey, 7 brown, 8 violet, 9 turquoise, 10 black, 11 orange, 12 pink

##### Fibre colour code with mark every 70 mm

- > 13 yellow, 14 white, 15 grey, 16 turquoise, 17 orange, 18 pink

##### Fibre colour code with mark every 35 mm

- > 19 yellow, 20 white, 21 grey, 22 turquoise, 23 orange, 24 pink

##### Strength member:

- > Ultra high modulus aramid yarns

##### Inner sheath:

- > Thermoplastic sheathing compound
- > Acc. to EN 50290-2-27.
- > Halogen free and flame retardant
- > UV stabilised

##### Armouring:

- > Corrugated steel tape 0,15 mm

##### Outer sheath:

- > 1.5 mm FireBur® material
- > Flame retardant and UV stabilised
- > Acc. to EN 50290-2-27
- > Blue

#### Standard & Approval

##### Standard:

- > ISO 11801 2nd edition, EN 187 000
- > IEC 60794-1 & 2, EN 50 173-1
- > IEC 60794-2-20

##### Approval:

- > CPR class: Eca

Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	Outer diameter mm	Weight kg/km	Installation load max. N	Tensile strength N		Bending radius	
				Short term	Permanent	Min.	Max.
2	8.5	90	1,000	560	280	130	170
4	8.5	90	1,000	560	280	130	170
6	11.0	130	1,000	560	280	170	220
8	11.0	130	1,000	560	280	170	220
12	11.0	130	1,200	680	340	170	220
16	11.0	230	1,200	680	340	170	220
24	14.0	230	2,000	1,000	500	200	260

## ALONG THE TRACK

## FTMRMSU

### UNIVERSAL, WATERTIGHT & ROBUST

#### Application

Universal distribution or mini-break-out cable suited for indoor and outdoor applications such as LAN and WAN backbones, central office inter-connections, backbones in data centres and many other applications. Suitable for installation on trays or directly buried in ducts that occasionally floods. Designed with double sheathing that makes it UV stabilised, water and moisture resistant. Between the two sheaths there is a layer of coated and water blocking glass yarns, giving the cable a very high tensile strength and a degree of rodent protection.

#### Technical data

##### Impact:

- > 15 Nm

##### Crush:

- > 2,000 N / 100 mm

##### Torsion:

- > 5 cycles  $\pm$  1 turn

##### Bending radius:

- > For stranded fibres: min. 20 mm
- > For Max-Cap-BB-Omx fibres: min. 7.5 mm
- > For BendBright XS fibres: min. 7.5 mm

#### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 20°C to + 70°C
- > Operation: - 20°C to + 70°C

#### Material property

- > Flame retardant: IEC 60332-1
- > Acidity: IEC 60754-2
- > Smoke density: IEC 61034

#### Construction

##### Fibre:

- > 2-24 tight buffered fibres
- > 900  $\mu$ m  $\pm$  50  $\mu$ m

##### Fibre colour code:

- > 1 red, 2 green, 3 blue, 4 yellow, 5 white
- > 6 grey, 7 brown, 8 violet, 9 turquoise, 10 black, 11 orange, 12 pink

##### Fibre colour code with mark every 70 mm

- > 13 yellow, 14 white, 15 grey, 16 turquoise, 17 orange, 18 pink

##### Fibre colour code with mark every 35 mm

- > 19 yellow, 20 white, 21 grey, 22 turquoise
- > 23 orange, 24 pink

##### Strength member:

- > Ultra high modulus aramid yarns

##### Inner sheath:

- > LZSH compound
- > Acc. to EN 50290-2-27.
- > Halogen free and flame retardant
- > UV stabilised

##### Reinforcement:

- > Coated glass yarns

##### Ripcord:

- > Polyester

##### Outer sheath:

- > 1.2 mm FireBur® material
- > Flame retardant and UV stabilised
- > Acc. to EN 50290-2-27
- > Blue

#### Standard

- > ISO 11801 2nd edition
- > EN 187 000
- > IEC 60794-2
- > EN 50 173-1
- > IEC 60794-2-20



Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	Outer diameter nom. mm	Weight nom. kg/km	Tensile strength short term N	Tensile strength permanent N	Bending radius min. mm	Prysmian article no.
2	9	80	2,700	1,300	110	60033616
4	9.5	85	2,700	1,300	105	60033615
24	13	140	3,600	1,800	130	60036524
4	9,5	85	2,700	1,300	105	60041029
16	11	115	3,200	1,600	120	60042476
24	13	140	3,600	1,800	130	60047265

## ALONG THE TRACK

### FZORMU-SD

#### OUTDOOR STRANDED LOOSE TUBE



70°



#### Application

Outdoor cable for LAN, MAN and telecom backbone installations direct in the ground or in trenches using ploughing method. Designed with a layer of coated and water blocking glass yarns, giving the cable a very high tensile strength and a degree of rodent protection.

#### Technical data

Short term tensile strength:

> 5,000 N

Permanent tensile strength:

> 3,500 N

Crush:

> 3,000 N

Impact:

> 20 Nm

Torsion:

> 5 cycles  $\pm$  1 turn

Kink:

> No kink at bending radius 12 x D

Bending radius:

> For 72 fibres: min. 150 mm

> For 96 fibres: min. 175 mm

Water penetration:

> No water on free end

#### Temperature range

> Storage: - 40°C to + 70°C

> Installation: - 40°C to + 70°C

> Operation: - 40°C to + 70°C

#### Construction

Central strength member:

> 2.5 mm diameter, FPR rod

Loose tube:

> Gel filled loose tube

> 2.3 mm diameter

> 12 fibres in each

> Up to 18 tubes in to layers

Water blocking:

> Swellable tape and yarn

Wrapping:

> Swellable tape

Reinforcement:

> Heavy layer of glass yarns

Rip cord:

> Polyester

Outer sheath:

> MDPE 1.5 mm

> Black

> Acc. to IEC 60811 & 60708

#### Standard

> EN 187 000

> IEC 60794-3

> IEC 60794-3-10

> IEC 60794-3-12

> ISO 11801 2nd edition

> EN 50 173-1

Content is subject to changes acc. to current product development and or any changes to standards.

#### UC FIBRE O ST D DA PE 5.0 kN

Cable type description	Fibre count no.	Outer diamter nom.mm	Weight nom. kg/km	Bending radius min. mm	Fibre type	Prysmian article no.
8 x 12 OM4B	96	13	140	175	MaxCap-BB-OM4	60027623
6 x 12 SM2D	72	11	105	150	OS2 Singlemode	60019579
8 x 12 SM2D	96	13	140	175	OS2 Singlemode	60019153
2 x 12 SM2D 4x12 MM61	72	11	105	150	Hybrid OS2 24 Singlemode + 48 OM1 62.5/125 multimode	60024964
4 x 12 SM2D 4 x 12 OM2B	96	13	140	175	Hybrid OS2 48 Singlemode + 48 MaxCap-BB-OM2	60031874

## ALONG THE TRACK

### FZOMVDMSU-SD

#### OUTDOOR & ARMoured STRANDED LOOSE TUBE

##### Application

Armoured outdoor cable for data communication connections, CATV trunk lines, telecom trunk lines and telecom access net connections. For direct burial in general conditions or with risk of severe rodent attacks.

##### Technical data

###### Short term tensile strength:

- > 1,800 N

###### Permanent tensile strength:

- > 1,200 N

###### Crush:

- > 3,000 N

###### Impact:

- > 20 Nm

###### Repeated bending:

- > 30 reverse bends, R = 300 mm

###### Torsion:

- > 5 cycles  $\pm$  1 turn

###### Kink:

- > No kink at bending radius 12 x D

###### Bending radius:

- > Min. 290 mm

###### Water penetration:

- > No water on free end (core only)

##### Temperature range

- > Storage: - 60°C to + 60°C
- > Installation: - 30°C to + 60°C
- > Operation: - 60°C to + 70°C

##### Construction

###### Central strength member:

- > 2.5 mm diameter, FPR rod

###### Fibre colour code:

- > 1 red, 2 green, 3 blue, 4 yellow, 5 white
- > 6 grey, 7 brown, 8 violet, 9 turquoise, 10 black, 11 orange, 12 pink.

