Prysmian Group

# Railway Main Line Cables

## DENMARK


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Prysmian Group

# 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.

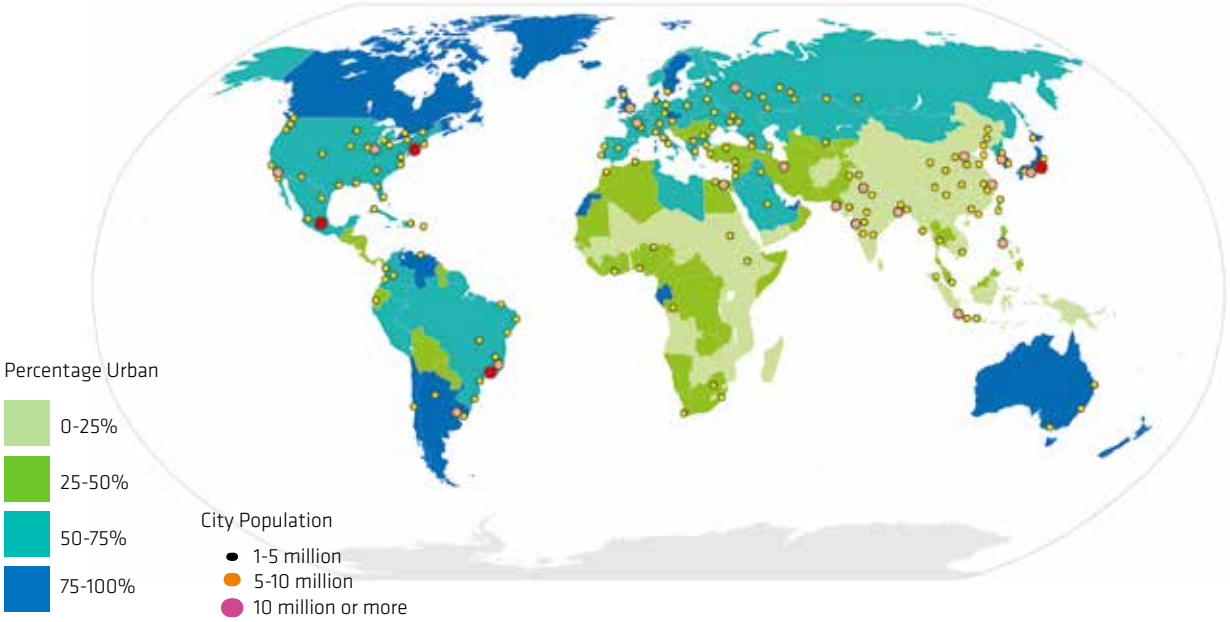
With the advent of civil aviation, the railway lost its role as the main means of transport for middle and long distances, and has long been regarded as outdated, slow and uncomfortable. But in recent years, the railway has experienced a revival. With the introduction of electronic interlocking technology 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

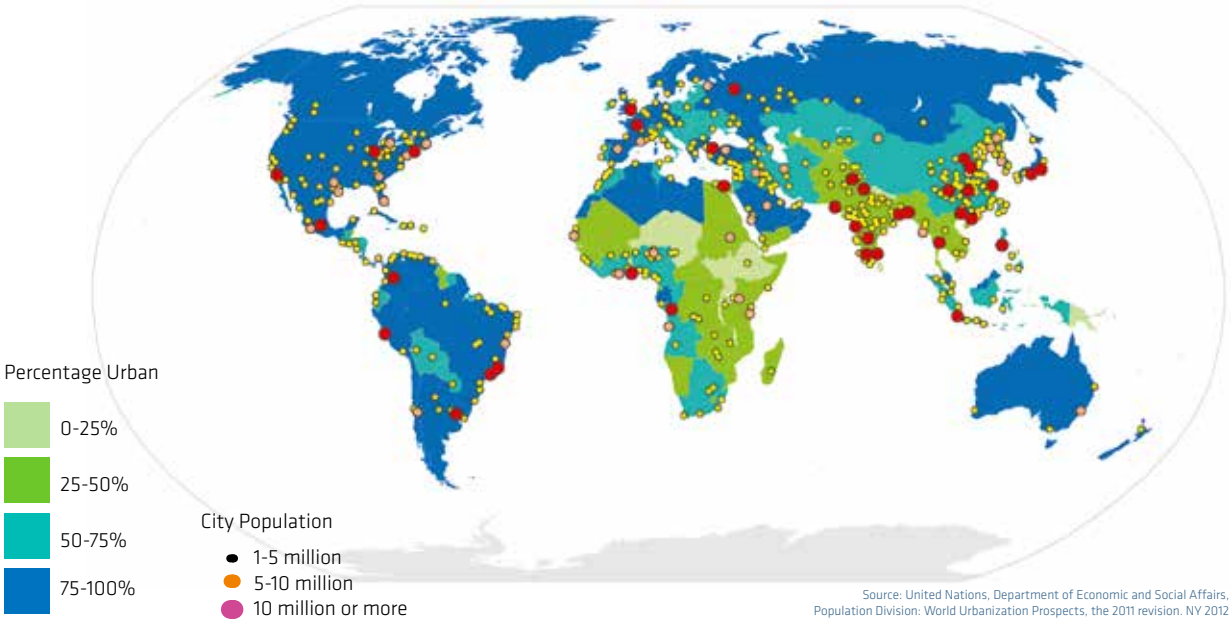
A major challenge for the railways as a means of mass transport, which is also an unparalleled opportunity, is represented by the increasing urbanisation of the world's population. In 2013, approximately 51% of the 7 billion people inhabiting the planet recided in an urban environment. By 2050, not only 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 inhabitans 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.

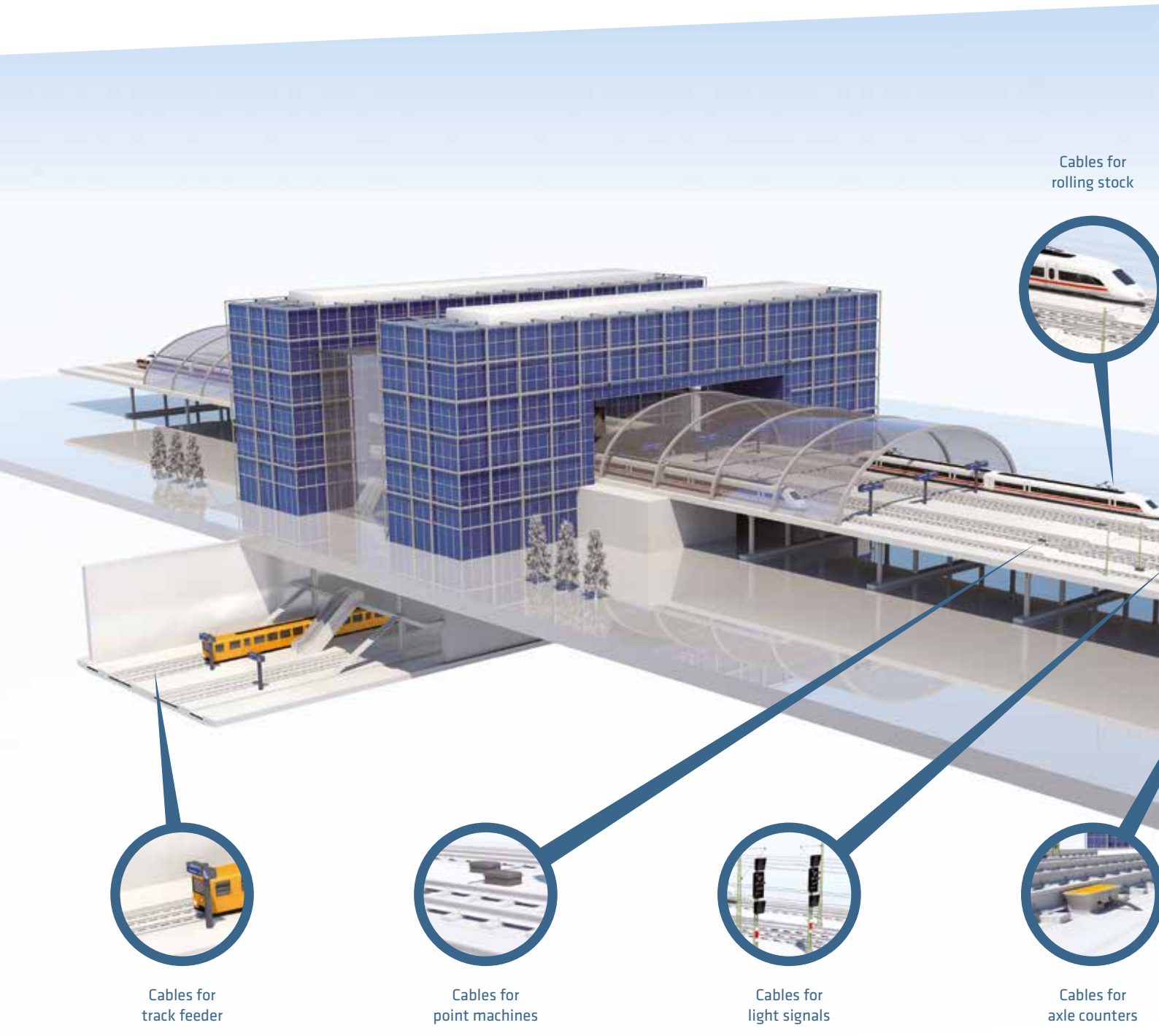
Railway projects are unique!

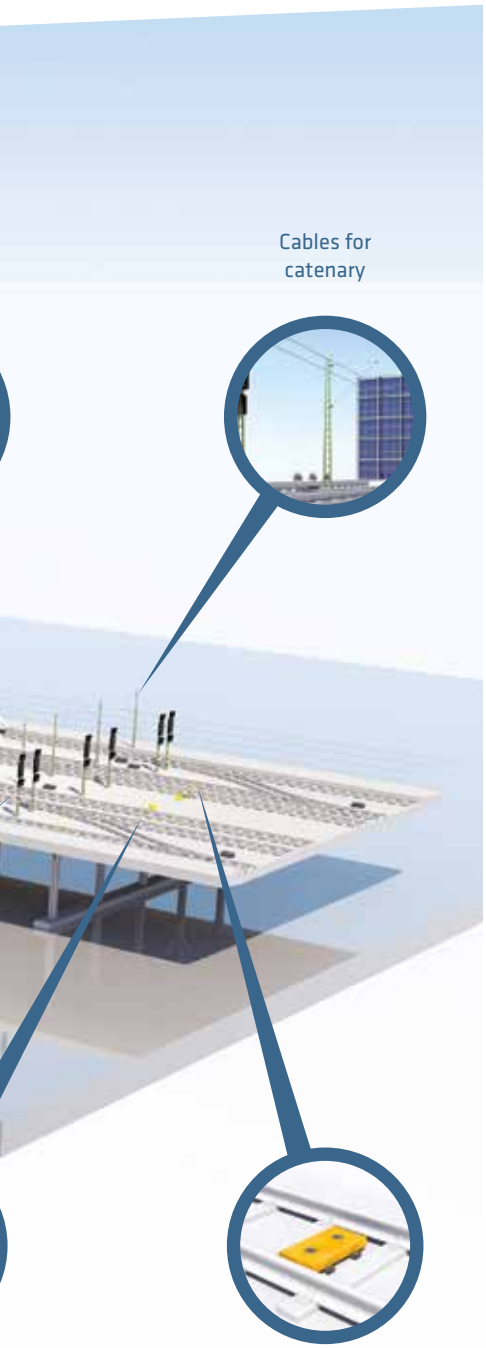
# Railway Main Line Cables

# Index

# 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 Power Networks**

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

**Railway Network Systems**

- MV and LV cables to distribute current to supervision 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.

**Overheard 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.

# Railway Main Line Cables

# Explanation of symbols


**Conductor temperature**
Max. conductor temperature °C in continuous operation.

**Flexible installation**
Due to IEC 60228 class 5 multi-standed 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

## Index of data sheets



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

# Popular railway cable data sheets


H8
PU
4rail.net - Ilkka Sissalo

SUBSTATION

# PEX-AL-LRT 170 kV

## SCREENED

**Application**

Underground high voltage transmission cable from substation to traction power feeding. Manufactured using triple extrusion process with completely dry curing and cooling by nitrogen gas.

**Technical data**

Rated voltage:

- 87/150 (170) kV

Bending radius:

- During pulling: 15 x D
- Fixed: 13 x D

Pulling force:

- 30 kN/mm²

Sideway pressure (T/R):

- 10 kN/m

**Standard**

- IEC 60840
- IEC 60228

**Construction**

Conductor:

- Round
- Compacted aluminium wires
- Stranded acc. to IEC 60228 class 2.
- Longitudinal waterwight

Conductor screen:

- Semi-conductive polymer compound

Insulation:

- XLPE

Insulation screen:

- Semi-conductive polymer compound

Wrapping:

- Semi-conductive water blocking tape

Screen:

- Copper wires and copper contact tape

Seperation layer:

- Waterblocking / binder tape

Radial water barrier:

- Aluminium foil laminated

Outer sheath:

- HDPE
- Extruded semi-conducting layer
- Black

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

| Conductor cross-section mm² | Outer diameter nom. mm | Weight kg/km | Screen cross-section mm² | Standard length m |
|---|---|---|---|---|
| 1 x 630/215 | 81 | 7.6 | 215 | |

| Conductor cross-section mm² | Screen DC resistance at 20°C Max. Ω/km | Capacitance in operation nom. µF/km | Short circuit current phase conductor max. kA/1 sec. | Short circuit current CU wire screen kA/1 sec. |
|---|---|---|---|---|
| 1 x 630/215 | 0.0469 | 0.20 | 50 | 40 |

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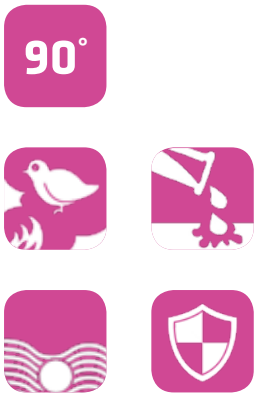
TRACTION POWER NETWORK

# PEX-AL-LT 52 kV

## SCREENED & WATERTIGHT




### Application

Halogen free single-core power supply cable. Longitudinal watertight with copper screen and water swelling tape. Suitable for installation directly in the ground or in ducts.

