# We are with you, down to the core.

Prysmian mining cables – stronger, faster, safer.


Prysmian Group

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 three renowned commercial brands – Prysmian, Draka and General Cable – 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, profitable growth.

In 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.

In telecoms, the Group is a leading manufacturer of all types of copper and fibre cables, systems and accessories – covering 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 precise needs of our customers across all continents, at the same time shaping the evolution of our industry.

# Contents



# 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 air and rail transport infrastructure to heavy duty and renewable industries such as on- and offshore wind turbines, Prysmian Group'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, delivering products and service platforms built on easy contact, bespoke solutions and effective supply chain, meeting their specialised requirements, to help them drive the wheels of industry and achieve sustainable growth and profitability.

Prysmian Group

# Mining cables

## Introduction

The development of elastomeric power cables for safe and reliable mining and industrial applications has paralleled the development of the electric motor and power generation since the 19th century.

Elastomeric cables are the natural choice for applications where durability, flexibility, and safe operation under extreme environmental conditions are important. The Prysmian Group's elastomeric cables have been "field proven" in thousands of operations, and with continuous development, utilise the best features of cables offered around the world.

In Germany, as elsewhere, there are many established guidelines governing manufacture of mining and industrial cables.

Innovation in work practices, with more equipment operating at higher voltages, has required the continued development of new elastomeric cable designs. Ongoing development programs have also been required to continually improve the reliability and safety of current designs. The major design responsibility for the Prysmian Group is to ensure that cables supplied will operate reliably and safely under a wide range of conditions. Personnel often work close to energised cables, especially in underground mines. The cable construction and materials must be selected to provide maximum safety during both normal operation and in the case of cable failure.

## Application

Opencast and underground mining requires ever-increasing performance of machines and methods. This has led to the large machines in use today. On bucket wheel and dragline excavators for instance, installed power of more than 15 MW and voltages up to 35 kV are no longer unusual.

These large, movable machines require medium voltage flexible reeling and trailing cables for power supply and are suitable for operation under the most extreme conditions.

Prysmian and Draka branded reeling and trailing cables for opencast and underground mining have been field-proven worldwide for decades.

In these mining applications, particular requirements such as mechanical strength and safety have led to the use of high-grade mechanically resistant rubber.

Prysmian Group has developed extensive know-how over many years about the special operational conditions of opencast and underground mining. The decisive factor was close cooperation with many significant mining companies.

The experience we gain every day contributes to the design of our mining cables. The high operational reliability and service life of Prysmian's reeling and trailing cables for mining is based on this experience.

# Made locally

We've been making cables in Germany since 1858. Today we have 2000 skilled co-workers developing state-of-the-art cables in seven plants all over the country. We can offer a complete range of cables covering everything from the deep blue sea, mines and tunnels to skyscrapers and satellites.

Two of our facilities are Centres of Excellence including R&D departments in which we develop new solutions to meet your specific needs as well as the common challenges of tomorrow.

When that is not enough, we have the largest cable manufacturer in the world to our disposal, Prysmian Group. That includes 50 countries, 112 plants, 25 R&D centres and about 30,000 skilled professionals doing nothing but developing and producing cable solutions that will solve your current and future needs.

# What we offer

Prysmian Group's Mining & Tunnelling cables offer significant benefits to a broad variety of specialized mining professionals such as OEMs, specifiers, contractors, installers, mining companies and more. These benefits include:

- **Unique mechanical performance**

  Prysmian Group's Mining and Tunnelling cables have been designed to withstand extreme conditions in terms of:

  - Tensile loads
  - Torsional stresses occurring during misalignment of cable guidance systems and oblique pay out
  - Minimum bending radius at any ambient temperature range and stress conditions
  - High travel speeds and acceleration

- **Chemical and climate resistance**

  Prysmian Group's Mining and Tunnelling cables have been designed to withstand the most severe conditions. For these applications Prysmian has developed the high performance compounds that are used in Mining and Tunnelling cables to guarantee resistance to extreme conditions (such as high-speed, oil and fuel, mud, moisture, and acids and basis), as well as to harsh environments (for instance, extreme low/hot temperature, UV irradiation and ozone).

- **Miniaturised**

  Prysmian Group's Mining and Tunnelling cables have the smallest possible dimensions. For instance, in MV cables:

  - Dimension – up to 30 % less and yet in strict compliance with the existing standards
  - Weight – higher cable performance allow up to a 40 % reduction in the cable weight
  - Robustness – higher physical/mechanical resistance, exceeding standard requirements in terms of abrasion, cut-through and repeated bending

- **Customised and multifunctional engineering**

  Prysmian designs, compounds and builds cables according to specific customer needs. This allows us to have an exhaustive product range covering all functionalities (MV/LV, Instrumentation and Control, Optical fibres). Prysmian designs multifunctional cables from the simplest to the most sophisticated.

- **Longer lifetime**

  Prysmian Group's Mining and Tunnelling cables guarantee an extended working lifetime (lower failure rate) in comparison with standard and traditional mining and tunneling cables. As a consequence the total cost of ownership is lower.

# Our products and brands

## Flexible cables

**CORDAFLEX®**

LHD cable for scoop operations 1 kV tough rubber-sheathed reeling cable.

**OPTOFLEX®**

Rubber-sheathed flexible fibre-optic cable.

**PROTOLON®**

Medium-voltage reeling cable, trailing cables, medium-voltage flexible cables.

**PROTOMONT®**

Heavy tough rubber-sheathed flexible cables.

**SUPROMONT®**

Medium-voltage mining-type cables for fixed installation.

**TENAX®**

Low- and medium-voltage flexible cables for underground and opencast application.

**FELTOFLEX®**

Medium-voltage flexible single core cables.

## Special compounds

**PROTODUR®**

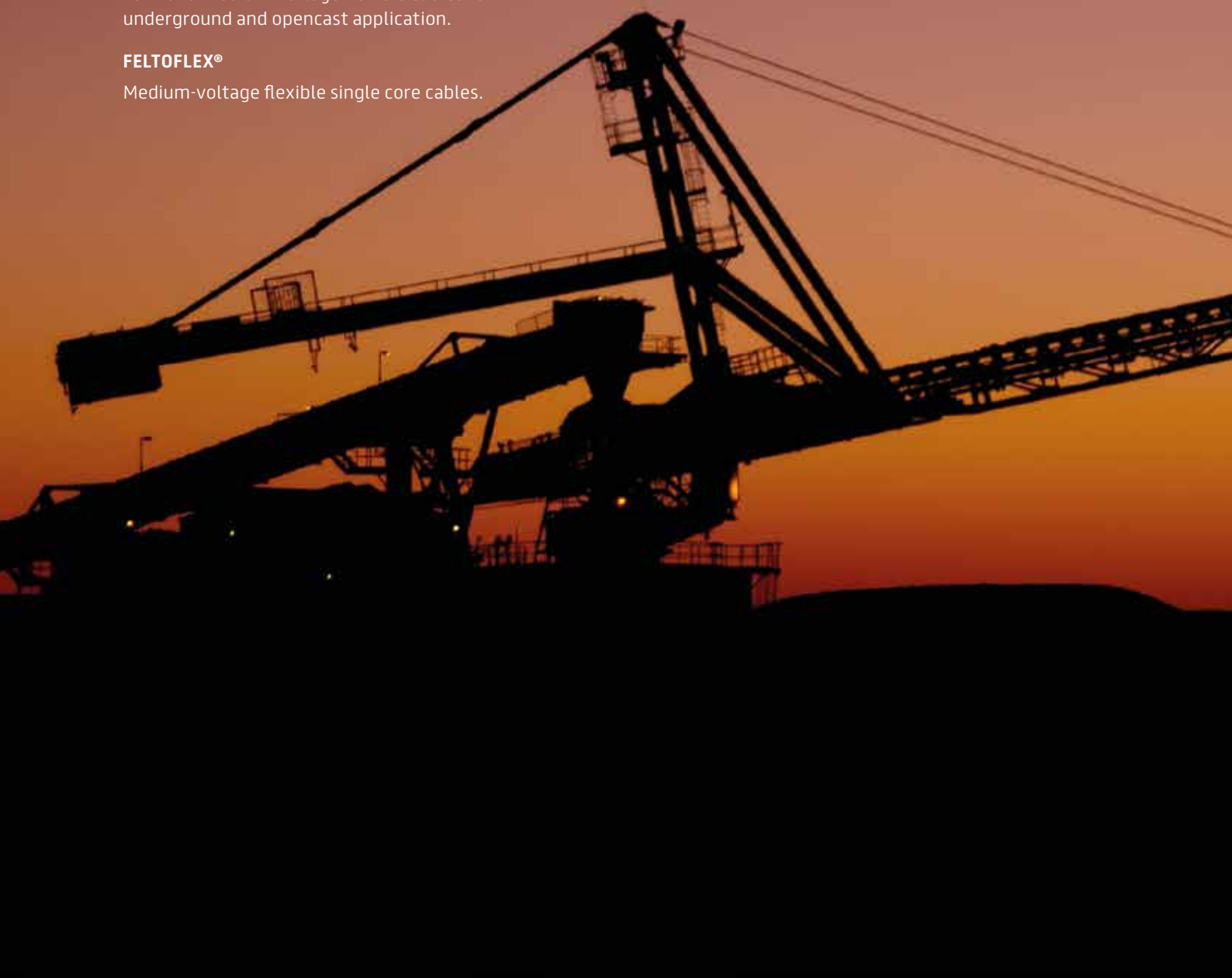
Insulating compound PVC used in SUPROMONT® cables.

**PROTOFIRM®**

Sheathing compound PCP used in CORDAFLEX®, PROTOLON®, PROTOMONT®, compound with special resistance to abrasion and tearing, 5GM5 quality.

**PROTOLON®**

Insulating compound EPR used in CORDAFLEX®, PROTOLON®, PROTOMONT®. Rubber compound with excellent electrical properties, resistant to heat and weather.



# TENAX-LUMEN

– A luminescent mining cable.

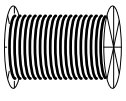
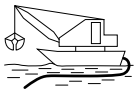
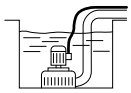
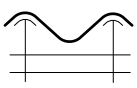
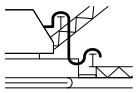
MAIN FEATURES

- Brightly self-luminous in dark areas
- Exceptional cold resistance down to -50 °C
- Excellent impact and abrasion resistant
- Resistant to oil, ozone and moisture

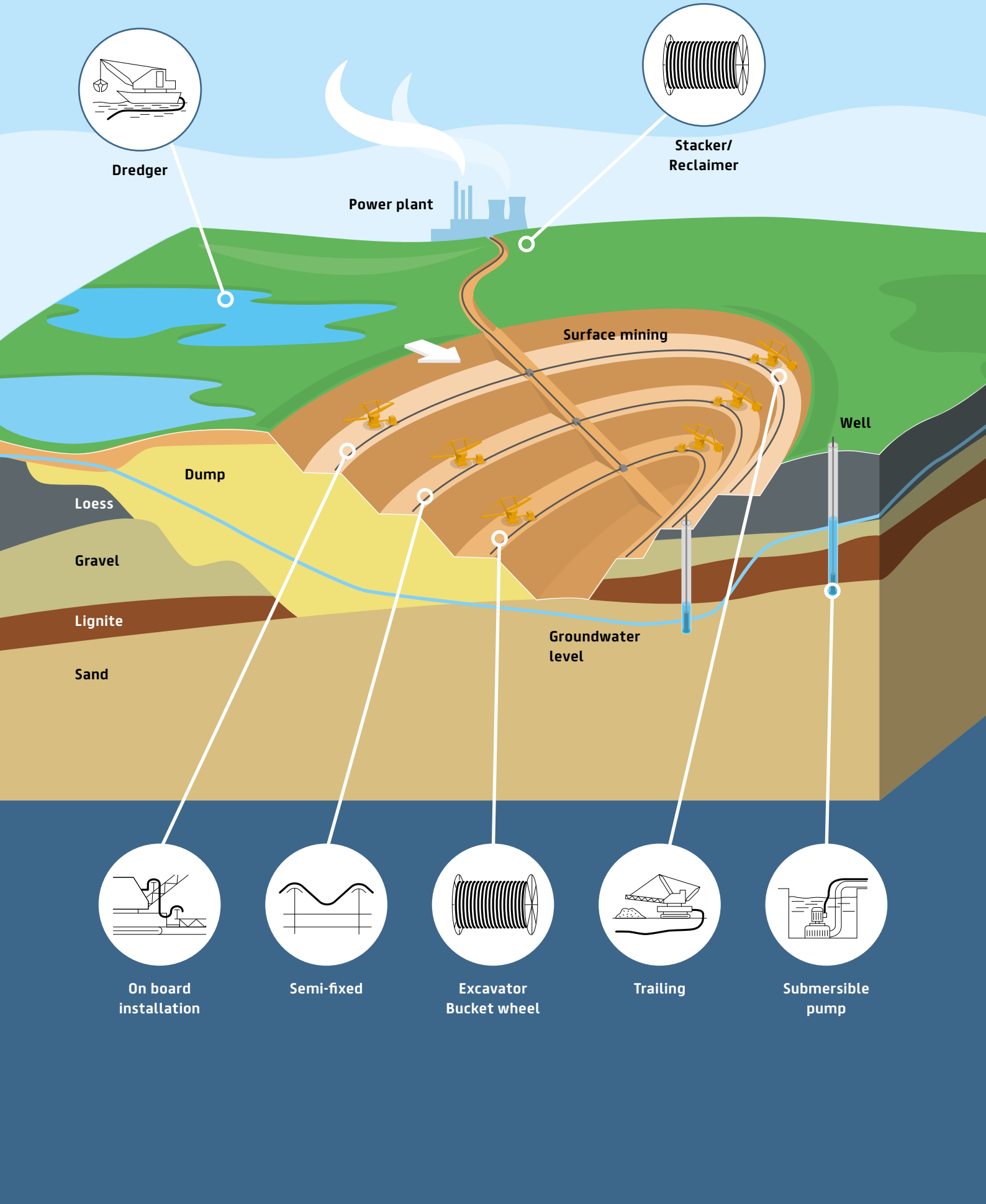
*“A security guarantee for personnel and equipment.”*

# Applications – overview

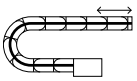
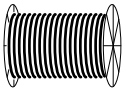
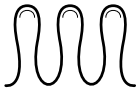
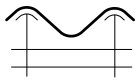
## Opencast

| Application groups: |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| | Stacker/ Reclaimer | Bunker, Drills | Trailing | Dredge | Submersible pump | Semi-fixed | Semi-fixed |
| **MEDIUM VOLTAGE REELING CABLES** | | | | | | | |
| PROTOLON(M)-R | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(M)-R FO | ● | ● | ● | ● | ● | ● | ● |
| **MEDIUM VOLTAGE TRAILING CABLES** | | | | | | | |
| TENAX-SAS | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(SB) | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(SB-SAM) | ● | ● | ● | ● | ● | ● | ● |
| TENAX-LUMEN | ● | ● | ● | ● | ● | ● | ● |
| **MEDIUM VOLTAGE DREDGING CABLES** | | | | | | | |
| PROTOLON(ST).../3E | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(ST) | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(M)-F | ● | ● | ● | ● | ● | ● | ● |
| **CABLES FOR SEMI-FLEXIBLE INSTALLATION** | | | | | | | |
| PROTOLON(M)-F | ● | ● | ● | ● | ● | ● | ● |
| PROTOMONT NSSHOEU | ● | ● | ● | ● | ● | ● | ● |
| PROTOMONT NSHXOEU | ● | ● | ● | ● | ● | ● | ● |
| PROTOMONT(MT) | ● | ● | ● | ● | ● | ● | ● |
| PROTOMONT EMV-FC | ● | ● | ● | ● | ● | ● | ● |
| **MEDIUM VOLTAGE SINGLE CORE CABLES** | | | | | | | |
| FELTOFLEX NTMCWOEU | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON NTMCGCWOEU | ● | ● | ● | ● | ● | ● | ● |
| PROTOLON(M) (N)TM.. | ● | ● | ● | ● | ● | ● | ● |
| **CONTROL AND SIGNALING CABLES** | | | | | | | |
| OPTOFLEX(M) | ● | ● | ● | ● | ● | ● | ● |
| PROTOMONT(MSR) | ● | ● | ● | ● | ● | ● | ● |

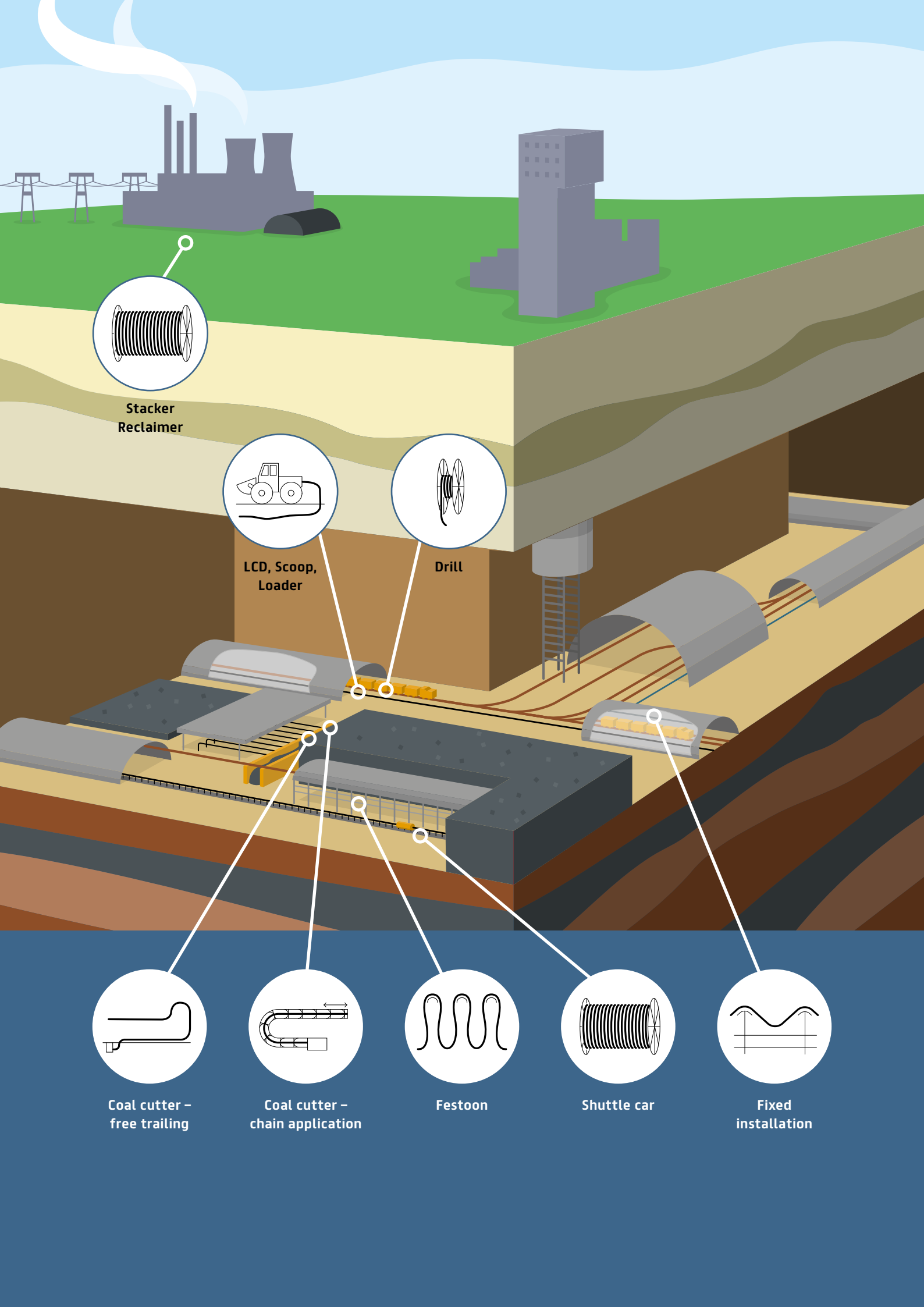
● Main application ● Suitable ● Not suitable


Dredger
Stacker/
Reclaimer
Power plant
Surface mining
Well
Dump
Loess
Gravel
Lignite
Sand
Groundwater
level
On board
installation
Semi-fixed
Excavator
Bucket wheel
Trailing
Submersible
pump

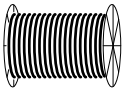
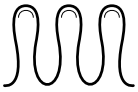
# Underground

| Application groups: |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| | Shearer/ Chain | Shearer/ trailing | Reeling | Reeling | Festoon | Semi-fixed |
| **SHEARER CABLES FOR CHAIN APPLICATION** | | | | | | |
| PROTOMONT(V) NSS... | ● | ● | ● | ● | ● | ● |
| PROTOMONT(V) NTS... | ● | ● | ● | ● | ● | ● |
| PROTOMONT(VO) | ● | ● | ● | ● | ● | ● |
| TENAX-CTE | ● | ● | ● | ● | ● | ● |
| **SHEARER CABLES FOR FREE TRAILING** | | | | | | |
| PROTOMONT(Z) | ● | ● | ● | ● | ● | ● |
| **UNDERGROUND REELING CABLES** | | | | | | |
| TENAX-LK | ● | ● | ● | ● | ● | ● |
| PROTOMONT(S) | ● | ● | ● | ● | ● | ● |
| CORDAFLEX(S) | ● | ● | ● | ● | ● | ● |
| PROTOMONT(M+) | ● | ● | ● | ● | ● | ● |
| **CABLES FOR SEMI-FIXED INSTALLATION** | | | | | | |
| PROTOMONT Festoon | ● | ● | ● | ● | ● | ● |
| SUPROMONT (N)3GHSSYCY | ● | ● | ● | ● | ● | ● |
| SUPROMONT (N)3GHSSHCH | ● | ● | ● | ● | ● | ● |
| PROTOMONT(MT) | ● | ● | ● | ● | ● | ● |
| PROTOMONT NSSH../3E | ● | ● | ● | ● | ● | ● |
| PROTOMONT EMV-FC | ● | ● | ● | ● | ● | ● |

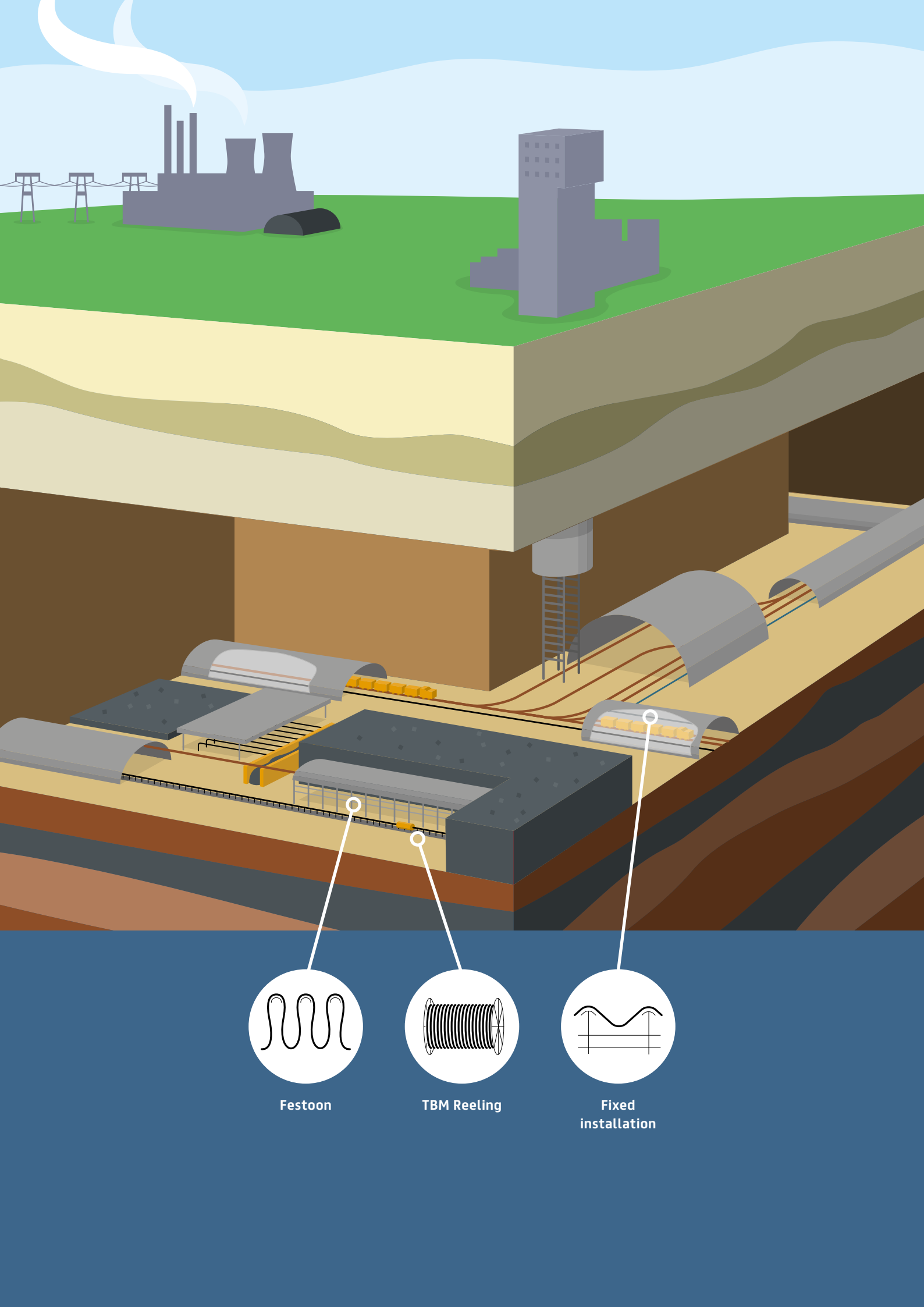
● Main application ● Suitable ● Not suitable


Stacker
Reclaimer
LCD, Scoop,
Loader
Drill
Coal cutter –
free trailing
Coal cutter –
chain application
Festoon
Shuttle car
Fixed
installation

# Tunnelling

| Application groups: |  |  |  |  |
|---|---|---|---|---|
| | Reeling | Reeling | Festoon | Semi-fixed |
| **TBM REELING** | | | | |
| PROTOMONT TBM (N)TSCGECWOEU | ● | ● | ● | ● |
| PROTOMONT TBM (N)TSCGECWHXOEU | ● | ● | ● | ● |
| TENAX-HTT | ● | ● | ● | ● |
| **CABLES FOR SEMI-FIXED INSTALLATION** | | | | |
| PROTOMONT Festoon | ● | ● | ● | ● |
| SUPROMONT (N)3GHSSYCY | ● | ● | ● | ● |
| SUPROMONT (N)3GHSSHCH | ● | ● | ● | ● |
| PROTOMONT(MT) | ● | ● | ● | ● |
| PROTOMONT NSSH../3E | ● | ● | ● | ● |
| PROTOMONT EMV-FC | ● | ● | ● | ● |

● Main application ● Suitable ● Not suitable


Festoon
TBM Reeling
Fixed installation

# Opencast

## Index

# Product overview

| MEDIUM VOLTAGE REELING CABLES | | |
|---|---|---|
| | PROTOLON(M) R- | PROTOLON(M) R-FO |
| Travel speed max. (m/min) | 120 | 120 |
| Permissible tensile force (N/mm²) | 20 | 20 |
| Stability against torsion (°/m) | +/- 100 | +/- 100 |
| Sheath quality | 5GM5 | 5GM5 |
| Reversed bending stability | +++ | +++ |
| Flexibility | +++ | +++ |
| Resistance against water | +++ | +++ |
| S-bendings in operation | Multiple planes | Multiple planes |
| Temperature range in fully flexible operation (°C) | -35 to +60 | -35 to +60 |
| Approvals | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B |

| MEDIUM VOLTAGE TRAILING CABLES | | | | |
|---|---|---|---|---|
| | TENAX-SAS | PROTOLON(SB) | PROTOLON (SB-SAM) | TENAX-LUMEN |
| Application | Trailing & Reeling | Trailing | Trailing | Trailing |
| Cable design | Acc. to VDE | Based on VDE | Based on VDE | Based on VDE |
| Permissible tensile force (N/mm²) | 25 | 15 | 20 | 25 |
| Sheath quality | 5GM5+ | 5GM5 | 5GM5 | PUR |
| Sheath abrasion against surface | ++++ | +++ | +++ | +++ |
| Reversed bending stability | +++ | +++ | +++ | +++ |
| Temperature range in fully flexible operation (°C) | -50 to +60 | -20 to +60 | -30 to +60 | -50 to +60 |
| Approvals | Fire certificate, Gost -R/-K/-B | DIN VDE 0250-813, MSHA P-189-4, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B | – |

| MEDIUM VOLTAGE DREDGING CABLES | | | |
|---|---|---|---|
| | PROTOLON(ST) .../3E | PROTOLON(ST) | PROTOLON(M) F |
| Cable design | Acc. to VDE | Acc. to VDE | Based on VDE |
| Permissible tensile force N/mm² | 15 | 15 | 15 |
| Stability against torsion (°/m) | +/- 25 | +/- 100 | +/- 100 |
| Sheath quality | 5GM3 | 5GM3 | 5GM3 |
| Water compatibility acc. to VDE 0282 part 16 | Excellent | Excellent | Very good |
| Stability against water penetration | +++ | +++ | ++ |
| Approvals | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B |

## CABLES FOR SEMI-FLEXIBLE INSTALLATION

| | PROTOLON(M) F | PROTOMONT NSSHOEU | PROTOMONT NSHXOEU | PROTOMONT (MT) (N)SSHOEU | PROTOMONT EMV-FC |
|---|---|---|---|---|---|
| Application | MV semi-fixed | LV semi-fixed | LV semi-fixed | LV semi-fixed | LV frequency converter cable |
| Cable design | Based on VDE | Acc. to VDE | Based on VDE | Based on VDE | Based on VDE |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 | 15 | 15 |
| Sheath quality | 5GM3 | 5GM5 | 5GM3 (halogen-free) | 5GM5 | 5GM5 |
| Sheath abrasion | ++ | +++ | ++ | +++ | +++ |
| Reversed bending stability | ++ | ++ | ++ | ++ | ++ |
| Stability against water penetration | ++ | +++ | +++ | +++ | +++ |
| Temperature range in fully flexible operation (°C) | -25 to +60 | -25 to +60 | -25 to +60 | -25 to +60 | -25 to +60 special version: -45 to +60 |
| Approvals | Fire certificate, Gost -R/-K/-B | MA – China, MSHA P-189-3, EAC certificate | – | VDE-REG F546 | MSHA P-189-3, EAC certificate |

## MEDIUM VOLTAGE SINGLE CORE CABLES

| | FELTOFLEX NTMCWOEU | PROTOLON NTMCGCWOEU | PROTOLON(M) (N)TMCGCWOEU |
|---|---|---|---|
| Application | Flexible/semi-fixed | Flexible/semi-fixed | Flexible/semi-fixed |
| Voltage range (kV) | up to 35 | up to 30 | up to 30 |
| Cable design | Acc. to VDE | Acc. to VDE | Based on VDE |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Sheath quality | 5GM5 | 5GM3 | 5GM3 |
| Outer semi-conductive layer | Cold removable | Warm removable | Cold removable |
| Stability against torsion (°/m) | +/- 25 | +/- 25 | +/- 25 |
| Temperature range in fully flexible operation (°C) | -25 to +80 | -25 to +60 | -25 to +60 |
| Approvals | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B |

## CONTROL AND SIGNALING CABLES

| | OPTOFLEX(M) | PROTOMONT(MSR) |
|---|---|---|
| Application | Semi-fixed | Semi-fixed |
| Cable design | Flexible fibre optic cable | Rubber sheathed data cable |
| Special design features | Glass fibres in jelly filled tubes | Twisted pairs, overall screen |
| Permissible tensile force (N/mm²) | max. 2000N | max. 15 |
| Sheath quality | 5GM5 | EM2 |
| Reversed bending stability | ++ | ++ |
| Temperature range in fully flexible operation (°C) | -30 to +60 | -25 to +60 |
| Approvals | – | EAC certificate |

# PROTOLON(M) R-(N)TSCGEWOEU 6 kV – 35 kV

## Medium voltage reeling cable


### Application

For connection of large material handling machines such as excavators, dumpers, mobile crusher in open-cast mines. Flexible MV reeling cable suitable for high mechanical stresses in conjunction with mono spiral reels and cylindrical reels.