###### Loose tube:

- > Gel filled loose tubes
- > 2.3 mm diameter
- > 12 fibers in each

###### Water blocking:

- > Swellable tape and yarn

###### Wrapping:

- > Polyester tape

###### Rip cord:

- > 1 rip cord

###### Inner sheath:

- > Blue FireBur® acc. to EN 50290-2-27

###### Rip cord:

- > 1 rip cord

###### Armouring:

- > Corrugated steel tape 0.155 mm

###### Outer sheath:

- > Blue FireBur® 1.5 mm
- > Ac. to EN 50290-2-27

##### Standard

- > IEC 60794-3
- > IEC 60794-3-10
- > IEC 60794-3-12
- > EN 50 173-1
- > ISO 11801 2nd edition

##### Material property

- > Flame retardant: IEC 60332-1
- > Halogen free: IEC 60754-1
- > Acidity: IEC 60754-2
- > Smoke density: IEC 61034



70°



Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	Outer diameter mm	Weight nom. kg/km	Tensile strength short term N	Bending radius min.mm	Fibre type	Product article no.
24	14.5	225	1800	290	OS2 Singlemode	
48	14.5	225	1800	290	OS2 Singlemode	60029965
72	14.5	225	1800	290	OS2 Singlemode	60020577
96	19.5	220	1800	290	OS2 Singlemode	



## ALONG THE TRACK

### FZOMU-SD

#### WEATHER PROOF & DRY CORE LOOSE TUBE



70°



#### Application

Outdoor weather proof and robust cable with HDPE sheath for blowing in pipes or direct installation in ducts. Both metal and halogen free. Core is dry with swellable materials and grease-filled fibre tubes to prevent longitudinal water penetration.

#### Technical data

##### Short term tensile strength:

- > 2,700 N (24 -144 mm<sup>2</sup>)
- > 2,000 N (192 mm<sup>2</sup>)

##### Permanent tensile strength:

- > 1,000 N

##### Crush:

- > 3,000 N

##### Impact:

- > 15 Nm

##### Bending:

- > < 0,05 dB no damage

##### Kink:

- > < 0,05 dB no damage

##### Water penetration:

- > < 3 m/24 hours

#### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 15°C to + 60°C
- > Operation: - 40°C to + 70°C

#### Construction

##### Central strength member:

- > 2.1 - 3.5 mm diameter, FPR rod

##### Loose tube:

- > 2.5 or 3.0 mm diameter
- > Grease filled
- > SZ twisted around FPR rod

##### Water blocking:

- > Swellable material
- > Dry core

##### Rip cord:

- > 1 rip cord

##### Outer sheath:

- > HDPE 1.5 mm
- > Black

#### Standard

- > EN 187000, EN 1871000
- > EN 187101, EN 188000
- > EN 60793, IEC 60794
- > ITU-T REC G650, REC G652

#### Material property

- > Halogen free: IEC 60754-1

Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	Outer diameter nom.mm	Weight nom. kg/km	Number of tubes and fillers	Bending radius max.mm	Bending radius min.mm	Prysmian article no.
12	10.6	85	1 + 5	212	106	60046044
24	10.6	85	2 + 4	212	106	60046182
48	10.6	85	4 + 2	212	106	60046045
96	12.2	120	8 + 0	244	122	60046043
144	15.5	190	12 + 0	310	155	60046046
192	14.2	160	8 + 0	284	142	60046047

## ALONG THE TRACK

### FYORVDMU

#### OUTDOOR & ARMoured CENTRAL LOOSE TUBE

##### Application

Suitable for LAN and WAN backbones, telecom access lines, fibre to business and fibre to the building drop connections as well as fibre to the home drop and access connections. MDPE sheathing ideal for outdoor installation and corrugated steel tape armouring makes it rodent proof. Applicable for installation in ducts and on trays as well as for direct burial with proper sand back filling.

##### Technical data

###### Short term tensile strength:

- > 1,000 N

###### Permanent tensile strength:

- > 500 N

###### Crush:

- > 2,000 N

###### Impact:

- > 10 Nm

###### Torsion:

- > 5 cycles  $\pm$  1 turn

###### Kink:

- > No kink at loop diameter of 100 mm

###### Bending radius:

- > Min. unloaded: R=55 mm
- > Min. loaded: R=110 mm

##### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 40°C to + 70°C
- > Operation: - 40°C to + 70°C

##### Construction

###### Loose tube:

- > 2.8 or 3.5 mm diameter
- > Gel-filled
- > 2-6 or 24 fibers in each

###### Fibre colour code:

- > 1 red, 2 green, 3 blue, 4 yellow, 5 white
- 6 grey, 7 brown, 8 violet, 9 turquoise,
- 10 black, 11 orange, 12 pink

###### Fibre colour code with mark every 70 mm

- > 13 yellow, 14 white, 15 grey
- 16 turquoise, 17 orange, 18 pink

###### Fibre colour code with mark every 35 mm

- > 19 yellow, 20 white, 21 grey, 22 turquoise
- 23 orange, 24 pink

###### Strength member:

- > E-glass yarns

###### Armouring:

- > Corrugated steel tape 0.15 mm

###### Outer sheath:

- > MDPE 1.5 mm
- > Acc. to IEC 60811, IEC 60708
- > Black

##### Standard

- > IEC 60794-1
- > EN 50 173-1
- > ISO 11801 2nd edition



70°



Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	Outer diameter mm	Weight nom. kg/km	MaxCap-BB OM2 fibres	MaxCap-BB OM3 fibres	MaxCap OM4 fibres	OM1 62.5/125 multimode	OS2 singlemode
2	8.5	75	60024911			60019683	60018976
4	8.5	75	60011387	60018856		60018741	60018850
6	8.5	75	60018892	60019590		60018743	60018744
8	8.5	75	60018893	60019384	60043719	60018746	60018931
12	8.5	75	60018894	60011435	60019807	60018749	60018750
16	8.5	75		60019386		60011298	60011340
24	8.5	80	60018895	60019387	60043985	60011745	60018751

## ALONG THE TRACK

### FZOMSUS-D

#### INDOOR/OUTDOOR STRANDED LOOSE TUBE



70°



#### Application

Indoor/Outdoor backbone cable for LAN, WAN and telecom backbone installations. Robust dielectric design with a wide temperature range. The core is dry and water protected by dry water blocking technology.

#### Technical data

Short term tensile strength:

- > 2,700 N

Tensile strength:

- > 900 N

Crush:

- > 3,000 N

Impact:

- > 15 Nm, R=300

Torsion:

- > 100 N, 10 cycles

Repeated bending:

- > R=20 x D, 100 N, 35 cycles

Cable bend:

- > R=20 x D, 4 turns, 3 cycles

Bending radius:

- > Loaded: min. 20 x D
- > Unloaded: min. 10 x D

Water penetration:

- > 3 m/24 hours - no water leakage

#### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 30°C to + 60°C
- > Operation: - 40°C to + 70°C

#### Standard

- > IEC 60794-3-10

#### Construction

Central strength member (CSM):

- > Glass fibre reinforced plastic rod, FPR
- > Plastic overshooting when needed

Loose tube:

- > Thermoplastic material
- > Up to 12 fibres per tube
- > Filled with watertight compound

Fibre colour code:

- > 1 blue, 2 yellow, 3 red, 4 white, 5 green
- > 6 violet, 7 orange, 8 grey, 9 aqua
- > 10 black, 11 brown, 12 pink

Filler:

- > Thermoplastic rods, where needed

Stranding:

- > SZ stranded around the CSM rod

Water blocking:

- > Longitudinal watertight
- > Water swellable material
- > Dry core

Strength member:

- > Glass yarns, when needed

Rip cord:

- > 2 rip cords

Outer sheath:

- > HFFR compound
- > Black

#### Material property

- > Flame retardant: IEC 60332-1
- > Halogen free: IEC 60754-1
- > Acidity: IEC 60754-2
- > Smoke density: IEC 61034

Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	12	24	48	96
No. tubes x no. fibres	5 x 12	5 x 12	5 x 12	8 x 12
Loose tube/filler diameter mm	2.5	2.5	2.5	2.5
CSM diameter mm	2.1	2.1	2.1	3.0
CSM oversheathing diameter mm	-	-	-	4.2
Outer sheath thickness mm	1.5	1.5	1.5	1.5
Cable diameter mm	11.0	11.0	11.0	12.5
Cable weight kg/km	110	110	110	150

## AERIAL

# FZORMU-SD - CLASS A

## OUTDOOR ADSS STANDED LOOSE TUBE

### Application

Aerial outdoor ADSS (ADSS-All Dielectric Self Support design) cable for LAN, MAN and telecom backbone installations. The robust design include double sheathing, with a thick layer of aramid yarn in between. The cable is also suitable for duct installation. The core is dry and water protected by dry water blocking technology.