### Technical data

Rated voltage:
- 26/45 (52) kV AC

Test voltage:
- 65 kV AC

Bending radius:
- During installation: 15 x D
- Single bend: 13 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 60840
- IEC 60228

### Construction

Conductor:
- Round
- Aluminium wire
- Stranded acc. to IEC 60228 class 2.
- Longitudinal watertight

Conductor screen:
- Extruded semi-conductive PE

Insulation:
- XLPE

Insulation screen:
- Extruded semi-conductive PE

Tape:
- Semi-conductive and water swellable

Screen:
- Concentric screen of copper wires
- Helix of copper tape

Outer sheath:
- Halogen free PE compound
- Black

### Material property

- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2

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 | Tensile strength kN | Bending radius at installation mm | Standard length m |
|---|---|---|---|---|---|
| 1 x 240+75 | 49.1 | 2,580 | 8.5 | 780 | 1000-K26 |
| 1 x 400+75 | 55.2 | 3,240 | 12.1 | 870 | 1000-K26 |
| 1 x 500+75 | 58.3 | 3,640 | 15.0 | 915 | 1000-K28 |

| Conductor cross-section mm² | Outer diameter mm | Insulation thickness nom. mm | Diameter over insulation mm | Screen cross-section mm² | Outer sheath thickness mm |
|---|---|---|---|---|---|
| 1 x 240+75 | 18.1 | 9.0 | 37.3 | 75 | 2.4 |
| 1 x 400+75 | 23.7 | 9.0 | 42.9 | 75 | 2.6 |
| 1 x 500+75 | 26.6 | 9.0 | 45.8 | 75 | 2.7 |

TRACTION POWER NETWORK

# PEX-CU-LT 17.5 kV

## SCREENED, WATERTIGHT & UV RESISTANT

### Application

Halogen free, flame retardant and longitudinal watertight single-core utility cable with copper screen and UV resistant sheath. Suitable for installation in pipes or directly in the ground. Can as well be ploughed down.

### Technical data

Rated voltage:

- 8.7/15 (17.5) kV AC

Bending radius:

- Bending radius: 10 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 60502

### Construction

Conductor:

- Round
- Copper wire
- Stranded acc. to IEC 60228 class 2.
- Longitudinal watertight

Conductor screen:

- Extruded semi-conductive polymer

Insulation:

- XLPE, halogen free
- Nom thickness 4.5 mm

Insulation screen:

- Extruded semi-conductive polymer

Screen:

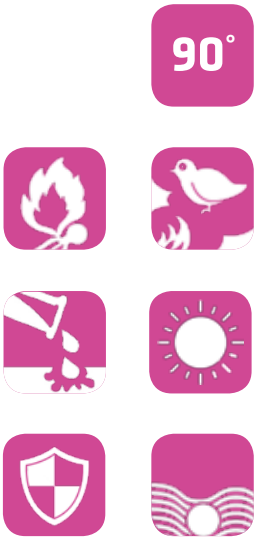
- Concentric screen of copper wires
- Helix of copper tape

Outer sheath:

- Halogen free polymer
- UV stabilised
- Red

### Material property

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




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

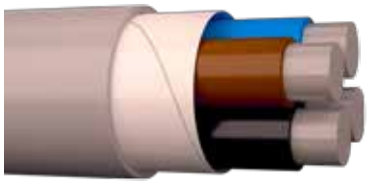
| Conductor cross-section mm² | Outer diameter mm | Weight kg/km | Standard length m | Bending radius at installation mm | Tensile strength kN |
|---|---|---|---|---|---|
| 1 x 150+25 | 33 | 2,200 | 500 - K14 | 495 | 7.5 |
| 1 x 240+35 | 37 | 3,250 | 500 - K16 | 55 | 12.0 |

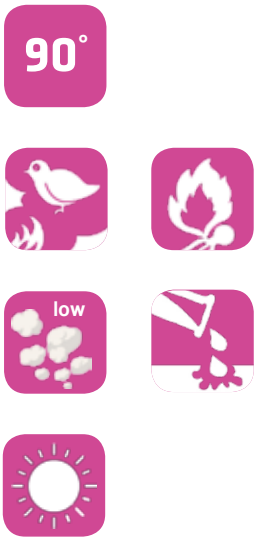
| Conductor cross-section mm² | DC resistance at 20°C Ω/km | Capacitans per phase µF/km | Reactans Triangle Ω/km | Short circuit current for conductor kA/1 sec. | Short circuit current for screen kA/1 sec. |
|---|---|---|---|---|---|
| 1 x 150+25 | 0.124 | 0.30 | 0.11 | 21.4 | 5.0 |
| 1 x 240+35 | 0.0754 | 0.36 | 0.11 | 34.3 | 7.0 |

RAILWAY NETWORK SYSTEM

# HIK AL-M 0.6/1 kV

## HALOGEN FREE & SOLID CONDUCTOR






### Application

Halogen free and flame retardant cable with low smoke and corrosive gas emission during fire. Suitable for application indoors and outdoors in pipes, trays or for direct burial. Can be ploughed down with caution.

### Technical data

- Rated voltage: 0.6/1 kV
- Test voltage: 4,000 V
- Bending radius: 15 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:

- Cenelec HD 604-5D, IEC 60502-1
- Cenelec N1ZC7Z1-U (R-S), N1ZA5Z1-U

Directive:

- Fulfills LVD, RoHS & REACH

Approval:

- CPR class: Eca
- DoP no.: 1002845 (≤25 mm²)
- DoP no.: 1004273 (≥50 mm² )

### Construction

Conductor:

- Round aluminium wire
- Annealed and solid
- Acc. to IEC 60228 class 1.
- From 16-25mm² : round
- From 150-240mm² : sector shaped

Insulation:

- XLPE

Core colouring:

- 4-core: brown, black, grey, blue
- 5-core: brown, black, grey, blue, yellow/green

Seperator:

- Plastic tape

Outer sheath:

- Halogen free compound
- UV resistent
- Grey

### Material property

- Flame retardant: IEC 60332-1
- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Smoke density: IEC 61034
- Current load: Acc. to SB 2001:6

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 | Max. current load A | Standard length m | Prysmian EAN no. |
|---|---|---|---|---|---|
| 4 x 16 | 20.0 | 506 | 77 | 1000 | 4741532901002 |
| 5 G 16 | 21.3 | 582 | 77 | 1000 | 4741532901026 |
| 4 x 25 | 24.0 | 740 | 97 | 1000 | 4741532901019 |
| 5 G 25 | 25.6 | 856 | 97 | 1000 | 4741532901033 |
| 4 x 50 | 25.4 | 775 | 146 | 1000 | 5701498014849 |
| 4 x 95 | 33.2 | 1,393 | 227 | 1000 | 5701498014887 |
| 4 x 150 | 40.1 | 2,104 | 304 | 1000 | 5701498014931 |
| 4 x 240 | 49.7 | 3,485 | 409 | 1000 | 5701498014986 |

RAILWAY NETWORK SYSTEM

# HIK AL-S 0,6/1 kV

## HALOGEN FREE & STRANDED CONDUCTOR

### Application

Halogen free and flame retardant cable with low smoke and corrosive gas emission during fire. Suitable for application indoors and outdoors in pipes, trays or directly in the ground. Can be ploughed down with caution.

### Technical data

- Rated voltage: 0,6/1 kV
- Test voltage: 4,000 V
- Bending radius: 15 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:

- Cenelec HD 604-5D, IEC 60502-1

Directive:

- Fulfills LVD, RoHS & REACH

Approval:

- CPR class: Eca
- DoP no. 1002844

### Construction

Conductor:

- Round aluminium wire
- Annealed and stranded
- Acc. to IEC 60228 class 2.
- Sector shaped

Insulation:

- XLPE

Core colouring:

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

Seperator:

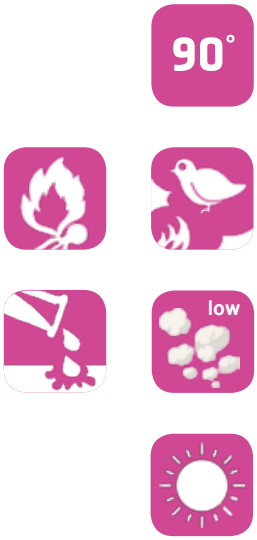
- Plastic tape

Outer sheath:

- Halogen free compound
- UV resistant
- Grey

### Material property

- Flame retardant: IEC 60332-1
- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Smoke density: IEC 61034
- Current load: Acc. to SB 2001:6




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 | Max. current load A | Standard length m | Prysmian EAN no. |
|---|---|---|---|---|---|
| 4 x 50 | 27.7 | 900 | 146 | 1000 | 5701498014719 |
| 4 x 70 | 31.0 | 1,180 | 187 | 1000 | 4741532901040 |
| 4 x 95 | 35.1 | 1,450 | 227 | 1000 | 5701498014726 |
| 4 x 120 | 42.0 | 1,945 | 263 | 1000 | 4741532901057 |
| 4 x 150 | 43.6 | 2,210 | 304 | 1000 | 5701498014733 |
| 4 x 185 | 48.0 | 2,925 | 347 | 1000 | 4741532901064 |
| 4 x 240 | 53.7 | 3,485 | 409 | 500 | 5701498014740 |
| 4 x 300 | 59.0 | 4,575 | 471 | 500 | 4741532900043 |

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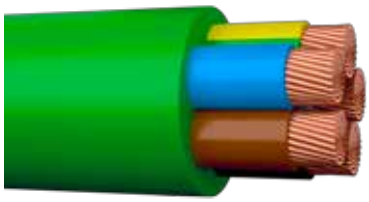
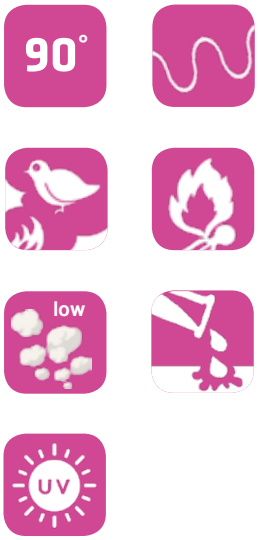
## RAILWAY NETWORK SYSTEM

# RZ1-K 0.6/1 kV

## FLEXIBLE & UV RESISTANT






### Application

Halogen free installation cable with high flexibility and low bending radius. Suitable for installation in machines and factories either in cable pipes, trays or cabinets. The cable is UV resistant and can be applied outdoors and indoors as well as directly in the ground.

### Technical data

Rated voltage:

- 0.6/1 kV

Test voltage:

- 3,500 kV

Bending radius:

- Fixed < 25 mm: 4 x D
- During installation > 25 mm: 5 x D
- Ploughed down > 50 mm: 6 x D

### Temperature range

- Max. conductor temperature: +90°C
- Short circuit temperature: +250°C
- Lowest temp. at installation: -40°C

### Standard & Directive & Approval

Standard:

- Cenelec UNE 21123-4
- IEC 60502-1

Directive:

- Fulfills LVD, RoHS & REACH

Approval:

- CPR class: Cca- s1bd1a1
- DoP no.: See table

### Construction

Conductor:

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

Insulation:

- XLPE
- UV resistant

Core colouring:

- 1-core: Green/yellow
- 3-core: Green/yellow, blue, brown
- 4-core: Green/yellow, brown, black, grey
- 4-core: Blue, brown, black, grey
- 5-core: G/Y, blue, brown, black, grey

Outer sheath:

- Halogen free compound
- Green

### Material property

- Flame retardant: IEC 60332-3-24 cat. 3
- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Smoke density: IEC 61034
- Current load: Acc. to SB 2001:6