### Global data

| | |
|---|---|
| Brand | PROTOLON(M) |
| Type designation | R-(N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, very finely stranded (class FS) |
| Insulation | High grade lead-free special compound based on HEPR (better than 3GI3) with improved mechanical and electrical characteristics (DIN VDE 0207-21) |
| Electrical field control | Inner and outer layer of semi-conductive rubber compound, cold strippable |
| Core identification | Natural colored with black semiconductive rubber and white numbers (1-3) |
| Core arrangement | Three-core design, with split earth conductor in the interstices |
| Inner sheath | Basic material EPR, compound type 5GM3 |
| Torsion protection | Braid of polyester threads in a vulcanized bond between inner and outer sheath |
| Outer sheath | High grade chloroprene compound CR/PCP (better than 5GM5).<br>Color: red (other colors available on request). |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

| | | |
|---|---|---|
| 14/25 kV | 18/30 kV | 20/35 kV |
| 17.3/30 kV | 20.8/36 kV | 24.2/42 kV |
| 22.5/45 kV | 27/54 kV | 31.5/63 kV |
| 36 kV ( 5 Min.) | 43 kV ( 5 Min.) | 50 kV ( 5 Min.) |
| 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 (HD 22.16) |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -35 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 20 N/mm² |
| Max. tensile load on the conductor during acceleration | 25 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |
| Travel speed | On rewinding: up to 100 m/min<br>Reeling operation: up to 120 m/min |
| Additional tests | Reversed bending test, torsional stress test, roller bending test (type C) |

## PROTOLON(M) R-(N)TSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20007613 | 5DK3923 | 7.1 | 35.5 | 38.5 | 2300 | 1500 | 0.7839 | 0.37 | 0.31 | 131 | 3.58 |
| 3x25+3x50/3 | 20171877 | 5DK3924 | 7.1 | 39.9 | 42.9 | 2760 | 1500 | 0.7839 | 0.37 | 0.35 | 131 | 3.58 |
| 3x35+3x25/3 | 20007426 | 5DK3900 | 8.4 | 39.3 | 42.3 | 2870 | 2100 | 0.554 | 0.43 | 0.3 | 162 | 5.01 |
| 3x35+3x50/3 | 20167803 | 5DK3926 | 8.4 | 42.2 | 45.2 | 3190 | 2100 | 0.554 | 0.43 | 0.32 | 162 | 5.01 |
| 3x50+3x25/3 | 20007893 | 5DK3915 | 10.1 | 42.8 | 45.8 | 3550 | 3000 | 0.386 | 0.49 | 0.28 | 202 | 7.15 |
| 3x50+3x50/3 | 20171416 | 5DK3908 | 10.1 | 42.8 | 45.8 | 3620 | 3000 | 0.386 | 0.49 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3 | 20156763 | 5DK3914 | 11.8 | 46.4 | 49.4 | 4340 | 4200 | 0.272 | 0.55 | 0.27 | 250 | 10.01 |
| 3x70+3x50/3 | 20216565 | 5DK3913 | 11.8 | 46.6 | 49.6 | 4450 | 4200 | 0.272 | 0.55 | 0.27 | 250 | 10.01 |
| 3x95+3x50/3 | 20004527 | 5DK3916 | 13.8 | 51.5 | 55.5 | 5790 | 5700 | 0.206 | 0.63 | 0.26 | 301 | 13.59 |
| 3x120+3x70/3 | 20004525 | 5DK3907 | 15.5 | 55.2 | 59.2 | 6950 | 7200 | 0.161 | 0.7 | 0.25 | 352 | 17.16 |
| 3x150+3x70/3 | 20004528 | 5DK3917 | 17.4 | 59.2 | 63.2 | 8200 | 9000 | 0.129 | 0.76 | 0.25 | 404 | 21.45 |
| 3x150+3x95/3 | | | 17.4 | 59.2 | 63.2 | 7983 | 9000 | 0.129 | 0.76 | 0.25 | 404 | 21.45 |
| 3x185+3x95/3 | 20007425 | 5DK3918 | 19.2 | 64.4 | 68.4 | 9800 | 11100 | 0.106 | 0.82 | 0.24 | 461 | 26.46 |
| 3x185+3x120/3 | | | 19.2 | 64.4 | 68.4 | 9591 | 11100 | 0.106 | 0.82 | 0.24 | 461 | 26.46 |
| 3x240+3x120/3 | 20014799 | 5DK3883 | 22.1 | 70.6 | 74.6 | 12490 | 14400 | 0.0801 | 0.93 | 0.24 | 540 | 34.32 |
| 3x300+3x150/3 | 20014797 | 5DK3885 | 24.7 | 77.5 | 81.5 | 15270 | 18000 | 0.0641 | 1.03 | 0.23 | 620 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20007429 | 5DK4310 | 7.1 | 36.8 | 39.8 | 2360 | 1500 | 0.7839 | 0.33 | 0.32 | 131 | 3.58 |
| 3x25+3x50/3 | | | 7.1 | 41.3 | 44.3 | 2880 | 1500 | 0.7839 | 0.33 | 0.32 | 131 | 3.58 |
| 3x35+3x25/3 | 20006949 | 5DK4309 | 8.4 | 40.5 | 43.5 | 2960 | 2100 | 0.554 | 0.38 | 0.31 | 162 | 5.01 |
| 3x35+3x50/3 | 20018359 | 5DK4312 | 8.4 | 42.9 | 45.9 | 3350 | 2100 | 0.554 | 0.38 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3 | 20008746 | 5DK4314 | 10.1 | 44.1 | 47.1 | 3610 | 3000 | 0.386 | 0.43 | 0.29 | 202 | 7.15 |
| 3x50+3x50/3 | 20031763 | 5DK4316 | 10.1 | 44.1 | 47.1 | 3820 | 3000 | 0.386 | 0.43 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3 | 20004607 | 5DK4317 | 11.8 | 47.9 | 50.9 | 4510 | 4200 | 0.272 | 0.49 | 0.28 | 250 | 10.01 |
| 3x70+3x50/3 | 20004608 | 5DK4318 | 11.8 | 47.9 | 50.9 | 4730 | 4200 | 0.272 | 0.49 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3 | 20004611 | 5DK4321 | 13.8 | 52.8 | 56.8 | 5810 | 5700 | 0.206 | 0.56 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20001446 | 5DK4322 | 15.5 | 56.4 | 60.4 | 7110 | 7200 | 0.161 | 0.62 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3 | 20007824 | 5DK4323 | 17.4 | 61.9 | 65.9 | 8380 | 9000 | 0.129 | 0.67 | 0.25 | 404 | 21.45 |
| 3x185+3x95/3 | 20008329 | | 19.2 | 65.7 | 69.7 | 10030 | 11100 | 0.106 | 0.73 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | 20170681 | | 22.1 | 73.3 | 77.3 | 12570 | 14400 | 0.0801 | 0.82 | 0.24 | 540 | 34.32 |
| 3x300+3x150/3 | 20233807 | 5DK4326 | 24.7 | 78.7 | 82.7 | 15060 | 18000 | 0.0641 | 0.91 | 0.24 | 620 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.

Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

## PROTOLON(M) R-(N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20174026 | | 7.1 | 41.4 | 44.4 | 2700 | 1500 | 0.7839 | 0.34 | 0.26 | 139 | 3.58 |
| 3x25+3x50/3 | | 5DK5122 | 7.1 | 43.6 | 46.6 | 3080 | 1500 | 0.7839 | 0.34 | 0.26 | 139 | 3.58 |
| 3x35+3x25/3 | 20153602 | | 8.4 | 43.9 | 46.9 | 3190 | 2100 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x35+3x50/3 | | | 8.4 | 43.9 | 46.9 | 3380 | 2100 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x50+3x25/3 | 20175507 | | 10.1 | 44.1 | 47.1 | 3890 | 3000 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x50+3x50/3 | 20004682 | 5DK5132 | 10.1 | 57 | 60 | 5790 | 3000 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x70+3x35/3 | 20233253 | | 11.8 | 52 | 56 | 5010 | 4200 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x70+3x50/3 | | | 11.8 | 52 | 56 | 5130 | 4200 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x95+3x50/3 | 20004683 | 5DK5135 | 13.8 | 66.2 | 70.2 | 8220 | 5700 | 0.206 | 0.41 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3 | | | 15.5 | 61.3 | 65.3 | 7580 | 7200 | 0.161 | 0.45 | 0.28 | 371 | 17.16 |
| 3x150+3x70/3 | | | 17.4 | 65.3 | 69.3 | 8980 | 9000 | 0.129 | 0.5 | 0.27 | 428 | 21.45 |
| 3x185+3x95/3 | 20163255 | | 19.2 | 69.1 | 73.1 | 10280 | 11100 | 0.106 | 0.54 | 0.26 | 488 | 26.46 |
| 3x240+3x120/3 | | | 22.1 | 76.6 | 80.6 | 13110 | 14400 | 0.0801 | 0.6 | 0.26 | 574 | 34.32 |
| 3x300+3x150/3 | | | 24.7 | 83.5 | 88.5 | 16010 | 18000 | 0.0641 | 0.66 | 0.25 | 660 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20008326 | 5DK5866 | 7.1 | 44.1 | 47.1 | 3110 | 1500 | 0.7839 | 0.23 | 0.36 | 139 | 3.58 |
| 3x25+3x50/3 | | | 7.1 | 44.1 | 47.1 | 3160 | 1500 | 0.7839 | 0.23 | 0.36 | 139 | 3.58 |
| 3x35+3x25/3 | 20025024 | 5DK5868 | 8.4 | 46.8 | 49.8 | 3620 | 2100 | 0.554 | 0.26 | 0.34 | 172 | 5.01 |
| 3x35+3x50/3 | | | 8.4 | 46.8 | 49.8 | 3660 | 2100 | 0.554 | 0.26 | 0.34 | 172 | 5.01 |
| 3x50+3x25/3 | 20142156 | 5DK5870 | 10.1 | 51.3 | 55.3 | 4490 | 3000 | 0.386 | 0.29 | 0.32 | 215 | 7.15 |
| 3x50+3x50/3 | 20015893 | 5DK5872 | 10.1 | 51.3 | 55.3 | 4720 | 3000 | 0.386 | 0.29 | 0.32 | 215 | 7.15 |
| 3x70+3x35/3 | 20151773 | | 11.8 | 55 | 59 | 5360 | 4200 | 0.272 | 0.33 | 0.31 | 265 | 10.01 |
| 3x70+3x50/3 | 20269483 | | 11.8 | 55 | 59 | 5480 | 4200 | 0.272 | 0.33 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3 | 20004728 | 5DK5875 | 13.8 | 61.8 | 65.8 | 6800 | 5700 | 0.206 | 0.37 | 0.3 | 319 | 13.59 |
| 3x95+3x70/3 | 20015538 | 5DK5876 | 13.8 | 59.2 | 63.2 | 7090 | 5700 | 0.206 | 0.37 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3 | | | 15.5 | 64.2 | 68.2 | 7980 | 7200 | 0.161 | 0.4 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3 | | | 17.4 | 68.2 | 72.2 | 9380 | 9000 | 0.129 | 0.44 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | 20161593 | | 19.2 | 73.4 | 77.4 | 10990 | 11100 | 0.106 | 0.48 | 0.27 | 488 | 26.46 |
| 3x240+3x120/3 | 20157265 | | 22.1 | 78.3 | 82.3 | 14200 | 14400 | 0.0801 | 0.54 | 0.26 | 574 | 34.32 |
| 3x300+3x150/3 | | | 24.7 | 86.4 | 91.4 | 16560 | 18000 | 0.0641 | 0.59 | 0.26 | 660 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.
Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

## PROTOLON(M) R-(N)TSCGEWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20258099 | | 7.1 | 47.9 | 50.9 | 3360 | 1500 | 0.7839 | 0.2 | 0.38 | 139 | 3.58 |
| 3x25+3x50/3 | | | 7.1 | 47.9 | 50.9 | 3540 | 1500 | 0.7839 | 0.2 | 0.38 | 139 | 3.58 |
| 3x35+3x25/3 | 20193175 | | 8.4 | 51.5 | 55.5 | 4050 | 2100 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x35+3x50/3 | | | 8.4 | 51.5 | 55.5 | 4240 | 2100 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x50+3x25/3 | | | 10.1 | 55.2 | 59.2 | 4820 | 3000 | 0.386 | 0.25 | 0.34 | 215 | 7.15 |
| 3x50+3x50/3 | 20009369 | | 10.1 | 51.2 | 55.2 | 5010 | 3000 | 0.386 | 0.25 | 0.34 | 215 | 7.15 |
| 3x70+3x35/3 | 20069172 | 5DK6125 | 11.8 | 58.8 | 62.8 | 6030 | 4200 | 0.272 | 0.28 | 0.33 | 265 | 10.01 |
| 3x70+3x50/3 | 20008713 | 5DK6124 | 11.8 | 58.8 | 62.8 | 6180 | 4200 | 0.272 | 0.28 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3 | 20182413 | 5DK6127 | 13.8 | 64.4 | 68.4 | 7280 | 5700 | 0.206 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120+3x70/3 | 20257651 | | 15.8 | 68 | 72 | 8850 | 7200 | 0.161 | 0.34 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3 | | | 17.4 | 73.4 | 77.4 | 10230 | 9000 | 0.129 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3 | | | 19.2 | 77.3 | 81.3 | 11610 | 11100 | 0.106 | 0.4 | 0.28 | 488 | 26.46 |
| 3x240+3x120/3 | | 5DK6132 | 22.1 | 84.7 | 89.7 | 14660 | 14400 | 0.0801 | 0.45 | 0.27 | 574 | 34.32 |
| 3x300+3x150/3 | 20233808 | | 24.7 | 91.8 | 96.8 | 17330 | 18000 | 0.0641 | 0.49 | 0.27 | 660 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | | | 7.1 | 52.2 | 56.2 | 3900 | 1500 | 0.7839 | 0.18 | 0.4 | 139 | 3.58 |
| 3x25+3x50/3 | | | 7.1 | 52.2 | 56.2 | 4090 | 1500 | 0.7839 | 0.18 | 0.4 | 139 | 3.58 |
| 3x35+3x25/3 | | | 8.4 | 55 | 59 | 4450 | 2100 | 0.554 | 0.19 | 0.38 | 172 | 5.01 |
| 3x35+3x50/3 | | | 8.4 | 55 | 59 | 4640 | 2100 | 0.554 | 0.19 | 0.38 | 172 | 5.01 |
| 3x50+3x25/3 | 20181197 | | 10.1 | 58.6 | 62.6 | 5250 | 3000 | 0.386 | 0.22 | 0.36 | 215 | 7.15 |
| 3x50+3x50/3 | 20136772 | | 10.1 | 58.6 | 62.6 | 5430 | 3000 | 0.386 | 0.22 | 0.36 | 215 | 7.15 |
| 3x70+3x35/3 | 20159423 | | 11.8 | 62.5 | 66.5 | 6500 | 4200 | 0.272 | 0.24 | 0.34 | 265 | 10.01 |
| 3x70+3x50/3 | 20004740 | 5DK6603 | 11.8 | 63.6 | 67.6 | 6840 | 4200 | 0.272 | 0.24 | 0.34 | 265 | 10.01 |
| 3x95+3x50/3 | 20143262 | 5DK6613 | 13.8 | 67.9 | 71.9 | 8160 | 5700 | 0.206 | 0.27 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3 | 20006962 | 5DK6607 | 15.5 | 72.8 | 76.8 | 9630 | 7200 | 0.161 | 0.29 | 0.31 | 371 | 17.16 |
| 3x150+3x70/3 | | | 17.4 | 76.9 | 80.9 | 10780 | 9000 | 0.129 | 0.32 | 0.3 | 428 | 21.45 |
| 3x185+3x95/3 | | | 19.2 | 80.6 | 84.6 | 12170 | 11100 | 0.106 | 0.34 | 0.3 | 488 | 26.46 |
| 3x240+3x120/3 | 20261692 | | 22.1 | 88.1 | 93.1 | 15280 | 14400 | 0.0801 | 0.38 | 0.28 | 574 | 34.32 |
| 3x300+3x150/3 | | | 24.7 | 94.6 | 99.6 | 18200 | 18000 | 0.0641 | 0.42 | 0.28 | 660 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.
Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

## PROTOLON(M) R-(N)TSCGEWOEU 20/35 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | | | 7.1 | 56.8 | 60.8 | 4450 | 1500 | 0.7839 | 0.16 | 0.42 | 139 | 3.58 |
| 3x35+3x25/3 | 20218424 | 5DK7*** | 8.4 | 61.1 | 65.1 | 5260 | 2100 | 0.554 | 0.18 | 0.4 | 172 | 5.01 |
| 3x50+3x25/3 | | | 10.1 | 64.6 | 68.6 | 6080 | 3000 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x50+3x50/3 | 20226377 | | 10.1 | 63.2 | 67.2 | 6500 | 3000 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3 | | | 11.8 | 68.2 | 72.2 | 7160 | 4200 | 0.272 | 0.23 | 0.36 | 265 | 10.01 |
| 3x70+3x50/3 | 20004750 | 5DK7304 | 11.8 | 68.2 | 72.2 | 7590 | 4200 | 0.272 | 0.25 | 0.36 | 265 | 10.01 |
| 3x120+3x70/3 | 20171878 | | 15.5 | 76.4 | 81.4 | 9850 | 7200 | 0.161 | 0.28 | 0.34 | 371 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.
Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

# Notes

# PROTOLON(M) R-(N)TSCGEWOEU FO 6 kV – 35 kV

## Medium voltage reeling cable with integrated fiber-optics

### Application

For connection of large material handling machines such as excavators, dumpers, mobile crushers in open-cast mines. Flexible MV reeling cable suitable for high mechanical stresses in conjunction with mono-spiral reels and cylindrical reels.

### Global data

| | |
|---|---|
| Brand | PROTOLON(M) |
| Type designation | R-(N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, very finely stranded (class FS) |
| Insulation | High grade lead-free special compound based on HEPR (better than 3GI3)<br>with improved mechanical and electrical characteristics (DIN VDE 0207-21) |
| Electrical field control | Inner and outer layer of semi-conductive rubber compound, cold strippable |
| Core identification | Natural colored with black semi conductive rubber and white numbers (1-3) |
| Optical fiber | Inner core diameter of fiber 9 µm, 62.5 µm or 50 µm;<br>Diameter over cladding 125 µm;<br>Diameter over coating 250 µm;<br>Designs up to 24 fibers available.<br><br>Fiber G50/125<br>Attenuation at 850 nm: <2.8 dB/km<br>Attenuation at 1310 nm: <0.8 dB/km<br>Bandwith at 850 nm: >400 MHz<br>Bandwith at 1300 nm: >1200 MHz<br>Nummerical aperture: 0.20 +/- 0.02<br><br>Fiber G62.5/125<br>Attenuation at 850 nm: <3.3 dB/km<br>Attenuation at 1310 nm: <0.9 dB/km<br>Bandwith at 850 nm: >400 MHz<br>Bandwith at 1300 nm: >600 MHz<br>Nummerical aperture: 0.275 +/- 0.02<br><br>Fiber E9/125<br>Attenuation at 1310 nm: <0.4 dB/km<br>Attenuation at 1550 nm: <0.3 dB/km<br>Nummerical aperture: 0.14 +/- 0.02<br>Chromatic dispersion at 1310 nm: <3.5 ps/nm km<br>Chromatic dispersion at 1550 nm: <18 ps/nm km |
| Fiber coding | Color coding of the fibers and buffering tube for identification of the fiber type |
| Fiber covering | Loose tube with filling compound, Basic material: ETFE, Compound: 7YI 1, Natural color |
| Arrangement of fiber optic elements | Six tubes laid-up around a central support element, with up to 4 fibers in each tube. |
| Core arrangement | Three-core design, with split earth conductor and fiber-optic element in the interstices |
| Inner sheath | Basic material EPR, compound type 5GM3 |
| Torsion protection | Braid of polyester threads in a vulcanized bond between inner and outer sheath |
| Outer sheath | High grade chloroprene compound CR/PCP (better than 5GM5).<br>Color: red (other colors available on request). |

## Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

| | | | |
|---|---|---|---|
| 18/30 kV | 14/25 kV | 20/35 kV | |
| 20.8/36 kV | 17.3/30 kV | 24.2/42 kV | |
| 27/54 kV | 22.5/45 kV | 31.5/63 kV | |
| 43 kV ( 5 Min.) | 36 kV ( 5 Min.) | 50 kV ( 5 Min.) | |
| 2 kV | 2 kV | 2 kV | |

## Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 (HD 22.16) |

## Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -35 °C ; max +80 °C |

## Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 20 N/mm² |
| Max. tensile load on the conductor during acceleration | 25 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x OD (OD = outer diameter) |
| Travel speed | On rewinding: up to 100 m/min<br>Reeling operation: up to 120 m/min |
| Additional tests | Reversed bending test, torsional stress test, roller bending test (type C) |

## PROTOLON(M) R-(N)TSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 40 | 43 | 2590 | 1500 | 0.7839 | 0.37 | 0.35 | 131 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 42.6 | 45.6 | 2900 | 1500 | 0.7839 | 0.37 | 0.38 | 131 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 41.6 | 44.6 | 2960 | 2100 | 0.554 | 0.43 | 0.32 | 162 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 44.5 | 47.5 | 3300 | 2100 | 0.554 | 0.43 | 0.35 | 162 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 42.8 | 45.8 | 3430 | 3000 | 0.386 | 0.49 | 0.28 | 202 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 46.4 | 49.4 | 3950 | 3000 | 0.386 | 0.49 | 0.31 | 202 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 46.4 | 49.4 | 4350 | 4200 | 0.272 | 0.55 | 0.27 | 250 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 49.8 | 53.8 | 4700 | 4200 | 0.272 | 0.55 | 0.29 | 250 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 51.5 | 55.5 | 5630 | 5700 | 0.206 | 0.63 | 0.26 | 301 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 55.2 | 59.2 | 6800 | 7200 | 0.161 | 0.7 | 0.25 | 352 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 59.2 | 63.2 | 7970 | 9000 | 0.129 | 0.76 | 0.25 | 404 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 64.4 | 68.4 | 9630 | 11100 | 0.106 | 0.82 | 0.24 | 461 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 70.6 | 74.6 | 12160 | 14400 | 0.0801 | 0.93 | 0.24 | 540 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 77.5 | 81.5 | 14880 | 18000 | 0.0641 | 1.03 | 0.23 | 620 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 41.3 | 44.3 | 2660 | 1500 | 0.7839 | 0.33 | 0.35 | 131 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 43.6 | 46.6 | 2900 | 1500 | 0.7839 | 0.33 | 0.38 | 131 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 42.9 | 45.9 | 3070 | 2100 | 0.554 | 0.38 | 0.33 | 162 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 45.2 | 48.2 | 3500 | 2100 | 0.554 | 0.38 | 0.35 | 162 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 44.1 | 47.1 | 3560 | 3000 | 0.386 | 0.43 | 0.29 | 202 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 47.8 | 50.8 | 3900 | 3000 | 0.386 | 0.43 | 0.32 | 202 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 47.7 | 50.7 | 4480 | 4200 | 0.272 | 0.49 | 0.28 | 250 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 51.2 | 55.2 | 5010 | 4200 | 0.272 | 0.49 | 0.3 | 250 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 52.8 | 56.8 | 5770 | 5700 | 0.206 | 0.56 | 0.27 | 301 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 56.4 | 60.4 | 6950 | 7200 | 0.161 | 0.62 | 0.25 | 352 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 61.9 | 65.9 | 8350 | 9000 | 0.129 | 0.67 | 0.25 | 404 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 65.7 | 69.7 | 9810 | 11100 | 0.106 | 0.73 | 0.24 | 461 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 73.3 | 77.3 | 12600 | 14400 | 0.0801 | 0.82 | 0.24 | 540 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 78.7 | 82.7 | 15090 | 18000 | 0.0641 | 0.91 | 0.23 | 620 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.

Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

Design with 6, 12, 18 or 24 fibers, in G62,5, G50 and E9 available upon request. Further combination with different fiber types is also possible

## PROTOLON(M) R-(N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 43.6 | 46.6 | 2910 | 1500 | 0.7839 | 0.26 | 0.36 | 139 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 45.9 | 48.9 | 3250 | 1500 | 0.7839 | 0.26 | 0.38 | 139 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 43.9 | 46.9 | 3180 | 2100 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 47.5 | 50.5 | 3600 | 2100 | 0.554 | 0.29 | 0.35 | 172 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 47.5 | 50.5 | 3900 | 3000 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 51 | 55 | 4500 | 3000 | 0.386 | 0.33 | 0.32 | 215 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 52 | 56 | 5020 | 4200 | 0.272 | 0.37 | 0.3 | 265 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 52 | 56 | 5130 | 4200 | 0.272 | 0.37 | 0.3 | 265 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 56.2 | 60.2 | 6180 | 5700 | 0.206 | 0.41 | 0.28 | 319 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 61.3 | 65.3 | 7600 | 7200 | 0.161 | 0.45 | 0.27 | 371 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 65.3 | 69.3 | 8820 | 9000 | 0.129 | 0.5 | 0.27 | 428 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 69.1 | 73.1 | 10300 | 11100 | 0.106 | 0.54 | 0.26 | 488 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 76.6 | 80.6 | 13140 | 14400 | 0.0801 | 0.6 | 0.25 | 574 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 83.5 | 88.5 | 16040 | 18000 | 0.0641 | 0.66 | 0.25 | 660 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 44.1 | 47.1 | 2980 | 1500 | 0.7839 | 0.23 | 0.36 | 139 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 47 | 50 | 3300 | 1500 | 0.7839 | 0.23 | 0.39 | 139 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 46.8 | 49.8 | 3480 | 2100 | 0.554 | 0.26 | 0.34 | 172 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 50.3 | 54.3 | 4000 | 2100 | 0.554 | 0.26 | 0.36 | 172 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 51.3 | 55.3 | 4370 | 3000 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 51.3 | 55.3 | 4450 | 3000 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 55 | 59 | 5370 | 4200 | 0.272 | 0.33 | 0.31 | 265 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 55 | 59 | 5480 | 4200 | 0.272 | 0.33 | 0.31 | 265 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 59.2 | 63.2 | 6550 | 5700 | 0.206 | 0.37 | 0.3 | 319 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 64.2 | 68.2 | 8000 | 7200 | 0.161 | 0.41 | 0.29 | 371 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 68.2 | 72.2 | 9240 | 9000 | 0.129 | 0.44 | 0.28 | 428 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 73.4 | 77.4 | 11010 | 11100 | 0.106 | 0.48 | 0.27 | 488 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 79.6 | 83.6 | 13650 | 14400 | 0.0801 | 0.54 | 0.26 | 574 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 86.4 | 91.4 | 16590 | 18000 | 0.0641 | 0.59 | 0.26 | 660 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.

Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

Design with 6, 12, 18 or 24 fibers, in G62,5, G50 and E9 available upon request. Further combination with different fiber types is also possible

## PROTOLON(M) R-(N)TSCGEWOEU 14/25 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 47.9 | 50.9 | 3360 | 1500 | 0.7839 | 0.2 | 0.38 | 139 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 47.9 | 50.9 | 3440 | 1500 | 0.7839 | 0.2 | 0.4 | 139 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 51.5 | 55.5 | 4050 | 2100 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 51.5 | 55.5 | 4130 | 2100 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 55.2 | 59.2 | 4830 | 3000 | 0.386 | 0.26 | 0.34 | 215 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 55.2 | 59.2 | 4900 | 3000 | 0.386 | 0.26 | 0.34 | 215 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 58.8 | 62.8 | 5840 | 4200 | 0.272 | 0.28 | 0.32 | 265 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 58.8 | 62.8 | 5950 | 4200 | 0.272 | 0.28 | 0.32 | 265 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 64.4 | 68.4 | 7280 | 5700 | 0.206 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 68 | 72 | 8530 | 7200 | 0.161 | 0.35 | 0.3 | 371 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 73.4 | 77.4 | 10080 | 9000 | 0.129 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 77.3 | 81.3 | 11630 | 11100 | 0.106 | 0.4 | 0.28 | 488 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 84.7 | 89.7 | 14690 | 14400 | 0.0801 | 0.45 | 0.27 | 574 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 90.2 | 95.2 | 17310 | 18000 | 0.0641 | 0.5 | 0.26 | 660 | 42.9 |

## PROTOLON(M) R-(N)TSCGEWOEU 18/30 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 52.2 | 56.2 | 3900 | 1500 | 0.7839 | 0.18 | 0.4 | 139 | 3.58 |
| 3x25+2x50/2+FO | 7.1 | 52.2 | 56.2 | 3980 | 1500 | 0.7839 | 0.18 | 0.4 | 139 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 55 | 59 | 4450 | 2100 | 0.554 | 0.2 | 0.38 | 172 | 5.01 |
| 3x35+2x50/2+FO | 8.4 | 55 | 59 | 4530 | 2100 | 0.554 | 0.2 | 0.38 | 172 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 58.6 | 62.6 | 5250 | 3000 | 0.386 | 0.22 | 0.35 | 215 | 7.15 |
| 3x50+2x50/2+FO | 10.1 | 58.6 | 62.6 | 5320 | 3000 | 0.386 | 0.22 | 0.35 | 215 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 63.6 | 67.6 | 6510 | 4200 | 0.272 | 0.25 | 0.34 | 265 | 10.01 |
| 3x70+2x50/2+FO | 11.8 | 63.6 | 67.6 | 6610 | 4200 | 0.272 | 0.25 | 0.34 | 265 | 10.01 |
| 3x95+2x50/2+FO | 13.8 | 67.8 | 71.8 | 7770 | 5700 | 0.206 | 0.27 | 0.33 | 319 | 13.59 |
| 3x120+2x70/2+FO | 15.5 | 72.8 | 76.8 | 9230 | 7200 | 0.161 | 0.29 | 0.31 | 371 | 17.16 |
| 3x150+2x70/2+FO | 17.4 | 76.9 | 80.9 | 10630 | 9000 | 0.129 | 0.32 | 0.3 | 428 | 21.45 |
| 3x185+2x95/2+FO | 19.2 | 80.6 | 84.6 | 12190 | 11100 | 0.106 | 0.34 | 0.3 | 488 | 26.46 |
| 3x240+2x120/2+FO | 22.1 | 88.1 | 93.1 | 15310 | 14400 | 0.0801 | 0.38 | 0.28 | 574 | 34.32 |
| 3x300+2x150/2+FO | 24.7 | 94.6 | 99.6 | 18220 | 18000 | 0.0641 | 0.42 | 0.28 | 660 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.

Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

Design with 6, 12, 18 or 24 fibers, in G62,5, G50 and E9 available upon request. Further combination with different fiber types is also possible

## PROTOLON(M) R-(N)TSCGEWOEU 20/35 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2+FO | 7.1 | 56.8 | 60.8 | 4450 | 1500 | 0.7839 | 0.16 | 0.42 | 139 | 3.58 |
| 3x35+2x25/2+FO | 8.4 | 61.1 | 65.1 | 5250 | 2100 | 0.554 | 0.18 | 0.4 | 172 | 5.01 |
| 3x50+2x25/2+FO | 10.1 | 64.6 | 68.6 | 6080 | 3000 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x50+2x35/2+FO | 10.1 | 64.6 | 68.6 | 6160 | 3000 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+2x35/2+FO | 11.8 | 68.2 | 72.2 | 7160 | 4200 | 0.272 | 0.23 | 0.36 | 265 | 10.01 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.

Special designs available upon request, e.g.:
- different outer sheath colors
- special types for cold regions (-45°C reeling)
- halogen-free version with 5GM3 outer sheath
- integration of additional control cores in the interstices

Design with 6, 12, 18 or 24 fibers, in G62,5, G50 and E9 available upon request. Further combination with different fiber types is also possible

# TENAX-SAS NTSCGEWOEU 6 kV – 20 kV

## MV cable for trailing applications cold flexible to -50 °C

### Application

As power supply cable to large mobile equipment in mines. Trailing cable for use with shovels and draglines in trailing and reeling applications. The outer sheath is extremly robust and tough against abrasion and tearing, fully flexible operation down to -50°C,

### Global data

| | |
|---|---|
| Brand | TENAX-SAS |
| Type designation | NTSCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Tinned copper, finely stranded (class 5), according to DIN VDE 0295 |
| PE-Conductor | Tinned copper, finely stranded (class 5) with semi conductive special rubber compound |
| Insulation | Rubber, Compound type: EPR 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound, cold strippable outer layer |
| Pilot conductor | Tinned copper, finely stranded (class 5), EPR-Insulation |
| Core arrangement | Cores laid up around conductive central cradle separator with aramid rope in the centre |
| Inner sheath | Rubber sheath, Special compound: 5GM3 (mechanical properties) |
| Outer sheath | Rubber, compound type: better 5GM5, acc. to DIN VDE 0207 part 21; Sheath color: Black |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60322-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | EN 50525-2-21 (HD 22.16) |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -50 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -50 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 25 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |

## TENAX-SAS NTSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+2x10+10 | 20095522 | 5 | 41 | 45 | 2270 | 1200 | 1.24 | 0.2 | 0.39 | 99 | 2.29 |
| 3x16+2x16+16 | | 5 | 40.5 | 44.5 | 2469 | 1200 | 1.24 | 0.2 | 0.39 | 99 | 2.29 |
| 3x25+2x16+16 | 20092078 | 6.2 | 43.5 | 47.5 | 2790 | 1875 | 0.795 | 0.23 | 0.36 | 131 | 3.58 |
| 3x35+2x16+16 | 20076465 | 7.5 | 46.5 | 50 | 3280 | 2625 | 0.565 | 0.26 | 0.34 | 162 | 5.01 |
| 3x50+2x16+16 | 20114035 | 9 | 49.5 | 54 | 3900 | 3750 | 0.393 | 0.29 | 0.32 | 202 | 7.15 |
| 3x70+2x25+16 | 20076466 | 10.6 | 55 | 59.5 | 5020 | 5250 | 0.277 | 0.34 | 0.3 | 250 | 10.01 |
| 3x95+2x25+16 | 20173155 | 12.6 | 58.5 | 63 | 5860 | 7125 | 0.21 | 0.37 | 0.29 | 301 | 13.59 |
| 3x120+2x35+16 | 20087396 | 14.8 | 65.5 | 70 | 7410 | 9000 | 0.164 | 0.41 | 0.28 | 352 | 17.16 |
| 3x150+2x35+16 | | 16 | 69.8 | 73.4 | 8456 | 11250 | 0.132 | 0.44 | 0.27 | 404 | 21.45 |
| 3x185+2x50+16 | | 17.7 | 72.7 | 77.2 | 9955 | 13875 | 0.108 | 0.48 | 0.27 | 461 | 26.46 |
| 3x240+2x70+16 | | 20.3 | 80.1 | 84.6 | 12618 | 18000 | 0.0817 | 0.54 | 0.26 | 540 | 34.32 |
| 3x300+2x95+16 | | 31.3 | 84 | 89 | 15075 | 22500 | 0.0654 | 0.78 | 0.24 | 620 | 42.9 |

## TENAX-SAS NTSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+2x16+16 | | 5 | 42.5 | 46.5 | 2613 | 1200 | 1.24 | 0.19 | 0.4 | 99 | 2.29 |
| 3x25+2x16+16 | | 6.2 | 46.1 | 49.6 | 3041 | 1875 | 0.795 | 0.21 | 0.37 | 131 | 3.58 |
| 3x35+2x16+16 | 20258100 | 7.5 | 52.5 | 56.5 | 3470 | 2625 | 0.565 | 0.24 | 0.35 | 162 | 5.01 |
| 3x50+2x16+16 | 20197175 | 9 | 52 | 56.5 | 4080 | 3750 | 0.393 | 0.27 | 0.33 | 202 | 7.15 |
| 3x70+2x25+16 | 20091980 | 10.6 | 57 | 61.5 | 5240 | 5250 | 0.277 | 0.31 | 0.31 | 250 | 10.01 |
| 3x95+2x25+16 | | 12.6 | 61.6 | 66.1 | 6503 | 7125 | 0.21 | 0.34 | 0.3 | 301 | 13.59 |
| 3x120+2x35+16 | 20117521 | 14.8 | 64.2 | 68.7 | 7630 | 9000 | 0.164 | 0.38 | 0.29 | 352 | 17.16 |
| 3x150+2x35+16 | | 16 | 70.6 | 75.1 | 8694 | 11250 | 0.132 | 0.41 | 0.28 | 404 | 21.45 |
| 3x185+2x50+16 | | 17.7 | 74.4 | 78.9 | 10467 | 13875 | 0.108 | 0.44 | 0.27 | 461 | 26.46 |
| 3x240+2x70+16 | | 20.3 | 81.8 | 86.3 | 12895 | 18000 | 0.0817 | 0.49 | 0.26 | 540 | 34.32 |
| 3x300+2x95+16 | | 31.3 | 87.5 | 92.5 | 15693 | 22500 | 0.0654 | 0.71 | 0.24 | 620 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## TENAX-SAS NTSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+2x16+16 | 5 | 47 | 51 | 3041 | 1200 | 1.24 | 0.16 | 0.43 | 105 | 2.29 |
| 3x25+2x16+16 | 6.2 | 52 | 56 | 3677 | 1875 | 0.795 | 0.18 | 0.4 | 139 | 3.58 |
| 3x35+2x16+16 | 7.5 | 55.4 | 59.9 | 4138 | 2625 | 0.565 | 0.2 | 0.37 | 172 | 5.01 |
| 3x50+2x16+16 | 9 | 57.5 | 61.5 | 4813 | 3750 | 0.393 | 0.22 | 0.35 | 215 | 7.15 |
| 3x70+2x25+16 | 10.6 | 64 | 68 | 6159 | 5250 | 0.277 | 0.26 | 0.33 | 265 | 10.01 |
| 3x95+2x25+16 | 12.6 | 68.2 | 72.7 | 7123 | 7125 | 0.21 | 0.28 | 0.32 | 319 | 13.59 |
| 3x120+2x35+16 | 14.8 | 72.9 | 77.4 | 8322 | 9000 | 0.164 | 0.31 | 0.31 | 371 | 17.16 |
| 3x150+2x35+16 | 16 | 75.4 | 79.9 | 9645 | 11250 | 0.132 | 0.33 | 0.3 | 428 | 21.45 |
| 3x185+2x50+16 | 17.7 | 80.9 | 85.4 | 11208 | 13875 | 0.108 | 0.36 | 0.29 | 488 | 26.46 |
| 3x240+2x70+16 | 20.3 | 86.5 | 91 | 13991 | 18000 | 0.0817 | 0.4 | 0.28 | 574 | 34.32 |
| 3x300+2x95+16 | 31.3 | 92 | 97 | 16533 | 22500 | 0.0654 | 0.57 | 0.25 | 660 | 42.9 |

## TENAX-SAS NTSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+2x16+16 | | 5 | 53.5 | 57.5 | 3655 | 1200 | 1.24 | 0.14 | 0.45 | 105 | 2.29 |
| 3x25+2x16+16 | | 6.2 | 56.9 | 61.4 | 4145 | 1875 | 0.795 | 0.16 | 0.42 | 139 | 3.58 |
| 3x35+2x16+16 | | 7.5 | 59.7 | 64.2 | 4628 | 2625 | 0.565 | 0.18 | 0.39 | 172 | 5.01 |
| 3x50+2x16+16 | | 9 | 62.8 | 67.3 | 5552 | 3750 | 0.393 | 0.2 | 0.37 | 215 | 7.15 |
| 3x95+2x25+16 | | 12.6 | 72.5 | 77 | 7727 | 7125 | 0.21 | 0.25 | 0.33 | 319 | 13.59 |
| 3x120+2x35+16 | | 14.8 | 79 | 83.5 | 9224 | 9000 | 0.164 | 0.27 | 0.32 | 371 | 17.16 |
| 3x150+2x35+16 | | 16 | 81.5 | 86 | 10324 | 11250 | 0.132 | 0.29 | 0.31 | 428 | 21.45 |
| 3x185+2x50+16 | | 17.7 | 85.5 | 90.5 | 12218 | 13875 | 0.108 | 0.31 | 0.3 | 488 | 26.46 |
| 3x240+2x70+16 | | 20.3 | 92.6 | 97.1 | 14768 | 18000 | 0.0817 | 0.35 | 0.29 | 574 | 34.32 |
| 3x300+2x95+16 | | 31.3 | 98.5 | 103.5 | 17694 | 22500 | 0.0654 | 0.49 | 0.26 | 660 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# Notes

# PROTOLON(SB) NTSCGEWOEU 6 kV – 20 kV

## Medium Voltage flexible trailing cables


### Application

As power supply or connection cables for large material handling machines, e.g. excavators in open-cast mines subject to extremely high mechanical stresses in which abrasion and chaffing stresses are to be expected in trailing operation.

### Global data

| | |
|---|---|
| Brand | PROTOLON(SB) |
| Type designation | NTSCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B<br>MSHA P-189-4 |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, tinned, finely stranded (class 5) |
| PE-Conductor | Electrolytic copper, tinned, very finely stranded (class FS) |
| Insulation | basic material EPR, compound type 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Core identification | Natural colored with black semi conductive rubber and white numbers (1-3) |
| Core arrangement | Three-core design, with split earth conductor in the interstices |
| Inner sheath | Special chloroprene rubber compound, type 5GM5. Color: natural |
| Torsion protection | Extremely tear-resistant reinforcing tape which prevents sheath movement |
| Outer sheath | Special extremely abrasion-resistant and tearproof chloroprene rubber compound, bonded to inner sheath, type 5GM5.<br>Color: black (other colors available upon request) |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60322-1-2 |
| Resistance to oil | IEC 60811-2-1 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 (HD 22.16) |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON(SB) NTSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20141997 | 5DK3239 | 6.4 | 43.1 | 46.1 | 2910 | 1125 | 0.795 | 0.34 | 0.36 | 131 | 3.58 |
| 3x35+3x25/3 | 20004488 | 5DK3241 | 7.6 | 42.5 | 45.5 | 3180 | 1575 | 0.565 | 0.39 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3 | 20004489 | 5DK3243 | 9.1 | 45.7 | 48.7 | 3860 | 2250 | 0.393 | 0.43 | 0.32 | 202 | 7.15 |
| 3x70+3x35/3 | 20007566 | 5DK3244 | 10.9 | 51.7 | 55.7 | 5080 | 3150 | 0.277 | 0.49 | 0.3 | 250 | 10.01 |
| 3x95+3x50/3 | 20196345 | 5DK3*** | 12.6 | 59.9 | 63.9 | 6580 | 4275 | 0.21 | 0.54 | 0.29 | 301 | 13.59 |
| 3x120+3x70/3 | 20141998 | 5DK3*** | 14.2 | 59 | 63 | 8110 | 5400 | 0.164 | 0.6 | 0.28 | 352 | 17.16 |
| 3x150+3x70/3 | | | 15.9 | 64.4 | 68.4 | 8610 | 6750 | 0.132 | 0.65 | 0.27 | 404 | 21.45 |
| 3x185+3x95/3 | | | 17.7 | 68.3 | 72.3 | 10020 | 8325 | 0.108 | 0.7 | 0.27 | 461 | 26.46 |

## PROTOLON(SB) NTSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004569 | 5DK4159 | 6.4 | 41.6 | 44.6 | 2880 | 1125 | 0.795 | 0.31 | 0.37 | 131 | 3.58 |
| 3x35+3x25/3 | 20042608 | 5DK4160 | 7.6 | 44.2 | 47.2 | 3340 | 1575 | 0.565 | 0.35 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3 | 20007120 | 5DK4148 | 9.1 | 47.3 | 50.3 | 4020 | 2250 | 0.393 | 0.39 | 0.33 | 202 | 7.15 |
| 3x70+3x35/3 | 20214092 | 5DK4743 | 10.9 | 53.4 | 57.4 | 5610 | 3150 | 0.277 | 0.44 | 0.31 | 250 | 10.01 |
| 3x95+3x50/3 | | | 12.6 | 57.4 | 61.4 | 6140 | 4275 | 0.21 | 0.49 | 0.3 | 301 | 13.59 |
| 3x120+3x70/3 | 20001445 | 5DK4151 | 14.2 | 62.6 | 66.6 | 8010 | 5400 | 0.164 | 0.54 | 0.29 | 352 | 17.16 |
| 3x150+3x70/3 | 20001444 | 5DK4147 | 15.9 | 66.1 | 70.1 | 9170 | 6750 | 0.132 | 0.58 | 0.28 | 404 | 21.45 |
| 3x185+3x95/3 | 20161680 | | 17.7 | 69.6 | 73.6 | 10280 | 8325 | 0.108 | 0.63 | 0.27 | 461 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.
Special designs available upon request, e.g.:
- with metallic screen over main cores (type designation: NTSCGECEWOEU)
- up to 3x70... with 50/3 earth conductor for applications according to DIN VDE 0168
- different outer sheath colors
- special types for cold regions (-45°C)
- integration of additional control cores or pilots in the interstices

## PROTOLON(SB) NTSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | | | 6.4 | 46.3 | 49.3 | 3230 | 1125 | 0.795 | 0.25 | 0.39 | 139 | 3.58 |
| 3x35+3x25/3 | | | 7.6 | 50.2 | 54.2 | 3920 | 1575 | 0.565 | 0.28 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3 | | | 9.1 | 53.3 | 57.3 | 4610 | 2250 | 0.393 | 0.31 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3 | 20271483 | 5DK5*** | 10.9 | 58 | 62 | 6000 | 3150 | 0.277 | 0.35 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3 | 20111952 | 5DK5*** | 12.6 | 68.2 | 72.2 | 7850 | 4275 | 0.21 | 0.39 | 0.32 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.2 | 67.2 | 71.2 | 8440 | 5400 | 0.164 | 0.42 | 0.031 | 371 | 17.16 |
| 3x150+3x70/3 | | | 15.9 | 70.8 | 74.8 | 9640 | 6750 | 0.132 | 0.46 | 0.3 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.7 | 76.4 | 80.4 | 11440 | 8325 | 0.108 | 0.5 | 0.29 | 488 | 26.46 |

## PROTOLON(SB) NTSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20231823 | 5DK5*** | 6.4 | 51.9 | 55.9 | 3920 | 1125 | 0.795 | 0.22 | 0.41 | 139 | 3.58 |
| 3x35+3x25/3 | 20004723 | 5DK5743 | 7.6 | 54.4 | 58.4 | 4450 | 1575 | 0.565 | 0.25 | 0.39 | 172 | 5.01 |
| 3x50+3x25/3 | 20227351 | 5DK5*** | 9.1 | 65 | 69 | 6300 | 2250 | 0.393 | 0.27 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3 | 20165211 | 5DK5*** | 10.9 | 68.9 | 72.9 | 7410 | 3150 | 0.277 | 0.3 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3 | | | 12.6 | 68.1 | 72.1 | 7950 | 4275 | 0.21 | 0.33 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.2 | 71.4 | 75.4 | 9160 | 5400 | 0.164 | 0.36 | 0.32 | 371 | 17.16 |
| 3x150+3x70/3 | | | 15.9 | 76.8 | 80.8 | 10720 | 6750 | 0.132 | 0.39 | 0.31 | 428 | 21.45 |
| 3x185+3x95/3 | 20227352 | 5DK5*** | 17.7 | 88.4 | 92.4 | 13530 | 8325 | 0.108 | 0.42 | 0.3 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix.
Special designs available upon request, e.g.:
- with metallic screen over main cores (type designation: NTSCGECEWOEU)
- up to 3x70... with 50/3 earth conductor for applications according to DIN VDE 0168
- different outer sheath colors
- special types for cold regions (-45°C)
- integration of additional control cores or pilots in the interstices

# Notes

# PROTOLON(SB-SAM) (N)TSCGEWOEU 6 kV – 20 kV

## Medium Voltage flexible trailing cable with optimized wall-thickness


### Application

As power supply or connection cables for large material handling machines, e.g. excavators in opencast mines subject to extremely high mechanical stresses in which abrasion and chaffing stresses are to be expected in trailing operation.

### Global data

| | |
|---|---|
| Brand | PROTOLON(SB-SAM) |
| Type designation | (N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Bare electrolytic copper, very finely stranded (class FS) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Core identification | Natural coloring with black semiconductive rubber on which white digits 1 to 3 are printed |
| Pilot conductor | EPR insulated copper conductor (class FS), Color: Yellow |
| Core arrangement | Three-core design, with split earth conductor and pilot in the interstices |
| Inner sheath | Special chloroprene rubber compound, type 5GM5. Color: natural |
| Torsion protection | Extremely tear-resistant reinforcing tape, which prevents sheath movement |
| Outer sheath | Special extremely abrasion-resistant and tearproof chloroprene rubber compound, bonded to inner sheath, type 5GM5.<br>Color: black (other colors available upon request) |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV | 29 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | HD 22.16 (EN 50525-2-21) |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -30 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 20 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON(SB-SAM) (N)TSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2 + 1x10ST | 20203078 | 5DK3246 | 6.5 | 35.5 | 42.5 | 2670 | 1500 | 0.78 | 0.35 | 0.32 | 131 | 3.58 |
| 3x35+2x25/2 + 1x10ST | 20181804 | 5DK3249 | 7.6 | 41.9 | 44.9 | 3020 | 2100 | 0.554 | 0.39 | 0.31 | 162 | 5.01 |
| 3x50+2x25/2 + 1x10ST | 20183832 | 5DK3*** | 9.1 | 42.8 | 45.8 | 3510 | 3000 | 0.386 | 0.45 | 0.29 | 202 | 7.15 |
| 3x70+2x35/2 + 1x10ST | | | 10.9 | 46.5 | 49.5 | 4300 | 4200 | 0.272 | 0.52 | 0.28 | 250 | 10.01 |
| 3x95+2x50/2 + 1x10ST | | | 12.7 | 52.9 | 56.9 | 5600 | 5700 | 0.206 | 0.58 | 0.27 | 301 | 13.59 |
| 3x120+2x70/2 + 1x10ST | | | 14.4 | 56.5 | 60.5 | 6750 | 7200 | 0.161 | 0.65 | 0.26 | 352 | 17.16 |
| 3x150+2x70/2 + 1x10ST | | | 16.2 | 63 | 67 | 8100 | 9000 | 0.129 | 0.71 | 0.25 | 404 | 21.45 |
| 3x185+2x95/2 + 1x10ST | | | 17.8 | 66.4 | 70.4 | 9400 | 11100 | 0.106 | 0.77 | 0.25 | 461 | 26.46 |
| 3x240+2x120/2 + 1x10ST | | | 20.6 | 72.3 | 76.3 | 11700 | 14400 | 0.08 | 0.88 | 0.24 | 540 | 34.32 |

## PROTOLON(SB-SAM) (N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2 + 1x10ST | | | 6.5 | 40.8 | 43.8 | 2700 | 1500 | 0.78 | 0.3 | 0.34 | 131 | 3.58 |
| 3x35+2x25/2 + 1x10ST | 20036708 | 5DK4548 | 7.6 | 41.1 | 44.1 | 3030 | 2100 | 0.554 | 0.33 | 0.32 | 162 | 5.01 |
| 3x50+2x25/2 + 1x10ST | | | 9.1 | 45.3 | 48.3 | 3600 | 3000 | 0.386 | 0.38 | 0.31 | 202 | 7.15 |
| 3x70+2x35/2 + 1x10ST | 20079290 | 5DK4459 | 10.9 | 47.7 | 50.7 | 4540 | 4200 | 0.272 | 0.43 | 0.29 | 250 | 10.01 |
| 3x95+2x50/2 + 1x10ST | | | 12.7 | 54.2 | 58.2 | 5700 | 5700 | 0.206 | 0.48 | 0.28 | 301 | 13.59 |
| 3x120+2x70/2 + 1x10ST | 20006948 | 5DK4243 | 14.4 | 57.7 | 61.7 | 7130 | 7200 | 0.161 | 0.54 | 0.27 | 352 | 17.16 |
| 3x150+2x70/2 + 1x10ST | | | 16.2 | 64.2 | 68.2 | 8300 | 9000 | 0.129 | 0.59 | 0.26 | 404 | 21.45 |
| 3x185+2x95/2 + 1x10ST | | | 17.8 | 67.6 | 71.6 | 9600 | 11100 | 0.106 | 0.64 | 0.26 | 461 | 26.46 |
| 3x240+2x120/2 + 1x10ST | 20008103 | 5DK4246 | 20.6 | 72.3 | 76.3 | 12060 | 14400 | 0.08 | 0.72 | 0.25 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs available upon request, e.g.:
- with metallic screen over main cores (type designation: (N)TSCGECEWOEU)
- different outer sheath colors
- special types for cold regions (-45°C)
- integration of additional control cores or pilots in the interstices

## PROTOLON(SB-SAM) (N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2 + 1x10ST | | | 6.5 | 41.9 | 44.9 | 2600 | 1500 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+2x25/2 + 1x10ST | 20069641 | 5DK5412 | 7.6 | 45.5 | 48.5 | 3440 | 2100 | 0.554 | 0.25 | 0.35 | 172 | 5.01 |
| 3x50+2x25/2 + 1x10ST | | | 9.1 | 47.4 | 50.4 | 3700 | 3000 | 0.386 | 0.28 | 0.33 | 215 | 7.15 |
| 3x70+2x35/2 + 1x10ST | 20069640 | 5DK5414 | 10.9 | 53.7 | 57.7 | 5380 | 4200 | 0.272 | 0.32 | 0.31 | 265 | 10.01 |
| 3x95+2x50/2 + 1x10ST | | | 12.7 | 57.6 | 61.6 | 6150 | 5700 | 0.206 | 0.35 | 0.3 | 319 | 13.59 |
| 3x120+2x70/2 + 1x10ST | 20088941 | 5DK5416 | 14.4 | 63 | 67 | 7840 | 7200 | 0.161 | 0.39 | 0.29 | 371 | 17.16 |
| 3x150+2x70/2 + 1x10ST | 20088942 | 5DK5417 | 16.2 | 66.8 | 70.8 | 8990 | 9000 | 0.129 | 0.43 | 0.28 | 428 | 21.45 |
| 3x185+2x95/2 + 1x10ST | | | 17.8 | 71 | 75 | 10100 | 11100 | 0.106 | 0.46 | 0.27 | 488 | 26.46 |
| 3x240+2x120/2 + 1x10ST | 20216531 | 5DK5*** | 20.6 | 78.3 | 83.3 | 12800 | 14400 | 0.08 | 0.52 | 0.27 | 574 | 34.32 |

## PROTOLON(SB-SAM) (N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+2x25/2 + 1x10ST | | | 6.5 | 44.9 | 47.9 | 3000 | 1500 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+2x25/2 + 1x10ST | 20203799 | 5DK6*** | 7.6 | 47.2 | 50.2 | 3500 | 2100 | 0.554 | 0.24 | 0.35 | 172 | 5.01 |
| 3x50+2x25/2 + 1x10ST | | | 9.1 | 51.7 | 55.7 | 4350 | 3000 | 0.386 | 0.27 | 0.33 | 215 | 7.15 |
| 3x70+2x35/2 + 1x10ST | | | 10.9 | 55.5 | 59.5 | 5400 | 4200 | 0.272 | 0.31 | 0.32 | 265 | 10.01 |
| 3x95+2x50/2 + 1x10ST | | | 12.7 | 60.5 | 64.5 | 6500 | 5700 | 0.206 | 0.35 | 0.3 | 319 | 13.59 |
| 3x120+2x70/2 + 1x10ST | | | 14.4 | 65.9 | 69.9 | 8000 | 7200 | 0.161 | 0.38 | 0.29 | 371 | 17.16 |
| 3x150+2x70/2 + 1x10ST | | | 16.2 | 70.6 | 74.6 | 9200 | 9000 | 0.129 | 0.42 | 0.28 | 428 | 21.45 |
| 3x185+2x95/2 + 1x10ST | | | 17.8 | 75.8 | 79.8 | 10850 | 11100 | 0.106 | 0.45 | 0.28 | 488 | 26.46 |
| 3x240+2x120/2 + 1x10ST | | | 20.6 | 81.2 | 86.2 | 13300 | 14400 | 0.08 | 0.51 | 0.27 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs available upon request, e.g.:
- with metallic screen over main cores (type designation: (N)TSCGECEWOEU)
- different outer sheath colors
- special types for cold regions (-45°C)
- integration of additional control cores or pilots in the interstices

# Notes

# TENAX-LUMEN (N)TSCGEH3S 6 kV – 10 kV

## Luminescent power cable for trailing application

### Application

The TENAX-LUMEN is intended as trailing cable for the power supply to large mobile equipment in mines, such as shovels and draglines. Especially intended for application where, to guarantee the safety of personnel and equipment, the cable must be visible in the dark. The outer sheath is extremely robust and tough against abraison and tearing, suitable for fully flexible operation down to -50°C.

### Global data

| | |
|---|---|
| Brand | TENAX-LUMEN |
| Type designation | (N)TSCGEH3S |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | in preparation |

### Design features

| | |
|---|---|
| Conductor | Tinned copper, finely stranded (claas 5), according to IEC 60228 / DIN VDE 0295 |
| PE-Conductor | Tinned copper, finely stranded (claas 5) with semi conductive special rubber compound |
| Insulation | Rubber, compound type EPR 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound, cold strippable outer layer |
| Pilot conductor | Tinned copper, finely stranded (claas 5), EPR-Insulation |
| Illuminating element | Special electroluminescent string designed for high visibility and low power consumption |
| Core arrangement | Cores laid up around semiconuctive central filler with armid yarns |
| Outer sheath | PUR compound, transparent |
| Outer sheath colour | Orange |

### Electrical parameters

| | | |
|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV |
| Max. permissible operating voltage DC | 5,4/10,8 kV | 9/18 kV |
| AC test voltage - main cores | 11 kV (5 Min.) | 17 kV (5 Min.) |
| Luminescent voltage max. | 125 V AC | 125 V AC |
| Luminescent frequency max. | 2000 Hz | 2000 Hz |
| Luminescent current absorption | ~ 15 A/km | ~ 15 A/km |
| Luminescent heat development | none | none |
| Luminescent light homogeneity | > 95% | > 95% |
| Luminescent irradiation | 360° | 360° |

### Chemical parameters

| | |
|---|---|
| Performance against fire | EN 60332-1-2; IEC 60332-1-2 |
| Resistance to oil | EN 60811-404; IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -50°C; max +80°C |
| Ambient temperature in fully flexible operation | min -50°C; max +60°C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 25 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x OD |

## TENAX-LUMEN (N)TSCGEH3S 3.6/6 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+2x16+16 | 7.5 | 46.2 | 49.7 | 746 | 3200 | 2625 | 0.565 | 0.34 | 162 | 5.01 |
| 3x50+2x16+16 | 9 | 49.3 | 53.8 | 807 | 3800 | 3750 | 0.393 | 0.32 | 202 | 7.15 |
| 3x70+2x25+16 | 10.6 | 54.6 | 59.1 | 887 | 4900 | 5250 | 0.277 | 0.3 | 250 | 10.01 |
| 3x95+2x25+16 | 12.6 | 58.9 | 63.4 | 951 | 5750 | 7125 | 0.21 | 0.29 | 301 | 13.59 |
| 3x120+2x35+16 | 14.8 | 65.5 | 70 | 1050 | 7250 | 9000 | 0.164 | 0.28 | 352 | 17.16 |
| 3x150+2x35+16 | 16 | 68.8 | 72.4 | 1086 | 8350 | 11250 | 0.132 | 0.27 | 404 | 21.45 |
| 3x185+2x50+16 | 17.7 | 71.7 | 76.2 | 1143 | 9850 | 13875 | 0.108 | 0.27 | 461 | 26.46 |
| 3x240+2x70+16 | 20.3 | 79.1 | 83.6 | 1254 | 12500 | 18000 | 0.0817 | 0.26 | 540 | 34.32 |

## TENAX-LUMEN (N)TSCGEH3S 6/10 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+2x16+16 | 7.5 | 51 | 55.5 | 833 | 3465 | 2625 | 0.565 | 0.35 | 162 | 5.01 |
| 3x50+2x16+16 | 9 | 52 | 56 | 840 | 4280 | 3750 | 0.393 | 0.33 | 202 | 7.15 |
| 3x70+2x25+16 | 10.6 | 56.3 | 60.8 | 912 | 5360 | 5250 | 0.277 | 0.31 | 250 | 10.01 |
| 3x95+2x25+16 | 12.6 | 60.6 | 65.1 | 977 | 6495 | 7125 | 0.21 | 0.3 | 301 | 13.59 |
| 3x120+2x35+16 | 14.8 | 67.2 | 71.7 | 1076 | 7660 | 9000 | 0.164 | 0.29 | 352 | 17.16 |
| 3x150+2x35+16 | 16 | 69.6 | 74.1 | 1112 | 8685 | 11250 | 0.132 | 0.28 | 404 | 21.45 |
| 3x185+2x50+16 | 17.7 | 73.4 | 77.9 | 1169 | 10460 | 13875 | 0.108 | 0.27 | 461 | 26.46 |
| 3x240+2x70+16 | 20.3 | 80.8 | 85.3 | 1280 | 12890 | 18000 | 0.0817 | 0.26 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# PROTOLON(ST) .../3E NTSCGEWOEU 3 kV – 30 kV

## Medium voltage flexible cables for use in water with copper core shield


### Application

Power supply cable for use in water, e.g. for connection to dredgers, floating docks, pumps, etc., in applications where high mechanical stresses are to be expected. Also suitable for use in sewage, salt water and brackish water at water depths of up to 500 m. This screened cable design is suitable for the use with dredging equipment acc. VDE 0168.