### Technical data

#### Tensile strength:

- > 15 kN

#### Crush:

- > 2,200 N

#### Impact:

- > 10 Nm

#### Bending radius:

- > Loaded: min. 20 x D
- > Unloaded: min. 10 x D

#### Modulus of electricity:

- > 70.8 kN/mm<sup>2</sup>

#### Effective area:

- > 11.1 mm<sup>2</sup>

#### Thermal expansion coefficient:

- > 4-72 fibres: 11.6 10<sup>-6</sup> °C<sup>-1</sup>
- > 96 fibres: 16.2 10<sup>-6</sup> °C<sup>-1</sup>

#### Tension in operation:

- > Max. 7 kN

#### Installation span:

- > 80 m, sag 0.6 m at 0°C

#### Water penetration:

- > 3 m/24 hours - no water leakage

### Temperature range

- > Storage: - 45°C to + 70°C
- > Installation: - 10°C to + 60°C
- > Operation: - 45°C to + 70°C

### Construction

#### Central strength member (CSM):

- > Glass fiber reinforced plastic rod, FPR
- > Plastic overheating when needed

#### Loose tube:

- > Thermoplastic material
- > Up to 12 fibres per tube
- > Filled with watertight compound

#### Fibre colour code:

- > 1 blue, 2 white, 3 yellow, 4 green, 5 grey
- 6 orange, 7 brown, 8 aqua, 9 black
- 10 violet, 11 pink, 12 red.

#### Buffered tube colour code:

- > 1 blue, 2 white, 3 yellow, 4 green
- 5 grey, 6 orange, 7 brown, 8 aqua.

#### Filler:

- > Thermoplastic rods, where needed

#### Stranding:

- > SZ stranded around the CSM rod

#### Water blocking:

- > Longitudinal watertight
- > Water swellable material
- > Dry core

#### Peripheral reinforcement:

- > Aramid yarns

#### Rip cord:

- > 1 rip cord

#### Outer sheath:

- > HDPE, 1.4 mm
- > Black

### Standard

- > IEC 60794-1-2

### Additional versions

- > Class B with 50 m span and 4.5 kN



70°



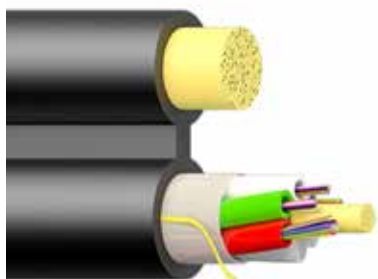
Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	4 - 12	24	48	72	96
No. tubes x no. fibres	6 x 12	6 x 12	6 x 12	6 x 12	8 x 12
Loose tube diameter mm	2.8	2.8	2.8	2.8	2.8
CSM oversheathing diameter mm	3.0	3.0	3.0	3.0	4.8
Cable diameter mm	11.7	11.7	11.7	11.7	13.5
Cable weight kg/km	105	105	105	105	145

## AERIAL

# FZOMURK

## OUTDOOR FIGURE 8 STRANDED LOOSE TUBE



70°

### Application

Optical cable for aerial installation on poles. The outer sheath is made of abrasion resistant polyethylene. The cable has a non-metallic FRP messenger wire suitable for up to 250 m span lengths. Span length is dependent on ice load, wind load and installation sag. The figure-8 construction allows easy installation with cable grips attached to the messenger wire. The core is dry and water protected by dry water blocking technology. The cable is completely non-metallic to eliminate any problem with induced electrical currents.

### Technical data

#### Short term tensile strength:

- > 9,000 N

#### Permanent tensile strength:

- > 9,000 N

#### Crush:

- > 1,000 N

#### Impact:

- > 15 Nm, 3 impacts, R=300 mm

#### Cable bend:

- > R ≤ 250 mm with messenger
- > R=10 x D, 4 turns, 3 cycles

#### Bending radius:

- > Loaded: min. 15 x D
- > Unloaded: min. 10 x D

#### Water penetration:

- > 3 m/24 hours - no water leakage

#### Web dimensions(WxH):

- > 2.5 ± 0.5 x 3.0 ± 1.0

### Temperature range

- > Storage: - 40°C to + 70°C
- > Installation: - 15°C to + 60°C
- > Operation: - 40°C to + 70°C

### Standard

- > IEC 60794-1-2

### Construction

#### Messenger:

- > Glass fibre reinforced plastic rod, FPR
- > 7.0 mm

#### Central strength member (CSM):

- > Glass fibre reinforced plastic rod, FPR
- > Plastic oversheating when needed

#### Loose tube:

- > Thermoplastic material
- > Up to 24 fibres per tube
- > Filled with watertight compound

#### Fibre colour code:

- > 1 white, 2 red, 3 yellow, 4 green, 5 blue
- > 6 grey, 7 brown, 8 black, 9 violet, 10 aqua
- > 11 orange, 12 pink.

#### Tube colour code:

- > 1 red, 2 green, 3-12 white

#### Stranding:

- > SZ stranded around the CSM rod
- > White-red identification thread

#### Water blocking:

- > Longitudinal watertight
- > Water swellable material
- > Dry core

#### Rip cord:

- > 2 rip cords

#### Outer sheath:

- > HDPE, minimum 1.5 mm
- > Black

### Delivery

- > Standard length: 2 or 4 km

Content is subject to changes acc. to current product development and or any changes to standards.

Fibre count	12	24	48	72	96
No. tubes x no. fibres	1 x 12	2 x 12	4 x 12	6 x 12	8 x 12
Loose tube/filler diameter mm	2.5	2.5	2.5	2.5	2.5
CSM diameter mm	2.6	2.6	2.6	2.6	2.6
CSM oversheathing diameter mm	-	-	-	-	4.2
Cable diameter mm	10.8	10.8	10.8	10.8	12.4
Cable weight kg/km	215	215	215	220	250





## CONNECTIVITY

# ORP 250 DISTRIBUTION PANEL INDOOR UNIVERSAL 19" RACK WITH STORAGE



### Application

Robust metallic ORP distribution panel designed for dry indoor termination and distribution of fibre optic cables in telecommunications, CATV and LAN networks. In a fibre optic network this panel works as a cross-connection and testing point between the optical cable network and the equipment.

Universal type of FO distribution panel for 19" racks. Contains a splicing section, patch panel and cover. Position of the panel can be adjusted freely.

ORP-250 also contains a storage shelf for excess lengths of patch cords

The constructions of the panel is simple and modular and independent of cable constructions. Easy to install, maintain and upgrade to higher capacity systems.

Entrance for two cables or multiple small size cables from the back of the panel. Fusion splice protection sleeve holders of rubber material attached to the bottom of the panel.

Additional materials such as adaptors, pigtails, slice protectors and grounding parts must be ordered separately.