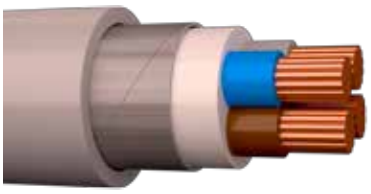
| Conductor cross-section mm² | Outer diameter mm | Weight kg/km | Standard length m | Max. current load in freeair at 30°C A | DoP no. | Prysmian EAN no. |
|---|---|---|---|---|---|---|
| 1 G 6 | 7.3 | 96 | 500 | 54 | 1000780 | 8430220087987 |
| 1 G 10 | 8.4 | 140 | 500 | 75 | 1000781 | 8430220087956 |
| 1 G 16 | 9.4 | 195 | 500 | 100 | 1000782 | 8430220087970 |
| 1 G 25 | 11.0 | 290 | 500 | 135 | 1000783 | 8430220087994 |
| 1 G 35 | 12.6 | 395 | 500 | 169 | 1000784 | 8430220087963 |
| 1 G 50 | 14.3 | 550 | 500 | 207 | 1000814 | 8430220088144 |
| 1 G 70 | 16.2 | 750 | 500 | 268 | 1000815 | 8430220088168 |
| 1 G 95 | 17.9 | 970 | 500 | 328 | 1000816 | 8430220088113 |
| 1 G 120 | 20.0 | 1,200 | 500 | 383 | 1000817 | 8430220088151 |
| 1 G 150 | 22.3 | 1,480 | 500 | 444 | 1000818 | 8430220088069 |
| 1 G 185 | 24.5 | 1,866 | 500 | 510 | 1000819 | 8430220088076 |
| 1 G 240 | 27.4 | 2,350 | 500 | 607 | 1000820 | 8430220088083 |
| 1 G 300 | 29.7 | 3,063 | 500 | 703 | 1000821 | 8430220088106 |
| 2 G 1.5 | 8.7 | 105 | 500 | 26 | 1000750 | 8430220087857 |
| 2 G 6 | 11.7 | 230 | 500 | 63 | 1000752 | 8430220087864 |
| 2 G 10 | 14.0 | 345 | 500 | 86 | 1000786 | 8430220087666 |
| 2 G 16 | 16.9 | 503 | 500 | 115 | 1000787 | 8430220087680 |
| 3 G 1.5 | 9.2 | 120 | 500 | 26 | 1000753 | 8430220087871 |
| 3 G 2.5 | 10.1 | 160 | 500 | 36 | 1000754 | 8430220087895 |
| 3 G 4 | 11.4 | 215 | 500 | 49 | 1000755 | 8430220087888 |
| 3 G 6 | 12.6 | 282 | 500 | 63 | 1000788 | 8430220087697 |
| 3 G 10 | 14.9 | 430 | 500 | 86 | 1000789 | 8430220087673 |
| 3 G 16 | 17.2 | 601 | 500 | 115 | 1000790 | 8430220087734 |
| 4 G 1.5 | 9.9 | 145 | 500 | 23 | 1000756 | 8430220087901 |
| 4 G 2.5 | 11.0 | 195 | 500 | 32 | 1000757 | 8430220087925 |
| 4 G 4 | 12.4 | 260 | 500 | 42 | 1000795 | 8430220087727 |
| 4 G 6 | 13.7 | 350 | 500 | 54 | 1000796 | 8430220087796 |
| 4 x 10 | 16.4 | 540 | 500 | 75 | 1000792 | 8430220087710 |
| 4 G 10 | 16.4 | 540 | 500 | 75 | 1000797 | 8430220087703 |
| 4 x 16 | 19.8 | 810 | 500 | 100 | 1000793 | 8430220087826 |
| 4 G 16 | 19.8 | 810 | 500 | 100 | 1000798 | 8430220087741 |
| 4 x 25 | 23.7 | 1,233 | 500 | 127 | 1000794 | 8430220087802 |
| 4 x 35 | 26.4 | 1,711 | 500 | 158 | 1000822 | 8430220088120 |
| 4 x 50 | 30.8 | 2,386 | 500 | 192 | 1000823 | 8430220088052 |
| 4 x 70 | 35.3 | 3,240 | 500 | 246 | 1000824 | 8430220088137 |
| 4 x 95 | 40.1 | 4,380 | 500 | 298 | 1000825 | 8430220088090 |
| 4 x 150 | 50.8 | 6,800 | 500 | 399 | 1000826 | 8430220088021 |
| 4 x 185 | 56.7 | 8,560 | 500 | 456 | 1000827 | 8430220088014 |
| 4 x 240 | 63.3 | 10,940 | 500 | 538 | 1000828 | 8430220088045 |
| 5 G 4 | 13.4 | 315 | 500 | 42 | 1000799 | 8430220087789 |
| 5 G 6 | 14.9 | 420 | 500 | 54 | 1000800 | 8430220087833 |
| 5 G 10 | 18.0 | 660 | 500 | 75 | 1000801 | 8430220087772 |
| 5 G 16 | 21.6 | 990 | 500 | 100 | 1000802 | 8430220087758 |
| 5 G 25 | 26.0 | 1,490 | 500 | 127 | 1000803 | 8430220087840 |
| 5 G 35 | 30.6 | 2,160 | 500 | 158 | 1000760 | 8430220088038 |
| 5 G 50 | 34.3 | 2,763 | 500 | 192 | 1000761 | 8430220088007 |

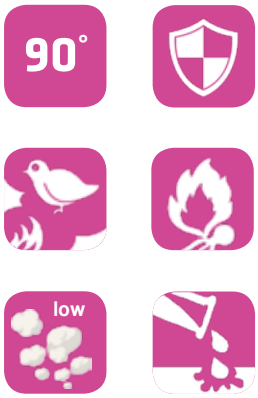
Prysmian Group

RAILWAY NETWORK SYSTEM

# HIKA 300/500 V

## ARMOURED






### Application

Halogen free light installation cable applicable for areas that require extra mechanical protection. Fulfills requirements for rodent protection. Suitable for indoor and outdoor installation in pipes, trays, directly in the ground or in non-vibrated cement. Insulation must be protected from UV-light.

### Technical data

Rated voltage:

- 300/300 AC

Test voltage:

- 2,000 V

Bending radius:

- 10 x D

### Temperature range

- Max. conductor temperature: +70°C
- Short circuit temperature: +250°C
- Max. installation temperature: -20°C
- Min. operating temperature: -40°C

### Standard & Directive & Approval

Standard:

- Partially adaped to DS 2393-3

Directive:

- Fulfills LVD, RoHS & REACH

Approval:

- CPR class: Eca
- DoP no. - see table

### Construction

Conductor:

- Round copper wires
- Solid or stranded
- Acc. to IEC 60228 class 1 and 2.

Insulation:

- XLPE

Core colouring:

- 4-core: blue, brown, black, grey
- 7-core: blue, brown, black, grey, white red, black

Filling:

- Halogen free compound

Armouring:

- Galvanized steel band
- Coverage 100%

Outer sheath:

- Halogen free compound
- Grey

### Material property

- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Flame retardant: IEC 60332-1
- Smoke density: IEC 61034
- Current load acc. to SB2006:6

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

| Conductor cross-section $mm^2$ | Outer diameter mm | Weight kg/km | Standard length m | DoP no. | Prysmian EAN no. |
|---|---|---|---|---|---|
| 4 x 4 | 12.8 | 307 | 500 | 1003090 | 8711401010025 |
| 4 x 10 | 18.2 | 700 | 500 | 1003932 | 8711401009890 |
| 4 x 16 | 21.0 | 1,000 | 500 | 1003089 | 8711401009968 |
| 7 x 1.5 | 11.8 | 236 | 500 | 1003095 | 8711401010629 |
| 7 x 2.5 | 13.0 | 312 | 500 | 1003096 | 8711401010643 |
| 7 x 2.5 | 13.0 | 312 | 2,000 | 1003096 | 8711401010728 |
| 7 x 4 | 14.9 | 435 | 500 | 1003097 | 8711401010933 |

RAILWAY NETWORK SYSTEM

# HIKAJ 300/500 V

## ARMOURED WITH GROUNDING WIRE

### Application

Halogen free light installation cable applicable for areas that require extra mechanical protection. Fulfills requirements for rodent protection. Suitable for indoor and outdoor installation in pipes, trays, directly in the ground or in non-vibrated cement. Insulation must be protected from UV-light.

### Technical data

Rated voltage:

- 300/300 AC

Test voltage:

- 2,000 V

Bending radius:

- 10 x D

### Temperature range

- Max. conductor temperature: +70°C
- Short circuit temperature: +250°C
- Max. installation temperature: -20°C
- Min. operating temperature: -40°C

### Standard & Directive & Approval

- Standard: Partially adaped to DS 2393-3
- Directive: Fulfills LVD, RoHS & REACH
- Approval: CPR class: Eca
- DoP no. - see table

### Construction

Conductor:

- Round copper wires
- 1.5 - 6 $mm^2$: Solid
- > 10 $mm^2$: Stranded

Insulation:

- XLPE

Core coloring:

- 3-corer: green/yellow, blue, brown
- 4-core: green/yellow, blue, brown, black
- 5-core: g/y, blue, brown, black, grey
- 7-core: green/yellow, blue, brown, black, grey, white, red

Filling:

- Halogen free compound

Armouring:

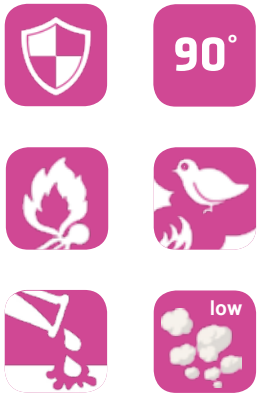
- Galvanized steel band
- Coverage 100%

Outer sheath:

- Halogen free compound, grey

### Material property

- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Flame retardant: IEC 60332-1
- Smoke density: IEC 61034
- Current load acc. to SB2006:6




| Conductor cross-section $mm^2$ | Conductor type | Outer diameter mm | Weight kg/km | Standard length m | DoP no. | Prysmian EAN no. |
|---|---|---|---|---|---|---|
| 3 G 1.5 | Class 1 | 9.6 | 143 | 100 | 1003081 | 8711401008947 |
| 3 G 1.5 | Class 1 | 9.6 | 143 | 500 | 1003081 | 8711401009173 |
| 3 G 2.5 | Class 1 | 10.4 | 179 | 500 | 1003085 | 8711401009425 |
| 4 G 1.5 | Class 1 | 10.3 | 167 | 100 | 1003082 | 8711401009265 |
| 4 G 1.5 | Class 1 | 10.3 | 167 | 500 | 1003082 | 8711401052208 |
| 5 G 1.5 | Class 1 | 11.1 | 196 | 100 | 1003083 | 8711401008923 |
| 5 G 1.5 | Class 1 | 11.1 | 196 | 500 | 1003083 | 8711401009296 |
| 5 G 2.5 | Class 1 | 12.1 | 253 | 100 | 1003086 | 8711401009739 |
| 5 G 2.5 | Class 1 | 12.1 | 253 | 500 | 1003086 | 8711401009777 |
| 5 G 6 | Class 1 | 15.2 | 460 | 500 | 1003087 | 8711401009821 |
| 5 G 10 | Class 2 | 20.0 | 842 | 500 | 1003088 | 8711401009852 |
| 5 G 16 | Class 2 | 23.2 | 1,214 | 500 | 1003931 | 8711401009876 |
| 7 G 1.5 | Class 1 | 11.8 | 236 | 100 | 1003084 | 8711401009371 |
| 7 G 1.5 | Class 1 | 11.8 | 236 | 500 | 1003084 | 8711401052292 |

Prysmian Group

## GROUNDING

# HK

## STRANDED ANNEALED COPPER CONDUCTOR

**Application**
Annealed copper wire for grounding of metal parts from transformer station to different systems of railway networks.

**Technical data**
Bending radius:
- During installation: 15 x D
- Fixed: 10 x D

Pulling force:
- Using eye or grip: max. 50 N/mm²

**Standard & Directive**
Standard:
- IEC 60228

Directive:
- Fultills 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 mm² | Outer diameter mm | Weight kg/km | Standard length m | Prysmian EAN no. |
|---|---|---|---|---|
| 1 x 16 | 5.1 | 145 | 500 - K6 | 6410001053167 |
| 1 x 16 | 5.1 | 145 | 25 | 6410001052054 |
| 1 x 16 | 5.1 | 145 | 50 | 6410001052061 |
| 1 x 16 | 5.1 | 145 | 100 | 6410001052078 |
| 1 x 25 | 6.5 | 225 | 500 - K6 | 6410001053273 |
| 1 x 25 | 6.5 | 225 | 100 | 6410001053259 |
| 1 x 25 | 6.5 | 225 | 50 | 6410001053242 |
| 1 x 25 | 6.5 | 225 | 25 | 6410001053235 |
| 1 x 35 | 7.6 | 315 | 1000 - K7 | 6410001053358 |
| 1 x 50 | 9 | 430 | 1000 - K7 | 6410001053501 |
| 1 x 70 | 11 | 610 | 1000 - K9 | 6410001053709 |
| 1 x 95 | 13 | 850 | 1000 - K11 | 6410001053952 |
| 1 x 120 | 15 | 1,100 | 500 - K11 | 6410001053976 |
| 1 x 150 | 16 | 1,312 | 500 - K11 | 6410001050142 |

GROUNDING

# HIL AL-R 0.6/1 kV

## INSULATED ALUMINIUM WIRE

**Application**

Halogen free and flame retardant cable with low emission of smoke and corrosive gasses during fire. Suitable for installation in buidlings or as grounding cable indoor and outdoors in cable trays or directly in the ground.

**Technical data**

Rated voltage:
- 0.6/1 kV

Test voltage:
- 4,000 V

Bending radius:
- 15 x D

Tensile strength:
- Max. 30N/mm²

**Temperature range**
- Max. conductor temperature: +90°C
- Short circuit temperature: +250°C
- Lowest temp. at installation: -5°C

**Standard & Directive & Approval**

Standard:
- Dimentioned acc. to EC 60502-1 and Bane Danmark's specifications.

Directive:
- Fulfills LVD, RoHS and REACH

Approval:
- CPR class: Eca
- DoP no. : 1002847

**Construction**

Conductor:
- Round aluminium wires
- Stranded
- Acc. to IEC 60228 class 2.

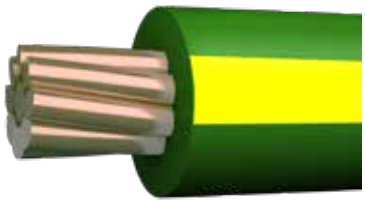
Conductor marking:
- Banedanmark

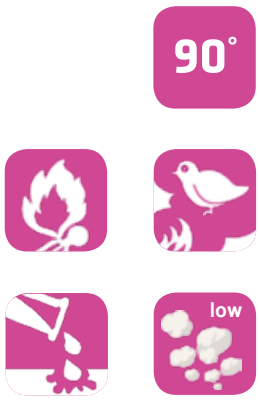
Insulation:
- Termoplastic compound
- 1 layer

Core colouring:
- 50-core: Green/yellow
- 70-core: Black

Marking:
- Prysmian HIL-AL-R 1 kV 1x50 mm²
- BANEDANMARK PROPERTY, date

**Material property**
- Flame retardant: IEC 60332-1
- Halogen free: IEC 60754-1
- Smoke density: IEC 61034
- Acidity: IEC 60754-2






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

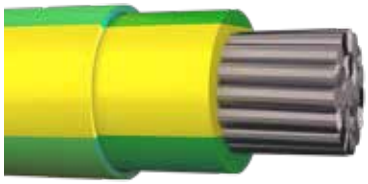
| Conductor corss-section mm² | Number and diameter of wires | Sheath thickness mm | Outer diameter | | Weight kg/km | Standard length m | BaneDanmark order no. |
|---|---|---|---|---|---|---|---|
| | | | Nom. mm | Max. mm | | | |
| 1 G 50 | 19 x 1.78 | 1.4 | 11.8 | 12.8 | 137 | 500 | 183360050 |
| 1 G 70 | 19 x 2.14 | 1.4 | 13.5 | 14.5 | 231 | 500 | 183360070 |

Prysmian Group

## GROUNDING

# HIK AL-R 0.6/1 kV

## ALUMINIUM CABLE



90°

low

### Application

Halogen free and flame retardant cable with low emission of smoke and corrosive gasses during fire. Suitable for installation in buildings or as grounding cable indoor and outdoors in cable trays and ducts or directly in the ground.