### Global data

| | |
|---|---|
| Brand | PROTOLON(ST) |
| Type designation | NTSCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MSHA P-189-4<br>Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, tinned, finely stranded (class 5) |
| Insulation | Basic material EPR, Compound type: 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound and metallic concentric screen on each core |
| Core identification | Natural coloring with black semiconductive rubber |
| Core arrangement | Three main conductor laid-up with individual concentric protective-earth conductors distributed over the insulation of the three main cores |
| Inner sheath | EPR inner sheath with special water-proof characteristics for prevention of formation of water bubbles, Compound type: GM1B |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CM (particularly water-proof), Compound type: 5GM3, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 1.8/3 kV | 3.6/6 kV | 6/10 kV | 8.7/15 kV |
| Max. permissible operating voltage AC | 2.1/3.6 kV | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV |
| Max. permissible operating voltage DC | 2.7/5.4 kV | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV |
| AC test voltage - main cores | 6 kV ( 5 Min.) | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) |
| | 12/20 kV | 14/25 kV | 18/30 kV | |
| | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV | |
| | 18/36 kV | 22.5/45 kV | 27/54 kV | |
| | 29 kV ( 5 Min.) | 36 kV ( 5 Min.) | 43 kV ( 5 Min.) | |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON(ST) .../3E NTSCGEWOEU 1.8/3 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E | | | 6.4 | 37.5 | 40.5 | 2400 | 1125 | 0.795 | 0.33 | 0.33 | 131 | 3.58 |
| 3x35+3x25/3E | | | 7.6 | 40.9 | 43.9 | 3000 | 1575 | 0.565 | 0.38 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3E | 20218322 | 5DK2*** | 9 | 45.4 | 48.4 | 3600 | 2250 | 0.393 | 0.43 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3E | 20218323 | 5DK2*** | 10.9 | 50.8 | 54.8 | 4800 | 3150 | 0.277 | 0.5 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E | | | 12.6 | 57.1 | 61.1 | 6200 | 4275 | 0.21 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E | 20008063 | 5DK2435 | 14.1 | 59.7 | 63.7 | 7540 | 5400 | 0.164 | 0.56 | 0.27 | 352 | 17.16 |
| 3x150+3x70/3E | | | 16 | 67.6 | 71.6 | 8700 | 6750 | 0.132 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185+3x95/3E | 20161198 | 5DK2*** | 17.8 | 69.3 | 73.3 | 10160 | 8325 | 0.108 | 0.69 | 0.25 | 461 | 26.46 |

## PROTOLON(ST) .../3E NTSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x16/3E | 20004508 | 5DK3779 | 5.7 | 37.5 | 40.5 | 2250 | 720 | 1.24 | 0.24 | 0.35 | 99 | 2.29 |
| 3x25+3x25/3E | 20233752 | 5DK3*** | 6.4 | 42.4 | 45.4 | 2800 | 1125 | 0.795 | 0.26 | 0.35 | 131 | 3.58 |
| 3x35+3x16/3E | 20004509 | 5DK3782 | 7.6 | 43.9 | 46.9 | 3310 | 1575 | 0.565 | 0.29 | 0.33 | 162 | 5.01 |
| 3x35+3x25/3E | 20004510 | 5DK3783 | 7.6 | 44.3 | 47.3 | 3420 | 1575 | 0.565 | 0.29 | 0.33 | 162 | 5.01 |
| 3x50+3x25/3E | 20004511 | 5DK3784 | 9 | 48.1 | 51.1 | 4160 | 2250 | 0.393 | 0.33 | 0.32 | 202 | 7.15 |
| 3x70+3x35/3E | 20004512 | 5DK3786 | 10.9 | 54.3 | 58.3 | 5440 | 3150 | 0.277 | 0.38 | 0.3 | 250 | 10.01 |
| 3x95+3x50/3E | 20165442 | 5DK3787 | 12.6 | 63.8 | 67.8 | 6610 | 4275 | 0.21 | 0.43 | 0.29 | 301 | 13.59 |
| 3x120+3x70/3E | 20061120 | 5DK3785 | 14.1 | 64 | 68 | 8240 | 5400 | 0.164 | 0.47 | 0.28 | 352 | 17.16 |
| 3x150+3x70/3E | 20160411 | 5DK3778 | 16 | 69.9 | 73.9 | 9520 | 6750 | 0.132 | 0.52 | 0.27 | 404 | 21.45 |
| 3x185+3x95/3E | | | 17.8 | 75.8 | 79.8 | 11000 | 8325 | 0.108 | 0.56 | 0.26 | 461 | 26.46 |

## PROTOLON(ST) .../3E NTSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E | 20007441 | 5DK4300 | 6.4 | 43.9 | 46.9 | 3100 | 1125 | 0.795 | 0.24 | 0.36 | 131 | 3.58 |
| 3x25+3x25/3E | | | 6.4 | 44.1 | 47.1 | 3100 | 1125 | 0.795 | 0.24 | 0.36 | 131 | 3.58 |
| 3x35+3x16/3E | 20004604 | 5DK4301 | 7.6 | 49.8 | 52.8 | 3850 | 1575 | 0.565 | 0.27 | 0.34 | 162 | 5.01 |
| 3x35+3x25/3E | 20230975 | 5DK4893 | 7.6 | 46.7 | 49.7 | 3740 | 1575 | 0.565 | 0.27 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3E | 20004597 | 5DK4206 | 9 | 52.4 | 56.4 | 4460 | 2250 | 0.393 | 0.3 | 0.32 | 202 | 7.15 |
| 3x70+3x35/3E | 20004598 | 5DK4207 | 10.9 | 57.3 | 61.3 | 5840 | 3150 | 0.277 | 0.34 | 0.31 | 250 | 10.01 |
| 3x95+3x50/3E | 20035932 | 5DK4209 | 12.6 | 63.2 | 67.2 | 7250 | 4275 | 0.21 | 0.38 | 0.29 | 301 | 13.59 |
| 3x120+3x70/3E | 20164605 | 5DK4897 | 14.1 | 67.1 | 71.1 | 8560 | 5400 | 0.164 | 0.42 | 0.29 | 352 | 17.16 |
| 3x150+3x70/3E | | | 16 | 71.9 | 75.9 | 9400 | 6750 | 0.132 | 0.46 | 0.28 | 404 | 21.45 |
| 3x185+3x95/3E | | | 17.8 | 77.6 | 81.6 | 11300 | 8325 | 0.108 | 0.5 | 0.27 | 461 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

## PROTOLON(ST) .../3E NTSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E | 6.4 | 48.4 | 52.4 | 3700 | 1125 | 0.795 | 0.2 | 0.39 | 139 | 3.58 |
| 3x35+3x25/3E | 7.6 | 52.8 | 56.8 | 4300 | 1575 | 0.565 | 0.22 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3E | 9 | 56.6 | 60.6 | 5000 | 2250 | 0.393 | 0.24 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3E | 10.9 | 60.8 | 64.8 | 6300 | 3150 | 0.277 | 0.28 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3E | 12.6 | 68 | 72 | 7700 | 4275 | 0.21 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120+3x70/3E | 14.1 | 71.7 | 75.7 | 8950 | 5400 | 0.164 | 0.33 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3E | 16 | 77.9 | 82.9 | 10500 | 6750 | 0.132 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3E | 17.8 | 81.8 | 86.8 | 12100 | 8325 | 0.108 | 0.4 | 0.28 | 488 | 26.46 |

## PROTOLON(ST) .../3E NTSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E | 20004727 | 5DK5834 | 6.4 | 55.3 | 59.3 | 4580 | 1125 | 0.795 | 0.17 | 0.41 | 139 | 3.58 |
| 3x35+3x16/3E | 20001449 | 5DK5760 | 7.6 | 56.6 | 60.6 | 4940 | 1575 | 0.565 | 0.19 | 0.39 | 172 | 5.01 |
| 3x25+3x25/3E | | | 6.4 | 55.3 | 59.3 | 4350 | 1125 | 0.795 | 0.17 | 0.41 | 139 | 3.58 |
| 3x35+3x25/3E | 20167511 | 5DK5*** | 7.6 | 57 | 61 | 4930 | 1575 | 0.565 | 0.19 | 0.39 | 172 | 5.01 |
| 3x50+3x25/3E | 20087015 | 5DK5764 | 9 | 59.9 | 63.9 | 5790 | 2250 | 0.393 | 0.21 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3E | 20170540 | 5DK5763 | 10.9 | 67.1 | 71.1 | 7090 | 3150 | 0.277 | 0.24 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3E | 20137463 | 5DK5*** | 12.6 | 71 | 75 | 8280 | 4275 | 0.21 | 0.26 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3E | | | 14.1 | 77.8 | 81.8 | 10000 | 5400 | 0.164 | 0.28 | 0.32 | 371 | 17.16 |
| 3x150+3x70/3E | | | 16 | 82.3 | 87.3 | 11400 | 6750 | 0.132 | 0.31 | 0.31 | 428 | 21.45 |
| 3x185+3x95/3E | | | 17.8 | 87.9 | 92.9 | 13300 | 8325 | 0.108 | 0.34 | 0.3 | 488 | 26.46 |

## PROTOLON(ST) .../3E NTSCGEWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E | 20008730 | 5DK6231 | 6.4 | 63 | 67 | 5790 | 1125 | 0.795 | 0.15 | 0.44 | 139 | 3.58 |
| 3x35+3x25/3E | | | 7.6 | 64.5 | 68.5 | 5900 | 1575 | 0.565 | 0.16 | 0.41 | 172 | 5.01 |
| 3x50+3x25/3E | 20235304 | 5DK6*** | 9 | 68.4 | 72.4 | 6700 | 2250 | 0.393 | 0.18 | 0.39 | 215 | 7.15 |
| 3x70+3x35/3E | | | 10.9 | 72.5 | 76.5 | 8000 | 3150 | 0.277 | 0.2 | 0.37 | 265 | 10.01 |
| 3x95+3x50/3E | | | 12.6 | 79.2 | 84.2 | 9700 | 4275 | 0.21 | 0.22 | 0.35 | 319 | 13.59 |
| 3x120+3x70/3E | | | 14.1 | 82.9 | 87.9 | 11000 | 5400 | 0.164 | 0.24 | 0.34 | 371 | 17.16 |
| 3x150+3x70/3E | | | 16 | 89.7 | 94.7 | 13000 | 6750 | 0.132 | 0.27 | 0.32 | 428 | 21.45 |
| 3x185+3x95/3E | | | 17.8 | 93.6 | 98.6 | 15000 | 8325 | 0.108 | 0.29 | 0.31 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

## PROTOLON(ST) .../3E NTSCGEWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E | | | 6.4 | 67.1 | 71.1 | 6300 | 1125 | 0.795 | 0.14 | 0.46 | 139 | 3.58 |
| 3x35+3x25/3E | 20154158 | 5DK6*** | 7.6 | 70.3 | 74.3 | 6720 | 1575 | 0.565 | 0.15 | 0.43 | 172 | 5.01 |
| 3x50+3x25/3E | | | 9 | 75.4 | 79.4 | 7900 | 2250 | 0.393 | 0.16 | 0.41 | 215 | 7.15 |
| 3x70+3x35/3E | | | 10.9 | 79 | 84 | 9200 | 3150 | 0.277 | 0.18 | 0.38 | 265 | 10.01 |
| 3x95+3x50/3E | | | 12.6 | 86.2 | 91.2 | 10950 | 4275 | 0.21 | 0.2 | 0.37 | 319 | 13.59 |
| 3x120+3x70/3E | | | 14.1 | 89.9 | 94.9 | 12400 | 5400 | 0.164 | 0.22 | 0.35 | 371 | 17.16 |
| 3x150+3x70/3E | | | 16 | 94.9 | 99.9 | 13800 | 6750 | 0.132 | 0.23 | 0.34 | 428 | 21.45 |
| 3x185+3x95/3E | | | 17.8 | 100.5 | 105.5 | 15950 | 8325 | 0.108 | 0.25 | 0.33 | 488 | 26.46 |
| 3x240+3x120/3E +3x2,5ST | 20083958 | 5DK6708 | 20.4 | 108.3 | 111.3 | 19480 | 10800 | 0.0817 | 0.26 | 0.32 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

# PROTOLON(ST) NTSCGEWOEU 3 kV – 30 kV

## Medium voltage flexible cables for use in water


### Application

Power supply cable for use in water, e.g. for connection to dredgers, floating docks, pumps, etc., in applications where high mechanical stresses are to be expected. Also suitable for use in sewage, salt water and brackish water at water depths of up to 500 m.

### Global data

| | |
|---|---|
| Brand | PROTOLON(ST) |
| Type designation | NTSCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MSHA P-189-4<br>Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, tinned, finely stranded (class 5) |
| PE-Conductor | Split into 3 in the outer interstices. |
| Insulation | Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Core identification | Natural colouring with black semiconductive rubber |
| Core arrangement | Three main conductor laid-up with protective-earth conductor split into 3 in the outer interstices |
| Inner sheath | EPR inner sheath with special water-proof characteristics for prevention of formation of water bubbles, Compound type: GM1B |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CM, particularly water-proof, Compound type: 5GM3, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 1.8/3 kV | 3.6/6 kV | 6/10 kV | 8.7/15 kV |
| Max. permissible operating voltage AC | 2.1/3.6 kV | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV |
| Max. permissible operating voltage DC | 2.7/5.4 kV | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV |
| AC test voltage - main cores | 6 kV ( 5 Min.) | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) |
| | 12/20 kV | 14/25 kV | 18/30 kV | |
| | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV | |
| | 18/36 kV | 22.5/45 kV | 27/54 kV | |
| | 29 kV ( 5 Min.) | 36 kV ( 5 Min.) | 43 kV ( 5 Min.) | |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON(ST) NTSCGEWOEU 1.8/3 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20117795 | 5DK2433 | 6.4 | 36.1 | 39.1 | 2370 | 1125 | 0.795 | 0.33 | 0.33 | 131 | 3.58 |
| 3x35+3x25/3 | 20166303 | | 7.6 | 37.8 | 40.8 | 2600 | 1575 | 0.565 | 0.38 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3 | 20166304 | 5DK2*** | 9 | 42.1 | 45.1 | 3320 | 2250 | 0.393 | 0.43 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3 | | | 10.9 | 47.4 | 50.4 | 4350 | 3150 | 0.277 | 0.5 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3 | 20025759 | 5DK2480 | 12.6 | 53.2 | 57.2 | 5850 | 4275 | 0.21 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20229702 | 5DK2*** | 14.1 | 56.4 | 60.4 | 6700 | 5400 | 0.164 | 0.56 | 0.27 | 352 | 17.16 |
| 3x150+3x70/3 | 20163600 | 5DK2479 | 16 | 60.4 | 64.4 | 8060 | 6750 | 0.132 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185+3x95/3 | | | 17.8 | 66.9 | 70.9 | 9450 | 8325 | 0.108 | 0.69 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 72.4 | 76.4 | 11000 | 10800 | 0.0817 | 0.77 | 0.25 | 540 | 34.32 |

## PROTOLON(ST) NTSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004485 | 5DK3201 | 6.4 | 40.1 | 43.1 | 2620 | 1125 | 0.795 | 0.26 | 0.35 | 131 | 3.58 |
| 3x35+3x25/3 | 20040326 | 5DK3202 | 7.6 | 42.6 | 45.6 | 3200 | 1575 | 0.565 | 0.29 | 0.33 | 162 | 5.01 |
| 3x50+3x25/3 | 20004486 | 5DK3203 | 9 | 45.6 | 48.6 | 3690 | 2250 | 0.393 | 0.33 | 0.32 | 202 | 7.15 |
| 3x70+3x35/3 | 20141683 | 5DK3204 | 10.9 | 52.2 | 56.2 | 5180 | 3150 | 0.277 | 0.38 | 0.3 | 250 | 10.01 |
| 3x95+3x50/3 | 20037272 | 5DK3511 | 12.6 | 58.4 | 62.4 | 6600 | 4275 | 0.21 | 0.43 | 0.29 | 301 | 13.59 |
| 3x120+3x70/3 | 20058135 | 5DK3212 | 14.2 | 59.1 | 63.1 | 7320 | 5400 | 0.164 | 0.47 | 0.28 | 352 | 17.16 |
| 3x150+3x70/3 | | | 16 | 65.6 | 69.6 | 8470 | 6750 | 0.132 | 0.52 | 0.27 | 404 | 21.45 |
| 3x185+3x95/3 | 20266828 | 5DK3*** | 17.8 | 69.4 | 73.4 | 9850 | 8325 | 0.108 | 0.56 | 0.26 | 461 | 26.46 |
| 3x240+3x120/3 | 20270201 | 5DK3*** | 20.4 | 76.7 | 80.7 | 11500 | 10800 | 0.0817 | 0.63 | 0.25 | 540 | 34.32 |

## PROTOLON(ST) NTSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004595 | 5DK4201 | 6.4 | 41.7 | 44.7 | 2910 | 1125 | 0.795 | 0.24 | 0.36 | 138 | 3.58 |
| 3x35+3x25/3 | 20006946 | 5DK4202 | 7.6 | 44.3 | 47.3 | 3380 | 1575 | 0.565 | 0.27 | 0.34 | 171 | 5.01 |
| 3x50+3x25/3 | 20004596 | 5DK4205 | 9 | 48.9 | 52.9 | 4310 | 2250 | 0.393 | 0.3 | 0.32 | 214 | 7.15 |
| 3x70+3x35/3 | 20016313 | 5DK4208 | 10.9 | 53.8 | 57.8 | 5380 | 3150 | 0.277 | 0.34 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3 | 20024967 | 5DK4211 | 12.6 | 57.4 | 61.4 | 6420 | 4275 | 0.21 | 0.38 | 0.29 | 321 | 13.59 |
| 3x120+3x70/3 | 20168742 | 5DK4212 | 14.1 | 60.6 | 64.6 | 7270 | 5400 | 0.164 | 0.42 | 0.29 | 372 | 17.16 |
| 3x150+3x70/3 | 20007894 | 5DK4213 | 16 | 66.4 | 70.4 | 9000 | 6750 | 0.132 | 0.46 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.8 | 71.1 | 75.1 | 10100 | 8325 | 0.108 | 0.5 | 0.27 | 488 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 77.9 | 82.9 | 12000 | 10800 | 0.0817 | 0.56 | 0.26 | 575 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

## PROTOLON(ST) NTSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20024469 | 5DK5161 | 6.4 | 46.4 | 49.4 | 3440 | 1125 | 0.795 | 0.2 | 0.39 | 138 | 3.58 |
| 3x35+3x25/3 | 20259710 | 5DK5*** | 7.6 | 48.4 | 52.4 | 3730 | 1575 | 0.565 | 0.22 | 0.37 | 171 | 5.01 |
| 3x50+3x25/3 | 20025240 | 5DK5155 | 9 | 53.3 | 57.3 | 4880 | 2250 | 0.393 | 0.24 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3 | | | 10.9 | 57.3 | 61.3 | 5780 | 3150 | 0.277 | 0.28 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3 | | | 12.6 | 63.9 | 67.9 | 7100 | 4275 | 0.21 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.1 | 67.1 | 71.1 | 8250 | 5400 | 0.164 | 0.33 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3 | 20227963 | 5DK5*** | 16 | 72 | 76 | 9450 | 6750 | 0.132 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3 | 20085931 | 5DK5163 | 17.8 | 76.6 | 80.6 | 11690 | 8325 | 0.108 | 0.4 | 0.28 | 488 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 82.6 | 87.6 | 12700 | 10800 | 0.0817 | 0.44 | 0.27 | 574 | 34.32 |

## PROTOLON(ST) NTSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004726 | 5DK5823 | 6.4 | 52 | 56 | 4190 | 1125 | 0.795 | 0.17 | 0.41 | 139 | 3.58 |
| 3x35+3x25/3 | 20152410 | 5DK5702 | 7.6 | 54.5 | 58.5 | 4720 | 1575 | 0.565 | 0.19 | 0.39 | 172 | 5.01 |
| 3x50+3x25/3 | 20004722 | 5DK5705 | 9 | 57.4 | 61.4 | 5460 | 2250 | 0.393 | 0.21 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3 | 20170539 | 5DK5708 | 10.9 | 64.5 | 68.5 | 6660 | 3150 | 0.277 | 0.24 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3 | | | 12.6 | 68.2 | 72.2 | 7760 | 4275 | 0.21 | 0.26 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.1 | 71.3 | 75.3 | 8930 | 5400 | 0.164 | 0.28 | 0.32 | 371 | 17.16 |
| 3x150+3x70/3 | 20227965 | 5DK5*** | 16 | 77.5 | 82.5 | 10500 | 6750 | 0.132 | 0.31 | 0.31 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.8 | 81.3 | 86.3 | 12000 | 8325 | 0.108 | 0.34 | 0.3 | 488 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 88.6 | 93.6 | 13800 | 10800 | 0.0817 | 0.38 | 0.29 | 574 | 34.32 |

## PROTOLON(ST) NTSCGEWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20205375 | 5DK6230 | 6.4 | 57.4 | 61.4 | 4670 | 1125 | 0.795 | 0.15 | 0.44 | 139 | 3.58 |
| 3x35+3x25/3 | 20061126 | 5DK6232 | 7.6 | 60 | 64 | 5500 | 1575 | 0.565 | 0.16 | 0.41 | 172 | 5.01 |
| 3x50+3x25/3 | | | 9 | 64.8 | 68.8 | 6220 | 2250 | 0.393 | 0.18 | 0.39 | 215 | 7.15 |
| 3x70+3x35/3 | | | 10.9 | 68.8 | 72.8 | 7500 | 3150 | 0.277 | 0.2 | 0.37 | 265 | 10.01 |
| 3x95+3x50/3 | | | 12.6 | 75.5 | 79.5 | 9000 | 4275 | 0.21 | 0.22 | 0.35 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.1 | 78.1 | 83.1 | 12250 | 5400 | 0.164 | 0.24 | 0.34 | 371 | 17.16 |
| 3x150+3x70/3 | | | 16 | 83 | 88 | 11600 | 6750 | 0.132 | 0.27 | 0.32 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.8 | 88.6 | 93.6 | 13500 | 8325 | 0.108 | 0.29 | 0.31 | 488 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 94.1 | 99.1 | 15500 | 10800 | 0.0817 | 0.32 | 0.3 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

## PROTOLON(ST) NTSCGEWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20271892 | 5DK6*** | 6.4 | 64.3 | 68.3 | 5650 | 1125 | 0.795 | 0.14 | 0.46 | 139 | 3.58 |
| 3x35+3x25/3 | | | 7.6 | 66.9 | 70.9 | 6230 | 1575 | 0.565 | 0.15 | 0.43 | 172 | 5.01 |
| 3x50+3x25/3 | 20273241 | 5DK6*** | 9 | 69.8 | 73.8 | 7000 | 2250 | 0.393 | 0.16 | 0.41 | 215 | 7.15 |
| 3x70+3x35/3 | 20157145 | 5DK6*** | 10.9 | 76.8 | 80.8 | 8710 | 3150 | 0.277 | 0.18 | 0.38 | 265 | 10.01 |
| 3x95+3x50/3 | 20157146 | 5DK6*** | 12.6 | 79.5 | 84.5 | 9910 | 4275 | 0.21 | 0.2 | 0.37 | 319 | 13.59 |
| 3x120+3x70/3 | | | 14.1 | 83.2 | 88.2 | 11280 | 5400 | 0.164 | 0.22 | 0.35 | 371 | 17.16 |
| 3x150+3x70/3 | 20157147 | 5DK6*** | 16 | 89 | 94 | 12910 | 6750 | 0.132 | 0.23 | 0.34 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.8 | 93.7 | 98.7 | 14500 | 8325 | 0.108 | 0.25 | 0.33 | 488 | 26.46 |
| 3x240+3x120/3 | | | 20.4 | 101 | 106 | 16500 | 10800 | 0.0817 | 0.28 | 0.32 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix
Special designs with control-cores and fiber optics available on request

# PROTOLON(M) F (N)TSCGEWOEU 3 kV – 30 kV

## Medium voltage flexible cables for semiflexible installation

### Application

For laying alongside the conveyor belts (also for shiftable units) and on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car) and for connection of submersible pump units.

### Global data

| | |
|---|---|
| Brand | PROTOLON(M) |
| Type designation | F-(N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, not tinned, very finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Core identification | Natural coloring with black semiconductive rubber on which white digits 1 to 3 are printed |
| Core arrangement | Three main conductors laid-up, with protective-earth conductor split into 3 in the outer interstices |
| Inner sheath | Basic material: EPR, Compound type: Special compound |
| Outer sheath | Basic material: Synthetic elastomer compound e.g. CM, Compound type: better 5GM3, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |
| | 14/25 kV | 18/30 kV | | |
| | 17.3/30 kV | 20.8/36 kV | | |
| | 22.5/45 kV | 27/54 kV | | |
| | 36 kV ( 5 Min.) | 43 kV ( 5 Min.) | | |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Additional tests | Torsional StressTest, Roller Bending Test Type C |

## PROTOLON(M) F (N)TSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004523 | 5DK3903 | 6.4 | 33.6 | 36.6 | 2090 | 1125 | 0.78 | 0.35 | 0.32 | 131 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 40.2 | 41.9 | 2730 | 1125 | 0.78 | 0.35 | 0.36 | 131 | 3.58 |
| 3x35+3x25/3 | 20006941 | 5DK3912 | 7.6 | 36.1 | 39.1 | 2510 | 1575 | 0.554 | 0.39 | 0.31 | 162 | 5.01 |
| 3x35+2x25/2+1x10 | 20220184 | 5DK3*** | 7.6 | 41 | 44 | 3000 | 1575 | 0.554 | 0.39 | 0.31 | 162 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 41.7 | 44.7 | 3190 | 1575 | 0.554 | 0.39 | 0.33 | 162 | 5.01 |
| 3x50+3x25/3 | 20007759 | 5DK3066 | 9.1 | 40.4 | 43.4 | 3210 | 2250 | 0.386 | 0.45 | 0.29 | 202 | 7.15 |
| 3x50+3x50/3 | 20004467 | 5DK3068 | 9.1 | 42.9 | 45.9 | 3640 | 2250 | 0.386 | 0.46 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3 | 20001438 | 5DK3071 | 10.8 | 43.9 | 46.9 | 4070 | 3150 | 0.272 | 0.51 | 0.28 | 250 | 10.01 |
| 3x70+3x50/3 | 20001439 | 5DK3072 | 10.8 | 44.4 | 47.4 | 4240 | 3150 | 0.272 | 0.51 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3 | 20004522 | 5DK3876 | 12.7 | 49.7 | 53.7 | 5300 | 4275 | 0.206 | 0.58 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20004520 | 5DK3872 | 14.3 | 53.1 | 57.1 | 6430 | 5400 | 0.161 | 0.64 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3 | 20151774 | 5DK3076 | 16 | 56.8 | 60.8 | 7310 | 6750 | 0.129 | 0.71 | 0.25 | 404 | 21.45 |
| 3x185+3x95/3 | 20007275 | 5DK3877 | 17.7 | 61.7 | 65.7 | 9000 | 8325 | 0.106 | 0.77 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | 20014793 | 5DK3846 | 20.6 | 68.4 | 72.4 | 11280 | 10800 | 0.0801 | 0.8 | 0.24 | 540 | 34.32 |
| 3x300+3x150/3 | 20014794 | 5DK3847 | 23.1 | 75.1 | 79.1 | 13770 | 13500 | 0.0641 | 0.85 | 0.23 | 620 | 42.9 |

## PROTOLON(M) F (N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004612 | 5DK4328 | 6.4 | 34.9 | 37.9 | 2190 | 1125 | 0.78 | 0.31 | 0.33 | 131 | 3.58 |
| 3x25+3x50/3 | 20004613 | 5DK4329 | 6.4 | 39.9 | 42.9 | 2830 | 1125 | 0.78 | 0.31 | 0.35 | 131 | 3.58 |
| 3x35+3x25/3 | 20004615 | 5DK4332 | 7.6 | 38.4 | 41.4 | 2710 | 1575 | 0.554 | 0.35 | 0.32 | 162 | 5.01 |
| 3x35+3x35/3 | 20214151 | 5DK4501 | 7.6 | 38.4 | 41.4 | 2790 | 1575 | 0.554 | 0.35 | 0.34 | 162 | 5.01 |
| 3x35+3x50/3 | 20004614 | 5DK4331 | 7.6 | 41.9 | 44.9 | 3230 | 1575 | 0.554 | 0.35 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3 | 20007428 | 5DK4333 | 9.1 | 41.6 | 44.6 | 3340 | 2250 | 0.386 | 0.4 | 0.3 | 202 | 7.15 |
| 3x50+3x50/3 | 20004616 | 5DK4334 | 9.1 | 42.2 | 45.2 | 3590 | 2250 | 0.386 | 0.4 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3 | 20004639 | 5DK4493 | 10.8 | 45.2 | 48.2 | 4200 | 3150 | 0.272 | 0.46 | 0.29 | 250 | 10.01 |
| 3x70+3x50/3 | 20001447 | 5DK4345 | 10.8 | 45.2 | 48.2 | 4300 | 3150 | 0.272 | 0.46 | 0.29 | 250 | 10.01 |
| 3x95+3x50/3 | 20004641 | 5DK4496 | 12.7 | 50.9 | 54.9 | 5440 | 4275 | 0.206 | 0.52 | 0.27 | 301 | 13.59 |
| 3x95+3x70/3 | 20214152 | 5DK4502 | 12.7 | 50.9 | 54.9 | 5610 | 4275 | 0.206 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20004619 | 5DK4337 | 14.3 | 54.4 | 58.4 | 6600 | 5400 | 0.161 | 0.57 | 0.27 | 352 | 17.16 |
| 3x150+3x70/3 | 20004642 | 5DK4498 | 16 | 57.9 | 61.9 | 7670 | 6750 | 0.129 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185+3x95/3 | 20004643 | 5DK4499 | 17.7 | 62.5 | 66.5 | 9170 | 8325 | 0.106 | 0.68 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | 20157800 | 5DK4*** | 20.6 | 68.7 | 72.7 | 11540 | 10800 | 0.0801 | 0.7 | 0.25 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOLON(M) F (N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20171875 | 5DK5*** | 6.4 | 40.2 | 43.2 | 2690 | 1125 | 0.78 | 0.24 | 0.36 | 139 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 41.8 | 44.8 | 3050 | 1125 | 0.78 | 0.24 | 0.38 | 139 | 3.58 |
| 3x35+3x25/3 | | | 7.6 | 41.8 | 44.8 | 2930 | 1575 | 0.554 | 0.27 | 0.34 | 172 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 41.8 | 44.8 | 3300 | 1575 | 0.554 | 0.27 | 0.34 | 172 | 5.01 |
| 3x50+3x25/3 | 20194632 | 5DK5143 | 9.1 | 45 | 48 | 3550 | 2250 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x50+3x50/3 | 20224829 | 5DK5*** | 9.1 | 45 | 48 | 3930 | 2250 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x70+3x35/3 | | | 10.8 | 49.5 | 53.5 | 4590 | 3150 | 0.272 | 0.34 | 0.31 | 265 | 10.01 |
| 3x70+3x50/3 | | | 10.8 | 49.9 | 53.9 | 4950 | 3150 | 0.272 | 0.34 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3 | 20004685 | 5DK5146 | 12.7 | 54.4 | 58.4 | 5930 | 4275 | 0.202 | 0.39 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3 | 20153603 | 5DK5*** | 14.3 | 57.3 | 61.3 | 7020 | 5400 | 0.161 | 0.42 | 0.28 | 371 | 17.16 |
| 3x150+3x70/3 | 20225874 | 5DK5*** | 16 | 63.8 | 67.8 | 8220 | 6750 | 0.129 | 0.46 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | 20161385 | 5DK5*** | 17.7 | 65.9 | 69.9 | 9760 | 8325 | 0.106 | 0.5 | 0.27 | 488 | 26.46 |