### Construction

#### Distribution panel:

- > For 19" racks
- > Splicing section
- > Patch panel, adjustable
- > Protection sleeve holder
- > Cover
- > Storage shelf, adjustable
- > Modular designed
- > Powder painted and zink coated steel

#### Entry ports:

- > On back
- > For 2 large or several small cables

#### Splice section capacity:

- > 48 - 96 fusion splices
- > Double connector adaptors (SC-D)
- > Heat shrinkable

#### Patch panel capacity:

- > 24 connection adaptors
- > SC, SC-D (SC duplex), LC duplex, LC Quad ST, FC\*D or 12 RJ45

#### Grounding of metallic parts:

- > Use part KT-1070 - order separately
- > Use part FT-920- order separately

#### Dimensions (h x w x d):

- > 60 (2U) x 440 (19") x 230 mm

#### Weight

- > 2.9 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type and name	Prysmian part no.
ORP-250 SC ODF	XEXSC01664
ORP-250 SC-D ODF	XEXSC01665
ORP-250 LC ODF	XEXSC01923
ORP-250 ST/FC*D ODF	XEXSC01666
ORP-250 LC-Q ODF	XEXSC02051

## CONNECTIVITY

# ORP 260 DISTRIBUTION PANEL

## INDOOR UNIVERSAL 19" METALLIC RACK



### Application

Robust metallic ORP distribution panel designed for dry indoor termination and distribution of fibre optic cables in telecommunications, CATV and LAN networks. In a fibre optic network this panel works as a cross-connection and testing point between the optical cable network and the equipment.

Universal type of FO distribution panel for 19" racks. Contains a splicing section, patch panel and cover. Position of the panel can be adjusted freely.

The constructions of the panel is simple and modular and independent of cable constructions. Easy to install, maintain and upgrade to higher capacity systems.

Entrance for two cables or multiple small size cables from the back of the panel. Fusion splice protection sleeve holders of rubber material attached to the bottom of the panel.

Additional materials such as adaptors, pigtails, splice protectors and grounding parts must be ordered separately.

### Construction

#### Distribution panel:

- > For 19" racks
- > Splicing section
- > Patch panel, adjustable
- > Protection sleeve holder
- > Cover
- > Modular designed
- > Powder painted and zink coated steel

#### Entry ports:

- > On back
- > For 2 large or several small cables

#### Splice section capacity:

- > 48 - 96 fusion splices
- > Double connector adaptors (SC-D)
- > Heat shrinkable

#### Patch panel capacity:

- > 24 connection adaptors
- > SC, SC-D (SC duplex), LC duplex, LC Quad ST, FC\*D or 12 RJ45

#### Grounding of metallic parts:

- > Use part KT-1070 - order separately
- > Use part FT-920- order separately

#### Dimensions (h x w x d):

- > 45 (1U) x 440 (19") x 230 mm

#### Weight

- > 1.9 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type and name	Prysmian part no.
ORP-260 SC ODF	XEXSC01664
ORP-260 12xRJ45 ODF	XEXSC01862
ORP-260 SC-D ODF	XEXSC01668
ORP-260 LC-Q ODF	XEXSC02052
ORP-260 LC ODF	XEXSC01924
FT-920 Guiding support	XEXSC01785
ORP-260 ST/FC*D ODF	XEXSC01669
KT-1070 Grounding partfor ORP-250/260	XEXSC02104

## CONNECTIVITY

# XOK JOINT CLOSURE

## MULTIPLE OUTDOOR APPLICATION IP68



### Application

Universal joint closure designed to provide water and pressure tight environmental protection for optical fibres and optical fibre splices, regardless of the cable design.

Application ranges from aerial pole or tower, duct to buried or manhole installations. The closure has anchoring points for strength members and facilities for earthing of metallic elements.

The splice organizer trays offer holders for heat shrink splice protectors and sufficient space for storage of spare fibres. The closure is easily assembled and re-entered.

The closure is available in seven basic configurations with two, three or four cable entrances. XOK A3/A4 branch joint closures and extension collars for more cable outlets are also available. Additional materials such as adaptors, pigtails, splice protectors and grounding parts must be ordered separately.

### Technical data

#### Impact resistance:

- > 30 Nm acc. to IEC 60794-1-E4

#### Crush resistance:

- > 1,000 N

#### Bending radius:

- > For fibres: 30 mm

#### Cable retention:

- > 1,000 N acc. to IEC 60794-1-E1

#### Water resistance:

- > Rating IP68

#### Torsion resistance:

- > <0.1 dB acc. to IEC 60794-1-E7

#### Temperature range

- > Storage: - 40°C to + 50°C
- > Installation: - 10°C to + 50°C
- > Operation: - 45°C to + 80°C

### Construction

#### Joint closure:

- > Universally applicable
- > Modular design - 3 sizes
- > Stainless steel housing 1.5 mm
- > Acid and weather resistant
- > No additional protection needed

#### Entry ports:

- > Several configurations
- > From 2 to 4 cable entry ports
- > Round or oval

#### Splice capacity:

- > XOK 103: 4 trays x 48 splices = 192
- > XOK 107: 7 trays x 48 splices = 336
- > XOK A3: 4 trays x 48 splices = 1000 using extension collars or splice trays for fibre ribbons

#### Closure sealing:

- > Mechanical entry port sealing
- > Heat shrink entry port sealing
- > Watertight seal, IP68
- > High cable pull strength

#### Anchoring point:

- > Anchor points for strength member

#### Storage tray:

- > For spare fibres

#### Dimensions (h x w x d):

- > XOK 103: 560 x 230 x 100 mm
- > XOK 107: 560 x 230 x 140 mm
- > XOK A3: 560 x 230 x 140 mm

Content is subject to changes acc. to current product development and or any changes to standards.

Joint closure model	Cable port placement	Splices max. numbers	Prysmian order no.
XOK 1030	2 ports on short end	24 splices	XJTSC00839
XOK 1030	2 ports on short end	48 splices	XJTSC00840
XOK 1030	2 ports on short end	96 splices	XJTSC00842
XOK 10304	2 port on both short ends	24 splices	XJTSC00843
XOK 10304	2 port on both short ends	48 splices	XJTSC00844
XOK 10304	2 port on both short ends	96 splices	XJTSC00845
XOK 10305	3 port on short end	24 splices	XJTSC00846
XOK 10305	3 port on short end	48 splices	XJTSC00847
XOK 10305	3 port on short end	72 splices	XJTSC00848
XOK 10305	3 port on short end	96 splices	XJTSC00849
XOK 10307	3 port on long end	24 splices	XJTSC00850
XOK 10307	3 port on long end	48 splices	XJTSC00851
XOK 10307	3 port on long end	96 splices	XJTSC00852
XOK 10707	3 port on long end	192 splices	XJTSC01064
XOK 10307A	3 port on long end	24 splices	XJTSC00853
XOK 10307A	3 port on long end	48 splices	XJTSC00854
XOK 10307A	3 port on long end	96 splices	XJTSC00855
XOK 10707A	3 port on long end	192 splices	XJTSC01065
XJTSC00919	3 port on long end	192 splices	XOK A3
XJTSC01247	4 ports on long end	192 splices	XOK A4

## CONNECTIVITY

# PK-300 TERMINATION BOX

## INDOOR WALL MOUNTED METALLIC IP54



### Application

Robust and dust-proof cabinet with lockable door for the termination, branching and distribution of fibre optic cables in telecommunication, CATV and LAN networks under dry indoor conditions.

Suitable for wall-mounted installations with small or intermediate numbers of fibres. The construction of the box is clear and simple and independent of cable constructions and is easy to install, maintain and upgrade.

A patch panel divides the box into splicing and cross-connection sections. Cross-connection section has cable entrances to both up and down, directions. Two cable inlets on the top and on the bottom can be connected to one wide inlet that gives the possibility to bring in and take out the cable from the box without cutting all the fibres.

The cabinet is delivered with frame and cover, mounting and grounding bar, splice tray, entrance material for one outdoor cable, stress relief bars for 24 pcs. of diameter 2 mm patch cords of 2 pcs, cable ports and patch panel.

Additional materials such as adaptors, pigtails, splice protectors and grounding parts must be ordered separately.