### Technical data

Rated voltage:
- 0.6/1 kV

Test voltage:
- 4,000 kV

Bending radius:
- 15 x D

Tensile strength:
- Max. 30 kN/mm²

### Temperature range

- Max. conductor temperature: +90°C
- Short circuit temperature: +250°C
- Lowest temp. at installation: -5°C

### Standard & Directive & Approval

Standard:
- Dimentioned acc. to DS 2393 and Bane Danmark's specifications.

Directive:
- Fulfills LVD, RoHS & REACH

Approval:
- CPR class: Eca
- DoP no.: 1002843

### Construction

Conductor:
- Round aluminium wires
- Stranded
- Acc. to IEC 60228 class 2.

Conductor marking:
- Banedanmark

Insulation:
- XLPE

Core colour:
- 120-core: Green/yellow
- 150-core: Black
- 240-core: Black

Outer sheath:
- Termoplastic compound
- 120-core: Green/yellow
- 150-core: Black
- 240-core: Black

Marking:
- Prysmian HIK-AL-R 1 kV 1x50 mm²
- BANEDANMARK PROPERTY

### Material property

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

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

| Conductor cross-section mm² | Number and diameter of wires | Outer cable diameter mm | | Weight kg/km | Standard length m | BaneDanmark order no. |
|---|---|---|---|---|---|---|
| | | Nom.mm | Max.mm | | | |
| 1 G 120 | 19 x 2.90 | 18.5 | 20.0 | 605 | 500 | 183360120 |
| 1 G 150 | 37 x 2.34 | 20.5 | 22.1 | 711 | 500 | 183360150 |
| 1 G 240 | 37 x 3.01 | 25.6 | 27.5 | 912 | 500 | 183360240 |

GROUNDING

# H07Z-K 450/750 kV

## FLEXIBLE COPPER WIRE

**Application**
Halogen free, flame retardant and flexible panel wire, designed for the internal wiring of switchboards, distributor boards, machinery and lighting fixtures. Suitable for installation in ducts or pipes.

**Technical data**
- Rated voltage: 450/750 V
- Test voltage: 2,500 V
- Bending radius: ≤ 8mm: 4 x D,
- 8 ≤ 12mm: 5 x D, > 12 ≤ 20mm: 6 x D
- > 20 mm: 6 x D

**Temperature range**
- Max. conductor temperature: +90°C
- Short circuit temperature: +250°C
- Lowest temp. at installation: -40°C

**Standard**
- UNE 21027-9, HD 22.9 S2 1
- Bureau Veritas acc. to IEC 60092
  Certificate no.: 11376/C0 BV
- >50 mm² not approved by Bureau Veritas

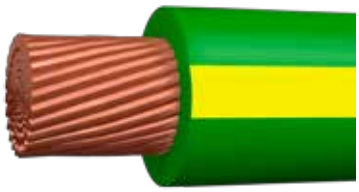
**Construction**
Conductor:
- Round copper wires
- Annealed
- Multi-stranded
- Acc. to IEC 60228 class 5.

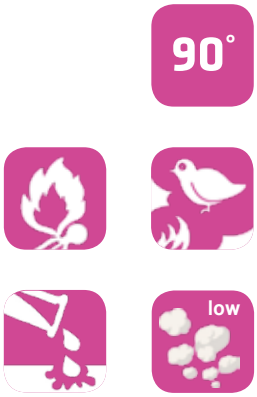
Insulation:
- Halogen free compound
- Type IE5

Core colour:
- Green/yellow

**Material property**
- Flame retardant: IEC 60332-1 & 3
- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Smoke density: IEC 61034-2
- Current load: Acc. to SB 2001:6

**Directives**
- Fulfills LVD, RoHS & REACH






| Conductor cross-section mm² | Outer diameter mm | Weight kg/km | Standard length m | Prysmian EAN no. |
|---|---|---|---|---|
| 1 G 1.5 | 3.0 | 20 | 100 | 8430220452839 |
| 1 G 2.5 | 3.6 | 31 | 100 | 8430220452846 |
| 1 G 4 | 4.1 | 64 | 100 | 8430220452853 |
| 1 G 6 | 4.6 | 64 | 100 | 8430220452860 |
| 1 G 10 | 6.1 | 108 | 100 | 8430220452877 |
| 1 G 16 | 7.2 | 160 | 100 | 8430220452884 |
| 1 G 25 | 8.8 | 243 | 50 | 8430220452891 |
| 1 G 25 | 8.8 | 243 | 500 | 8430220452907 |
| 1 G 35 | 10.3 | 323 | 50 | 8430220452914 |
| 1 G 35 | 10.3 | 323 | 500 | 8430220452921 |
| 1 G 50 | 12.0 | 495 | 500 | 8430220452938 |
| 1 G 70 | 13.6 | 680 | 500 | 8430220452945 |
| 1 G 95 | 15.7 | 885 | 500 | 8430220452952 |
| 1 G 120 | 17.8 | 1,110 | 500 | 8430220452969 |
| 1 G 150 | 20,0 | 1,435 | 500 | 8430220452976 |
| 1 G 185 | 22.1 | 1,690 | 500 | 8430220452983 |
| 1 G 240 | 24.0 | 2,235 | 500 | 8430220452990 |

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 FMCS-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) $mm^2$
- 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 no. | 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 | 120/150 |
| 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 mm²
- 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

- Elascon is available in versoin 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 mm² (for guidance only) | | Kit reference 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 | 330. | 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 |
| 24 | 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 |

Prysmian Group

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 mm²
- 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 mm² | Kit reference name | Max. OD sheath mm | Max. conductor size mm² | 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 | | | |

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 horizonal 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 mm²
- 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 permettivity tape
- PVC tape
- Sealing mastic tape
- Embassed 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 | Model type | 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 |

Prysmian Group

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 mm² (240 kcmil) up to 1000 mm² (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.)



| Product references | Rated voltage max. kV | Model type | Cross-section range mm² | Cable 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 | 300-1,000 | 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 mm²

### 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 platic 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 max. kV | Model type | Cross-section mm² | Insulation thickness mm | Outer diamter max. 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 |


DaneDanmark
5 210-2

## 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.

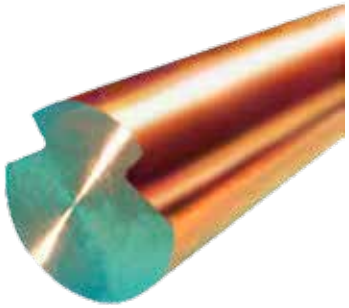
**Standard**

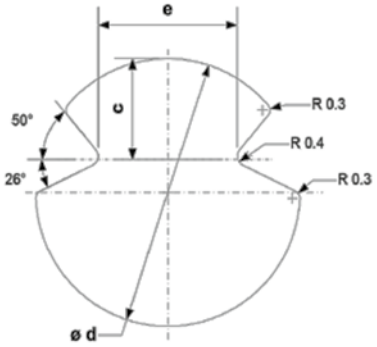
> EN 50149 type A

**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 mm² | Conductor diameter mm | Weight kg/km | Standard length m | Prysmian order no. |
|---|---|---|---|---|
| 80 | 10.6 | 710 | | 0104008 |
| 100 | 12.0 | 890 | | 0104010 |
| 120 | 13.2 | 1,067 | | |

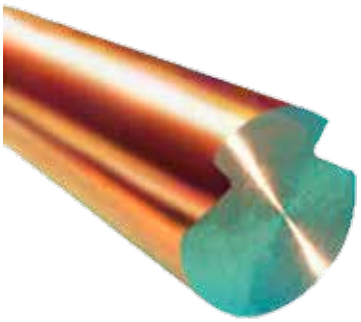
| Conductor cross-section mm² | Rated tensile strength (RTS) kN | Coefficient of liniar expansion /°C | Final modulus of elasticity GPa | Thermal oxide resistance kA |
|---|---|---|---|---|
| 80 | 28.4 | $17 \times 10^{-6}$ | 120 | 12 |
| 100 | 35.5 | $17 \times 10^{-6}$ | 120 | 15 |
| 120 | 42.0 | $17 \times 10^{-6}$ | 120 | |

Prysmian Group

## 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.

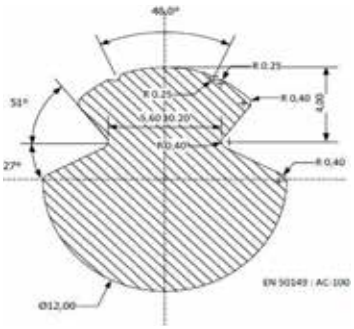
**Standard**

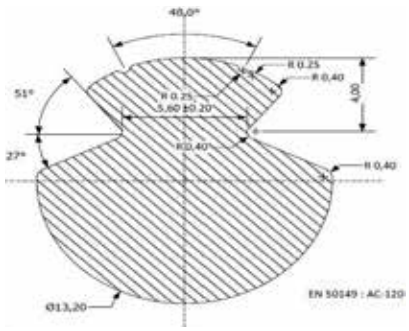
- EN 50149

**Construction**

Conductor:

- Copper-silver alloyed
- Single strand
- 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 mm² | Outer diameter mm | Weight kg/km | Standard length m | Prysmian EAN no. |
|---|---|---|---|---|
| 80 | 10.6 | 711 | | |
| 100 | 12.0 | 980 | | |
| 120 | 13.2 | 1067 | | |

| Conductor cross-section mm² | Rated tensile strength (RTS) kN | Coefficient of liniar expansion /°C | Final modulus of elasticity GPa | DC resistance at 20°C Ω/km |
|---|---|---|---|---|
| 80 | 29.2 | $17 \times 10^{-6}$ | 120 | 0.229 |
| 100 | 36.0 | $17 \times 10^{-6}$ | 120 | 0.183 |
| 120 | 42.0 | $17 \times 10^{-6}$ | 120 | 0.153 |

CATENARY WIRE & DROPPER

# KK Bz-II 10 mm² or 50 mm²

## 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 mm² suitable as dropper wire and KK Bz-II 50 mm² suitable as catenary wire in railway appllications.

**Technical data**

Tensile strength:

- Min. 618 N/mm²

Resistivity:

- Max 27.78 nΩm

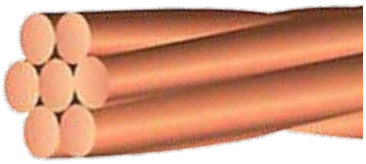
**Standard**

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

**Construction**

Conductor:

- Round copper wires
- Bronze alloyed
- Hard drawn
- Diameter nom: 1.35 mm or 3.0 mm
- Stranded
- Outer layer "Z" stranded



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 | Prysmian EAN no. |
|---|---|---|---|---|
| 10 (7 x 1.35) | 4.1 | 90 | | |
| 50 (7 x 3.0) | 9.0 | 446 | | |

| Conductor cross-section mm² | Rated tensile strength (RTS) kN | Coefficient of liniar expansion /°C | Final modulus of elasticity GPa | DC resistance at 20°C Ω/km |
|---|---|---|---|---|
| 10 (7 x 1.35) | 5.88 | $17 \times 10^{-6}$ | 113 | 2.8 |
| 50 (7 x 3.0) | 28.58 | $17 \times 10^{-6}$ | 113 | 0.569 |

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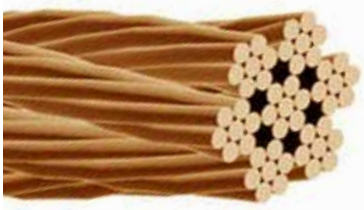
## DROPPER

# KKM Bz-II 10 mm²

## MULTI-STRANDED COPPER ALLOYED CONDUCTOR



### Application

Stranded bronze alloyed 0.5 mm copper wire concentrically bundled acc. to DIN 48201 part 2. Suitable as dropper wire in railway applications.

### Technical data

Tensile strength:

- Wires before stranding: Min. 618 N/mm²
- Stranded conductor: Min. 589 N/mm²

Resistivity:

- Wires before stranding: Max 27.78 nΩm

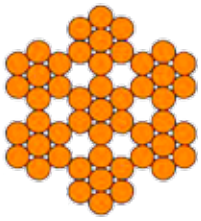
### Standard

- DIN 48200 part 2.
- DIN 43138

### Construction

Conductor:

- Round
- Bronze alloyed copper wires
- Hard drawn
- Diameter nom: 0.5 mm ± 0.03
- Bunched sub-conductor: 7 x 0.5 mm
- Sub-conductor left handed "S" stranded
- Outer layer right handed "Z" stranded



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

| Conductor cross-section mm² | Outer diameter mm | Sub-conductor diameter mm | Weight kg/km | Prysmian EAN no. |
|---|---|---|---|---|
| 10 (7 x 7 x 0.5) | 4.5 | 7 x 0.05 | 89 | |

| Conductor cross-section mm² | Rated tensile strength (RTS) kN | DC resistance at 20°C Ω/km | Direction of outer layer | Standard length m |
|---|---|---|---|---|
| 10 (7 x 7 x 0.5) | 589 | 2.98 | Right handed | |

RETURN WIRE

# ACSR 328-AL1/46-ST1A DOVE

## STEEL REINFORCED AL CONDUCTOR

**Application**

Cable for energy transmission designed with concentric layers, consisting on the outside of 26 aluminium wires and inside of 7 galvanized and fat enclosed steel wires. Suitable for fixed installation as return wire for outdoor railway applications.