## PROTOLON(M) F (N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20008856 | 5DK5682 | 6.4 | 42.3 | 45.3 | 2870 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 42.3 | 45.3 | 3120 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+3x25/3 | 20163964 | 5DK5684 | 7.6 | 45.8 | 48.8 | 3470 | 1575 | 0.554 | 0.24 | 0.35 | 172 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 44.8 | 47.8 | 3620 | 1575 | 0.554 | 0.24 | 0.35 | 172 | 5.01 |
| 3x50+3x25/3 | 20014374 | 5DK5691 | 9.1 | 47.9 | 50.9 | 4010 | 2250 | 0.386 | 0.27 | 0.33 | 215 | 7.15 |
| 3x50+3x50/3 | | | 9.1 | 47.9 | 50.9 | 4430 | 2250 | 0.386 | 0.27 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3 | 20007431 | 5DK5686 | 10.8 | 52.4 | 56.4 | 5110 | 3150 | 0.272 | 0.31 | 0.32 | 265 | 10.01 |
| 3x70+3x50/3 | 20058841 | 5DK5687 | 10.8 | 52.4 | 56.4 | 5270 | 3150 | 0.272 | 0.35 | 0.32 | 265 | 10.01 |
| 3x95+3x50/3 | 20101416 | 5DK5688 | 12.7 | 56.5 | 60.5 | 6170 | 4275 | 0.206 | 0.35 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3 | 20004720 | 5DK5689 | 14.3 | 61.7 | 65.7 | 7650 | 5400 | 0.161 | 0.38 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3 | 20004721 | 5DK5690 | 16 | 65.9 | 69.9 | 8930 | 6750 | 0.129 | 0.41 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | 20151697 | 5DK5689 | 17.7 | 68.8 | 72.8 | 10230 | 8325 | 0.106 | 0.45 | 0.28 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOLON(M) F (N)TSCGEWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20220192 | 5DK6*** | 6.4 | 46 | 49 | 3120 | 1125 | 0.78 | 0.19 | 0.4 | 139 | 3.58 |
| 3x35+3x25/3 | 20098412 | 5DK6464 | 7.6 | 49.5 | 53.5 | 3930 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x35+3x35/3 | 20213010 | 5DK6*** | 7.6 | 49.5 | 53.5 | 3890 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3 | 20170690 | 5DK6* | 9.1 | 53.3 | 57.3 | 4760 | 2250 | 0.386 | 0.23 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3 | 20008497 | 5DK6469 | 10.8 | 56.2 | 60.2 | 5570 | 3150 | 0.272 | 0.26 | 0.33 | 265 | 10.01 |
| 3x70+3x50/3 | 20008499 | 5DK6470 | 10.8 | 56.8 | 60.8 | 5710 | 3150 | 0.272 | 0.26 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3 | 20155393 | | 12.7 | 61.9 | 65.9 | 6990 | 4275 | 0.206 | 0.29 | 0.32 | 319 | 13.59 |
| 3x120+3x70/3 | 20129015 | 5DK6472 | 14.3 | 65.9 | 69.9 | 8200 | 5400 | 0.161 | 0.32 | 0.31 | 371 | 17.16 |
| 3x150+3x70/3 | 20183334 | 5DK6... | 16 | 70.6 | 74.6 | 9210 | 6750 | 0.129 | 0.35 | 0.3 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.7 | 75.5 | 79.5 | 10820 | 8325 | 0.106 | 0.38 | 0.29 | 488 | 26.46 |

## PROTOLON(M) F (N)TSCGEWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20171275 | 5DK6844 | 6.4 | 47 | 51 | 3650 | 1125 | 0.78 | 0.17 | 0.42 | 139 | 3.58 |
| 3x35+3x25/3 | 20014796 | 5DK6845 | 7.6 | 52.9 | 56.9 | 4350 | 1575 | 0.554 | 0.18 | 0.39 | 172 | 5.01 |
| 3x50+3x25/3 | 20174410 | 5DK6... | 9.1 | 52.6 | 56.6 | 4850 | 2250 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3 | 20156750 | 5DK6*** | 10.8 | 61.7 | 65.7 | 6420 | 3150 | 0.272 | 0.23 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3 | 20008614 | 5DK6850 | 12.7 | 65.1 | 69.1 | 7410 | 4275 | 0.206 | 0.25 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3 | 20004748 | 5DK6852 | 14.3 | 68.8 | 72.8 | 8660 | 5400 | 0.161 | 0.28 | 0.32 | 371 | 17.16 |
| 3x150+3x70/3 | 20172216 | 5DK6*** | 16 | 75.3 | 79.3 | 9970 | 6750 | 0.129 | 0.3 | 0.31 | 428 | 21.45 |
| 3x185+3x95/3 | 20007274 | 5DK6856 | 17.7 | 78.9 | 82.9 | 11730 | 8325 | 0.106 | 0.32 | 0.3 | 488 | 26.46 |
| 3x240+3x120/3 | 20008496 | 5DK6857 | 20.6 | 84.4 | 89.4 | 14510 | 10800 | 0.0801 | 0.35 | 0.29 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# PROTOLON(M) F (N)TSCGEWOEU 3 kV – 30 kV

## Medium voltage flexible cables for semiflexible installation

### Application

For laying alongside the conveyor belts (also for shiftable units) and on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car) and for connection of submersible pump units.

### Global data

| | |
|---|---|
| Brand | PROTOLON(M) |
| Type designation | F-(N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, not tinned, very finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Core identification | Natural coloring with black semiconductive rubber on which white digits 1 to 3 are printed |
| Core arrangement | Three main conductors laid-up, with protective-earth conductor split into 3 in the outer interstices |
| Inner sheath | Basic material: EPR, Compound type: Special compound |
| Outer sheath | Basic material: Synthetic elastomer compound e.g. CM, Compound type: better 5GM3, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage - main cores | 11 kV ( 5 Min.) | 17 kV ( 5 Min.) | 24 kV ( 5 Min.) | 29 kV ( 5 Min.) |

| | |
|---|---|
| 14/25 kV | 18/30 kV |
| 17.3/30 kV | 20.8/36 kV |
| 22.5/45 kV | 27/54 kV |
| 36 kV ( 5 Min.) | 43 kV ( 5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Additional tests | Torsional StressTest, Roller Bending Test Type C |

## PROTOLON(M) F (N)TSCGEWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004523 | 5DK3903 | 6.4 | 33.6 | 36.6 | 2090 | 1125 | 0.78 | 0.35 | 0.32 | 131 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 40.2 | 41.9 | 2730 | 1125 | 0.78 | 0.35 | 0.36 | 131 | 3.58 |
| 3x35+3x25/3 | 20006941 | 5DK3912 | 7.6 | 36.1 | 39.1 | 2510 | 1575 | 0.554 | 0.39 | 0.31 | 162 | 5.01 |
| 3x35+2x25/2+1x10 | 20220184 | 5DK3*** | 7.6 | 41 | 44 | 3000 | 1575 | 0.554 | 0.39 | 0.31 | 162 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 41.7 | 44.7 | 3190 | 1575 | 0.554 | 0.39 | 0.33 | 162 | 5.01 |
| 3x50+3x25/3 | 20007759 | 5DK3066 | 9.1 | 40.4 | 43.4 | 3210 | 2250 | 0.386 | 0.45 | 0.29 | 202 | 7.15 |
| 3x50+3x50/3 | 20004467 | 5DK3068 | 9.1 | 42.9 | 45.9 | 3640 | 2250 | 0.386 | 0.46 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3 | 20001438 | 5DK3071 | 10.8 | 43.9 | 46.9 | 4070 | 3150 | 0.272 | 0.51 | 0.28 | 250 | 10.01 |
| 3x70+3x50/3 | 20001439 | 5DK3072 | 10.8 | 44.4 | 47.4 | 4240 | 3150 | 0.272 | 0.51 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3 | 20004522 | 5DK3876 | 12.7 | 49.7 | 53.7 | 5300 | 4275 | 0.206 | 0.58 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20004520 | 5DK3872 | 14.3 | 53.1 | 57.1 | 6430 | 5400 | 0.161 | 0.64 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3 | 20151774 | 5DK3076 | 16 | 56.8 | 60.8 | 7310 | 6750 | 0.129 | 0.71 | 0.25 | 404 | 21.45 |
| 3x185+3x95/3 | 20007275 | 5DK3877 | 17.7 | 61.7 | 65.7 | 9000 | 8325 | 0.106 | 0.77 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | 20014793 | 5DK3846 | 20.6 | 68.4 | 72.4 | 11280 | 10800 | 0.0801 | 0.8 | 0.24 | 540 | 34.32 |
| 3x300+3x150/3 | 20014794 | 5DK3847 | 23.1 | 75.1 | 79.1 | 13770 | 13500 | 0.0641 | 0.85 | 0.23 | 620 | 42.9 |

## PROTOLON(M) F (N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20004612 | 5DK4328 | 6.4 | 34.9 | 37.9 | 2190 | 1125 | 0.78 | 0.31 | 0.33 | 131 | 3.58 |
| 3x25+3x50/3 | 20004613 | 5DK4329 | 6.4 | 39.9 | 42.9 | 2830 | 1125 | 0.78 | 0.31 | 0.35 | 131 | 3.58 |
| 3x35+3x25/3 | 20004615 | 5DK4332 | 7.6 | 38.4 | 41.4 | 2710 | 1575 | 0.554 | 0.35 | 0.32 | 162 | 5.01 |
| 3x35+3x35/3 | 20214151 | 5DK4501 | 7.6 | 38.4 | 41.4 | 2790 | 1575 | 0.554 | 0.35 | 0.34 | 162 | 5.01 |
| 3x35+3x50/3 | 20004614 | 5DK4331 | 7.6 | 41.9 | 44.9 | 3230 | 1575 | 0.554 | 0.35 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3 | 20007428 | 5DK4333 | 9.1 | 41.6 | 44.6 | 3340 | 2250 | 0.386 | 0.4 | 0.3 | 202 | 7.15 |
| 3x50+3x50/3 | 20004616 | 5DK4334 | 9.1 | 42.2 | 45.2 | 3590 | 2250 | 0.386 | 0.4 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3 | 20004639 | 5DK4493 | 10.8 | 45.2 | 48.2 | 4200 | 3150 | 0.272 | 0.46 | 0.29 | 250 | 10.01 |
| 3x70+3x50/3 | 20001447 | 5DK4345 | 10.8 | 45.2 | 48.2 | 4300 | 3150 | 0.272 | 0.46 | 0.29 | 250 | 10.01 |
| 3x95+3x50/3 | 20004641 | 5DK4496 | 12.7 | 50.9 | 54.9 | 5440 | 4275 | 0.206 | 0.52 | 0.27 | 301 | 13.59 |
| 3x95+3x70/3 | 20214152 | 5DK4502 | 12.7 | 50.9 | 54.9 | 5610 | 4275 | 0.206 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3 | 20004619 | 5DK4337 | 14.3 | 54.4 | 58.4 | 6600 | 5400 | 0.161 | 0.57 | 0.27 | 352 | 17.16 |
| 3x150+3x70/3 | 20004642 | 5DK4498 | 16 | 57.9 | 61.9 | 7670 | 6750 | 0.129 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185+3x95/3 | 20004643 | 5DK4499 | 17.7 | 62.5 | 66.5 | 9170 | 8325 | 0.106 | 0.68 | 0.25 | 461 | 26.46 |
| 3x240+3x120/3 | 20157800 | 5DK4*** | 20.6 | 68.7 | 72.7 | 11540 | 10800 | 0.0801 | 0.7 | 0.25 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOLON(M) F (N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20171875 | 5DK5*** | 6.4 | 40.2 | 43.2 | 2690 | 1125 | 0.78 | 0.24 | 0.36 | 139 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 41.8 | 44.8 | 3050 | 1125 | 0.78 | 0.24 | 0.38 | 139 | 3.58 |
| 3x35+3x25/3 | | | 7.6 | 41.8 | 44.8 | 2930 | 1575 | 0.554 | 0.27 | 0.34 | 172 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 41.8 | 44.8 | 3300 | 1575 | 0.554 | 0.27 | 0.34 | 172 | 5.01 |
| 3x50+3x25/3 | 20194632 | 5DK5143 | 9.1 | 45 | 48 | 3550 | 2250 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x50+3x50/3 | 20224829 | 5DK5*** | 9.1 | 45 | 48 | 3930 | 2250 | 0.386 | 0.3 | 0.32 | 215 | 7.15 |
| 3x70+3x35/3 | | | 10.8 | 49.5 | 53.5 | 4590 | 3150 | 0.272 | 0.34 | 0.31 | 265 | 10.01 |
| 3x70+3x50/3 | | | 10.8 | 49.9 | 53.9 | 4950 | 3150 | 0.272 | 0.34 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3 | 20004685 | 5DK5146 | 12.7 | 54.4 | 58.4 | 5930 | 4275 | 0.202 | 0.39 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3 | 20153603 | 5DK5*** | 14.3 | 57.3 | 61.3 | 7020 | 5400 | 0.161 | 0.42 | 0.28 | 371 | 17.16 |
| 3x150+3x70/3 | 20225874 | 5DK5*** | 16 | 63.8 | 67.8 | 8220 | 6750 | 0.129 | 0.46 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | 20161385 | 5DK5*** | 17.7 | 65.9 | 69.9 | 9760 | 8325 | 0.106 | 0.5 | 0.27 | 488 | 26.46 |

## PROTOLON(M) F (N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20008856 | 5DK5682 | 6.4 | 42.3 | 45.3 | 2870 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x25+3x50/3 | | | 6.4 | 42.3 | 45.3 | 3120 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+3x25/3 | 20163964 | 5DK5684 | 7.6 | 45.8 | 48.8 | 3470 | 1575 | 0.554 | 0.24 | 0.35 | 172 | 5.01 |
| 3x35+3x50/3 | | | 7.6 | 44.8 | 47.8 | 3620 | 1575 | 0.554 | 0.24 | 0.35 | 172 | 5.01 |
| 3x50+3x25/3 | 20014374 | 5DK5691 | 9.1 | 47.9 | 50.9 | 4010 | 2250 | 0.386 | 0.27 | 0.33 | 215 | 7.15 |
| 3x50+3x50/3 | | | 9.1 | 47.9 | 50.9 | 4430 | 2250 | 0.386 | 0.27 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3 | 20007431 | 5DK5686 | 10.8 | 52.4 | 56.4 | 5110 | 3150 | 0.272 | 0.31 | 0.32 | 265 | 10.01 |
| 3x70+3x50/3 | 20058841 | 5DK5687 | 10.8 | 52.4 | 56.4 | 5270 | 3150 | 0.272 | 0.35 | 0.32 | 265 | 10.01 |
| 3x95+3x50/3 | 20101416 | 5DK5688 | 12.7 | 56.5 | 60.5 | 6170 | 4275 | 0.206 | 0.35 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3 | 20004720 | 5DK5689 | 14.3 | 61.7 | 65.7 | 7650 | 5400 | 0.161 | 0.38 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3 | 20004721 | 5DK5690 | 16 | 65.9 | 69.9 | 8930 | 6750 | 0.129 | 0.41 | 0.28 | 428 | 21.45 |
| 3x185+3x95/3 | 20151697 | 5DK5689 | 17.7 | 68.8 | 72.8 | 10230 | 8325 | 0.106 | 0.45 | 0.28 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOLON(M) F (N)TSCGEWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20220192 | 5DK6*** | 6.4 | 46 | 49 | 3120 | 1125 | 0.78 | 0.19 | 0.4 | 139 | 3.58 |
| 3x35+3x25/3 | 20098412 | 5DK6464 | 7.6 | 49.5 | 53.5 | 3930 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x35+3x35/3 | 20213010 | 5DK6*** | 7.6 | 49.5 | 53.5 | 3890 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3 | 20170690 | 5DK6* | 9.1 | 53.3 | 57.3 | 4760 | 2250 | 0.386 | 0.23 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3 | 20008497 | 5DK6469 | 10.8 | 56.2 | 60.2 | 5570 | 3150 | 0.272 | 0.26 | 0.33 | 265 | 10.01 |
| 3x70+3x50/3 | 20008499 | 5DK6470 | 10.8 | 56.8 | 60.8 | 5710 | 3150 | 0.272 | 0.26 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3 | 20155393 | | 12.7 | 61.9 | 65.9 | 6990 | 4275 | 0.206 | 0.29 | 0.32 | 319 | 13.59 |
| 3x120+3x70/3 | 20129015 | 5DK6472 | 14.3 | 65.9 | 69.9 | 8200 | 5400 | 0.161 | 0.32 | 0.31 | 371 | 17.16 |
| 3x150+3x70/3 | 20183334 | 5DK6... | 16 | 70.6 | 74.6 | 9210 | 6750 | 0.129 | 0.35 | 0.3 | 428 | 21.45 |
| 3x185+3x95/3 | | | 17.7 | 75.5 | 79.5 | 10820 | 8325 | 0.106 | 0.38 | 0.29 | 488 | 26.46 |

## PROTOLON(M) F (N)TSCGEWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3 | 20171275 | 5DK6844 | 6.4 | 47 | 51 | 3650 | 1125 | 0.78 | 0.17 | 0.42 | 139 | 3.58 |
| 3x35+3x25/3 | 20014796 | 5DK6845 | 7.6 | 52.9 | 56.9 | 4350 | 1575 | 0.554 | 0.18 | 0.39 | 172 | 5.01 |
| 3x50+3x25/3 | 20174410 | 5DK6... | 9.1 | 52.6 | 56.6 | 4850 | 2250 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3 | 20156750 | 5DK6*** | 10.8 | 61.7 | 65.7 | 6420 | 3150 | 0.272 | 0.23 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3 | 20008614 | 5DK6850 | 12.7 | 65.1 | 69.1 | 7410 | 4275 | 0.206 | 0.25 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3 | 20004748 | 5DK6852 | 14.3 | 68.8 | 72.8 | 8660 | 5400 | 0.161 | 0.28 | 0.32 | 371 | 17.16 |
| 3x150+3x70/3 | 20172216 | 5DK6*** | 16 | 75.3 | 79.3 | 9970 | 6750 | 0.129 | 0.3 | 0.31 | 428 | 21.45 |
| 3x185+3x95/3 | 20007274 | 5DK6856 | 17.7 | 78.9 | 82.9 | 11730 | 8325 | 0.106 | 0.32 | 0.3 | 488 | 26.46 |
| 3x240+3x120/3 | 20008496 | 5DK6857 | 20.6 | 84.4 | 89.4 | 14510 | 10800 | 0.0801 | 0.35 | 0.29 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# PROTOMONT NSSHOEU 1 kV

## Low Voltage flexible rubber cable

### Application

For flexible use and fixed installation open-cast mining applications, in quarries, on construction sites and similar applications, with heavy mechanical stresses. The cables can be used indoors as well as outdoors, in explosion-hazard areas, in industry and in agriculture. They can be used permanently in waste water up to 40°C at a depth of max. 2000 m and in industrial water, cooling water, surface water, rainwater and mixed water - and in groundwater and seawater to a more limited extent. The requirements for accessibility and inspection depend on the consistency of the water. In aggressive water or composed of special substances, the cable's resistance properties should be tested. In other respects the specifications of DIN VDE 0298 part 3 applies.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NSSHOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MA – China<br>MSHA P-189-3<br>EAC Certificate |

### Notes on installation

| | |
|---|---|
| Notes on installation | Maximum submersing depth 2000 meters |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, tinned, finely stranded (class 5) acc. to DIN EN 60228 / IEC 60228 |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 in accordance with DIN EN 50363 |
| Core identification | Up to 5 cores: colored in accordance with DIN VDE 0293-308<br>from 6 cores: light colored with black numbers |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B in accordance with DIN EN 50363 (not for single-core cables) |
| Outer sheath | Vulcanized rubber compound, synthetic elastomer compound e.g. CPE, Compound: 5GM5 in accordance with DIN EN 50363, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3,5 kV (5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | DIN EN 60332-1-2 |
| Resistance to oil | DIN EN 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | DIN EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Max. permissible water temperature | 40 °C (At higher water temperatures, a shortened cable service life is to be expected) |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NSSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT NSSHÖU-O 1x... | | | | | | | | | | | | | | |
| 1x16 | 20004811 | 5DL1112 | 5.4 | 10.6 | 11.6 | 35 | 46 | 240 | 240 | 1.21 | 0.42 | 0.26 | 135 | 2.29 |
| 1x25 | 20008654 | 5DL1113 | 6.3 | 10 | 13.7 | 55 | 69 | 360 | 375 | 0.7839 | 0.42 | 0.26 | 178 | 3.58 |
| 1x35 | 20004812 | 5DL1114 | 7.4 | 13.7 | 14.9 | 60 | 75 | 460 | 525 | 0.554 | 0.49 | 0.25 | 220 | 5.01 |
| 1x50 | 20004813 | 5DL1115 | 8.8 | 15.2 | 16.7 | 67 | 84 | 630 | 750 | 0.386 | 0.51 | 0.25 | 275 | 7.15 |
| 1x70 | 20004814 | 5DL1116 | 10.6 | 14.5 | 18.8 | 75 | 94 | 850 | 1050 | 0.272 | 0.59 | 0.24 | 340 | 10.01 |
| 1x95 | 20004815 | 5DL1117 | 12.1 | 19.4 | 20.9 | 84 | 105 | 1070 | 1425 | 0.206 | 0.6 | 0.24 | 409 | 13.59 |
| 1x120 | 20004816 | 5DL1118 | 14.3 | 18.3 | 23.4 | 94 | 117 | 1370 | 1800 | 0.161 | 0.69 | 0.23 | 479 | 17.16 |
| 1x150 | 20004817 | 5DL1120 | 15.9 | 23.9 | 25.4 | 102 | 127 | 1660 | 2250 | 0.129 | 0.69 | 0.23 | 549 | 21.45 |
| 1x185 | 20069571 | 5DL1121 | 17.5 | 26.6 | 28.8 | 115 | 144 | 2060 | 2775 | 0.106 | 0.68 | 0.23 | 627 | 26.46 |
| 1x240 | 20004818 | 5DL1122 | 20.3 | 29.8 | 32 | 128 | 160 | 2630 | 3600 | 0.0801 | 0.73 | 0.23 | 734 | 34.32 |
| 1x300 | 20004819 | 5DL1123 | 23.1 | 34.6 | 36.8 | 147 | 184 | 3300 | 4500 | 0.0641 | 0.76 | 0.23 | 843 | 42.9 |
| 1x400 | 20154805 | 5DL1124 | 26.2 | 38.5 | 40.5 | 162 | 203 | 4260 | 6000 | 0.0486 | 0.76 | 0.24 | 1024 | 57.2 |
| PROTOMONT NSSHÖU-O 2x... | | | | | | | | | | | | | | |
| 2x1,5 | 20004826 | 5DL1204 | 1.6 | 10.3 | 11.9 | 36 | 48 | 170 | 45 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 2x2,5 | 20008593 | 5DL1205 | 1.9 | 11.4 | 13 | 52 | 65 | 210 | 75 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| 2x4 | 20227264 | 5DL1206 | 2.4 | 7.5 | 9.5 | 29 | 38 | 220 | 120 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| PROTOMONT NSSHÖU-O 3x... | | | | | | | | | | | | | | |
| 3x1,5 | 20231497 | 5DL1*** | 1.6 | 10.8 | 12.4 | 50 | 62 | 180 | 68 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 3x2,5 | 20004872 | 5DL1751 | 1.9 | 12 | 13.6 | 54 | 68 | 240 | 113 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| 3x4 | | 5DL1760 | 2.4 | 14.7 | 16.7 | 67 | 84 | 340 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6 | | 5DL1946 | 2.9 | 15.7 | 17.7 | 71 | 89 | 415 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 3x10 | 20141441 | 5DL1901 | 3.9 | 20.7 | 21.8 | 87 | 109 | 680 | 450 | 1.91 | 0.32 | 0.28 | 74 | 1.43 |
| 3x16 | 20173651 | 5DL1311 | 5.4 | 22.2 | 24.2 | 97 | 121 | 890 | 720 | 1.21 | 0.42 | 0.26 | 99 | 2.29 |
| 3x25 | 20004897 | 5DL1964 | 6.3 | 26.8 | 28.5 | 114 | 143 | 1330 | 1125 | 0.784 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35 | 20004837 | 5DL1391 | 7.5 | 29.5 | 32.5 | 130 | 163 | 1770 | 1575 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50 | 20148227 | 5DL1393 | 8.9 | 35.2 | 38.3 | 153 | 192 | 2450 | 2250 | 0.386 | 0.55 | 0.27 | 202 | 7.15 |
| 3x70 | 20008777 | 5DL1767 | 10.6 | 39.1 | 42.1 | 168 | 211 | 3170 | 3150 | 0.272 | 0.57 | 0.28 | 250 | 10.01 |
| PROTOMONT NSSHÖU-J 3x... | | | | | | | | | | | | | | |
| 3x1,5 | 20004827 | 5DL1304 | 1.6 | 10.7 | 12.3 | 49 | 62 | 190 | 68 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 3x2,5 | 20004828 | 5DL1305 | 1.9 | 12 | 13.6 | 54 | 68 | 240 | 113 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| 3x4 | 20007174 | 5DL1306 | 2.4 | 14.2 | 16.2 | 65 | 81 | 350 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6 | | 5DL1914 | 2.9 | 16.6 | 18.6 | 74 | 93 | 415 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 4x1,5 | 20085843 | 5DL1403 | 1.6 | 12 | 13.1 | 52 | 66 | 220 | 90 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| PROTOMONT NSSHÖU-J 4x... | | | | | | | | | | | | | | |
| 4x1,5 | 20004838 | 5DL1404 | 1.6 | 11.5 | 13.1 | 52 | 66 | 220 | 90 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 4x2,5 | 20004839 | 5DL1405 | 1.9 | 13.7 | 15.7 | 63 | 79 | 320 | 150 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| 4x4 | 20004840 | 5DL1406 | 2.4 | 15.3 | 17.3 | 69 | 87 | 420 | 240 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 4x6 | 20004841 | 5DL1407 | 2.9 | 16.5 | 18.5 | 74 | 93 | 520 | 360 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 4x10 | 20004842 | 5DL1410 | 3.9 | 20.9 | 22.9 | 92 | 115 | 830 | 600 | 1.91 | 0.32 | 0.28 | 74 | 1.43 |
| 4x16 | 20004843 | 5DL1412 | 5.4 | 25.9 | 27.6 | 110 | 138 | 1190 | 960 | 1.21 | 0.42 | 0.26 | 99 | 2.29 |
| 4x16+4x2,5 | 20004871 | 5DL1749 | 5.4 | 27.1 | 30.1 | 120 | 151 | 1480 | 960 | 1.21 | 0.42 | 0.26 | 99 | 2.29 |
| 4x25 | 20004844 | 5DL1413 | 6.3 | 29.3 | 32.3 | 129 | 162 | 1740 | 1500 | 0.7839 | 0.42 | 0.26 | 131 | 3.58 |
| 4x25+1x(4x1,5)ST | 20220185 | 5DL1*** | 6.3 | 32.4 | 35.4 | 142 | 177 | 2000 | 1500 | 0.784 | 0.42 | 0.26 | 131 | 3.58 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

Special designs available upon request, e.g.:
- special black outer sheath for -45°C
- halogen-free version with 5GM3 outer sheath

Continued from previous page.