### Construction

#### Termination box:

- > Steel plate
- > Powder painted
- > Wall mountable
- > Dust-proof
- > Patch panel divider
- > Splice section with separate door
- > Cross-connection section

#### Entry ports to splicing section:

- > 6 cable entry port in total
- > 3 on top and 3 on bottom

#### Entry ports to cross-connection section:

- > Entry plates
- > In up and down direction

#### Splice section capacity:

- > 5 trays x 24 splices = 120 splices

#### Patch panel capacity:

- > 48 connection adapters
- > SC, LC-D (LC-duplex) or ST/FC\*D

#### Sealing:

- > Rating of IP54

#### Dimensions (h x w x d):

- > 400 x 480 x 155 mm

#### Weight:

- > 11 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type	Special feature	Prysmian order no.
PK-300	SC	XCPSC01559
PK-300	ST/FC*D	XCPSC01560
Splice tray	KT-1412/24	XJTSC00884



## CONNECTIVITY

# PK-100 TERMINATION BOX

## INDOOR WALL MOUNTED METALLIC



### Application

Robust metallic termination box suitable for indoor installations with splicing, cable branching and cross connection functions.

Capacity for 48 splices and 12 SC, LC-D (LC-duplex), ST or FC\*D (D-hole) adapters. In addition there is space for two more splice trays with holder for 24 splice protectors (heat shrinkable) per tray.

The box has three cable inlets on the bottom with maximum cable diameter of 20 mm. Metallic cables can be grounded with earthing screw on the outer surface of the bottom part.

The distribution box is delivered with metallic box, bottom and cover, mounting and grounding bar, splice tray KT-1412 for 12/2 and entrance material KT-1016 with mechanical seal for one cable.

Additional materials such as adaptors, pigtails, splice protectors, additional splice trays and grounding parts must be ordered separately.

### Construction

#### Distribution box:

- > Metal
- > Powder painted
- > Splicing section
- > Splice tray - room for 2 more
- > Cross-connection section
- > Cable branching
- > Cover
- > Bottom

#### Entry ports:

- > 3 on the bottom
- > Max. cable diameter 20 mm

#### Splice section capacity:

- > 48 fusion splices
- > Space for 2 more splice trays
- > Heat shrinkable

#### Cross-connection capacity:

- > 12 connection adaptors
- > SC, LC-D (LC-duplex), ST or FC\*D (D-hole) adapters

#### Grounding:

- > Earthing screws on the bottom

#### Dimensions (h x w x d):

- > 350 x 210 x 66 mm

#### Weight

- > 3.0 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type	Special feature	Prysmian order no.
Termination box	PK-100 SC	XCPSC01555
Termination box	PK-100 ST/FC*D	XCPSC01556
Splice tray	KT-1412/24	XJTSC00884
Entrance material	KT-1016 with mechanical seal for one cable	XJTSC00879

## CONNECTIVITY

# PK-100A TERMINATION BOX

## INDOOR WALL MOUNTED METALLIC



### Application

Robust metallic termination box suitable for indoor installations with splicing, cable branching and cross connection functions.

Capacity for 24 splices and 12 SC or LC-D (LC-duplex) adaptors.

The box has two cable inlets on the bottom with maximum cable diameter of 20 mm. Metallic cables can be grounded with earthing screw on the outer surface of the bottom part.

The distribution box is delivered with metallic box, bottom and cover, mounting and grounding bar, splice protector holder for 24 splices and entrance material KT-1020 with mechanical seal for one cable.

Additional materials such as adaptors, pigtails, splice protectors, additional entry material and grounding parts must be ordered separately.

### Construction

#### Distribution box:

- > Metal
- > Powder painted
- > Splicing section
- > Cross-connection section
- > Cable branching
- > Cover
- > Bottom

#### Entry ports:

- > 2 on the bottom
- > Max. cable diameter 20 mm

#### Splice section capacity:

- > 24 fusion splices
- > Heat shrinkable

#### Cross-connection capacity:

- > 12 connection adaptors
- > SC, LC-D (LC-duplex) adaptors

#### Grounding:

- > Earthing screws on the bottom

#### Dimensions (h x w x d):

- > 160 x 360 x 50 mm

#### Weight

- > 1.9 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type	Special feature	Prysmian order no.
Termination box	PK-100A SC	XCPSC01555
Entrance material	KT-1020 with mechanical seal for one cable	XJTSC00880

CONNECTIVITY

PK-107 TERMINATION BOX  
OUTDOOR SMALL METALLIC



Application

Robust metallic termination box suitable for outdoor installations with a small number of fibres. No need for extra protection of fibres when using central tube type optical cables.

Capacity for 12 splices and 2 SC-D or LC-Q (LC-quad) adapters. Suitable for installation inside traffic signs and display poles.

The box has three cable inlets on the bottom with maximum cable diameter of 11 or 16 mm. Metallic grounding of two cables is possible.

The distribution box is delivered as a metallic cabinet with a bottom and cover, adapter plate, wall fixing accessories, mounting and grounding bar, splice protector holder for twelve 12 splice protectors and entrance material for three cables and two heat shrinkable tubes and one mechanical seal.

Additional materials such as adaptors, pigtails, splice protectors and grounding parts must be ordered separately.

Construction

Distribution box:

- > Metal - aluminium
- > Powder painted
- > Adaptor plate
- > Splice protector holder
- > Cover
- > Bottom
- > Wall fixing accessory

Entry ports:

- > 3 on the bottom
- > Max. cable diameter 1 x 11 or 2 x 16 mm
- > 2 heat shrinkable and 1 mechanical

Splice protection capacity:

- > 12 splices protectors
- > Heat shrinkable

Cross-connection capacity:

- > 2 connection adaptors
- > SC-D or LC-Q

Grounding:

- > Possible for two metallic cables

Dimensions (h x w x d):

- > 336 x 88 x 40 mm

Weight

- > 0.7 kg

Content is subject to changes acc. to current product development and or any changes to standards.

Product type	Special feature	Prysmian order no.
Termination box	PK-107	XJTSC00861

## CONNECTIVITY

# PK-200 TERMINATION BOX

## INDOOR WALL MOUNTED METALLIC



### Application

Robust metallic termination box suitable for indoor installations with splicing, cable branching and cross connection functions.

Capacity for 96 splices and 24 SC, LC-D (LC-duplex), ST or FC\*D (D-hole) adapters.

The box has three cable inlets on the bottom with maximum cable diameter of 20 mm. Grounding of metallic cables is possible via earthing screws on the outer surface of the bottom part.

The termination box is delivered with bottom and cover, mounting and grounding bar, one splice tray KT-1412/24 for 24 splices and entrance material KT-1016 with mechanical seal for one cable.

Additional materials such as adaptors, pigtails, splice protectors, splice tray KT-1412, entrance material KT-1016 and grounding parts must be ordered separately.

### Construction

#### Distribution box:

- > Metal
- > Powder painted
- > Mounting and grounding bar
- > One splice tray (space for 2 in total)
- > Cover
- > Bottom

#### Entry ports:

- > 3 on the bottom
- > Max. cable diameter 20 mm
- > Heat shrinkable

#### Splice tray capacity:

- > Up to 4 splice trays
- > Holder for 24 splice protectors per tray
- > Heat shrinkable

#### Cross-connection capacity:

- > 24 connection adaptors
- > SC, LC-D (LC-duplex), ST or FC\*D (D-hole)

#### Grounding:

- > Possible to ground metallic cables
- > Earthing screws on the bottom

#### Dimensions (h x w x d):

- > 400 x 210 x 120 mm

#### Weight

- > 3.5 kg

Product type	Special feature	Prysmian order no.
Termination box PK-200	SC	XCPSC01557
Termination box PK-200	ST/FC*D	XCPSC01558
Splice tray	KT-1412/24	XJTSC00884
Entrance material	KT-1016 with mechanical seal for one cable	XJTSC00879

# Railway Main Line Cables

## Cables with reduction factor

Parallel laid railway cables on electrified tracks using alternating current or under high voltage power lines are exposed to the influence electromagnetic fields. These electromagnetic fields induce current in the cables, which can lead to disturbances and destruction of the equipment connected to them as well as present a hazard to life and limb. In order to reduce this influence to a non-hazardous level, the cables are provided with a metallic shield according to their cross-section. This shield has to be earthed on both sides of the cable.