**Technical data**

Short circuit current:

- Max. 31.2 kA

Initial modulus of electricity of conductor:

- 62 GPa/mm²

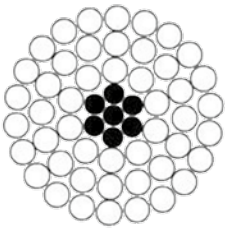
**Standard**

- EN 50182:2001

**Construction**

Conductor:

- Round
- Outside 26 aluminium wires 3.72 mm
- Inside 7 steel wires 2.89 mm
- Steel core diameter 29.8 mm
- Stranded
- Outer layer right handed "Z" stranded



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 | Prysmian EAN no. |
|---|---|---|---|---|
| 1 x 328 (33 wires) | 23.6 | 1,139.6 | 2500 - K22 | |

| Conductor cross-section mm² | Rated tensile strength (RTS) kN | Coefficient of liniar expansion /°C | Final modulus of elasticity GPa | DC resistance at 20°C Ω/km |
|---|---|---|---|---|
| 1 x 328 (33 wires) | 97.56 | 19.2 x $10^{-6}$ | 77 | 0.1022 |

Prysmian Group

## RETURN WIRE

# ACSR 328-AL1/46-ST1A DOVE

## INSULATED STEEL REINFORCED AL CONDUCTOR



**Application**

PEX insulation cable for energy transmission. Designed with concentric layers consisting on the outside of 26 aluminium wires and inside of 7 galvanized and fat enclosed steel wires. Suitable for fixed installation as return wire for outdoor railway applications.

**Technical data**

Rated voltage:

- 0.6/1 kV

Bending radius:

- During installation 0.48 m

**Standard**

- EN 50182:2001, IEC 60502-1

**Temperature range**

- Max. operating temperature: +90°C
- Short circuit temperature: +200°C
- Min. temperature at installation: -15°C

**Construction**

Conductor:

- Round
- Stranded wires
- Outer layers 26 aluminium wires 3.72 mm
- Core 7 steel wires 2.89 mm
- Steel core diameter 29.8 mm
- Outer layer right handed "Z" stranded

Insulation:

- PEX compound
- Black

Sheath:

- Halogen free compound
- Black
- UV resistant

**Material property**

- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2

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 | Prysmian EAN no. |
|---|---|---|---|---|
| 1 x 328 (33 wires) | 23.0 | 1,595 | 1000 - K20 | |

| Conductor cross-section mm² | Rated tensile strength (RTS) kN | Coefficient of liniar expansion /°C | Final modulus of elasticity GPa | DC resistance at 20°C Ω/km |
|---|---|---|---|---|
| 1 x 328 (33 wires) | 97.56 | $19.2 \times 10^{-6}$ | 77 | 0.1022 |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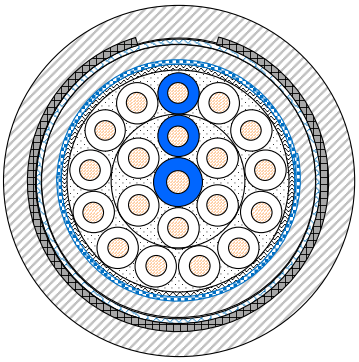
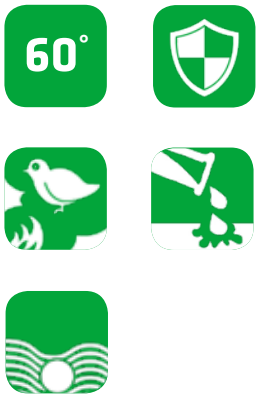
SIGNALLING

# A-2YOF(L)2YB2Y

## HALOGEN FREE, WATERTIGHT & ARMOURED






**Application**

For railway signalling applications, such as wiring of light signals, point machines, balises, axle counters and similar wayside equipment, up to 420 V AC or 600 V DC. The cable is longitudinally watertight with stranded copper conductor and steel tape armouring.

**Technical data**

Design:
- n x 1 x diameter mm

Bending radius:
- Flexible: ≥ 20 x D
- Fixed: ≥ 15 x D

**Temperature range**
- During installation: - 10°C to + 60°C
- In operations: - 40°C to + 60°C

**Standard**
- PH 416.0113 V2.1

**Material property**
- Halogen free: IEC 60754-1 & 2

**Construction**

Conductor:
- Solid copper
- Soft annealed
- Diameter 0.9 or 1.4 or 1.8 mm

Insulation:
- PE (2Y)
- Naturally coloured
- Blue marking/tracer core in each layer

Twisting:
- Cores twised in concentric layers

Filling:
- Longitudinal watertight
- Low capacitance filling compound
- Drip point > 80 °C

Moisture barrier wrapping:
- Swellable material
- Longitudinally applied with overlap

Inner sheath:
- Laminated with AL tape 0.15 mm
- One side copolymer coated
- Bonded with PE sheath
- Black

Armouring:
- 1 or 2 layers of galvanized steel tape
- 0.2 or 0.3 mm
- Helically applied

Outer sheath:
- PE (2Y)
- Black

| Characteristics | Unit | 0.9 mm | 1.4 mm | 1.8 mm |
|---|---|---|---|---|
| Conductor resistance | Ω/km | ≤ 28.9 | ≤ 11.9 | ≤ 7.2 |
| Insulation resistance | GΩxkm | ≥ 1.5 | ≥ 1.5 | ≥ 1.5 |
| Mutual capacitance at 800 Hz | nF/km | ≤ 115 [1] | ≤ 145 [2] | ≤ 145 [2] |
| Operating voltage DC/AC | V | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 |
| Test voltage at 50 Hz - 1 min | | | | |
| core/core | $V_{rms}$ | 2500 | 2500 | 2500 |
| core/screen | $V_{rms}$ | 2500 | 2500 | 2500 |

[1] ≤ 120 nF/km for single core in center
[2] ≤ 155 nF/km for single core in center

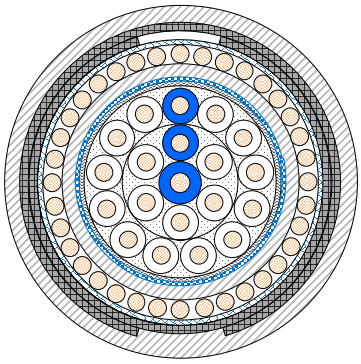
| No. of cores | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m |
|---|---|---|---|---|---|---|---|---|---|
| | | n x 1 x 0.9 mm | | | n x 1 x 1.4 mm | | | n x 1 x 1.8 mm | |
| 2 | 13.0 | 160 | 1000 | - | - | - | - | - | - |
| 4 | 13.0 | 170 | 1000 | 14.0 | 240 | 1000 | 16.0 | 300 | 1000 |
| 7 | 14.0 | 220 | 1000 | 17.0 | 320 | 1000 | 19.0 | 430 | 1000 |
| 10 | 17.0 | 290 | 1000 | 18.0 | 410 | 1000 | 21.0 | 560 | 1000 |
| 14 | 17.0 | 300 | 1000 | 19.0 | 490 | 1000 | 22.0 | 680 | 1000 |
| 20 | 18.0 | 380 | 1000 | 22.0 | 630 | 1000 | 25.0 | 890 | 1000 |
| 24 | 20.0 | 460 | 1000 | 23.0 | 730 | 1000 | 27.0 | 1060 | 1000 |
| 30 | 20.0 | 490 | 1000 | 24.0 | 840 | 1000 | 29.0 | 1230 | 1000 |
| 40 | 21.0 | 590 | 1000 | 27.0 | 1050 | 1000 | 32.0 | 1560 | 1000 |
| 50 | 23.0 | 700 | 1000 | 29.0 | 1280 | 1000 | 36.0 | 1940 | 1000 |
| 60 | 25.0 | 800 | 1000 | 32.0 | 1490 | 1000 | 38.0 | 2280 | 1000 |
| 80 | 26.0 | 1000 | 1000 | 35.0 | 1920 | 1000 | 42.0 | 2920 | 1000 |
| 100 | 27.5 | 1250 | 1000 | 39.0 | 2350 | 1000 | 47.0 | 3630 | 500 |
| 120 | 32.0 | 1390 | 1000 | 41.0 | 2730 | 1000 | 49.0 | 4230 | 500 |
| 140 | 35.0 | 1650 | 1000 | 44.0 | 3140 | 1000 | 53.0 | 4890 | 500 |
| 160 | 36.0 | 1790 | 1000 | 46.0 | 3540 | 500 | 55.0 | 5490 | 500 |
| 180 | 39.0 | 2030 | 1000 | 49.0 | 3970 | 500 | 59.0 | 6160 | 500 |
| 200 | 39.0 | 2150 | 1000 | 50.0 | 4310 | 500 | 60.0 | 6710 | 500 |

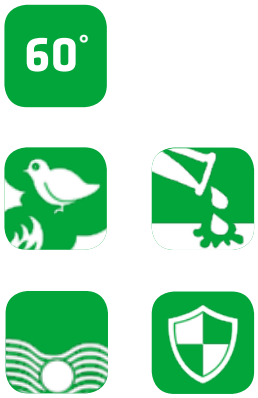
Prysmian Group

## SIGNALLING

# AJ-2YOF(L)2YDB2Y

## HALOGEN FREE & WATERTIGHT






### Application

For railway signalling applications, such as wiring of light signals, point machines, balises and axle counters and similar wayside equipment, up to 420 V AC or 600 V DC. Protected against inductive interferences, for example on AC electrifed railroads. The cable is longitudinally watertight with stranded copper conductor and steel tape armouring.

### Technical data

Design:
- n x 1 x diameter mm

Bending radius:
- Flexible: ≥ 20 x D
- Fixed: ≥ 15 x D

### Temperature range

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

### Material property

- Halogen free: IEC 60754-1 & 2

### Construction

Conductor:
- Solid copper
- Soft annealed
- Diameter 0.9 or 1.4 or 1.8 mm

Insulation:
- PE (2Y)
- Naturally coloured
- Blue marking/tracer core in each layer

Twisting:
- Cores twisted in concentric layers

Filling:
- Longitudinal watertight
- Low capacitance filling compound
- Drip point > 80 °C

Moisture barrier wrapping:
- Water swellable material
- Longitudinally watertight
- Applied with overlap

Sheath:
- Laminated with AL tape 0.15 mm
- One side copolymer coated
- Bonded with PE sheath
- Black

Screen (inductive protection):
- Concentric screen of copper wires
- 0.9, 1.2, 1.4 or 1.8 mm
- 2 layers of galvanized steel tape
- 0.5 or 0.8 mm

Outer sheath:
- PE
- Black

| Characteristics | Unit | 0.9 mm | 1.4 mm | 1.8 mm |
|---|---|---|---|---|
| Conductor resistance | Ω/km | ≤ 28.9 | ≤ 11.9 | ≤ 7.2 |
| Insulation resistance | GΩxkm | ≥ 1.5 | ≥ 1.5 | ≥ 1.5 |
| Mutual capacitance at 800 Hz | nF/km | ≤ 115 [1] | ≤ 145 [2] | ≤ 145 [2] |
| Operating voltage DC/AC | V | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 |
| Test voltage at 50 Hz - 1 min | | | | |
| core/core | $V_{rms}$ | 2500 | 2500 | 2500 |
| core/screen | $V_{rms}$ | 2500 | 2500 | 2500 |

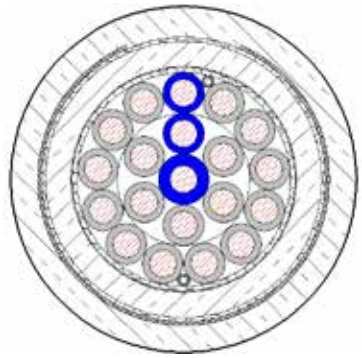
[1] ≤ 120 nF/km for single core in center
[2] ≤ 155 nF/km for single core in center

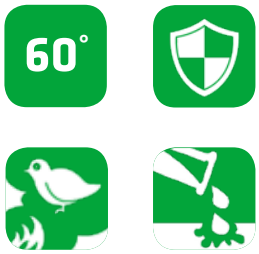
| No. of cores | Reduction factor class $r_k$ | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m |
|---|---|---|---|---|---|---|---|---|---|---|
| | | n x 1 x 0.9 mm | | | n x 1 x 1.4 mm | | | n x 1 x 1.8 mm | | |
| 10 | 600 | 21.0 | 650 | 1000 | 22.0 | 790 | 1000 | 25.0 | 1010 | 1000 |
| 20 | 600 | 22.0 | 750 | 1000 | 26.0 | 1090 | 1000 | 29.0 | 1420 | 1000 |
| 30 | 600 | 24.0 | 900 | 1000 | 28.0 | 1350 | 1000 | 33.0 | 1840 | 1000 |
| 50 | 600 | 27.0 | 1190 | 1000 | 33.0 | 1890 | 1000 | 39.0 | 2670 | 1000 |
| 80 | 600 | 30.0 | 1560 | 1000 | 32.0 | 2630 | 1000 | 42.0 | 3770 | 500 |
| 120 | 600 | 35.0 | 2040 | 1000 | 44.0 | 3560 | 1000 | 52.0 | 5210 | 500 |
| 160 | 600 | 39.0 | 2500 | 1000 | 49.0 | 4460 | 500 | 58.0 | 6600 | 500 |
| 200 | 600 | 41.0 | 2930 | 1000 | 53.0 | 5290 | 500 | 63.0 | 7900 | 250 |
| 10 | 500 | 21.0 | 750 | 1000 | 22.0 | 920 | 1000 | 25.0 | 1150 | 1000 |
| 20 | 500 | 22.0 | 870 | 1000 | 26.0 | 1230 | 1000 | 29.0 | 1570 | 1000 |
| 30 | 500 | 24.0 | 1040 | 1000 | 28.0 | 1490 | 1000 | 33.0 | 2010 | 1000 |
| 50 | 500 | 27.0 | 1320 | 1000 | 33.0 | 2080 | 1000 | 32.0 | 2870 | 1000 |
| 80 | 500 | 30.0 | 1740 | 1000 | 38.0 | 2850 | 1000 | 46.0 | 4090 | 500 |
| 120 | 500 | 35.0 | 2230 | 1000 | 45.0 | 3380 | 500 | 53.0 | 5560 | 500 |
| 160 | 500 | 39.0 | 2720 | 1000 | 50.0 | 4790 | 500 | 59.0 | 6980 | 250 |
| 200 | 500 | 41.0 | 3160 | 1000 | 54.0 | 5650 | 500 | 64.0 | 8320 | 250 |
| 30 | 400 | - | - | - | - | - | - | 36.0 | 2690 | 1000 |
| 50 | 400 | - | - | - | 36.0 | 2770 | 1000 | 43.0 | 3800 | 500 |
| 80 | 400 | - | - | - | 42.0 | 3770 | 500 | 49.0 | 5100 | 500 |
| 120 | 400 | - | - | - | 48.0 | 4870 | 500 | 56.0 | 6730 | 500 |
| 160 | 400 | - | - | - | 53.0 | 5880 | 500 | 62.0 | 8290 | 250 |
| 200 | 400 | - | - | - | 57.0 | 6830 | 500 | 67.0 | 9730 | 250 |

SIGNALLING

# A-2Y2YB2Y

## HALOGEN FREE & ARMOURED






**Application**

PE insulated and halogen free signalling cable, with cores in concentric layers and armouring. Suitable for railway application directly in the ground or in ducts.