## PROTOMONT NSSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4x35 | 20004845 | 5DL1414 | 7.5 | 32.1 | 35.1 | 140 | 176 | 2200 | 2100 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 4x50 | 20004846 | 5DL1415 | 8.8 | 38.2 | 41.2 | 165 | 206 | 3050 | 3000 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 4x70 | 20004847 | 5DL1416 | 10.6 | 42.5 | 45.5 | 182 | 228 | 3980 | 4200 | 0.272 | 0.59 | 0.24 | 250 | 10.01 |
| 4x95 | 20004848 | 5DL1417 | 12.1 | 48.3 | 52.3 | 209 | 262 | 5220 | 5700 | 0.206 | 0.6 | 0.24 | 301 | 13.59 |
| 4x120 | 20016763 | 5DL1418 | 14.2 | 54.8 | 58.8 | 235 | 294 | 6690 | 7200 | 0.161 | 0.69 | 0.23 | 352 | 17.16 |
| 4x150 | 20023637 | 5DL1420 | 16.1 | 60.2 | 64.2 | 257 | 321 | 8140 | 9000 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 4x185 | 20007494 | 5DL1421 | 17.9 | 67.3 | 71.3 | 285 | 357 | 10010 | 11100 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 4x240 | 20060343 | 5DL1422 | 20.3 | 72.4 | 76.4 | 306 | 382 | 12240 | 14400 | 0.0801 | 0.73 | 0.23 | 540 | 34.32 |
| PROTOMONT NSSHÖU-J 3x.../... | | | | | | | | | | | | | | |
| 3x50/25 | 20004863 | 5DL1715 | 8.8 | 38.2 | 41.2 | 165 | 206 | 2890 | 3000 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70/35 | 20004864 | 5DL1716 | 10.6 | 42.5 | 45.5 | 182 | 228 | 3750 | 4200 | 0.272 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95/50 | 20004865 | 5DL1717 | 12.1 | 48.3 | 52.3 | 209 | 262 | 4940 | 5700 | 0.206 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120/70 | 20004866 | 5DL1718 | 14.2 | 54.8 | 58.8 | 235 | 294 | 6380 | 7200 | 0.161 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150/70 | 20004868 | 5DL1722 | 16.1 | 60.2 | 64.2 | 257 | 321 | 7660 | 9000 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185/95 | 20004867 | 5DL1721 | 17.9 | 67.3 | 71.3 | 285 | 357 | 9490 | 11100 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240/120 | 20196331 | 5DL1745 | 20.2 | 72.4 | 76.4 | 306 | 382 | 11620 | 14400 | 0.08 | 0.73 | 0.23 | 540 | 34.32 |
| PROTOMONT NSSHÖU-J 3x... +3x.../3 | | | | | | | | | | | | | | |
| 3x185+3x95/3 | | 5DL1973 | 17.9 | 60.7 | 64.7 | 259 | 324 | 8690 | 8325 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| PROTOMONT NSSHÖU-J 5x... | | | | | | | | | | | | | | |
| 5x1,5 | 20004855 | 5DL1504 | 1.6 | 12.4 | 14 | 56 | 70 | 250 | 113 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 5x2,5 | 20004856 | 5DL1505 | 1.9 | 14.7 | 16.7 | 67 | 84 | 370 | 188 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| 5x4 | 20004857 | 5DL1506 | 2.4 | 16.5 | 18.5 | 74 | 93 | 490 | 300 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 5x6 | 20004858 | 5DL1507 | 2.9 | 18.6 | 20.6 | 82 | 103 | 650 | 450 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 5x10 | 20004859 | 5DL1510 | 3.9 | 22.5 | 24.5 | 98 | 123 | 980 | 750 | 1.91 | 0.32 | 0.28 | 74 | 1.43 |
| 5x16 | 20004860 | 5DL1512 | 5.4 | 26.7 | 29.7 | 119 | 149 | 1420 | 1200 | 1.21 | 0.42 | 0.26 | 99 | 2.29 |
| 5x25 | 20004861 | 5DL1513 | 6.3 | 31.8 | 34.8 | 139 | 174 | 2080 | 1875 | 0.7839 | 0.42 | 0.26 | 131 | 3.58 |
| 5x35 | 20006970 | 5DL1514 | 7.5 | 37.1 | 40.1 | 160 | 201 | 2760 | 2625 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 5x50 | 20024298 | 5DL1519 | 8.8 | 46.4 | 44.5 | 178 | 223 | 3670 | 3750 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 5x70 | 20024963 | 5DL1516 | 10.6 | 47 | 51 | 204 | 255 | 5050 | 5250 | 0.272 | 0.57 | 0.24 | 250 | 10.01 |
| 5x95 | 20023910 | 5DL1517 | 12.1 | 53.4 | 57.4 | 230 | 287 | 6450 | 7125 | 0.206 | 0.65 | 0.24 | 301 | 13.59 |
| 5x120 | 20023647 | 5DL1518 | 14.1 | 59.6 | 63.6 | 254 | 318 | 8130 | 9000 | 0.161 | 0.68 | 0.24 | 352 | 17.16 |
| 5x185 | 20211472 | 5DL1*** | 17.8 | 74.6 | 78.7 | 315 | 394 | 12010 | 13875 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 5x240 | 20062184 | 5DL1521 | 20.2 | 79.9 | 84.9 | 340 | 425 | 15430 | 18000 | 0.08 | 0.73 | 0.23 | 540 | 34.32 |
| PROTOMONT NSSHÖU-J ...x1,5 | | | | | | | | | | | | | | |
| 7x1,5 | 20004891 | 5DL1933 | 1.6 | 14.9 | 16.9 | 68 | 85 | 380 | 158 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 8x1,5 | 20004890 | 5DL1931 | 1.6 | 16.1 | 18.1 | 72 | 91 | 430 | 180 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 10x1,5 | 20004886 | 5DL1879 | 1.6 | 17.7 | 19.7 | 79 | 99 | 470 | 225 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 12x1,5 | 20023911 | 5DL1777 | 1.6 | 13 | 20.3 | 81 | 102 | 560 | 270 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 7x10+5x1,5ST | 20004896 | 5DL1962 | 3.9 | 26 | 29 | 116 | 145 | 1460 | 1050 | 1.91 | 0.33 | 0.28 | 74 | 1.43 |
| 19x1,5 | 20023912 | 5DL1859 | 1.6 | 19.7 | 23.7 | 95 | 119 | 790 | 428 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| 24x1,5 | 20088402 | 5DL1907 | 1.6 | 24.3 | 27.3 | 109 | 137 | 950 | 540 | 13.3 | 0.22 | 0.33 | 23 | 0.21 |
| PROTOMONT NSSHÖU-J ...x2,5 | | | | | | | | | | | | | | |
| 7x2,5 | 20004887 | 5DL1911 | 1.9 | 16.9 | 18.9 | 76 | 95 | 500 | 263 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 10x2,5 | 20174408 | 5DL1748 | 2 | 22.6 | 23.6 | 94 | 118 | 650 | 375 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Special designs available upon request, e.g.:
- special black outer sheath for -45°C
- halogen-free version with 5GM3 outer sheath

Continued from previous page.

## PROTOMONT NSSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12x2,5 | 20004874 | 5DL1755 | 1.9 | 20.7 | 22.7 | 91 | 114 | 750 | 450 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 18x2,5 | 20004892 | 5DL1937 | 1.9 | 24.5 | 27.5 | 110 | 138 | 1070 | 675 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 19x2,5 | 20025547 | 5DL1860 | 2 | 26 | 28 | 112 | 140 | 1140 | 713 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 24x2,5 | 20171197 | 5DL1842 | 1.9 | 27.6 | 30.6 | 122 | 153 | 1360 | 900 | 7.98 | 0.23 | 0.32 | 30 | 0.36 |
| PROTOMONT NSSHÖU-J ...x4 | | | | | | | | | | | | | | |
| 7x4 | 20059552 | 5DL1750 | 2.4 | 20 | 22 | 88 | 110 | 710 | 420 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 12x4 | 20040505 | 5DL1957 | 2.4 | 23.5 | 26.5 | 106 | 133 | 1060 | 720 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 7x4+5x1,5ST | 20004893 | 5DL1938 | 2.4 | 23.5 | 25.5 | 102 | 128 | 940 | 420 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

Special designs available upon request, e.g.:
- special black outer sheath for -45°C
- halogen-free version with 5GM3 outer sheath

# PROTOMONT NSHXOEU 1 kV

## Flexible rubber cables for use in mining and industries


### Application

For flexible use and fixed installation in underground mining applications, tunnel building applications, open-cast mining applications, in quarries, on construction sites and similar applications, with medium mechanical stresses. The cables can be used indoors as well as outdoors, in explosion-hazard areas, in industry and in agriculture. They can be used permanently in waste water up to 40 °C. The cables can also be used in industrial water, cooling water, surface water, rainwater and mixed water - and in groundwater and seawater to a more limited extent. The requirements for accessibility and inspection are less stringent in such cases at depths greater than 10 m up to 500 m. In other respects the specifications of DIN VDE 0298 part 3 apply.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NSHXOEU |
| Standard | Based on DIN VDE 0250 part 812 |

### Notes on installation

| | |
|---|---|
| Maximum Submersing Depth | 500 Meter |

### Design features

| | |
|---|---|
| Conductor | Copper, tinned, finely stranded (class 5) in accordance with DIN VDE 0295 / IEC 60228 |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3, in accordance with DIN VDE 0207 |
| Core identification | Up to 5 cores: colored in accordance with DIN VDE 0293-308<br>from 6 cores: light with black numbers |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B, in accordance with DIN VDE 0207 (not for single-core cables) |
| Outer sheath | Vulcanized rubber compound, basis EVA, compound 5GM3 in accordance with DIN VDE 0207<br>Colour: yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3 kV (5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Flame propagation | DIN EN 60332-1-2 |
| Resistance to oil | DIN EN 60811-2-1 |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Max. permissible water temperature | 40 °C (At higher water temperatures, a shortened cable service life is to be expected) |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NSHXOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT NSHXOEU-O 1x... | | | | | | | | | | | | | |
| 1x300 | 20216518 | 5DL4850 | 22.9 | 34.5 | 36.8 | 147 | 3330 | 4500 | 0.0654 | 0.76 | 0.23 | 843 | 42.9 |
| 1x400 | 20216519 | 5DL4*** | 26.2 | 38.5 | 40.5 | 162 | 4210 | 6000 | 0.0495 | 0.76 | 0.24 | 1024 | 57.2 |
| PROTOMONT NSHXOEU-J 3x... | | | | | | | | | | | | | |
| 3x2,5 | 20156737 | 5DL4816 | 2 | 12 | 13.6 | 54 | 250 | 113 | 8.21 | 0.23 | 0.32 | 30 | 0.36 |
| PROTOMONT NSHXOEU-J 3x.../... | | | | | | | | | | | | | |
| 3x50/25 | 20121240 | 5DL4800 | 8.8 | 38.1 | 41.1 | 164 | 2930 | 3000 | 0.393 | 0.5 | 0.25 | 202 | 7.15 |
| 3x70/35 | 20121239 | 5DL4801 | 10.6 | 42.3 | 45.3 | 181 | 3790 | 4200 | 0.277 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95/50 | 20057423 | 5DL4802 | 12.1 | 48.2 | 52.2 | 209 | 5170 | 5700 | 0.21 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120/70 | | | 14.2 | 54.6 | 58.6 | 234 | 6482 | 7200 | 0.164 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150/70 | | | 16.1 | 60 | 64 | 256 | 7568 | 9000 | 0.132 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185/95 | | | 17.9 | 67.3 | 71.3 | 285 | 9328 | 11100 | 0.108 | 0.71 | 0.23 | 461 | 26.46 |
| PROTOMONT NSHXOEU-J 4x... | | | | | | | | | | | | | |
| 4x2,5 | 20153827 | 5DL4*** | 2 | 14.2 | 16 | 64 | 310 | 150 | 8.21 | 0.23 | 0.32 | 30 | 0.36 |
| PROTOMONT NSHXOEU-J 5x... | | | | | | | | | | | | | |
| 5x1,5 | | | 1.6 | 12.7 | 14.3 | 57 | 250 | 113 | 13.7 | 0.22 | 0.33 | 23 | 0.21 |
| 5x2,5 | 20156738 | 5DL4815 | 2 | 14.7 | 16.7 | 67 | 380 | 188 | 8.21 | 0.23 | 0.32 | 30 | 0.36 |
| 5x4 | 20156739 | 5DL4814 | 2.4 | 16.5 | 18.5 | 74 | 500 | 300 | 5.09 | 0.26 | 0.31 | 41 | 0.57 |
| 5x6 | 20121283 | 5DL4810 | 2.9 | 18.6 | 20.6 | 82 | 660 | 450 | 3.39 | 0.3 | 0.29 | 53 | 0.86 |
| 5x10 | 20121282 | 5DL4811 | 3.9 | 22.5 | 24.5 | 98 | 1000 | 750 | 1.95 | 0.32 | 0.28 | 74 | 1.43 |
| 5x16 | 20156740 | 5DL4813 | 5.4 | 26.7 | 29.7 | 119 | 1440 | 1200 | 1.24 | 0.42 | 0.26 | 99 | 2.29 |
| 5x25 | 20121281 | 5DL4812 | 6.3 | 31.7 | 34.7 | 139 | 2110 | 1875 | 0.795 | 0.42 | 0.26 | 131 | 3.58 |
| 5x35 | | | 7.5 | 36.9 | 39.9 | 160 | 2743 | 2625 | 0.565 | 0.49 | 0.25 | 162 | 5.01 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(MT) (N)SSHOEU 1 kV

## Low Voltage light and flexible rubber cable

### Application

Rubber-sheated flexible cables for mining and tunneling application, under heavy mechanical stress. Suitable for laying alongside conveyor belts and tunnel walls, on material handling equipment, e.g. as connection between upper and lower cars, and on movable equipment. The cables can be used indoor as well as outdoor, in explosion-hazard areas, in industry and in agriculture.
The cables are water resistant up to 10m water depth.
In other respects the specifications of DIN VDE 0298 part 3 applies.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(MT) |
| Type designation | (N)SSHOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | VDE-REG F546 |

### Notes on installation

| | |
|---|---|
| Notes on installation | Max. submersing depth 10m |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound better 3GI3 |
| Core identification | Light gray with black digits |
| Inner sheath | Basic material: EPR, Compound type: Special compound |
| Outer sheath | Basic material: Chlorinated rubber, Compound type: Special compound, 5GM5<br>Colour: yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3,5 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Max. permissible water temperature | 40 °C (At higher water temperatures, a shortened cable service life is to be expected) |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 1x16 | 20265363 | 5.2 | 9.5 | 11.1 | 230 | 240 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 1x25 | 20265364 | 6.4 | 11 | 12.6 | 335 | 375 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 1x35 | 20265365 | 7.5 | 12.3 | 13.9 | 435 | 525 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 1x50 | 20265366 | 9 | 14.5 | 16.5 | 615 | 750 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 1x70 | 20265367 | 11.1 | 16.4 | 18.4 | 830 | 1050 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 1x95 | 20265369 | 12.8 | 18.5 | 20.5 | 1060 | 1425 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 1x120 | 20265370 | 14.5 | 20.4 | 22.4 | 1300 | 1800 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 1x150 | 20265372 | 16.5 | 22.8 | 24.8 | 1600 | 2250 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 1x185 | 20265373 | 17.9 | 24.7 | 27.7 | 2020 | 2775 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 1x240 | 20265374 | 21.2 | 27.6 | 30.6 | 2548 | 3600 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 1x300 | 20265377 | 23.6 | 31.6 | 34.6 | 3200 | 4500 | 0.0641 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 2x1,5 | 20265378 | 1.6 | 9.8 | 11.4 | 150 | 45 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 2x2,5 | 20265379 | 2 | 10.7 | 12.3 | 185 | 75 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 2x4 | | 2.4 | 11.9 | 13.5 | 220 | 120 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 3x2,5 | 20265395 | 2 | 11.1 | 12.7 | 210 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265396 | 2.4 | 12.1 | 13.7 | 271 | 180 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 3x6 | 20265397 | 2.9 | 13.2 | 14.8 | 350 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 3x10 | 20265398 | 3.9 | 16.1 | 18.1 | 505 | 450 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 3x16 | 20265399 | 5.2 | 19 | 21 | 775 | 720 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 3x25 | 20265400 | 6.4 | 22.9 | 24.9 | 1160 | 1125 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 3x35 | 20265401 | 7.5 | 24.9 | 27.9 | 1550 | 1575 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 3x50 | 20265402 | 9 | 29.4 | 32.4 | 2180 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70 | 20265403 | 11.1 | 34.8 | 37.8 | 3020 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95 | 20265405 | 12.8 | 40.9 | 43.9 | 3810 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120 | 20265406 | 14.4 | 44.7 | 47.7 | 4970 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150 | 20265407 | 16.1 | 50 | 54 | 6290 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185 | 20265408 | 17.9 | 54.6 | 58.6 | 7470 | 8325 | 0.106 | 0.95 | 0.22 | 461 | 26.46 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x1,5 | 20265409 | 1.6 | 10.2 | 11.8 | 170 | 68 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 3x2,5 | 20265410 | 2 | 11.1 | 12.7 | 220 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265411 | 2.4 | 12.1 | 13.7 | 290 | 180 | 4.95 | 0.27 | 0.31 | 41 | 0.57 |
| 3x6 | 20265412 | 2.9 | 13.2 | 14.8 | 360 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 4x1,5 | 20265413 | 1.6 | 11 | 12.6 | 204 | 90 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 4x2,5 | 20265414 | 2 | 12 | 13.6 | 270 | 150 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 4x4 | 20265415 | 2.4 | 13 | 14.6 | 338 | 240 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 4x6 | 20265416 | 2.9 | 14.9 | 16.9 | 450 | 360 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 4x10 | 20265417 | 3.9 | 17.4 | 19.4 | 690 | 600 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 4x16 | 20265418 | 5.2 | 21 | 23 | 980 | 960 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 4x25 | 20265419 | 6.4 | 24.5 | 27.5 | 1490 | 1500 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 4x35 | 20265420 | 7.5 | 28.4 | 31.4 | 1870 | 2100 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

Continued from previous page.

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4x50 | 20265421 | 9 | 33.6 | 36.6 | 2570 | 3000 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 4x70 | 20265423 | 10.6 | 39.5 | 42.5 | 3920 | 4200 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 4x95 | 20265424 | 12.8 | 44.8 | 47.8 | 5040 | 5700 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 4x120 | 20265425 | 14.4 | 49.8 | 53.8 | 6200 | 7200 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 4x150 | | 16.1 | 54.9 | 58.9 | 7578 | 9000 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x50+3x25/3 | 20278765 | 9 | 29.4 | 32.4 | 2350 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20268926 | 10.6 | 35.1 | 38.1 | 3220 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95/50 | 20220195 | 12.1 | 44.8 | 47.8 | 4400 | 4275 | 0.206 | 0.6 | 0.24 | 301 | 13.59 |
| 3x95+3x50/3 | 20268927 | 12.8 | 40.7 | 43.7 | 4300 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20268929 | 14.4 | 44.5 | 47.5 | 5370 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20278766 | 16.5 | 51.6 | 55.6 | 6950 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20278767 | 17.9 | 54.5 | 58.5 | 8150 | 8325 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20278768 | 20.6 | 62.2 | 66.2 | 10700 | 10800 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 3x300+3x150/3 | 20278769 | 23.4 | 70.3 | 74.3 | 13300 | 13500 | 0.064 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 5x1,5 | 20278770 | 1.6 | 11.9 | 13.5 | 240 | 113 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 5x2,5 | 20278771 | 2 | 12.9 | 14.5 | 310 | 188 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 5x4 | 20268918 | 2.4 | 14.7 | 16.7 | 420 | 300 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 5x6 | 20268919 | 2.9 | 16.1 | 18.1 | 530 | 450 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 5x10 | 20268772 | 3.9 | 19 | 21 | 795 | 750 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 5x16 | 20268920 | 5.2 | 22.8 | 24.8 | 1180 | 1200 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 5x25 | 20278773 | 6.4 | 28 | 31 | 1880 | 1875 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 5x35 | 20278774 | 7.5 | 34.5 | 37.5 | 2650 | 2625 | 0.554 | 0.46 | 0.25 | 162 | 5.01 |
| PROTOMONT(MT) (N)SSHOEU-O Control cables | | | | | | | | | | | |
| 12x4 | 20278807 | 2.4 | 20.8 | 22.8 | 870 | 720 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 12x6 | 20278808 | 2.9 | 23.4 | 26.4 | 1150 | 1080 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J Control cables | | | | | | | | | | | |
| 7x1,5 | 20278776 | 1.6 | 12.9 | 14.5 | 300 | 158 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 8x1,5 | | 1.6 | 13.8 | 15.4 | 325 | 180 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 10x1,5 | | 1.6 | 15.5 | 17.5 | 400 | 225 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 12x1,5 | 20278777 | 1.6 | 15.8 | 17.8 | 500 | 270 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 14x1,5 | | 1.6 | 16.8 | 18.8 | 495 | 315 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 18x1,5 | 20278778 | 1.6 | 18.5 | 20.5 | 610 | 405 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 19x1,5 | 20278779 | 1.6 | 18.9 | 20.9 | 650 | 428 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 24x1,5 | 20278780 | 1.6 | 20 | 22 | 800 | 540 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 7x2,5 | 20278801 | 2 | 14.9 | 16.9 | 450 | 263 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 8x2,5 | 20278802 | 2 | 15.8 | 17.8 | 480 | 300 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 10x2,5 | | 2 | 16.4 | 18.4 | 500 | 375 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 12x2,5 | 20278803 | 2 | 18 | 20 | 600 | 450 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 15x2,5 | 20278804 | 2 | 20.7 | 22.7 | 780 | 563 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 18x2,5 | 20278805 | 2 | 21.2 | 23.2 | 850 | 675 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 19x2,5 | | 2 | 22.3 | 24.3 | 900 | 713 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 24x2,5 | 20278806 | 2 | 22.8 | 24.8 | 1070 | 900 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 37x2,5 | | 2 | 29 | 31 | 1600 | 1388 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

# Notes

# PROTOMONT EMV-FC (N)SSHCOEU 1 kV

## Cables for Variable Frequency Converter

### Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining industry, on construction sites and similar applications, with heavy mechanical stresses. For laying on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car). Can be applied in water up to 40°C, approximately up to 10 m depth.

### Global data

| | |
|---|---|
| Brand | PROTOMONT EMV-FC |
| Type designation | (N)SSHCOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | MSHA P-189-3<br>EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) according to DIN EN 60228 |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Natural coloring with black figures |
| Core arrangement | Three power cores laid up with the protective earth conductors split into three in the outer interstices |
| Screen | EMC optimized, concentric braid of tinned copper wires |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 5 kV ( 5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT EMV-FC (N)SSHCOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x2,5 | 20004904 | 5DL2108 | 5.4 | 24.4 | 27.4 | 1190 | 720 | 1.24 | 0.42 | 0.26 | 99 | 2.29 |
| 3x25+3x4 | 20016716 | 5DL2107 | 6.3 | 28.2 | 31.2 | 1680 | 1125 | 0.795 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3 | 20004903 | 5DL2106 | 7.5 | 30.5 | 33.5 | 2000 | 1575 | 0.565 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3 | 20004902 | 5DL2105 | 8.9 | 36 | 39 | 2820 | 2250 | 0.393 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20004901 | 5DL2104 | 10.6 | 41.2 | 44.2 | 3800 | 3150 | 0.277 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3 | 20004900 | 5DL2103 | 12.1 | 45.7 | 48.7 | 4760 | 4275 | 0.21 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20001453 | 5DL2100 | 14.1 | 48.7 | 52.7 | 5890 | 5400 | 0.164 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20004899 | 5DL2101 | 16 | 55.7 | 59.7 | 7230 | 6750 | 0.132 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20004905 | 5DL2109 | 17.8 | 60.4 | 64.4 | 8640 | 8325 | 0.108 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20008903 | 5DL2102 | 20.2 | 68.2 | 72.2 | 11100 | 10800 | 0.0817 | 0.73 | 0.23 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT EMV-FC (N)SSHCOEU (-45°C) 1 kV

## Cables for Variable Frequency Converter


### Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining industry, on construction sites and similar applications, with heavy mechanical stresses. For laying on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car). Can be applied in water up to 40°C, approximately up to 10 m depth.

### Global data

| | |
|---|---|
| Brand | PROTOMONT EMV-FC |
| Type designation | (N)SSHCOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | MSHA P-189-3<br>EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Natural coloring with black figures |
| Core arrangement | Three power cores laid-up with the protective earth conductors split into three in the outer interstices |
| Screen | EMC optimized, concentric braid of tinned copper wires |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Black |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 5 kV ( 5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -60 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -45 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT EMV-FC (N)SSHCOEU (-45°C) 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x2,5 | | | 5.4 | 24.4 | 27.4 | 1200 | 720 | 1.24 | 0.42 | 0.26 | 99 | 2.29 |
| 3x25+3x4 | | | 6.3 | 28.2 | 31.2 | 1700 | 1125 | 0.795 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3 | 20292045 | | 7.5 | 30.5 | 33.5 | 2200 | 1575 | 0.565 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3 | 20160629 | 5DL2135 | 8.9 | 36 | 39 | 2810 | 2250 | 0.393 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20016544 | 5DL2134 | 10.6 | 41.2 | 44.2 | 3870 | 3150 | 0.277 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3 | 20035936 | 5DL2133 | 12.1 | 45.7 | 48.7 | 4850 | 4275 | 0.21 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | | | 14.1 | 48.7 | 52.7 | 5800 | 5400 | 0.164 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20004907 | 5DL2131 | 16 | 55.7 | 59.7 | 7350 | 6750 | 0.132 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20267596 | 5DL2139 | 17.8 | 60.4 | 64.4 | 8640 | 8325 | 0.108 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | | | 20.2 | 65 | 71 | 11000 | 10800 | 0.0817 | 0.73 | 0.23 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# FELTOFLEX NTMCWOEU 6 kV – 30 kV

## Single core MV rubber cable, ultra-bendable

### Application

These cables are intended for use as connection in switch-gear or transformer houses where a very small bending radius is required. These cables may be used in festoon systems up to a speed of 120 m/min. The prefered case due to the flexibility of the cable are shiftable units, big drivers, mobile transformers etc.

### Global data

| | |
|---|---|
| Brand | FELTOFLEX |
| Type designation | NTMCWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Copper tinned, finely stranded (class 5), according to DIN VDE 0295 |
| Insulation | Rubber, compound type: EPR-3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound, cold strippable outer layer |
| Core identification | Acc. to DIN VDE 0250 P 813, Color: Natural |
| Screen | Spinning of tinned copper wires |
| Outer sheath | Rubber, compound type: 5GM5 acc. to DIN VDE 0207 part 21, Color: Red |

### Electrical parameters

| | | |
|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV |
| AC test voltage - main cores | 11 kV (5 Min.) | 17 kV (5 Min.) |
| Max. partial discharge intensity | IEC 60502-2, 1,75 x Uo, <10pC | IEC 60502-2, 1,75 x Uo, <10pC |
| | 8.7/15 kV | 12/20 kV |
| | 10.4/18 kV | 13.9/24 kV |
| | 13.5/27 kV | 18/36 kV |
| | 24 kV (5 Min.) | 29 kV (5 Min.) |
| | IEC 60502-2, 1,75 x Uo, <10pC | IEC 60502-2, 1,75 x Uo, <10pC |
| | 14/25 kV | 18/30 kV |
| | 17.3/30 kV | 20.8/36 kV |
| | 22.5/45 kV | 27/54 kV |
| | 36 kV (5 Min.) | 43 kV (5 Min.) |
| | IEC 60502-2, 1,75 x Uo, <10pC | IEC 60502-2, 1,75 x Uo, <10pC |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## FELTOFLEX NTMCWOEU 3.6/6 kV

| Number of cores x cross section | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 6.2 | 14.6 | 19.1 | 21.6 | 129.6 | 216 | 750 | 375 | 0.795 | 0.24 | 178 | 3.58 |
| 1x35/16KON | 7.5 | 15.9 | 20.4 | 22.9 | 137.4 | 229 | 850 | 525 | 0.565 | 0.27 | 220 | 5.01 |
| 1x50/16KON | 9 | 17.36 | 21.8 | 24.3 | 145.8 | 243 | 1000 | 750 | 0.393 | 0.3 | 275 | 7.15 |
| 1x70/16KON | 10.6 | 19 | 23.5 | 26 | 156 | 260 | 1250 | 1050 | 0.277 | 0.34 | 340 | 10.01 |
| 1x95/16KON | 12.6 | 21 | 26.1 | 28.6 | 171.6 | 286 | 1500 | 1425 | 0.21 | 0.38 | 409 | 13.59 |
| 1x120/16KON | 14.8 | 23.2 | 28.1 | 30.6 | 183.6 | 306 | 1800 | 1800 | 0.164 | 0.43 | 479 | 17.16 |
| 1x150/25KON | 16 | 24.4 | 29.4 | 31.9 | 191.4 | 319 | 2150 | 2250 | 0.132 | 0.46 | 549 | 21.45 |
| 1x185/25KON | 17.7 | 26.1 | 32.2 | 34.7 | 208.2 | 347 | 2550 | 2775 | 0.108 | 0.5 | 627 | 26.46 |
| 1x240/25KON | 20.3 | 28.7 | 34.8 | 37.3 | 223.8 | 373 | 3100 | 3600 | 0.0817 | 0.56 | 734 | 34.32 |
| 1x300/25KON | 22.5 | 30.9 | 38 | 40.5 | 243 | 405 | 3750 | 4500 | 0.0654 | 0.61 | 843 | 42.9 |

## FELTOFLEX NTMCWOEU 6/10 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x16/16KON | 20203071 | 5.3 | 14.5 | 19 | 22 | 132 | 220 | 760 | 240 | 1.24 | 0.2 | 135 | 2.29 |
| 1x25/16KON | 20171451 | 6.2 | 15.8 | 21.8 | 24.3 | 145.8 | 243 | 890 | 375 | 0.795 | 0.21 | 178 | 3.58 |
| 1x35/16KON | 20076099 | 7.5 | 17.1 | 23.1 | 25.6 | 153.6 | 256 | 990 | 525 | 0.565 | 0.24 | 220 | 5.01 |
| 1x50/16KON | 20074726 | 9 | 18.7 | 26.1 | 28.6 | 171.6 | 286 | 1260 | 750 | 0.393 | 0.26 | 275 | 7.15 |
| 1x70/16KON | 20074263 | 10.6 | 20.5 | 28.3 | 30.8 | 184.8 | 308 | 1540 | 1050 | 0.277 | 0.29 | 340 | 10.01 |
| 1x95/16KON | 20074265 | 12.6 | 22.3 | 29.4 | 31.9 | 191.4 | 319 | 1720 | 1425 | 0.21 | 0.34 | 409 | 13.59 |
| 1x120/16KON | 20074724 | 14.8 | 24.2 | 31.6 | 34.1 | 204.6 | 341 | 2010 | 1800 | 0.164 | 0.39 | 479 | 17.16 |
| 1x150/25KON | 20142777 | 16 | 25.9 | 33.3 | 35.8 | 214.8 | 358 | 2430 | 2250 | 0.132 | 0.4 | 549 | 21.45 |
| 1x185/25KON | 20074821 | 17.7 | 27.7 | 35.1 | 37.6 | 225.6 | 376 | 2800 | 2775 | 0.108 | 0.42 | 627 | 26.46 |
| 1x240/25KON | 20074284 | 20.3 | 29.5 | 38.7 | 41.2 | 247.2 | 412 | 3420 | 3600 | 0.0817 | 0.51 | 734 | 34.32 |
| 1x300/25KON | 20131478 | 22.5 | 32.2 | 40.9 | 43.4 | 260.4 | 434 | 4100 | 4500 | 0.0654 | 0.53 | 843 | 42.9 |
| 1x400/35KON | 20142778 | 26.5 | 34.9 | 44.3 | 47.3 | 283.8 | 473 | 5260 | 6000 | 0.05 | 0.7 | 1024 | 57.2 |
| 1x500/35KON | 20088035 | 29.3 | 37.7 | 47.7 | 50.7 | 304.2 | 507 | 6260 | 7500 | 0.0391 | 0.76 | 1178 | 71.5 |
| 1x630/35KON | 20142779 | 33.9 | 42.3 | 52.2 | 56.2 | 337.2 | 562 | 7930 | 9450 | 0.0292 | 0.87 | 1364 | 90.09 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