The measure of quality used to shield cables in railway applications is referred to as the reduction factor. The reduction factor is the ratio of induced tension with shielding to the induced tension without shielding. A reduction factor of 1 would mean "no shielding effect". A reduction factor of 0.5, for example, would mean a reduction of the induced tension by one half.

The effect of shielding of the materials used (copper, steel, aluminium, etc.) is dependent on the conducting cross-section of shielding as well as the frequency of the interfering signal.

Depending upon the local circumstances, the cable design and hence the resultant reduction factor can be optimised to best match the expected field strength along the railway track. A typical description for the request for a cable protected against inductive interference shall include disturbing frequency and field intensity as well as the requested reduction factor. For example:

- Reduction factor  $< 0.5$  at 16.7 Hz in the range of 80 – 150 V/km or
- Reduction factor  $< 0.3$  at 50 Hz in the range of 80 – 250 V/km.

The tension induced in the cable increases with the length the cable is exposed to the electrical field. A cable which is exposed over a length of 2000 m to the field can require a lower (better) reduction factor than the same cable, which is only exposed to the induced field over a length of 1000 m.

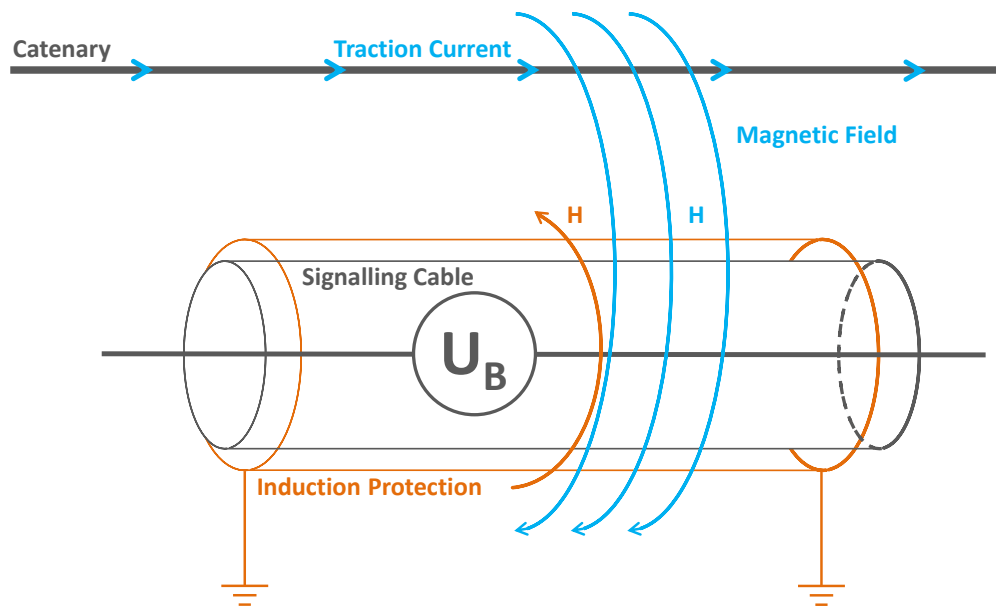
The calculation of the actually required reduction factor is very complicated and depends on a multitude of different parameters:

- Distance of the cable to be shielded from the interfering cable (overhead line...),
- Type of installation (underground, in conduits, on the ground...),
- Characteristics of the ground,
- etc.

A respective calculation of the required reduction factor can only be carried out by experts. The cable manufacturer then develops the correct cable design based on the given factors.

As a supplier of cables for railway applications and development partners of well-known European railway operators of long standing, We are pleased to develop the right cable design for you according to your needs.





Picture: Magnetic field compensation by inductive protection



Picture: Cable AJ-2Y(L)2YDB2Y 10x4x1.4 mm S (H45) rk 600 of Deutsche Bahn with protection against inductive interference

# Railway Main Line Cables

## Requirements for fire characteristics of cable installations in tunnels or stations

Prysmian provides a complete product range of cables and circuits for the railway infrastructure sector. We also take into consideration the special requirements needed for laying cables in closed environments.

Most railway infrastructure operators specify cables with a black polyethylene (PE) outer sheath for use in the open air. PE is extremely robust and resistant, has very good UV resistance due to the black colouring and guarantees a cable life of about 35 years. PE is halogen-free and burns with low smoke emissions without releasing toxic gases.

In closed areas and narrow spaces, in applications such as tunnels or railway stations, the requirements for the cables are very demanding.

Even though PE is halogen-free and burns with low smoke, it is not recommended for such applications. PE is not self-extinguishing and contributes to further propagation of fire. The fire can penetrate into adjacent rooms and cause more damage. Cables with PVC outer sheath are no alternative either. Although PVC is flame retardant and usually self-extinguishing, it burns producing dark soot and releases toxic gases.

The ideal materials combine the advantages of PE and PVC, are halogen free, produce little smoke, and are flame retardant and self-extinguishing. Such materials are manufactured, refined and improved in Prysmian's material laboratories.

Known halogen-containing materials are, for example, chloroprene rubber (CR), ethylene tetrafluoroethylene (ETFE), perfluoroethylene propylene (FEP) or polyvinyl chloride (PVC). Halogen-free materials are, among others, silicone rubber (SIR), polyamide (PA), ethylene propylene polymers (EPR), thermoplastic elastomers (PE) or polyethylene (PE).

There are European and international standards regarding the unique and comparable classification of flammability properties of cables. We want to briefly introduce to you the most important test procedures.

# Fire testing

## **EN/IEC 60332-1**

(Tests on electric and optical fibre cables under fire conditions: test for vertical flame propagation for single insulated wire or cable)

The flame propagation is tested according to IEC 332-1 on a single cable. A vertical sample of cable about 600 mm in length is exposed to a flame for 60 s and/or 120 s in an area 100 mm above the lower end with a 1 kW Bunsen burner. After removing the burner, the flame must self-extinguish. The zones of the cable damaged by the flame should not reach to the upper end of the cable. The flaming time is dependant on the diameter of the cable.

Comparable tests are DIN VDE 0482-332-1-2, EN 50265-2-1, NF C 32-070 C2, BS 4066-1.



## **EN/IEC 60332-3**

(Tests on electric and optical fibre cables under fire conditions: test for vertical flame spread of vertically mounted bunched wires or cables)

The test for the spread of the flame with an array of several cables, i.e. a bunch of cables, is normally carried out according to IEC 332-3 (EN 50266-2, test method A, B, C or D – for use of different volumes of non-metallic materials).

The test specimens, mounted in a vertical frame, are exposed to a flame over a length of 3600 mm starting in the lower section using a special burner with a high output. During and/or after exposure to the intensive flame for 20 and/or 40 minutes, the cables may not continue to burn to their upper end.

Comparable tests are DIN VDE 0482-266-2-4, EN 50266, NBN C30-004 Cat. F2, BS 4066-3.