**Technical data**

Design:

- n x 1 x diameter mm

Bending radius:

- ≥ 10 x D

**Temperature range**

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

**Standard**

- PH 416.0115 V1.1

**Material property**

- Halogen free: IEC 60754-1 & 2

**Construction**

Conductor:

- Solid copper
- Soft annealed
- Diameter 0.9 or 1.4 or 1.8 mm

Insulation:

- PE
- Natural coloured
- Blue marking/tracer core in each layer

Twisting:

- Cores twisted in concentric layers
- 2 perforated pilot cores if ≥ 14 cores
- 0.5 mm

Wrapping:

- Non-hygroscopic foil

Inner sheath:

- PE
- Black

Armouring:

- 1 layers of galvanized steel tape 0.2-3 mm
- 2 layers of galvanized steel tape 0.1 mm
- Helically applied

Outer sheath:

- PE
- Black

| Characteristics | Unit | 0.9 mm | 1.4 mm | 1.8 mm |
|---|---|---|---|---|
| Conductor resistance | Ω/km | ≤ 28.9 | ≤ 11.9 | ≤ 7.2 |
| Insulation resistance | GΩxkm | ≥ 10 | ≥ 10 | ≥ 10 |
| Mutual capacitance at 800 Hz | nF/km | ≤ 115 [1)] | ≤ 145 [2)] | ≤ 145 [2)] |
| Operating voltage DC/AC | V | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 | ≤ 600/ ≤ 420 |
| Test voltage at 50 Hz - 1 min | | | | |
| core/core | $V_{rms}$ | 2500 | 2500 | 2500 |
| core/screen | $V_{rms}$ | 2500 | 2500 | 2500 |

[1)] ≤ 120 nF/km for single core in center
[2)] ≤ 155 nF/km for single core in center

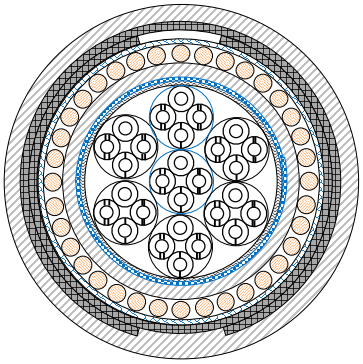
| No. of cores | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m |
|---|---|---|---|---|---|---|---|---|---|
| | n x 1 x 0.9 mm | | | n x 1 x 1.4 mm | | | n x 1 x 1.8 mm | | |
| 4 | 14.0 | 190 | 1000 | 14.0 | 190 | 1000 | 15.5 | 250 | 1000 |
| 7 | 15.5 | 260 | 1000 | 15.5 | 260 | 1000 | 17.0 | 350 | 1000 |
| 10 | 18.0 | 340 | 1000 | 180. | 340 | 1000 | 20.0 | 470 | 1000 |
| 14 | 19.0 | 420 | 1000 | 19.0 | 420 | 1000 | 21.0 | 600 | 1000 |
| 20 | 21.0 | 550 | 1000 | 21.0 | 550 | 1000 | 24.0 | 800 | 1000 |
| 24 | 22.0 | 360 | 1000 | 22.0 | 630 | 1000 | 26.0 | 910 | 1000 |
| 30 | 23.0 | 750 | 1000 | 23.0 | 750 | 1000 | 27.0 | 1100 | 1000 |
| 40 | 25.0 | 940 | 1000 | 25.0 | 940 | 1000 | 30.0 | 1400 | 1000 |
| 50 | 28.0 | 1140 | 1000 | 28.0 | 1140 | 1000 | - | - | - |
| 60 | 30.0 | 1320 | 1000 | 30.0 | 1320 | 1000 | - | - | - |

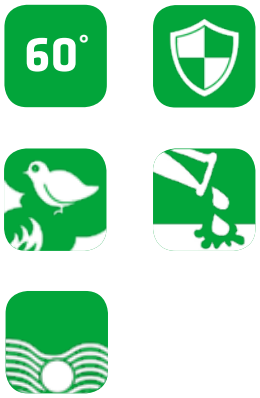
Prysmian Group

## SIGNALLING & AXLE COUNTER

# AJ-2Y(L)2YDB2Y

## ARMOURED & INTERFERENCE PROTECTED






### Application

For railway signalling application for transmission of low frequent signal through symmetric circuits, for example axle counter devices and similar wayside equipment. Protected against inductive interferences, for example on AC electrified railroads.

Protected against inductive interferences, for example on AC electrified railroads. The cable is star quad stranded with steel tape armouring.

### Technical data

Design:

- n x 4 x diameter mm

Bending radius:

- ≥ 10 x D

### Temperature range

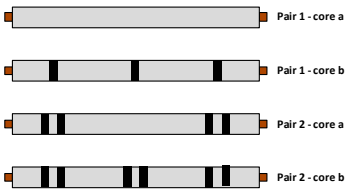
- Upon installation: - 10°C to + 60°C
- In operations: - 40°C to + 60°C

### Standard

- PH 416.0115 V1.1

### Material property

- Halogen free: IEC 60754-1 & 2




### Construction

Conductor:

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

Insulation:

- PE (2Y)
- Natural colour with black ring marketing
- Quad in each layer carry open blue helix

Twisting:

- Cores twisted to star quads
- Quads laid up in concentric layers
- 2 perforated pilot cores if ≥ 7 quads

Wrapping:

- SNon-hygroscopic plastic tape

Moisture barrier:

- Laminated sheath
- Aluminium tape 0.15 mm
- One side copolymer coated
- Bonded with inner sheath

Inner sheath:

- PE
- Black

Screen:

- Copper wires 1.9, 1.2, 1.4 or 1.8 mm
- Helically applied

Armouring:

- Two layers of galvanized steel tape
- 0.5 or 0,8

Outer sheath:

- PE (2Y)
- Black

| Characteristics | Unit | 0.9 mm | 1.4 mm |
|---|---|---|---|
| Conductor loop resistance | Ω/km | ≤ 56.6 | ≤ 23.4 |
| Insulation resistance | GΩxkm | ≥ 10 | ≥ 10 |
| Mutual capacitance at 800 Hz | nF/km | ≤ 45 [1)] | ≤ 45 [1)] |
| Capacitance unbalance at 800 Hz | | | |
| $k_1$ (100 % / 50 % of all values) | pF/500 m | ≤ 650 / ≤ 150 | ≤ 650 / - |
| $k_{9-12}$ neighboured quads | pF/500 m | ≤ 500 / ≤ 150 | ≤ 500 / - |
| $k_{9-12}$ over-neighboured quads | pF/500 m | ≤ 150 | ≤ 150 |
| $e_{a1/2}$ | pF/500 m | ≤ 1300 | ≤ 1300 |
| Far-end crosstalk attenuation at 90 kHz | | | |
| 100 % / 80 % of all values | dB/km | ≥ 58 / ≥ 62 | ≥ 33 / - |
| Attenuation at 90 kHz | dB/km | ≤ 3.3 | ≤ 2.6 |
| Test voltage at 50 Hz - 1 min | | | |
| core/core | $V_{rms}$ | 2500 | 2500 |
| core/screen | $V_{rms}$ | 2500 | 2500 |

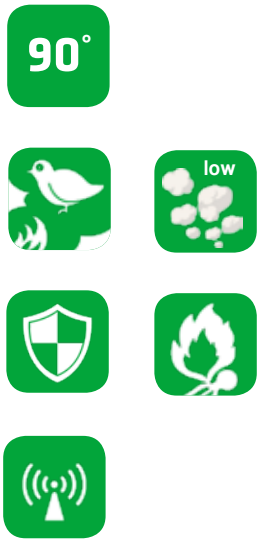
[1)] ≤ 52 nF/km for 1 x 4 x ø and for central quads, where 1st layer consist only of one quad, as well as in the outer layer of armoured cables.

| No. of quads | Reduction factor class $r_k$ | Outer diameter mm | Weight kg/km | Standard length m | Outer diameter mm | Weight kg/km | Standard length m |
|---|---|---|---|---|---|---|---|
| | | n x 4 x 0.9 mm (H45) | | | n x 4 x 1.4 mm (H45) | | |
| 3 | 600 | 21.0 | 800 | 1000 | - | - | - |
| 5 | 600 | 23.0 | 1010 | 1000 | - | - | - |
| 10 | 600 | 28.0 | 1430 | 1000 | - | - | - |
| 20 | 600 | 35.0 | 2130 | 1000 | - | - | - |
| 30 | 600 | 40.0 | 2800 | 1000 | - | - | - |
| 40 | 600 | 45.0 | 3380 | 1000 | - | - | - |
| 3 | 500 | - | - | - | 25.0 | 1350 | 1000 |
| 5 | 500 | - | - | - | 29.0 | 1760 | 1000 |
| 10 | 500 | - | - | - | 37.0 | 2620 | 1000 |
| 20 | 500 | - | - | - | 47.0 | 4040 | 500 |
| 30 | 500 | - | - | - | 54.0 | 5330 | 500 |
| 40 | 500 | - | - | - | 61.0 | 6550 | 500 |
| 5 | 400 | - | - | - | 31.0 | 2470 | 1000 |
| 10 | 400 | 31.0 | 2250 | 1000 | 39.0 | 3610 | 1000 |
| 20 | 400 | 38.0 | 3240 | 1000 | 49.0 | 5260 | 500 |
| 30 | 400 | 43.0 | 4080 | 500 | 56.0 | 6690 | 500 |
| 40 | 400 | 48.0 | 4800 | 500 | 63.0 | 8070 | 250 |

CONTROL

# MCCMK-HF EMC 0.6/1 kV

## HALOGEN FREE & EMC SCREENED




### Application

Low smoke halogen free and EMC protected cable with 100% dense copper screen with low coupling impedance that fulfills the EMC-directive. For fixed installation indoor and outdoors, in pipes, trays , non-vibrated cement and directly in the ground.

### Technical data

Rated voltage:
- 0.6/1 kV

Test voltage:
- 4,000 V

Tensile strength:
- Max. 50 x A N/mm²

Bending radius:
- Fixed 10 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

Standard:
- HD 604-5D
- IEC 60502-1
- EN 50267

Directive:
- Fulfills LVD, RoHS and REACH

### Construction

Conductor:
- Round copper wires
- Annealed
- < 6 mm²: Solid
- 10-35 mm²: Stranded
- 50-240 mm²: Sector-shaped