## FELTOFLEX NTMCWOEU 8.7/15 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 6.2 | 20 | 24.6 | 27.1 | 162.6 | 271 | 1000 | 375 | 0.795 | 0.16 | 189 | 3.58 |
| 1x35/16KON | | 7.5 | 21.3 | 25.9 | 28.4 | 170.4 | 284 | 1150 | 525 | 0.565 | 0.18 | 234 | 5.01 |
| 1x50/16KON | | 9 | 22.9 | 27.3 | 29.8 | 178.8 | 298 | 1350 | 750 | 0.393 | 0.2 | 292 | 7.15 |
| 1x70/16KON | | 10.6 | 24.7 | 31.1 | 33.6 | 201.6 | 336 | 1650 | 1050 | 0.277 | 0.22 | 360 | 10.01 |
| 1x95/16KON | | 12.6 | 26.5 | 32 | 34.5 | 207 | 345 | 1900 | 1425 | 0.21 | 0.25 | 434 | 13.59 |
| 1x120/16KON | | 14.8 | 28.4 | 34.2 | 36.7 | 220.2 | 367 | 2200 | 1800 | 0.164 | 0.28 | 505 | 17.16 |
| 1x150/25KON | | 16 | 30.1 | 36.5 | 39 | 234 | 390 | 2700 | 2250 | 0.132 | 0.29 | 582 | 21.45 |
| 1x185/25KON | | 17.7 | 31.9 | 38.3 | 40.8 | 244.8 | 408 | 3050 | 2775 | 0.108 | 0.31 | 664 | 26.46 |
| 1x240/25KON | | 20.3 | 34 | 40.9 | 43.4 | 260.4 | 434 | 3600 | 3600 | 0.0817 | 0.36 | 781 | 34.32 |
| 1x300/25KON | | 22.5 | 35.2 | 43.1 | 45.6 | 273.6 | 456 | 4200 | 4500 | 0.0654 | 0.41 | 898 | 42.9 |
| 1x400/35KON | | 26.5 | 39.1 | 47 | 50 | 300 | 500 | 4620 | 6000 | 0.05 | 0.47 | 1074 | 57.2 |
| 1x500/35KON | 20174427 | 29.3 | 41.9 | 49 | 52 | 312 | 520 | 4800 | 7500 | 0.0391 | 0.51 | 1224 | 71.5 |

## FELTOFLEX NTMCWOEU 12/20 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20091155 | 6.2 | 20 | 26.4 | 28.9 | 173.4 | 289 | 1090 | 375 | 0.795 | 0.16 | 189 | 3.58 |
| 1x35/16KON | 20074729 | 7.5 | 21.3 | 27.6 | 30.1 | 180.6 | 301 | 1250 | 525 | 0.565 | 0.18 | 234 | 5.01 |
| 1x50/16KON | 20074260 | 9 | 22.9 | 29.3 | 31.8 | 190.8 | 318 | 1460 | 750 | 0.393 | 0.2 | 292 | 7.15 |
| 1x70/16KON | 20074256 | 10.6 | 24.7 | 33.5 | 36 | 216 | 360 | 1850 | 1050 | 0.277 | 0.22 | 360 | 10.01 |
| 1x95/16KON | 20074253 | 12.6 | 26.5 | 34.6 | 37.1 | 222.6 | 371 | 2090 | 1425 | 0.21 | 0.25 | 434 | 13.59 |
| 1x120/16KON | 20074727 | 14.8 | 28.4 | 36.4 | 38.9 | 233.4 | 389 | 2380 | 1800 | 0.164 | 0.28 | 505 | 17.16 |
| 1x150/25KON | 20074259 | 16.2 | 30.1 | 38.9 | 41.4 | 248.4 | 414 | 2920 | 2250 | 0.132 | 0.29 | 582 | 21.45 |
| 1x185/25KON | 20143211 | 17.7 | 31.9 | 40.1 | 42.6 | 255.6 | 426 | 3260 | 2775 | 0.108 | 0.31 | 664 | 26.46 |
| 1x240/25KON | 20074267 | 20.3 | 34 | 43.3 | 45.8 | 274.8 | 458 | 3840 | 3600 | 0.0817 | 0.36 | 781 | 34.32 |
| 1x300/25KON | 20087237 | 22.5 | 35.2 | 44.9 | 47.4 | 284.4 | 474 | 4470 | 4500 | 0.0654 | 0.41 | 898 | 42.9 |
| 1x400/35KON | 20140653 | 26.5 | 39.1 | 48 | 52 | 312 | 520 | 5730 | 6000 | 0.05 | 0.47 | 1074 | 57.2 |
| 1x500/35KON | 20142780 | 29.3 | 41.9 | 52 | 56 | 336 | 560 | 6720 | 7500 | 0.0391 | 0.51 | 1224 | 71.5 |
| 1x630/35KON | 20087238 | 35.2 | 47.4 | 58.5 | 61.5 | 369 | 615 | 8660 | 9450 | 0.0292 | 0.53 | 1360 | 90.09 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

## FELTOFLEX NTMCWOEU 14/25 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 6.2 | 21.4 | 29.2 | 31.7 | 190.2 | 317 | 1300 | 375 | 0.795 | 0.15 | 189 | 3.58 |
| 1x35/16KON | | 7.5 | 23.5 | 31.5 | 34 | 204 | 340 | 1500 | 525 | 0.565 | 0.16 | 234 | 5.01 |
| 1x50/16KON | | 9 | 24.96 | 32.9 | 35.4 | 212.4 | 354 | 1700 | 750 | 0.393 | 0.18 | 292 | 7.15 |
| 1x70/16KON | | 10.6 | 26.6 | 34.6 | 37.1 | 222.6 | 371 | 1950 | 1050 | 0.277 | 0.2 | 360 | 10.01 |
| 1x95/16KON | | 12.6 | 28.6 | 37.6 | 40.1 | 240.6 | 401 | 2300 | 1425 | 0.21 | 0.22 | 434 | 13.59 |
| 1x120/16KON | 20170617 | 14.8 | 30.8 | 39.8 | 42.3 | 253.8 | 423 | 2850 | 1800 | 0.164 | 0.25 | 505 | 17.16 |
| 1x150/25KON | | 16 | 32 | 41.1 | 43.6 | 261.6 | 436 | 3050 | 2250 | 0.132 | 0.26 | 582 | 21.45 |
| 1x185/25KON | | 17.7 | 33.7 | 42.9 | 45.4 | 272.4 | 454 | 3450 | 2775 | 0.108 | 0.28 | 664 | 26.46 |
| 1x240/25KON | | 20.3 | 36.3 | 45.5 | 48 | 288 | 480 | 4050 | 3600 | 0.0817 | 0.31 | 781 | 34.32 |
| 1x300/25KON | 20168352 | 22.5 | 38.8 | 48.7 | 51.2 | 307.2 | 512 | 4860 | 4500 | 0.0654 | 0.33 | 898 | 42.9 |
| 1x400/35KON | | 26.5 | 41.3 | 49.2 | 53.2 | 319.2 | 532 | 5300 | 6000 | 0.05 | 0.41 | 1074 | 57.2 |
| 1x500/35KON | | 29.3 | 44.1 | 52 | 56 | 336 | 560 | 5500 | 7500 | 0.0391 | 0.44 | 1224 | 71.5 |
| 1x630/35KON | | 33.9 | 48.7 | 56.6 | 60.6 | 363.6 | 606 | 5800 | 9450 | 0.0292 | 0.5 | 1360 | 90.09 |

## FELTOFLEX NTMCWOEU 18/30 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20196724 | 6.2 | 24.6 | 32.4 | 34.9 | 209.4 | 349 | 1520 | 375 | 0.795 | 0.14 | 189 | 3.58 |
| 1x35/16KON | | 7.5 | 25.9 | 33.7 | 36.2 | 217.2 | 362 | 1650 | 525 | 0.565 | 0.15 | 234 | 5.01 |
| 1x50/16KON | 20216846 | 9 | 26.5 | 35.1 | 37.6 | 225.6 | 376 | 1910 | 750 | 0.393 | 0.17 | 292 | 7.15 |
| 1x70/16KON | | 10.6 | 29 | 37.8 | 40.3 | 241.8 | 403 | 2200 | 1050 | 0.277 | 0.18 | 360 | 10.01 |
| 1x95/16KON | | 12.6 | 31 | 39.8 | 42.3 | 253.8 | 423 | 2500 | 1425 | 0.21 | 0.2 | 434 | 13.59 |
| 1x120/16KON | 20091156 | 14.8 | 33.2 | 42 | 44.5 | 267 | 445 | 3000 | 1800 | 0.164 | 0.22 | 505 | 17.16 |
| 1x150/25KON | 20081589 | 16 | 34.6 | 43.5 | 46 | 276 | 460 | 3380 | 2250 | 0.132 | 0.23 | 582 | 21.45 |
| 1x185/25KON | 20170101 | 17.7 | 36 | 45.1 | 47.6 | 285.6 | 476 | 3740 | 2775 | 0.108 | 0.25 | 664 | 26.46 |
| 1x240/25KON | 20234523 | 20.3 | 38.7 | 48.7 | 51.2 | 307.2 | 512 | 4530 | 3600 | 0.0817 | 0.28 | 781 | 34.32 |
| 1x300/25KON | 20259251 | 22.5 | 42.5 | 50.9 | 54.4 | 326.4 | 544 | 5050 | 4500 | 0.065 | 0.28 | 898 | 42.9 |
| 1x400/35KON | 20174753 | 26.5 | 45.5 | 52.2 | 56.2 | 337 | 562 | 6340 | 6000 | 0.05 | 0.32 | 1074 | 57.2 |
| 1x500/35KON | 20175568 | 29.3 | 47.7 | 56 | 60 | 360 | 600 | 7560 | 7500 | 0.0391 | 0.37 | 1224 | 71.5 |
| 1x630/35KON | 20157481 | 36.2 | 53.4 | 62 | 66 | 396 | 660 | 9380 | 9450 | 0.0292 | 0.46 | 1360 | 90.09 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

# PROTOLON NTMCGCWOEU 6 kV – 30 kV

## Medium voltage flexible single-core cable


### Application

In general single-core cables are used in short lengths e.g. for the connection of switchgear cubicles and for connection of mobile transformer substations to overhead lines. While laying and during operation, care should be taken to protect the cables against excessive mechanical stresses. Furthermore the general conditions in DIN VDE 0298-3 have to be applied.

### Global data

| | |
|---|---|
| Brand | PROTOLON |
| Type designation | NTMCGCWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5), acc. DIN VDE 0295/ IEC 60228 |
| PE-Conductor | Spinning with tinned copper wires 16 mm² or 25 mm² |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3, acc. DIN VDE 0207 Part 20 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound |
| Outer sheath | Special compound, Basic material: Chlorinated rubber, Compound type: 5GM3, Color: Red, acc. DIN VDE 0207 Part 21 |

### Electrical parameters

| | | | |
|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV |
| | 12/20 kV | 14/25 kV | 18/30 kV |
| | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| | 18/36 kV | 22.5/45 kV | 27/54 kV |
| | 29 kV | 36 kV | 43 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON NTMCGCWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 5DK3562 | 6.4 | 14 | 20.6 | 22.1 | 133 | 221 | 820 | 375 | 0.795 | 0.26 | 178 | 3.58 |
| 1x35/16KON | | | 7.5 | 15.1 | 21.5 | 23 | 138 | 230 | 930 | 525 | 0.565 | 0.29 | 220 | 5.01 |
| 1x50/16KON | | | 9 | 16.6 | 23 | 24.5 | 147 | 245 | 1110 | 750 | 0.393 | 0.33 | 275 | 7.15 |
| 1x70/16KON | 20223892 | 5DK3*** | 10.8 | 18.4 | 25.1 | 27.4 | 164 | 274 | 1380 | 1050 | 0.277 | 0.38 | 340 | 10.01 |
| 1x95/16KON | 20141681 | 5DK35 | 12.6 | 20.2 | 26.9 | 29.2 | 175 | 292 | 1630 | 1425 | 0.21 | 0.42 | 409 | 13.59 |
| 1x120/16KON | 20001442 | 5DK3954 | 14.2 | 21.8 | 28.5 | 30.8 | 185 | 308 | 1940 | 1800 | 0.164 | 0.46 | 479 | 17.16 |
| 1x150/25KON | 20004502 | 5DK3565 | 15.8 | 23.4 | 31.4 | 33.6 | 202 | 336 | 2410 | 2250 | 0.132 | 0.5 | 549 | 21.45 |
| 1x185/25KON | 20004503 | 5DK3569 | 17.4 | 25 | 33 | 35.2 | 211 | 352 | 2750 | 2775 | 0.108 | 0.54 | 627 | 26.46 |
| 1x240/25KON | 20001441 | 5DK3577 | 20.4 | 28.3 | 37.3 | 39.5 | 237 | 395 | 3430 | 3600 | 0.0817 | 0.6 | 734 | 34.32 |
| 1x300/25KON | 20004504 | 5DK3578 | 22.9 | 30.5 | 39.5 | 41.7 | 250 | 417 | 4000 | 4500 | 0.0641 | 0.68 | 843 | 42.9 |

## PROTOLON NTMCGCWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20230509 | 5DK4113 | 6.4 | 14.8 | 19 | 20.5 | 123 | 205 | 890 | 375 | 0.795 | 0.24 | 178 | 3.58 |
| 1x35/16KON | 20004559 | 5DK4114 | 7.5 | 15.9 | 22.3 | 23.8 | 143 | 238 | 1000 | 525 | 0.565 | 0.27 | 220 | 5.01 |
| 1x50/16KON | 20004560 | 5DK4115 | 9 | 17.4 | 23.8 | 25.3 | 152 | 253 | 1190 | 750 | 0.393 | 0.3 | 275 | 7.15 |
| 1x70/16KON | 20004561 | 5DK4116 | 10.8 | 19.2 | 25.9 | 28.2 | 169 | 282 | 1460 | 1050 | 0.277 | 0.34 | 340 | 10.01 |
| 1x95/16KON | 20004562 | 5DK4117 | 12.6 | 21 | 27.7 | 30 | 180 | 300 | 1710 | 1425 | 0.21 | 0.38 | 409 | 13.59 |
| 1x120/16KON | 20004563 | 5DK4118 | 14.2 | 22.6 | 30.3 | 32.6 | 196 | 326 | 2070 | 1800 | 0.164 | 0.42 | 479 | 17.16 |
| 1x150/25KON | 20004565 | 5DK4120 | 15.8 | 24.2 | 32.2 | 34.4 | 206 | 344 | 2470 | 2250 | 0.132 | 0.46 | 549 | 21.45 |
| 1x185/25KON | 20057165 | 5DK4121 | 17.4 | 25.8 | 33.8 | 36 | 216 | 360 | 2810 | 2775 | 0.108 | 0.49 | 627 | 26.46 |
| 1x240/25KON | 20004566 | 5DK4122 | 20.4 | 29.1 | 38.1 | 40.3 | 242 | 403 | 3490 | 3600 | 0.0817 | 0.54 | 734 | 34.32 |
| 1x300/25KON | 20154987 | 5DK4*** | 22.9 | 31.6 | 40.3 | 42.5 | 255 | 425 | 4150 | 4500 | 0.0641 | 0.59 | 843 | 42.9 |
| 1x400/25KON | 20161468 | 5DK4*** | 26.2 | 33 | 43 | 46 | 276 | 460 | 5000 | 6000 | 0.05 | 0.66 | 1024 | 57.2 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

Special designs available upon request, e.g.:
- halogen-free version with 5GM3 outer sheath
- special version for submersible application

## PROTOLON NTMCGCWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20004680 | 5DK5104 | 6.4 | 17 | 23.4 | 24.9 | 149 | 249 | 950 | 375 | 0.795 | 0.2 | 189 | 3.58 |
| 1x35/16KON | | | 7.5 | 18.1 | 24.9 | 27.1 | 163 | 271 | 1110 | 525 | 0.565 | 0.22 | 234 | 5.01 |
| 1x50/16KON | 20160141 | 5DK5*** | 9 | 19.6 | 26.4 | 28.6 | 172 | 286 | 1300 | 750 | 0.393 | 0.25 | 292 | 7.15 |
| 1x70/16KON | | | 10.8 | 21.4 | 28.1 | 30.4 | 182 | 304 | 1550 | 1050 | 0.277 | 0.28 | 360 | 10.01 |
| 1x95/16KON | | 5DK5101 | 12.6 | 23.2 | 30.9 | 33.2 | 199 | 332 | 1880 | 1425 | 0.21 | 0.31 | 434 | 13.59 |
| 1x120/16KON | 20042544 | 5DK5105 | 14.2 | 24.8 | 32.5 | 34.8 | 209 | 348 | 2200 | 1800 | 0.164 | 0.34 | 505 | 17.16 |
| 1x150/25KON | 20092201 | 5DK5097 | 15.8 | 26.4 | 34.4 | 36.6 | 220 | 366 | 2610 | 2250 | 0.132 | 0.37 | 582 | 21.45 |
| 1x185/25KON | 20067340 | 5DK5098 | 17.4 | 28 | 37 | 39.2 | 235 | 392 | 3090 | 2775 | 0.108 | 0.4 | 664 | 26.46 |
| 1x240/25KON | 20004677 | 5DK5099 | 20.4 | 31 | 40 | 42.2 | 253 | 422 | 3680 | 3600 | 0.0817 | 0.45 | 781 | 34.32 |
| 1x300/25KON | 20004678 | 5DK5102 | 22.9 | 33.5 | 42.2 | 44.4 | 266 | 444 | 4290 | 4500 | 0.0654 | 0.49 | 898 | 42.9 |
| 1x400/35KON | 20025950 | 5DK5100 | 26.2 | 36.8 | 45.2 | 48.2 | 289 | 482 | 5290 | 6000 | 0.0495 | 0.55 | 1074 | 57.2 |

## PROTOLON NTMCGCWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20004710 | 5DK5562 | 6.4 | 19 | 25.7 | 28 | 168 | 280 | 1150 | 375 | 0.795 | 0.18 | 189 | 3.58 |
| 1x35/16KON | 20004711 | 5DK5564 | 7.5 | 20.1 | 26.8 | 29.1 | 175 | 291 | 1290 | 525 | 0.565 | 0.19 | 234 | 5.01 |
| 1x50/16KON | 20004712 | 5DK5566 | 9 | 21.6 | 28.3 | 30.6 | 184 | 306 | 1490 | 750 | 0.393 | 0.22 | 292 | 7.15 |
| 1x70/16KON | 20004713 | 5DK5568 | 10.8 | 23.4 | 31.1 | 33.4 | 200 | 334 | 1750 | 1050 | 0.277 | 0.24 | 360 | 10.01 |
| 1x95/16KON | 20004714 | 5DK5571 | 12.6 | 25.2 | 32.9 | 35.2 | 211 | 352 | 2110 | 1425 | 0.21 | 0.27 | 434 | 13.59 |
| 1x120/16KON | 20037708 | 5DK5573 | 14.2 | 26.8 | 34.5 | 36.8 | 221 | 368 | 2400 | 1800 | 0.164 | 0.29 | 505 | 17.16 |
| 1x150/25KON | 20004715 | 5DK5575 | 15.8 | 28.4 | 37.4 | 39.6 | 238 | 396 | 2910 | 2250 | 0.132 | 0.32 | 582 | 21.45 |
| 1x185/25KON | 20004716 | 5DK5577 | 17.4 | 30 | 39 | 41.2 | 247 | 412 | 3270 | 2775 | 0.108 | 0.34 | 664 | 26.46 |
| 1x240/25KON | 20004717 | 5DK5580 | 20.4 | 33 | 42 | 44.2 | 265 | 442 | 3880 | 3600 | 0.0817 | 0.39 | 781 | 34.32 |
| 1x300/25KON | 20098501 | 5DK5581 | 22.9 | 34.7 | 44 | 47 | 282 | 470 | 4540 | 4500 | 0.0654 | 0.43 | 898 | 42.9 |
| 1x400/35KON | 20004718 | 5DK5582 | 26.2 | 39.3 | 49.4 | 52.4 | 314 | 524 | 5760 | 6000 | 0.0495 | 0.5 | 1074 | 57.2 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

Special designs available upon request, e.g.:
- halogen-free version with 5GM3 outer sheath
- special version for submersible application

## PROTOLON NTMCGCWOEU 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | | 6.4 | 21.6 | 28.3 | 30.6 | 184 | 306 | 1250 | 375 | 0.795 | 0.16 | 189 | 3.58 |
| 1x35/16KON | 20166631 | 5DK6*** | 7.5 | 22.7 | 30.4 | 32.7 | 196 | 327 | 1470 | 525 | 0.565 | 0.17 | 234 | 5.01 |
| 1x50/16KON | | | 9 | 24.2 | 31.9 | 34.2 | 205 | 342 | 1680 | 750 | 0.393 | 0.19 | 292 | 7.15 |
| 1x70/16KON | | | 10.8 | 26 | 33.7 | 36 | 216 | 360 | 1950 | 1050 | 0.277 | 0.21 | 360 | 10.01 |
| 1x95/16KON | 20004737 | 5DK6483 | 12.6 | 27.8 | 38.1 | 40.4 | 242 | 404 | 2620 | 1425 | 0.21 | 0.23 | 434 | 13.59 |
| 1x120/16KON | 20004737 | 5DK6483 | 14.2 | 29.4 | 38.1 | 40.4 | 242 | 404 | 2620 | 1800 | 0.164 | 0.25 | 505 | 17.16 |
| 1x150/25KON | | | 15.8 | 31 | 40.5 | 42.7 | 256 | 427 | 3050 | 2250 | 0.132 | 0.27 | 582 | 21.45 |
| 1x185/25KON | | | 17.4 | 32.6 | 42.1 | 44.3 | 266 | 443 | 3420 | 2775 | 0.108 | 0.29 | 664 | 26.46 |
| 1x240/25KON | | | 20.4 | 35.6 | 45.1 | 47.3 | 284 | 473 | 4070 | 3600 | 0.0817 | 0.33 | 781 | 34.32 |
| 1x300/25KON | 20024422 | 5DK6484 | 22.9 | 38.1 | 48.1 | 50.3 | 302 | 503 | 4920 | 4500 | 0.0654 | 0.36 | 898 | 42.9 |

## PROTOLON NTMCGCWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20163251 | 5DK68** | 6.4 | 24 | 32.7 | 35 | 210 | 350 | 1570 | 375 | 0.795 | 0.14 | 189 | 3.58 |
| 1x35/16KON | | | 7.5 | 25.1 | 32.8 | 35.1 | 211 | 351 | 1600 | 525 | 0.565 | 0.15 | 234 | 5.01 |
| 1x50/16KON | 20160142 | 5DK68** | 9 | 26.6 | 34.4 | 36.6 | 220 | 366 | 1860 | 750 | 0.393 | 0.17 | 292 | 7.15 |
| 1x70/16KON | 20163749 | 5DK6871 | 10.8 | 28.4 | 37.1 | 39.4 | 236 | 394 | 2230 | 1050 | 0.277 | 0.19 | 360 | 10.01 |
| 1x95/16KON | 20004749 | 5DK6876 | 12.6 | 30.2 | 39.4 | 41.7 | 250 | 417 | 2470 | 1425 | 0.21 | 0.21 | 434 | 13.59 |
| 1x120/16KON | 20091154 | 5DK687 | 14.2 | 31.8 | 40.5 | 42.8 | 257 | 428 | 2840 | 1800 | 0.164 | 0.23 | 505 | 17.16 |
| 1x150/25KON | | | 15.8 | 33.4 | 42.9 | 45.1 | 271 | 451 | 3280 | 2250 | 0.132 | 0.24 | 582 | 21.45 |
| 1x185/25KON | 20179552 | 5DK6894 | 17.4 | 35 | 44 | 46.2 | 277 | 462 | 3750 | 2775 | 0.108 | 0.26 | 664 | 26.46 |
| 1x240/25KON | 20016646 | 5DK6879 | 20.4 | 38 | 48 | 50.2 | 301 | 502 | 4550 | 3600 | 0.0817 | 0.29 | 781 | 34.32 |
| 1x300/25KON | | | 22.9 | 40.5 | 50.7 | 53.7 | 322 | 537 | 5100 | 4500 | 0.0654 | 0.32 | 898 | 42.9 |
| 1x400/35KON | | | 26.2 | 43.8 | 57 | 60 | 360 | 600 | 6100 | 6000 | 0.0495 | 0.35 | 1074 | 57.2 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

Special designs available upon request, e.g.:
- halogen-free version with 5GM3 outer sheath
- special version for submersible application

# PROTOLON(M) (N)TMCGCWOEU 6 kV – 30 kV

## MV flexible single-core cable with optimized wall-thickness


### Application

In general single-core cables are used in short length e.g. for connection of switchgear cubicles and for connection of mobile transformer substations to the overhead lines. While laying and during operation care should be taken to protect the cables against excessive mechanical stresses. Furthermore the general conditions in DIN VDE 0298-3 have to be applied.

### Global data

| | |
|---|---|
| Brand | PROTOLON(M) |
| Type designation | (N)TMCGCWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5), acc. DIN VDE 0295/ IEC 60228 |
| PE-Conductor | Spinning with tinned copper wires, 16mm² or 25mm² |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound better 3GI3 |
| Electrical field control | Inner and outer layer of semiconductive rubber compound, cold strippable outer layer |
| Outer sheath | Special compound, Basic material: Chlorinated rubber, Compound type: 5GM3, Color: Red |

### Electrical parameters

| | | | |
|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV |
| | 12/20 kV | 14/25 kV | 18/30 kV |
| | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| | 18/36 kV | 22.5/45 kV | 27/54 kV |
| | 29 kV | 36 kV | 43 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOLON(M) (N)TMCGCWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 5DT0124 | 6.4 | 12.2 | 18.8 | 20.3 | 122 | 203 | 710 | 375 | 0.795 | 0.33 | 178 | 3.58 |
| 1x35/16KON | 20267593 | 5DK3*** | 7.5 | 13.3 | 17.9 | 19.4 | 116 | 194 | 790 | 525 | 0.565 | 0.37 | 220 | 5.01 |
| 1x50/16KON | 20176480 | 5DK3*** | 9 | 14.8 | 21.2 | 22.7 | 136 | 227 | 990 | 750 | 0.393 | 0.43 | 275 | 7.15 |
| 1x70/16KON | 20205594 | 5DK3*** | 10.8 | 16.6 | 23 | 24.5 | 147 | 245 | 1210 | 1050 | 0.277 | 0.49 | 340 | 10.01 |
| 1x95/16KON | | 5DT0128 | 12.6 | 18.4 | 25.1 | 27.4 | 164 | 274 | 1490 | 1425 | 0.21 | 0.55 | 409 | 13.59 |
| 1x120/16KON | | 5DT0129 | 14.2 | 20 | 26.7 | 29 | 174 | 290 | 1750 | 1800 | 0.164 | 0.61 | 479 | 17.16 |
| 1x150/25KON | | 5DT0130 | 15.8 | 21.6 | 29.1 | 31.3 | 188 | 313 | 2150 | 2250 | 0.132 | 0.66 | 549 | 21.45 |
| 1x185/25KON | 20181101 | 5DK3*** | 17.4 | 23.2 | 31.7 | 33.9 | 203 | 339 | 2540 | 2775 | 0.108 | 0.72 | 627 | 26.46 |
| 1x240/25KON | | 5DT0132 | 20.4 | 26.2 | 34.7 | 36.9 | 221 | 369 | 3120 | 3600 | 0.0817 | 0.82 | 734 | 34.32 |
| 1x300/25KON | | 5DT0133 | 22.9 | 28.7 | 38.2 | 40.4 | 242 | 404 | 3780 | 4500 | 0.0641 | 0.91 | 843 | 42.9 |
| 1x400/35KON | 20154644 | 5DK3*** | 26.2 | 32 | 39.7 | 42.7 | 256 | 427 | 4400 | 6000 | 0.0486 | 1.03 | 1024 | 57.2 |

## PROTOLON(M) (N)TMCGCWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 5DT0135 | 6.4 | 12.2 | 19.4 | 20.9 | 125 | 209 | 720 | 375 | 0.795 | 0.33 | 178 | 3.58 |
| 1x35/16KON | | 5DT0136 | 7.5 | 13.9 | 20.5 | 22 | 132 | 220 | 850 | 525 | 0.565 | 0.34 | 220 | 5.01 |
| 1x50/16KON | | 5DT0137 | 9 | 15.4 | 21.8 | 23.3 | 140 | 233 | 1020 | 750 | 0.393 | 0.39 | 275 | 7.15 |
| 1x70/16KON | | 5DT0138 | 10.8 | 17.2 | 23.6 | 25.1 | 151 | 251 | 1240 | 1050 | 0.277 | 0.44 | 340 | 10.01 |
| 1x95/16KON | | 5DT0139 | 12.6 | 19 | 25.7 | 28 | 168 | 280 | 1520 | 1425 | 0.21 | 0.5 | 409 | 13.59 |
| 1x120/16KON | 20183692 | 5DK4*** | 14.2 | 20.6 | 25 | 27.3 | 164 | 273 | 1780 | 1800 | 0.164 | 0.55 | 479 | 17.16 |
| 1x150/25KON | 20167513 | 5DK4*** | 15.8 | 22.2 | 30.7 | 32.9 | 197 | 329 | 2250 | 2250 | 0.132 | 0.6 | 549 | 21.45 |
| 1x185/25KON | | 5DT0142 | 17.4 | 23.79 | 32.3 | 34.5 | 207 | 345 | 2580 | 2775 | 0.108 | 0.65 | 627 | 26.46 |
| 1x240/25KON | 20167514 | 5DK4*** | 20.4 | 26.79 | 37.9 | 40.1 | 241 | 401 | 3360 | 3600 | 0.0817 | 0.74 | 734 | 34.32 |
| 1x300/25KON | 20258128 | 5DK4*** | 22.9 | 29.29 | 38.8 | 41 | 246 | 410 | 3850 | 4500 | 0.0641 | 0.82 | 843 | 42.9 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

## PROTOLON(M) (N)TMCGCWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 5DT0146 | 6.4 | 14.4 | 21 | 22.5 | 135 | 225 | 800 | 375 | 0.795 | 0.25 | 189 | 3.58 |
| 1x35/16KON | 20113330 | 5DK5107 | 7.5 | 15.5 | 22 | 23.5 | 141 | 235 | 940 | 525 | 0.565 | 0.28 | 234 | 5.01 |
| 1x50/16KON | | 5DT0148 | 9 | 17 | 23.4 | 24.9 | 149 | 249 | 1090 | 750 | 0.393 | 0.31 | 292 | 7.15 |
| 1x70/16KON | | 5DT0149 | 10.8 | 18.8 | 25.5 | 27.8 | 167 | 278 | 1360 | 1050 | 0.277 | 0.36 | 360 | 10.01 |
| 1x95/16KON | 20227705 | 5DK5*** | 12.6 | 20.6 | 26.3 | 28.6 | 172 | 286 | 1550 | 1425 | 0.21 | 0.4 | 434 | 13.59 |
| 1x120/16KON | | 5DT0151 | 14.2 | 22.2 | 28.9 | 31.2 | 187 | 312 | 1880 | 1800 | 0.164 | 0.44 | 505 | 17.16 |
| 1x150/25KON | 20225873 | 5DK5*** | 15.8 | 23.8 | 32.3 | 34.5 | 207 | 345 | 2360 | 2250 | 0.132 | 0.48 | 582 | 21.45 |
| 1x185/25KON | | 5DT0153 | 17.4 | 25.4 | 33.9 | 36.1 | 217 | 361 | 2690 | 2775 | 0.108 | 0.52 | 664 | 26.46 |
| 1x240/25KON | 20007564 | 5DK5110 | 20.4 | 28.1 | 36.4 | 38.6 | 232 | 386 | 3330 | 3600 | 0.0817 | 0.61 | 781 | 34.32 |
| 1x300/25KON | | 5DT0154 | 22.9 | 30.9 | 40.4 | 42.6 | 256 | 426 | 3960 | 4500 | 0.0641 | 0.65 | 898 | 42.9 |
| 1x400/35KON | 20025884 | 5DK5112 | 26.2 | 33.9 | 41.9 | 44.9 | 269 | 449 | 4980 | 6000 | 0.0486 | 0.76 | 1074 | 57.2 |