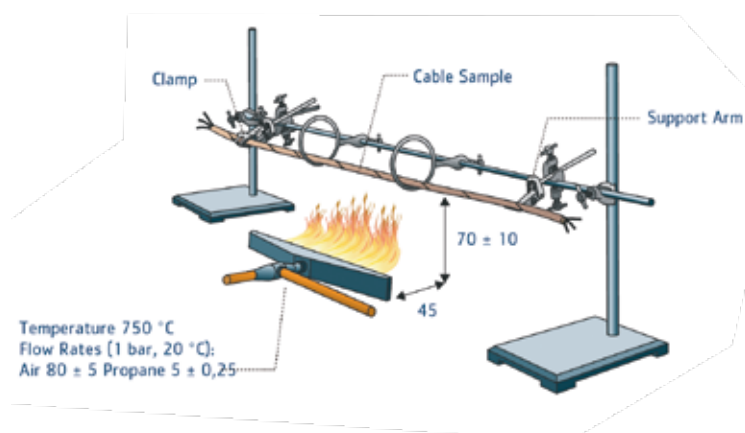
# Railway Main Line Cables

## IEC 331

(Cable with insulation integrity)

A horizontal cable sample is exposed to a flame over a width of 1200 mm with a flame temperature of at least 750 °C for a recommended duration of at least 90 minutes. The cable is connected up electrically and under tension. During flaming and a cooling down time of an additional 15 minutes, no short circuiting or interruption of the current may arise.

Comparable tests are EN 50200, EN 50263, NF C 32070 CR1, BS 6287.



## DIN 4102 part 12

(Cable with functional integrity – system testing of cable and the cable mounting system)

This test is very extensive. As it is a test of the system which includes the cable and the cable mounting system, the product to be tested is completely walled into a closed space. The cables are connected up electrically and are kept under tension during the test. The entire room is set alight with a defined temperature unit curve. After at least 30 minutes flame exposure, neither short-circuiting or interruption of circuit may arise. It is extremely difficult to pass the test, as the cable mounting system has a considerable influence on the result. Cable clips, ducts or conductors exert mechanical loads on the cable, as the material changes during flaming: cable ducts start to bend through the load exerted by the cable and the originally smooth cable suddenly hangs down at several points. This mechanical change of position of the burned cable can lead to interruption or short-circuiting.

**IEC 61034**

(Measurement of smoke density of cables burning under defined conditions)

A plastic sample is burned under controlled conditions. In this way, the light transmission through the combustion gases which arise is measured.

Comparable tests are DIN VDE 0482-286-1 and -2, NFX 10702, BS 7622-2.

**IEC 60754-1**

(Test on halogen acid gases evolved during combustion of materials from cables)

A plastic sample is burned under controlled conditions. In this way, the smoke gases are measured for their halogen content.

Comparable tests are DIN VDE 0482-267-2-1 and EN 50267-2, NF C 20454, BS 6425-1.

**IEC 60754-2**

(Test on acidity of gases evolved during combustion of materials from cables)

A plastic sample is burned under controlled conditions. In this way, the pH-value and the conductivity of the smoke gases are measured.

A comparable test is DIN VDE 0276-604.

With the exception of the small fire test according to EN/IEC 60332-1, the cable is normally destroyed during the flame test. Although no short-circuiting or interruptions should arise, it is difficult to speak about defined electrical values such as operating capacity or characteristic impedance. In this case we are talking about either: current flowing or not. This may in reality be adequate for loudspeaker announcements or sprinkler systems. Control and safety technology using electronic interlocking is during or after a cable fire, if at all, hardly still sensible and feasible. Under these circumstances, the need to maintain fire testing standards according to EN/IEC 60331 (insulation integrity) and/or DIN 4102 part 12 (functional integrity) makes little sense for railway signalling cables for electronic interlocking.

# Railway Main Line Cables

## Construction Product Regulation

Since 01/07/2013, the “Construction Product Directive” (CPD) in the EU has been replaced by the “Construction Product Regulation” (CPR) and is thus valid law in all member states of the EU. The CPR and/or the building product directive (BPVo) affects all cables which are intended for permanent installation in a building. Products have to fulfil requirements in terms of behaviour and/or resistance in the case of fire.

CPR itself does not define any performance requirements regarding the affected products. The definition of safety requirements remains the responsibility of the national authorities.

CPR has introduced binding performance requirements (Declaration of Performance, DoP) and the corresponding CE-mark for labelling the products. The cable's fire characteristics shall be marked in the future with a combination of different classes (The index “ca” stands for “cable”):

CPR classes are:	$A_{ca}$ , $B1_{ca}$ , $B2_{ca}$ , $C_{ca}$ , $D_{ca}$ , $E_{ca}$ , $F_{ca}$	(see table to the right)
Smoke classes are:	s1, s1a, s1b, s2, s3	(EN 50399/EN 61034-2)
Acidity classes are:	a1, a2, a3	(EN 60754-2)
Flaming droplets classes are:	d0, d1, d2	(EN 50399)

The CPR has no class or guideline for railway cables laid in exposed outdoor areas. These cables may continue to be designed, produced and installed as previously. For railway cables in tunnels or train stations, the relevant cable manufacturers associations recommend a classification according to the EU regulation (1303/2014), clause 4.2.2.4: “In case of fire, exposed cables shall have the characteristics of low flammability, low fire spread, low toxicity and low smoke density. These requirements are fulfilled when the cables fulfil as a minimum the requirements of classification  $B2_{ca}$ , s1a, a1, as per Commission Decision 2006/751/EC.”

Prysmian Group will observe these obligations and, as far as they do not satisfy existing cable designs, will provide cables and products to the market with the corresponding properties.



Class	Test method(s)	Classification criteria	Additional classification
A <sub>CA</sub>	EN ISO 1716	PCS ≤ 2,0 MJ/kg and PCS ≤ 2,0 MJ/kg and	
B1 <sub>CA</sub>	EN 50399 and	FS ≤ 1.75 m and THR1200s ≤ 10 MJ and Peak HRR ≤ 20 kW and FIGRA ≤ 120 Ws-1	Smoke production and Flaming droplets/particles and Acidity
	EN 50265-2-1	H ≤ 425 mm	
B2 <sub>CA</sub>	EN 50399 and	FS ≤ 1.5 m; and THR1200s ≤ 15 MJ; and Peak HRR ≤ 30 kW; and FIGRA ≤ 150 Ws-1	Smoke production and Flaming droplets/particles and Acidity
	EN 50265-2-1	H ≤ 425 mm	
C <sub>CA</sub>	EN 50399 and	FS ≤ 2.0 m; and THR1200s ≤ 30 MJ; and Peak HRR ≤ 60 kW; and FIGRA ≤ 300 Ws-	Smoke production and Flaming droplets/particles and Acidity
	EN 50265-2-1	H ≤ 425 mm	
D <sub>CA</sub>	EN 50399 and	THR1200s ≤ 70 MJ; and Peak HRR ≤ 400 kW; and FIGRA ≤ 1300 Ws-1	
	EN 50265-2-1	H ≤ 425 mm	
E <sub>CA</sub>	EN 50265-2-1	H ≤ 425 mm	
F <sub>CA</sub>	no performance determined		

Table: Overview of the CPR classifications

# Railway Main Line Cables

## Transport and storage of cable drums

Even if cable and drum look very strong, there are certain rules to follow to avoid damage of the cable and an accompanying impairment of mechanical and electrical characteristics.

### **Transport and storage of cable drum**

It is possible to store cable drums outdoors. When storage has occurred in heated rooms, a minimum 24-hour acclimatisation period must be observed before installation (possible condensation build-up in the cable!).

For outdoor storage the ground must be even and clean. Stones or bumps in the ground should be removed or smoothed out. Damage to the wound goods/cable should be avoided at all costs.

Cables should be secured against accidental rolling away. Under no circumstances should the drum flange of neighbouring cables touch any wound goods.

Cable drums should always be stored and transported standing on both flanges.

They should not be pushed along the ground standing on the flanges. It is possible that the strength of the cable drum would then no longer be guaranteed.

Observe the rolling direction. The arrow printed on the drum flange indicates the rolling direction so that the wound goods do not become loose.

Always uncoil the cable at a tangent, never over the flange, since the torsion thus resulting would damage the cable and laying would not be possible.

### **Cable ends**

Finally it remains for us to point out the necessity of having faultless cable ends. Pressure-tight and impermeable cable ends are particularly essential for cables which are not longitudinally water-proof, as well as for cables which are insulated with paper, cellular-PE and foam-skin-PE. Carelessness in this area can lead to moisture penetration which is accompanied by a drastic deterioration in the electrical transmission rate. Power failures and expensive replacement work are the result.