Insulation:
- XLPE compound

Core colouring:
- 3-core: brown, black, gray
- 4-core: blue, brown, black, gray

Screen:
- Copper tape
- Concentric screen of copper wires

Outer sheath:
- Halogen free compound
- Black

### Material property

- Flame retardant: IEC 60332-1-2
- Halogen free: IEC 60754-1 & 2
- Smoke density: IEC 61034
- EMC: IEC/EN 6100

| Conductor cross-section mm² | Outer diameter mm | Weight kg/km | Max. DC resistance of phase conductor at 20°C Ω/km | Standard length m | Prysmian article no. |
|---|---|---|---|---|---|
| 3 x 25/16 | 23 | 1,100 | 0.727 | 500 - K11 | 0600230 |
| 3 x 50/25 | 27 | 1,900 | 0.387 | 500 - K11 | 0600236 |
| 3 x 95/50 | 35 | 3,500 | 0.193 | 500 - K14 | 0600234 |
| 3 x 120/70 | 38 | 4,300 | 0.153 | 500 - K16 | 0600235 |
| 3 x 150/70 | 42 | 5,200 | 0.124 | 500 - K16 | 0600238 |
| 3 x 185/95 | 47 | 6,500 | 0.099 | 500 - K20 | 0600237 |
| 3 x 240/120 | 51 | 8,400 | 0.075 | 500 - K22 | 0600239 |
| 4 x 25/16 | 26 | 1,400 | 0.727 | 500 - K11 | 0607644 |
| 4 x 35/16 | 29 | 1,800 | 0.524 | 500 - K12 | 0607641 |
| 4 x 50/25 | 31 | 2,300 | 0.387 | 500 - K14 | 0607640 |
| 4 x 70/35 | 34 | 3,200 | 0.268 | 500 - K14 | 0607642 |
| 4 x 95/50 | 39 | 4,300 | 0.193 | 500 - K16 | 0607643 |
| 4 x 120/70 | 43 | 5,400 | 0.153 | 500 - K19 | 0607651 |
| 4 x 150/70 | 46 | 6,600 | 0.124 | 500 - K20 | 0607647 |
| 4 x 185/95 | 53 | 8,300 | 0.099 | 500 - K22 | 0607645 |
| 4 x 240/120 | 58 | 11,000 | 0.075 | 500 - K26 | 0607646 |

| Conductor cross-section mm² | Puling force with eye Max. kN | Max. short circuit current PE conductor kA | Inductance mH/km | Operating capacitance uF/km | Current rating in free air at 90°C A |
|---|---|---|---|---|---|
| 3 x 25/16 | 3.8 | 2.4 | 0.26 | 0.35 | 135 |
| 3 x 50/25 | 5.3 | 4.0 | 0.26 | 0.40 | 200 |
| 3 x 95/50 | 7.5 | 6.7 | 0.25 | 0.45 | 310 |
| 3 x 120/70 | 10.5 | 9.6 | 0.24 | 0.50 | 360 |
| 3 x 150/70 | 14.3 | 9.6 | 0.24 | 0.50 | 410 |
| 3 x 185/95 | 18.20 | 12.0 | 0.24 | 0.50 | 470 |
| 3 x 240/120 | 20 | 14.8 | 0.23 | 0.55 | 560 |
| 4 x 25/16 | 5 | 2.4 | 0.28 | 0.30 | 135 |
| 4 x 35/16 | 7 | 2.4 | 0.28 | 0.32 | 165 |
| 4 x 50/25 | 10 | 4.0 | 0.28 | 0.35 | 200 |
| 4 x 70/35 | 14 | 5.2 | 0.27 | 0.40 | 250 |
| 4 x 95/50 | 19 | 6.7 | 0.27 | 0.42 | 310 |
| 4 x 120/70 | 20 | 9.6 | 0.26 | 0.44 | 360 |
| 4 x 150/70 | 20 | 9.6 | 0.26 | 0.46 | 410 |
| 4 x 185/95 | 20 | 12.0 | 0.26 | 0.49 | 470 |
| 4 x 240/120 | 20 | 14.8 | 0.25 | 0.52 | 560 |

CONTROL

# MCCMO-HF C-PRO 450/750 V

## HALOGEN FREE & EMC PROTECTED

90°

low

**Application**

EMC-protected cable for the control, measuring and signal circuits of electrical equipment for fixed surface and flush-mounted installations, indoors, outdoors and also underground - specially in places where the cable is exposed to vibration.

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

**Standard & Directive**

Standard:
- HD 627 7B2

Directive:
- Fulfills RoHS and REACH

Approval:
- CPR class: Cca-s1d1a1

**Construction**

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

Insulation:
- HFFR
- White
- Black numbering

Wrapping:
- Halogen free

Screen:
- Helix of copper wires
- Counter helix of copper wires or tape
- Min. cross-section area 6 mm²

Outer sheath:
- Halogen free polymer
- Black

**Material property**
- Halogen free: IEC 60754
- Flame retardant: IEC 60332-1 & 3
- Smoke density: EN 60134

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 delivery m | Prysmian EAN no. |
|---|---|---|---|---|
| 7 x 1.5 | 14.1 | 340 | 1000 - K9 | |
| 12 x 1.5 | 15.9 | 449 | 500 - K8 | |
| 19 x 1.5 | 17.3 | 481 | 1000 - K11 | |
| 7 x 2.5 | 20.0 | 666 | 1000 - K12 | |
| 12 x 2.5 | 19.7 | 647 | 500 - K9 | |

CONTROL

# HIKA 300/500 V

## ARMOURED

### Application

Halogen free light installation cable applicable for areas that require extra mechanical protection. Fulfills requirements for rodent protection. Suitable for indoor and outdoor installation in pipes, trays, directly in the ground or in non-vibrated cement. Insulation must be protected from UV-light.

### Technical data

Rated voltage:

- 300/300 VC

Test voltage:

- 2,000 V

Bending radius:

- 10 x D

### Temperature range

- Max. conductor temperature: +70°C
- Short circuit temperature: +250°C
- Max. installation temperature: -20°C
- Min. operating temperature: -40°C

### Standard & Directive & Approval

Standard:

- Partially adaped to DS 2393-3

Directive:

- Fulfills LVD, RoHS & REACH

Approval:

- CPR class: Eca
- DoP no. - see table

### Construction

Conductor:

- Round copper wires
- Solid or stranded
- Class 1. and 2. acc. to IEC 60228

Insulation:

- XLPE

Core colouring:

- 4-core: blue, brown, black, grey
- 7-core: blue, brown, black, grey, white red, black

Filling:

- Halogen free compound

Armouring:

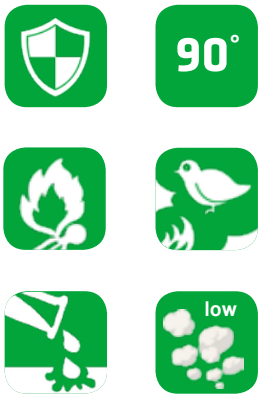
- Galvanized steel band
- Coverage 100%

Outer sheath:

- Halogen free compound
- Grey

### Material property

- Halogen free: IEC 60754-1
- Acidity: IEC 60754-2
- Flame retardant: IEC 60332-1
- Smoke density: IEC 61034
- Current load acc. to SB2006:6




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 | DoP no. | Prysmian EAN no. |
|---|---|---|---|---|---|
| 4 x 4 | 12.8 | 307 | 500 | 1003090 | 8711401010025 |
| 4 x 10 | 18.2 | 700 | 500 | 1003932 | 8711401009890 |
| 4 x 16 | 21.0 | 1000 | 500 | 1003089 | 8711401009968 |
| 7 x 1.5 | 11.8 | 236 | 500 | 1003095 | 8711401010629 |
| 7 x 2.5 | 13.0 | 312 | 500 | 1003096 | 8711401010643 |
| 7 x 2.5 | 13.0 | 312 | 2000 | 1003096 | 8711401010728 |
| 7 x 4 | 14.9 | 435 | 500 | 1003097 | 8711401010933 |


21.10
Til
Helsingør
Klampenborg Skodsborg Vedbæk Rungsted Kyst Kokkedal
Nivå Humlebæk Espergærde Snekkersten
Kort tog

COMMUNICATION

# A-DQ2Y

## DUCT INSTALLATION VIA BLOWING TECHNIQUE

**Application**
Optical cable designed for duct installation by blowing technique. Core is dry with swellable materials to prevent longitudinal water penetration.

**Technical data**

Tensile strength:
- 7,000 N

Crush:
- 1,500 N

Impact:
- 1 J, 3 impacts, R=300

Torsion:
- 5 cycles

Repeated bending:
- 4 x D, 25 cycles

Kink:
- No kink at bending radius 20 x OD

Bending radius:
- Loaded: 20 x D
- Unloaded: 15 x D

Water penetration:
- No water penetration 1 m/24 hours

**Temperature range**
- Storage: - 40°C to + 70°C
- Installation: - 5°C to + 55°C
- Operation: - 30°C to + 60°C

**Construction**

Central strength member (CSM):
- Glass fibres
- Reinforced plastic material, FPR rod

Loose tube:
- Thermoplastic tubes
- 6-12 fibres in each

Tube colours:
- 12 fibres - red tube
- 24 fibres - red and green tube
- 1st. tube red, 2nd. tube green, rest white

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

Filler:
- Thermoplastic rod, when needed

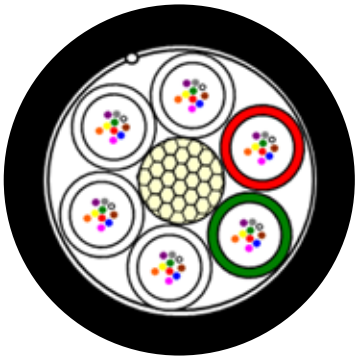
Identification:
- Thread

Stranding:
- Loose tubes
- "SZ" stranded around the CSM

Water blocking:
- Swellable material
- Longitudinal watertight
- Dry core

Outer sheath:
- PE, with min. 2% carbon black
- Black

**Standard**
- IEC 60794-3-10
- IEC 60794-1-2



60°

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

| Fibre count | Number of fillers | Tube diameter mm | CMS enlargement dia. mm | Sheath thickness mm | Outer diameter mm | Weight kg/km |
|---|---|---|---|---|---|---|
| 24 | 2 x 12 | 1.55 | 1.6 | 0.5 | 5.7±0.2 | 30 |
| 48 | 4 x 12 | 1.55 | 1.6 | 0.5 | 5.7±0.2 | 30 |

Prysmian Group

COMMUNICATION

# COMPACT MULTI-FUNCTION JOINT

## 144 FIBRE CAPACITY & IP68

70°

### Application

The Compact Multi-function Joint (CMJ) is for jointing optical fibre cables. The joint is ideal for use as a Cable Chamber Joint, Track Joint, Spur Joint or Distribution Joint due to its capacity and compact size.

It has a maximum capacity of 144 fibres. The splice trays are factory fitted and each tray can accommodate up to 12 spliced fibres.

A multi-functional bracket can be supplied with the joint which enables wall or pole mounting of the joint, vertically or horizontally.

The joint has four circular ports for mechanical entry glands, one oval port for heat shrink or mechanical entry and two additional small circular ports also for heat shrink entry.

A kit is supplied with following items:
A base, cap, clamp, O seal, fibre routing management, two tube retainers, four tube retainer covers and one loop storage basket.

### Order no.

- Example: CMJ-H-M-X-Y-D
- Additional kits order seperately

### Standard

- Closure sealing: IP68
- Optical tested: 1310, 1550, 1625 nm
- Change temperature: IEC 61300-2-22
- Dry sealing: BS EN 60068-2-2
- Damp heat: IEC 60068-2-3
- Vibration: IEC 61300-2-1
- Torsion: IEC 61300-2-5
- Bending: IEC 61300-2-37
- Impact: IEC 61300-2-12
- Cable retention: IEC 61300-2-4
- Crush resistance: IEC 61300-2-10

### Construction

Joint:
- Ultra compact design
- Cap and base of GF polypropylene
- Trays of FR ABS
- Integrated loop storage basket
- Multi-way entry glands available

Input manifold:
- Route management of fibres

Splice tray capacity:
- 12 single element trays - 96 fibres
- 12 single circuit double trays - 144 fibres
- 1.3 mm splice protectors
- Splice trays hinge upwards
- Heat shrinkable

Entry ports:
- 4 circular, 7-20 mm
- 1 oval, 7-21 mm - heat shrink
- 2 emergency, 4-12 mm

Dimentions:
- Size: H 290 x W 231 x D 164 mm
- Weight: 1.9 kg

### Technical data

Bending radius:
- Positive bend managed to 20 mm

### Temperature range

- In operation: - 40°C to + 70°C

| CMJ type | Seal type | Mechanical gland type | Pressure test valve | Mounting type | No. splice protectors |
|---|---|---|---|---|---|
| CMJ Single element<br><br>CMJ Single circuit | X - none<br>H - heat shrink<br>A - mechanical 5-7 mm<br>B - mechanical 7-9 mm<br>C - mechanical 9-11 mm<br>D - mechanical 11-13 mm<br>E - mechanical 13-14 mm | X- none<br>C - single 7-20 mm<br>E - 8 way 2-3 mm flat<br>M - 4 way 5-7 mm | X - no valve<br>Y - with valve | X - no bracket<br>Y - with bracket | X - none<br>A - 1 pack x 12<br>B - 2 pack x 12<br>C - 3 pack x 12<br>D- 1 pack x 50<br>E- 2 pack x 50<br>F- 3 pack x 50 |

| Kit description | Kit order number | | | | |
|---|---|---|---|---|---|
| Oval port heat shrink | XJTSC01756 | | | Pole/ wall mounting bracket XJTSC00136 | |
| Oval port mechanical | XJTSC02028 (5-7 mm) | XJTSC02029 (7-9 mm) | XJTSC02030 (9-11mm) | XJTSC02031 (11-13mm) | XJTSC01896 (13-15mm) |
| Circular port | Single entry gland XJTSC01754 | MS 4-ways entry gland XJTSC01755 | MS 8-ways flat drop gland XJTSC01878 | Emergency port entry XkTSC00401 | |
| Accessories | Optical splitters 16 pcs. XSPSG00004 | Optical splitters 32 pcs. XSPSG00005 | HS splice protectors 12 pcs. XKTSC01284 | HS splice protectors 50 pcs. XPESC00057 | Silicone grease 5 pcs. XBFSC00260 |

Prysmian Group

COMMUNICATION

# SRS3000 SPLICE & PATCH SHELF

## 19" MODULAR 1U

60°

### Application

This type of splice and patch shelf is a modular unit available in a variety of configurations for integration in to 19" and ETSI racks, street side or wall mounted cabinets.

The product consists of a metal chassis, a plastic light weight splice and patch module and a cable anchoring system.

The product has a capacity of up to 48 fibres in a 1U unit for SC and LC type connectors, and up to 24 fibres for FC, ST and E2000 type connectors.

The panel has in-built fibre management to ensure the product is installed correctly and the same every time by installers.

The shelf is fully compatible with all optical cable types, with blown fibre tube cables and can be configured to hold optical devices (i.e. splitters & WDM's) on request.

### Temperature range

- In operation: - 20°C to + 60°C

### Standard

Optical:
- Tested at 1310, 1550 and 1625 nm

Dry heat:
- BS EN 60068-2-2 Test Bb

Optical:
- IEC 60068-2-3: 1969

Change temperture:
- IEC 60068-2-14: 1984

Vibration:
- IEC 60068-2-6: 1995

Shock:
- IEC 60068-2-27: 1987

### Construction

Shelf:
- Steel, modular shelf design
- Drop down front panel
- Labeling
- Easy upgrade from 12 to 48 fibres
- For 19" rack systems
- Wall mountable

Splice & patch modules:
- High impact polystyrene
- Detachable lid with screws
- Pivots outward for easy access

Splice & patch capacity:
- 48 SC or LC connectors, 2 mm
- 24 FC, ST or E2000 connectors

Dimentions:
- Size: W 480 x D 245 x H 44.5 mm
- Weight: 2.4 kg

### Technical data

Bending radius:
- Positive bend managed to 30 mm

| Part number | Connector type | Fibre type | Adaptor type | No of fibres | Upgradeable | Part number |
|---|---|---|---|---|---|---|
| SRS1-002 | FC/UPC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00288 |
| SRS1-003 | FC/UPC | S/mode | Simplex | 24 | No | N/A |
| SRS1-004 | FC/APC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00291 |
| SRS1-005 | FC/APC | S/mode | Simplex | 24 | No | N/A |
| SRS1-006 | FC | 62.5/125 | Simplex | 12 | Yes to 24 | XSRSC00289 |
| SRS1-007 | FC | 62.5/125 | Simplex | 24 | No | N/A |
| SRS1-008 | FC | 50/125 | Simplex | 12 | Yes to 24 | XSRSC00290 |
| SRS1-009 | FC | 50/125 | Simplex | 24 | Yes to 24 | N/A |

| Part number | Connector type | Fibre type | Adaptor type | No of fibres | Upgradeable | Part number |
|---|---|---|---|---|---|---|
| SRS1-010 | SC/UPC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00292 |
| SRS1-011 | SC/UPC | S/mode | Simplex | 24 | No | N/A |
| SRS1-012 | SC/UPC | S/mode | Duplex | 12 | Yes to | 24 XSRSC00296 |
| SRS1-013 | SC/UPC | S/mode | Duplex | 24 | No | N/A |
| SRS1-014 | SC/UPC | S/mode | Quad * | 24 | Yes to 48 | XSRSC00344 |
| SRS1-015 | SC/UPC | S/mode | Quad * | 48 | No | N/A |
| SRS1-016 | SC/APC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00295 |
| SRS1-017 | SC/APC | S/mode | Simplex | 24 | No | N/A |
| SRS1-018 | SC/APC | S/mode | Duplex | 12 | Yes to 24 | XSRSC00299 |
| SRS1-019 | SC/APC | S/mode | Duplex | 24 | No | N/A |
| SRS1-020 | SC/APC | S/mode | Quad * | 24 | Yes to 48 | XSRSC00345 |
| SRS1-021 | SC/APC | S/mode | Quad * | 48 | No | N/A |
| SRS1-022 | SC | 62.5/125 | Simplex | 12 | Yes to 24 | XSRSC00293 |
| SRS1-023 | SC | 62.5/125 | Simplex | 24 | No | N/A |
| SRS1-024 | SC | 62.5/125 | Duplex | 12 | Yes to 24 | XSRSC00297 |
| SRS1-025 | SC | 62.5/125 | Duplex | 24 | No | N/A |
| SRS1-026 | SC | 62.5/125 | Quad * | 24 | Yes to 48 | XSRSC00346 |
| SRS1-027 | SC | 62.5/125 | Quad * | 48 | No | N/A |
| SRS1-028 | SC | 50/125 | Simplex | 12 | Yes to 24 | XSRSC00294 |
| SRS1-029 | SC | 50/125 | Simplex | 24 | No | N/A |
| SRS1-030 | SC | 50/125 | Duplex | 12 | Yes to 24 | XSRSC00298 |
| SRS1-031 | SC | 50/125 | Duplex | 24 | No | N/A |
| SRS1-032 | SC | 50/125 | Quad * | 24 | Yes to 48 | XSRSC00347 |
| SRS1-033 | SC | 50/125 | Quad * | 48 | No | N/A |

| Part number | Connector type | Fibre type | Adaptor type | No of fibres | Upgradeable | Part number |
|---|---|---|---|---|---|---|
| SRS1-034 | LC/UPC | S/mode | Duplex | 24 | Yes to 48 | XSRSC00300 |
| SRS1-035 | LC/UPC | S/mode | Duplex | 48 | No | N/A |
| SRS1-036 | LC/UPC | S/mode | Quad | 24 | Yes to 48 | XSRSC00304 |
| SRS1-037 | LC/UPC | S/mode | Quad | 48 | No | N/A |
| SRS1-038 | LC/APC | S/mode | Duplex | 24 | Yes to 48 | XSRSC00303 |
| SRS1-039 | LC/APC | S/mode | Duplex | 48 | No | N/A |
| SRS1-040 | LC/APC | S/mode | Quad | 24 | Yes to 48 | XSRSC00307 |
| SRS1-041 | LC/APC | S/mode | Quad | 48 | No | N/A |
| SRS1-042 | LC | 62.5/125 | Duplex | 24 | Yes to 48 | XSRSC00301 |
| SRS1-043 | LC | 62.5/125 | Duplex | 48 | No | N/A |
| SRS1-044 | LC | 62.5/125 | Quad | 24 | Yes to 48 | XSRSC00302 |
| SRS1-045 | LC | 62.5/125 | Quad | 48 | No | N/A |
| SRS1-046 | LC | 50/125 | Duplex | 24 | Yes to 48 | XSRSC00305 |
| SRS1-047 | LC | 50/125 | Duplex | 48 | No | N/A |
| SRS1-048 | LC | 50/125 | Quad | 24 | Yes to 48 | XSRSC00306 |
| SRS1-049 | LC | 50/125 | Quad | 48 | No | N/A |

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

| Part Number | Connector type | Fibre type | Adaptor type | No. of fibres | Upgradable | Part Number |
|---|---|---|---|---|---|---|
| SRS1-050 | E2000/UPC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00308 |
| SRS1-051 | E2000/UPC | S/mode | Simplex 24 | No | N/A | |
| SRS1-052 | E2000/APC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00311 |
| SRS1-053 | E2000/APC | S/mode | Simplex | 24 | No | N/A |
| SRS1-054 | E2000 | 62.5/125 | Simplex | 12 | Yes to 24 | XSRSC00309 |
| SRS1-055 | E2000 | 62.5/125 | Simplex | 24 | No | N/A |
| SRS1-056 | E2000 | 50/125 | Simplex | 12 | Yes to 24 | XSRSC00310 |
| SRS1-057 | E2000 | 50/125 | Simplex | 24 | No | N/A |

| Part number | Connector type | Fibre type | Adaptor type | No of fibres | Upgradeable | Part Number |
|---|---|---|---|---|---|---|
| SRS1-058 | ST/UPC | S/mode | Simplex | 12 | Yes to 24 | XSRSC00341 |
| SRS1-059 | ST/UPC | S/mode | Simplex | 24 | No | N/A |
| SRS1-060 | ST | 62.5/125 | Simplex | 12 | Yes to 24 | XSRSC00342 |
| SRS1-061 | ST | 62.5/125 | Simplex | 24 | No | N/A |
| SRS1-062 | ST | 50/125 | Simplex | 12 | Yes to 24 | XSRSC00343 |
| SRS1-063 | ST | 50/125 | Simplex | 24 | No | N/A |

| Kit description | Kit order number | Kit order number |
|---|---|---|
| Heat shrink splice protectors | XKTSC00050 (pack of 12) | XPESC00053 (pack of 50) |
| Chrimp splice protectors | XKTSC00079 (pack of 12) | XKTSC00078 (pack of 50) |
| Splice protector holders | XSRSC00358 (pack of 10)<br>Crimp splice | XKTSC00377 (pack of 10)<br>Heat shrink |
| ETSI conversion brackets | XKTSC00171 Grey | |
| Rear mounting brackte | XSRSC00361 | |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til Malmö alle dage 20.02-23.22
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# Cables with reduction factor

On electrified tracks which are operated using alternating current or under high-voltage power lines, parallel laid railway cables are exposed at the same time to the influence of 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.

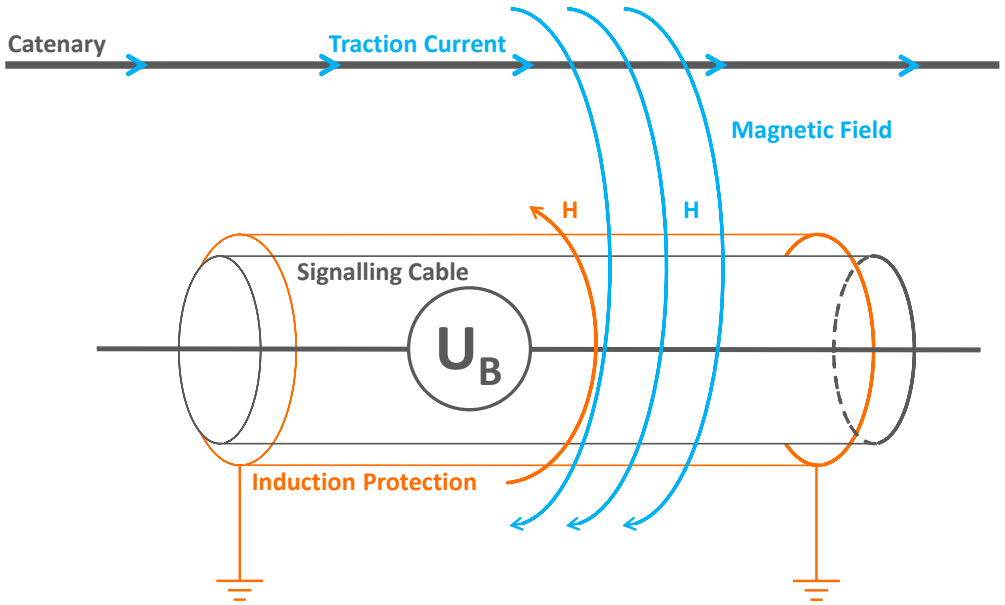
The tension induced in the cable increases with the length the cable is exposed to the electrical field. A cable which is exposed over a length of 2000 m to the field can require a lower (better) reduction factor than the same cable, which is only exposed to the induced field over a length of 1000 m.

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, Prysmian offers an extensive portfolio of different cables with reduction factor. Upon request we shall be pleased to develop the right cable design for a customer's purposes.




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

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

Prysmian Group provides a complete product range ofcables 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 tetra-fluoroethylene (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.

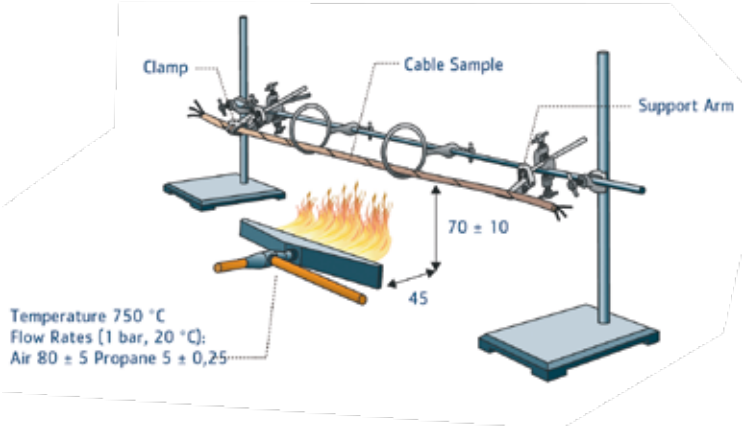
Comparable tests are DIN VDE 0482-266-2-4, EN 50266, NBN C30-004 Cat. F2, BS 4066-3.

# 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.

# 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 |
|---|---|---|---|
| $A_{ca}$ | EN ISO 1716 | PCS ≤ 2,0 MJ/kg and<br>PCS ≤ 2,0 MJ/kg and | |
| $B1_{ca}$ | EN 50399<br><br><br>and | FS ≤ 1.75 m and<br>THR1200s ≤ 10 MJ and<br>Peak HRR ≤ 20 kW and<br>FIGRA ≤ 120 Ws-1 | Smoke production and Flaming droplets/particles and Acidity |
| | EN 50265-2-1 | H ≤ 425 mm | |
| $B2_{ca}$ | EN 50399<br><br><br>and | FS ≤ 1.5 m; and<br>THR1200s ≤ 15 MJ; and<br>Peak HRR ≤ 30 kW; and<br>FIGRA ≤ 150 Ws-1 | Smoke production and Flaming droplets/particles and Acidity |
| | EN 50265-2-1 | H ≤ 425 mm | |
| $C_{ca}$ | EN 50399<br><br><br>and | FS ≤ 2.0 m; and<br>THR1200s ≤ 30 MJ; and<br>Peak HRR ≤ 60 kW; and<br>FIGRA ≤ 300 Ws- | Smoke production and Flaming droplets/particles and Acidity |
| | EN 50265-2-1 | H ≤ 425 mm | |
| $D_{ca}$ | EN 50399<br><br>and | THR1200s ≤ 70 MJ; and<br>Peak HRR ≤ 400 kW; and<br>FIGRA ≤ 1300 Ws-1 | |
| | EN 50265-2-1 | H ≤ 425 mm | |
| $E_{ca}$ | EN 50265-2-1 | H ≤ 425 mm | |
| $F_{ca}$ | no performance determined | | |

Table: Overview of the CPR classifications

# 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!).

# 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-Bourgas 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 Subaqua Cable
- Spain: Vandellos-Tarragona line, Madrid – Leon – Burgos high speed Line
- Turkey: Ankara-Konya high speed line, Eskisehir – Balikesir line, Metro Istanbul, Metro Ankara
- USA: JFK Air Train, New York City Transit, Oakland Bay Area Rapid Transit

**We are here for you**

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

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