Pressure-tight and impermeable cable ends can be achieved, for example, through the use of synthetic sealing resin or compressed air sealing stoppers.



# Important physical characteristics

## Temperature range

The temperature range of the cable is of great importance for both the user and fitter. After all the cable is meant to function equally well in cold and hot temperatures. It is particularly during the fitting process that powerful mechanical forces act on the cable. The plastic used serves as the limiting element for the possible temperature range. At overly warm temperatures the plastic becomes very soft and can change into a thermoplastic state (up to melting point), which causes irreversible changes in the cable.

At very cold temperatures, however, the material stiffens and becomes hard and inflexible. Here, too, irreparable damage can occur.

Tears in the sheath allow dampness and moisture in and impair the transmission rate. Details about the permissible temperature range during laying and use (following successful fitting) can be found in the information sheets of the cable manufacturer. Since the mechanical strain on the cable in its laid form is significantly less, the permissible temperature range is greater than the range valid for the installation period.

## Bending radius

Regarding the bending radius we distinguish between multiple and single bending (shaping into the final position).

Multiple bending occurs mainly during the laying process. Cables are laid under tension around deflector rolls. The particular stress of multiple bending lies in the alternating stress on the materials, which can be stretched several times as well as compressed during the laying process.

To prevent permanent damage there are prescribed minimum bending radii of, for example, 10 x cable external diameter for multiple bending.

The stress on the material during final bending is not characterised by alternating stress. The cable is bent into form a final time and stays in this position for the duration of its use. The minimum bending radius in this case is, for example, 7.5 x cable external diameter. During final bending the cable can, therefore, be bent more tightly.

Exact minimum bending radii for specific cables can be found in the information sheets of the cable manufacturer.

## Tension

During laying of the cable particular attention must be paid to the maximum possible tension. The cable is very quickly damaged by the use of too much force and must then be replaced. The maximum possible tension depends in the first place on the overall cross section and the tensile strength of the conducting materials used.

For cables with steel tape or copper wire spiral armouring it is the internal copper conductors alone which determine the maximum tension! The armouring has no influence on the maximum tension or can possibly reduce it through additional weight. For armouring with steel or steel profile wires, however, the tension is determined solely by the steel and steel profile wires.

## Cable weight

The cable weight of larger cable dimensions can take weights of up to more than 10 t/km (without the reel!).

# Railway Main Line Cables

## Certifications and compliance

### **Certifications of Railway and Infrastructure Authorities**

Being a very complex system with a high safety integrity level, railway products are subject to detailed requirements and strong supervision. Many railway infrastructure operators issued dedicated cable specifications which require homologation and frequent auditing. Prysmian Railway Cables are designed and produced according to a number of railway cables standards, like DB, SBB, ÖBB, SNCF, TCDD, ADIF/RENFE, RFI, RATP and many more in Europe and around the globe. High quality manufacturing processes, many decades of experience in cable design and engineering as well as intense testing procedures guarantee state-of-the-art cable products and satisfied customers worldwide.

### **REACH (Registration, Evaluation and Authorisation of Chemicals)**

Adopted on December 18th, 2006, the Regulation of the European Parliament and the European Union Council, modernized the European legislation regarding chemical substances, and set up a unique integrated system of chemical substances in the European Union. Its objective is to improve the protection of the human health and of the environment, while maintaining the European chemical industry's competitiveness and strengthening its spirit of innovation. All Prysmian railway cables are REACH compliant.

### **RoHS (Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment)**

The RoHS directive aims at restricting the use of certain dangerous substances commonly used in electric and electronic equipment (EEE). Cables concerned by this directive are any cables rated below 250V, which function is the connection or the extension of an EEE to electrical outlet or the connection of two or more EEE to each other. All Prysmian railway cables are RoHS compliant.

### **Management Systems**

- Quality Management System EN ISO 9001:2008
- Environmental Management System EN ISO 14001:2005
- Energy Management System EN ISO 50001:2011

# Our responsibilities

## **Social Responsibility**

Within the social dimension of its business, the Prysmian Group recognises its commitment and responsibility towards the persons who work as part of the Organisation, as well as those who form the local communities in the territories in which the Group is active. Accordingly, consistent with its values, Prysmian constantly seeks to ensure the personal and professional satisfaction of its human resources, and to communicate with and involve local populations, in order to generate value for these important categories of stakeholder.

## **Environmental responsibility**

The Group's commitment to safeguarding the environment and conserving natural resources is expressed not only by the intrinsic characteristics of our products, but also by how our production systems are managed. In particular, the prevention and reduction of their environmental impact is achieved, for example, by the efficient use of natural resources, the optimisation of logistics flows and the responsible management of waste.

During 2015, HSE further consolidated its activities at various levels within the Group (corporate, country or geographical area, business unit, production unit), centralising activities and coordinating the work of the local HSE functions. Group policies for Health, Safety and Environment, as well as the related Operating Procedures and Technical Standards, have been adopted and applied at operating unit level. The HSE function, with support from the Group audit team, periodically checks the effectiveness and proper application of the HSE rules at local level.

The aspects monitored by HSE using indicators include compliance with health and safety at work standards, energy consumption, waste management, water usage and greenhouse gas emissions. In particular, with reference to the greenhouse gas emissions, the Group has begun to collect energy consumption data in order to track both "direct" emissions (deriving from production processes) and "indirect" emissions (deriving from the energy purchased). This system of monitoring and reporting enabled the Group to participate in 2015, once again, in the Carbon Disclosure Project (CDP), which seeks to contribute to the pursuit of the objectives agreed in the Kyoto Protocol regarding the global reduction of greenhouse gas emissions

## **Product responsibility**

Quality and innovation are the hallmarks of Prysmian's approach, both in sectors where the level of technology, the ability to innovate constantly and the commitment to offering high value-added services together establish a differentiated competitive positioning, and in those sectors where products are more standardised, such as medium and low-voltage cables. The Group applies a customer-centric approach, reflecting an ability to anticipate and satisfy the needs of customers with the maximum possible attention.

# Railway Main Line Cables

## References

Prysmian Group has been supplying the railway industry for many decades. We supply all renowned European railway infrastructure companies, often as part of long-term master agreements. Many important projects have been completed in the recent years all around the world, even more are yet to come. There is always our office close to you.

The following excerpt of our success records shall give you an idea about our local and global presence.

### **North Europe:**

- Denmark: ERTMS Signalling Program, Electrification of Danish Railways, Renewal of Danish Rail Infrastructure, Copenhagen Metro and S-Bane, Aarhus Tram
- Finland: Länsi Metro, Helsinki Metro, Rail Safety Project, Electrification of Jyväskylä-Äänekoski Line
- Norway: LKAB Narvik-Kiruna Line, InterCity Project, GSM-R Network for the ERTMS Signalling Program
- Sweden: Renewal of Stockholm Metro
- Latvia: Modernization of LZD-infrastructure

### **Rest of the world:**

- Australia: QueenslandRail, conversion to axle counter detection technology
- Egypt: Cairo – Alexandria line
- Bulgaria: Plovdiv-Burgas line
- Chile: Rancagua project
- Germany: Framework contract and development partner of Deutsche Bahn
- Israel: Ashkelon – Netivot line
- Canada: Toronto Transit Authority
- Croatia: Zagreb Central Station
- Malaysia: Thomson Line project
- Morocco: Casablanca – Tanger line
- Mexico: Metro Monterey
- Saudi Arabia: North-South-Rail project, Mecca Metro
- Switzerland: Framework contract with SBB
- Singapore: Singapore Metro Subaquea Cable
- Spain: Vandellos-Tarragona line, Madrid – Leon – Burgos high speed Line
- Turkey: Ankara-Konya high speed line, Eskisehir – Balıkesir line, Metro Istanbul, Metro Ankara
- USA: JFK Air Train, New York City Transit, Oakland Bay Area Rapid Transit



VR track



#### **We are here for you**

You are always welcome to contact us directly with technical questions or sales enquires.

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