## PROTOLON(M) (N)TMCGCWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | | 5DT0156 | 6.4 | 15.8 | 22.2 | 23.7 | 142 | 237 | 860 | 375 | 0.795 | 0.22 | 189 | 3.58 |
| 1x35/16KON | 20008239 | 5DK5593 | 7.5 | 16.3 | 22.3 | 23.8 | 143 | 238 | 970 | 525 | 0.565 | 0.26 | 234 | 5.01 |
| 1x50/16KON | | 5DT0157 | 9 | 18.4 | 25.1 | 27.4 | 164 | 274 | 1200 | 750 | 0.393 | 0.27 | 292 | 7.15 |
| 1x70/16KON | | 5DT0158 | 10.8 | 20.2 | 26.9 | 29.2 | 175 | 292 | 1440 | 1050 | 0.277 | 0.31 | 360 | 10.01 |
| 1x95/16KON | 20219047 | 5DK5*** | 12.6 | 22 | 28.7 | 31 | 186 | 310 | 1690 | 1425 | 0.21 | 0.35 | 434 | 13.59 |
| 1x120/16KON | 20016475 | 5DK5597 | 14.2 | 23.4 | 30.7 | 33 | 198 | 330 | 2020 | 1800 | 0.164 | 0.39 | 505 | 17.16 |
| 1x150/25KON | | 5DT0160 | 15.8 | 25.2 | 33.7 | 35.9 | 215 | 359 | 2450 | 2250 | 0.132 | 0.41 | 582 | 21.45 |
| 1x185/25KON | | 5DT0161 | 17.4 | 26.8 | 35.3 | 37.5 | 225 | 375 | 2790 | 2775 | 0.108 | 0.44 | 664 | 26.46 |
| 1x240/25KON | 20067202 | 5DK5599 | 20.4 | 29.9 | 38.4 | 40.6 | 244 | 406 | 3460 | 3600 | 0.0817 | 0.5 | 781 | 34.32 |
| 1x300/25KON | | 5DT0162 | 22.9 | 32.3 | 41.8 | 44 | 264 | 440 | 4080 | 4500 | 0.0641 | 0.55 | 898 | 42.9 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

## PROTOLON(M) (N)TMCGCWOEU 14/25 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 5DT0164 | 6.4 | 17.6 | 24.3 | 26.6 | 160 | 266 | 980 | 375 | 0.795 | 0.19 | 189 | 3.58 |
| 1x35/16KON | 5DT0165 | 7.5 | 18.7 | 25.4 | 27.7 | 166 | 277 | 1110 | 525 | 0.565 | 0.21 | 234 | 5.01 |
| 1x50/16KON | 5DT0166 | 9 | 20.2 | 26.9 | 29.2 | 175 | 292 | 1290 | 750 | 0.393 | 0.24 | 292 | 7.15 |
| 1x70/16KON | 5DT0167 | 10.8 | 22 | 28.7 | 31 | 186 | 310 | 1540 | 1050 | 0.277 | 0.27 | 360 | 10.01 |
| 1x95/16KON | 5DT0168 | 12.6 | 23.8 | 31.5 | 33.8 | 203 | 338 | 1870 | 1425 | 0.21 | 0.3 | 434 | 13.59 |
| 1x120/16KON | 5DT0169 | 14.2 | 25.4 | 33.1 | 35.4 | 212 | 354 | 2150 | 1800 | 0.164 | 0.33 | 505 | 17.16 |
| 1x150/25KON | 5DT0170 | 15.8 | 27 | 36.5 | 38.7 | 232 | 387 | 2660 | 2250 | 0.132 | 0.35 | 582 | 21.45 |
| 1x185/25KON | 5DT0171 | 17.4 | 28.6 | 38.1 | 40.3 | 242 | 403 | 3013 | 2775 | 0.108 | 0.38 | 664 | 26.46 |
| 1x240/25KON | 5DT0172 | 20.4 | 31.6 | 41.1 | 43.3 | 260 | 433 | 3620 | 3600 | 0.0817 | 0.43 | 781 | 34.32 |
| 1x300/25KON | 5DT0173 | 22.9 | 34.1 | 43.6 | 45.8 | 275 | 458 | 4230 | 4500 | 0.0641 | 0.47 | 898 | 42.9 |

## PROTOLON(M) (N)TMCGCWOEU 18/30 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Diameter over insulation (nom.) mm | Outer diameter min. mm | Outer diameter max. mm | Bending radius fixed min. mm | Bending radius free moving min. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1x25/16KON | 20170616 | 5DK6*** | 6.4 | 19.2 | 23.6 | 25.9 | 155 | 259 | 1070 | 375 | 0.795 | 0.18 | 189 | 3.58 |
| 1x35/16KON | | 5DT0176 | 7.5 | 20.3 | 27 | 29.3 | 176 | 293 | 1200 | 525 | 0.565 | 0.19 | 234 | 5.01 |
| 1x50/16KON | 20180066 | 5DK6*** | 9 | 23.6 | 28.5 | 30.8 | 185 | 308 | 1390 | 750 | 0.393 | 0.21 | 292 | 7.15 |
| 1x70/16KON | 20168804 | 5DK6*** | 10.8 | 21.8 | 30.3 | 32.6 | 196 | 326 | 1640 | 1050 | 0.277 | 0.24 | 360 | 10.01 |
| 1x95/16KON | 20160148 | 5DK6*** | 12.6 | 25.4 | 32.1 | 34.4 | 206 | 344 | 1910 | 1425 | 0.21 | 0.27 | 434 | 13.59 |
| 1x120/16KON | 20181538 | 5DK6895 | 14.2 | 27 | 34.7 | 37 | 222 | 370 | 2300 | 1800 | 0.164 | 0.29 | 505 | 17.16 |
| 1x150/25KON | 20175508 | 5DK6*** | 15.8 | 28.6 | 36.5 | 38.7 | 232 | 387 | 2660 | 2250 | 0.132 | 0.31 | 582 | 21.45 |
| 1x185/25KON | 20222816 | 5DK6*** | 17.4 | 30.2 | 39.8 | 42 | 252 | 420 | 3100 | 2775 | 0.108 | 0.34 | 664 | 26.46 |
| 1x240/25KON | 20007565 | 5DK6867 | 20.4 | 32.9 | 41.2 | 43.4 | 260 | 434 | 3730 | 3600 | 0.0817 | 0.39 | 781 | 34.32 |
| 1x300/25KON | 20171274 | 5DK6*** | 22.9 | 35.7 | 45.2 | 47.4 | 284 | 474 | 4380 | 4500 | 0.0641 | 0.42 | 898 | 42.9 |

(1) Nominal current carrying capacity for single-core rubber cables laid on a surface, at 30°C ambient temperature. For derating-factors see tables in Technical Appendix

# OPTOFLEX(M) E9/125

## Rubber sheathed flexible fiber-optic cables


### Application

For optical signal and data transmission in open-cast mining applications, for use on material handling equipment and for laying alongside conveyor belts (including shiftable conveyor belts).

### Global data

| | |
|---|---|
| Brand | OPTOFLEX(M) |
| Type designation | E9/125µ |
| Standard | Based on FDDI<br>Based on DIN VDE 0888<br>ISO/IEC 9314-3 |

### Design features

| | |
|---|---|
| Core identification | Color coding of the fibers and buffering tube for identification of the fiber type |
| Optical fiber | Transmission data:<br>Monomode fiber: E9/125<br>Attenuation at wavelength 850 nm: -<br>Attenuation at wavelength 1310 nm: 0.4 dB/km<br>Attenuation at wavelength 1550 nm: 0.3 dB/km<br>Numerical aperture: 0.14 +/- 0.02<br>Dispersion value at 1300 nm: <3.5 ps/nm km<br>Dispersion value at 1550 nm: <18 ps/nm km<br>Fibre core diameter: 9 µm;<br>Diameter across the cladding: 125 µm;<br>Diameter over the coating: 250 µm; |
| Fiber covering | Loose tube with filling compound, Basic material: ETFE, Compound: 7YI 1, Natural color |
| Core arrangement | Six buffering tubes, one layer, especially laid-up around a GRP supporting element (GRP= Glass-fiber reinforced plastic) |
| Torsion protection | Special braid of Kevlar threads, tensile-strength reinforcement by means of longitudinal Kevlar threads, Surface covered: approx. 80% |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Orange |

### Chemical parameters

| | |
|---|---|
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Torsional stress +/- | 100 °/m |
| Bending radii min. | 50 mm (fixed installation) |
| Additional tests | Tensile load test, transverse pressure test, reversed bending test, roller bending test, torsional stress test |

### OPTOFLEX(M) E9/125

| Number of cores x cross section | Part number | MLFB Number | Outer diameter min.<br>mm | Outer diameter max.<br>mm | Weight (approx.)<br>kg/km |
|---|---|---|---|---|---|
| 6E9/125µ | 20003606 | 5DG8 031 | 9.7 | 10.1 | 100 |
| 12E9/125µ | 20003607 | 5DG8 032 | 9.7 | 10.1 | 100 |
| 18E9/125µ | 20160113 | 5DG8 033 | 9.7 | 10.1 | 100 |
| 24E9/125µ | 20024482 | 5DG8 034 | 9.7 | 10.1 | 100 |

# OPTOFLEX(M) G50/125

## Rubber sheathed flexible fiber-optic cables


### Application

For optical signal and data transmission in open-cast mining applications, for use on material handling equipment and for laying alongside conveyor belts (including shiftable conveyor belts).

### Global data

| | |
|---|---|
| Brand | OPTOFLEX(M) |
| Type designation | G50/125µ |
| Standard | Based on FDDI<br>ISO/IEC 9314-3<br>Based on DIN VDE 0888 |

### Design features

| | |
|---|---|
| Core identification | Color coding of the fibers and buffering tube for identification of the fiber type |
| Optical fiber | Fibre core diameter: 50 µm;<br>Diameter across the cladding: 125 µm;<br>Diameter over the coating: 250 µm;<br>Transmission data:<br>Graded-index: 50/125<br>Attenuation at wavelength 850 nm: 2.8 dB/km<br>Attenuation at wavelength 1310 nm: 0.8dB/km<br>Attenuation at wavelength 1550 nm: -<br>Bandwidth at 850 nm: >=400 MHz<br>Bandwidth at 1300 nm: >1200 MHz<br>Numerical aperture: 0.200 +/- 0.02 |
| Fiber covering | Loose tube with filling compound, Basic material: ETFE, Compound: 7YI 1, Natural color |
| Core arrangement | Six buffering tubes, one layer, especially laid-up around a GRP supporting element (GRP= Glass-fiber reinforced plastic) |
| Torsion protection | Special braid of Kevlar threads, tensile-strength reinforcement by means of longitudinal Kevlar threads, Surface covered: approx. 80% |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Orange |

### Chemical parameters

| | |
|---|---|
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Torsional stress +/- | 100 °/m |
| Bending radii min. | 50 mm (fixed installation) |
| Additional tests | Tensile load test, transverse pressure test, reversed bending test, roller bending test, torsional stress test |

### OPTOFLEX(M) G50/125

| Number of cores x cross section | Part number | MLFB Number | Outer diameter min.<br>mm | Outer diameter max.<br>mm | Weight (approx.)<br>kg/km |
|---|---|---|---|---|---|
| 6G50/125µ | 20003604 | 5DG8 028 | 9.7 | 10.1 | 100 |
| 12G50/125µ | 20003605 | 5DG8 030 | 9.7 | 10.1 | 100 |
| 18G50/125µ | 20008465 | 5DG8 027 | 9.7 | 10.1 | 100 |
| 24G50/125µ | 20101418 | 5DG8 026 | 9.7 | 10.1 | 100 |

# OPTOFLEX(M) G62,5/125

## Rubber sheathed flexible fiber-optic cables


### Application

For optical signal and data transmission in open-cast mining applications, for use on material handling equipment and for laying alongside conveyor belts (including shiftable conveyor belts).

### Global data

| | |
|---|---|
| Brand | OPTOFLEX(M) |
| Type designation | G62,5/125µ |
| Standard | Based on FDDI<br>Based on DIN VDE 0888<br>ISO/IEC 9314-3 |

### Design features

| | |
|---|---|
| Core identification | Color coding of the fibers and buffering tube for identification of the fiber type |
| Optical fiber | Transmission data:<br>Graded-index: 62.5/125<br>Attenuation at wavelength 850 nm: 3.3 dB/km<br>Attenuation at wavelength 1310 nm: 0.9 dB/km<br>Attenuation at wavelength 1550 nm: -<br>Bandwidth at 850 nm: >=400 MHz<br>Bandwidth at 1300 nm: >600 MHz<br>Numerical aperture: 0.275 +/- 0.02<br>Fibre core diameter: 62.5 µm;<br>Diameter across the cladding: 125 µm;<br>Diameter over the coating: 250 µm; |
| Fiber covering | Loose tube with filling compound, Basic material: ETFE, Compound: 7YI 1, Natural color |
| Core arrangement | Six buffering tubes, one layer, especially laid-up around a GRP supporting element (GRP= Glass-fiber reinforced plastic) |
| Torsion protection | Special braid of Kevlar threads, tensile-strength reinforcement by means of longitudinal Kevlar threads, Surface covered: approx. 80% |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Orange |

### Chemical parameters

| | |
|---|---|
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Torsional stress +/- | 100 °/m |
| Bending radii min. | 50 mm (fixed installation) |
| Additional tests | Tensile load test, transverse pressure test, reversed bending test, roller bending test, torsional stress test |

### OPTOFLEX(M) G62.5/125

| Number of cores x cross section | Part number | MLFB Number | Outer diameter min.<br>mm | Outer diameter max.<br>mm | Weight (approx.)<br>kg/km |
|---|---|---|---|---|---|
| 6G62,5/125µ | 20003601 | 5DG8 021 | 9.7 | 10.1 | 100 |
| 12G62,5/125µ | 20003602 | 5DG8 022 | 9.7 | 10.1 | 100 |
| 18G62,5/125µ | 20160111 | 5DG8 038 | 9.7 | 10.1 | 100 |
| 24G62,5/125µ | 20160112 | 5DG8 ... | 9.7 | 10.1 | 100 |

# Notes

# PROTOMONT(MSR) 2YSLGCGOEU 250V

## Data, signal and control cables for mining installations


### Application

Control, signalling and bus cables with the necessary transmission characteristics used for electric and electronic equipment, such as for measured value and process data processing and automation units in open-cast mining applications. Suitable for laying alongside conveyor belts and on material handling equipment for open-cast and underground mining.

### Global data

| | |
|---|---|
| Brand | PROTOMONT MSR-Mining |
| Type designation | 2YSLGCGOEU |
| Standard | Based on DIN VDE 0250-1 |
| Certifications / Approvals | EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely-stranded bare copper conductor class 5 (acc. to IEC 60028) |
| Insulation | Basic material: Polyethylene (PE), Compound type: 2YI1 |
| Core identification | Cores white with black digits imprinted |
| Core arrangement | Cores are laid-up in pairs in layers with a continuous serving of non-hygroscopic material over the conductor assembly |
| Inner sheath | Basic material (special compound type): Chlorinated rubber, Compound type: EM2 |
| Screen over inner sheath | Screen braiding of tinned copper wires between inner and outer sheath |
| Outer sheath | Basic material (Special compound type): Chlorinated rubber, Compound type: EM2 |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 250/250 V |
| Max. permissible operating voltage AC | 0.350 (peak value) kV |
| Max. permissible operating voltage DC | 0.350 (peak value) kV |
| AC test voltage | 1.5 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 60 °C |
| Max. short circuit temperature of the conductor | 150 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +60 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT(MSR) 2YSLGCGOEU 250V

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Current carrying capacity (1) A |
|---|---|---|---|---|---|---|---|---|---|---|
| 2x2x1 | 20005126 | 5DM4995 | 1.24 | 11 | 13 | 240 | 60 | 19.5 | 0.65 | 12 |
| 5x2x1 | 20005127 | 5DM4996 | 1.24 | 16.5 | 18.1 | 450 | 150 | 19.5 | 0.65 | 9 |
| 10x2x1 | 20005128 | 5DM4997 | 1.24 | 20.5 | 22.2 | 630 | 300 | 19.5 | 0.65 | 7 |
| 20x2x1 | 20005129 | 5DM4998 | 1.24 | 25.1 | 28.1 | 960 | 600 | 19.5 | 0.65 | 5 |

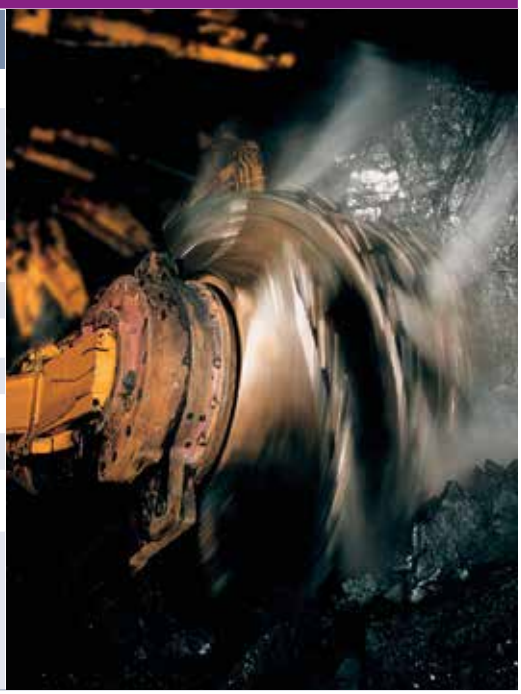
# Underground

## Index

# Product overview

| SHEARER CABLES FOR CHAIN APPLICATION | | | | |
|---|---|---|---|---|
| | | PROTOMONT(V) | PROTOMONT(VO) | TENAX-CTE |
| Voltage range (kV) | | 0.6/1 to 3.6/6 | 1.8/3 (3.3) | 0.6/1 (1.2) |
| Cable design | | Double screen tech.; semicond. core screen (cold removable) | Single screen tech.; semicond. core screen (cold removable) | Single screen tech.; semicond. inner sheat |
| Permissible tensile force (N/mm²) | | 15 | 15 | 15 |
| Stability against torsion (°/m) | | +/- 25 | +/- 50 | +/- 50 |
| Sheath quality | | 5GM5 | 5GM3 | 5GM5 |
| Reversed bending stability | | +++ | +++ | +++ |
| Minimum bending radii | at max. 5 N/mm² | 2.3 x D | 2.3 x D | 2.3 x D |
| | at max. 15 N/mm² | 5 x D | 5 x D | 5 x D |
| Fully flexible temperature range (°C) | | -20 to +60 | -20 to +60 | -20 to +60 |
| Approvals | | MA – China, MSHA P-07-KA140034-MSHA, EAC certificate, Fire certificate, Gost -R/-K/-B<br>BAS-Certificat (only for 0.6/1 kV)<br>WUG-Poland (only for 3.6/6 kV) | MA – China, Gost -R/-K/-B | EAC certificate |

| SHEARER CABLES FOR FREE TRAILING | | |
|---|---|---|
| | | PROTOMONT(Z) |
| Voltage range (kV) | | 0.6/1 to 3.6/6 |
| Cable design | | Double screen tech.; semicond. core screen (cold removable) |
| Permissible tensile force (N/mm²) | | 40 |
| Stability against torsion (°/m) | | +/- 10 |
| Sheath quality | | 5GM5 |
| Reversed bending stability | | +++ |
| Minimum bending radii | at max. 5 N/mm² | 2.3 x D |
| | at max. 15 N/mm² | 5 x D |
| Fully flexible temperature range (°C) | | -20 to +60 |
| Approvals | | MA – China, MSHA P-07-KA140034-MSHA, BAS-certificate, EAC certificate |



## UNDERGROUND REELING CABLES

| | TENAX-LK | PROTOMONT(S) | CORDAFLEX(S) | PROTOMONT(M+) |
|---|---|---|---|---|
| Special design features | Steel + copper pilot/earth core element; semi-cond. inner sheath | Double concentric copper pilot/earth core element; semi-cond. core screen | No semi-conductive layer | No semi-conductive layer |
| Travel speed max. (m/min) | 160 | 160 | 160 | 60 |
| Permissible tensile force (N/mm²) | 30 | 30 | 30 | 15 |
| Stability against torsion (°/m) | +/- 100 | +/- 50 | +/- 25 | +/- 25 |
| Sheath quality | 5GM5 | 5GM5 | 5GM5 | 5GM5 |
| Sheath abrasion | +++ | +++ | +++ | ++ |
| Reversed bending stability | +++ | +++ | +++ | ++ |
| S-bendings in operation | Multiple planes | Multiple planes | Multiple planes | Single plane |
| Fully flexible temperature range (°C) | -25 to +60 | -25 to +60 | -25 to +60 | -25 to +60 |
| Approvals | EAC certificate | MA - China, EAC certificate | MSHA P-189-3, EAC certificate | |

## CABLES FOR SEMI-FIXED INSTALLATION

| | PROTOMONT Festoon | SUPROMONT (N)3GHSSYCY | SUPROMONT (N)3GHSSHCH |
|---|---|---|---|
| Application | MV semi-fixed | MV semi-fixed | MV semi-fixed |
| Cable design | Acc. to VDE | Based on VDE | Based on VDE |
| Special design features | Double screen technology | Double screen technology | Double screen techn. Halogen-free |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Sheath quality | 5GM5 | PVC YM5 | HM4 |
| Reversed bending stability | +++ | ++ | ++ |
| Temperature range in fully flexible operation (°C) | -25 to +60 | +5 to +60 | +5 to +60 |
| Approvals | MA – China, WUG - Poland, BAS-Certificate, Fire certificate, Gost -R/-B/-K | VDE certificate of conformity | VDE certificate of conformity |

| | PROTOMONT(MT) (N)SSHOEU | PROTOMONT NSSHOEU../3E | PROTOMONT EMV-FC |
|---|---|---|---|
| Application | LV semi-fixed | LV semi-fixed | LV frequency converter cable |
| Cable design | Based on VDE | Acc. to VDE | Acc. to VDE |
| Special design features | | Concentric core screens | Excellent EMC properties |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Stability against torsion (°/m) | | +/- 25 | +/- 25 |
| Sheath quality | 5GM5 | 5GM5 | 5GM5 |
| Reversed bending stability | ++ | +++ | ++ |
| Temperature range in fully flexible operation (°C) | -25 to +60 | -25 to +60 | -25 to +60<br>-45 to +60 |
| Approvals | VDE-REG F546 | MA-China, MSHA P-189-3, BAS-certificate, EAC certificate | MSHA P-189-3, EAC certificate |

# PROTOMONT(V) NSSHCGEOEU 1 kV

## Coal cutter cables for chain operation with concentric earth conductor between inner and outer sheath

### Application

Used as power supply connection cable for mobile equipment and machines in underground mining applications, such as coal cutting machines, etc. (V)-Coal-Cutter cables are designed for use in cable protection chains (cable handler), which are trailed behind the machine and which absorb the thereby occuring tensile forces.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(V) |
| Type designation | NSSHCGEOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MA – China<br>MSHA P-07-KA140034-MSHA<br>BAS - Bosnia-Herzogowina<br>EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class FS) |
| PE-Conductor | Concentric earth conductor made of steel-copper strands, helically applied between inner and outer sheath |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Cold strippable outer layer of semiconductive rubber compound |
| Core identification | Main cores: Colored, Black, Grey, Brown;<br>Control cores: Blue |
| Core arrangement | Three main cores laid-up, with double concentric control/monitoring conductor elements in the outer<br>interstice |
| Inner sheath | Vulcanized rubber inner sheath,<br>Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, Basic material: Synthetic elastomer compound e.g. CM, Compound type: 5GM5<br>Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Bending radii min. | 2.3 x D at a tensile load of max. 5 N/mm²<br>Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |

## PROTOMONT(V) NSSHCGEOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6/1 kV NSSHCGEOEU. three-core design | | | | | | | | | | | | |
| 3x25/16KON +3x(1,5STKON/ 1,5UELKON) | 20024746 | 5DM1055 | 7.1 | 36.9 | 39.9 | 2760 | 1125 | 0.795 | 0.6 | 0.25 | 131 | 3.58 |
| 3x35/16KON +3x(1,5STKON/ 1,5UELKON) | 20005034 | 5DM1056 | 8.4 | 36.9 | 39.9 | 2960 | 1575 | 0.565 | 0.69 | 0.24 | 162 | 5.01 |
| 3x50/35KON +3x(1,5STKON/ 1,5UELKON) | 20005035 | 5DM1057 | 10.1 | 42.7 | 45.7 | 3920 | 2250 | 0.393 | 0.72 | 0.24 | 202 | 7.15 |
| 3x70/35KON +3x(1,5STKON/ 1,5UELKON) | 20005036 | 5DM1058 | 11.9 | 47.7 | 50.7 | 5000 | 3150 | 0.277 | 0.84 | 0.23 | 250 | 10.01 |
| 3x95/50KON +3x(1,5STKON/ 1,5UELKON) | 20005038 | 5DM1060 | 14 | 56 | 60 | 6690 | 4275 | 0.21 | 0.86 | 0.23 | 301 | 13.59 |
| 3x120/70KON +3x(1,5STKON/ 1,5UELKON) | 20005049 | 5DM1090 | 15.5 | 58.3 | 62.3 | 7690 | 5400 | 0.164 | 0.9 | 0.22 | 352 | 17.16 |
| 3x150/70KON +3x(1,5STKON/ 1,5UELKON) | 20007853 | 5DM1091 | 17.2 | 65.9 | 69.9 | 9570 | 6750 | 0.132 | 0.93 | 0.22 | 404 | 21.45 |
| 0.6/1 kV (N)SSHCGEOEU. six-core design | | | | | | | | | | | | |
| (3+3)x50/35KON + 3x(2x1,5STKON)/ 3x1,5UELKON | | | 10.1 | 63.3 | 67.3 | 8140 | 4500 | 0.393 | | | 137 | 7.15 |
| (3+3)x70/70KON +3x(2x1,5STKON)/ 3x1,5UELKON | 20005030 | 5DM1039 | 11.9 | 65.4 | 69.4 | 9470 | 6300 | 0.277 | 0.53 | 0.4 | 170 | 10.01 |
| (3+3)x95/70KON +3x(2x1,5STKON)/ 3x1,5UEKON | 20005026 | 5DM1031 | 14 | 71.9 | 73.9 | 11270 | 8550 | 0.21 | 0.54 | 0.37 | 205 | 13.59 |
| (3+3)x120/70KON +3x(2x1,5STKON)/ 3x1,5UELKON | | | 15.8 | 76.7 | 80.7 | 15030 | 10800 | 0.164 | 0.59 | 0.35 | 239 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(V) NSSHCGEOEU 1 kV

## Coal cutter cables for chain operation, with concentric earth conductor over control cores

### Application

Used as power supply connection cable for mobile equipment and machines in underground mining applications, such as coal cutting machines, etc. (V)-Coal-Cutter cables are designed for use in cable protection chains (cable handler), which are trailed behind the machine and which absorb the thereby occuring tensile forces.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(V) |
| Type designation | NSSHCGEOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MA – China<br>MSHA P-07-KA140034-MSHA<br>BAS - Bosnia-Herzogowina<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class FS) |
| PE-Conductor | Double concentric control/PE wire spinning in outer interstices |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Cold strippable outer layer of semiconductive rubber compound |
| Core identification | Main cores: Colored, Black, Grey, Brown;<br>Control cores: Blue |
| Core arrangement | Three main cores laid-up, with double concentric control/PE conductor elements in the outer interstice |
| Inner sheath | Vulcanized rubber inner sheath,<br>Basic material: EPR, Compound type: GM1B |
| Monitoring conductor | Closed lay spinning of steel/copper wires in a vulcanized bond between inner and outer sheath - monitoring conductor |
| Outer sheath | PROTOFIRM, Basic material: Synthetic elastomer compound e.g. CM, Compound type: 5GM5,<br>Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | 2.3 x D at a tensile load of max. 5 N/mm²<br>Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |

## PROTOMONT(V) NSSHCGEOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.6/1 kV NSSHCGEOEU, three-core design | | | | | | | | | | | | |
| 3x25+3x(1,5STKON + 16/3KON)+UELKON | 20171091 | 5DM1*** | 7.1 | 38.4 | 41.4 | 2900 | 1125 | 0.795 | 0.35 | 0.33 | 131 | 3.58 |
| 3x35+3x(1,5STKON + 16/3KON)+UELKON | 20174776 | 5DM1156 | 8.4 | 41 | 44 | 3520 | 1575 | 0.565 | 0.4 | 0.3 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON)+UELKON | 20181151 | 5DM1*** | 10.1 | 45.4 | 48.4 | 4300 | 2250 | 0.393 | 0.46 | 0.28 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON)+UELKON | 20180359 | 5DM1*** | 11.9 | 48.8 | 52.8 | 5400 | 3150 | 0.277 | 0.53 | 0.27 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON)+UELKON | 20180360 | 5DM1159 | 14 | 56 | 60 | 7020 | 4275 | 0.21 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x(1,5STKON + 70/3KON)+UELKON | 20181191 | 5DM1*** | 15.5 | 60.3 | 64.3 | 8600 | 5400 | 0.164 | 0.58 | 0.26 | 352 | 17.16 |
| 3x150+3x(1,5STKON + 70/3KON)+UELKON | 20168984 | 5DM1616 | 17.2 | 66.7 | 70.7 | 10310 | 6750 | 0.132 | 0.64 | 0.26 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON)+UELKON | 20181193 | 5DM1*** | 19.1 | 71.7 | 75.7 | 12300 | 8325 | 0.108 | 0.7 | 0.26 | 461 | 26.46 |
| 3x240+3x(1,5STKON + 120/3KON)+UELKON | 20181194 | 5DM1*** | 22 | 80.1 | 85.1 | 15400 | 10800 | 0.0817 | 0.79 | 0.25 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(V) NTSKCGECWOEU 3 kV – 6 kV

## Coal cutter cable for chain operation

### Application

Used as power supply connection cable for mobile equipment and machines in underground mining applications, such as coal cutting machines, etc. (V) Coal-Cutter-Cables are designed for use in cable protection chains (cable handler), which are trailed behind the machine and which absorb the thereby occuring tensile forces.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(V) |
| Type designation | NTSKCGECWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MA – China<br>MSHA P-07-KA140034-MSHA<br>Fire Certificate of Russian Federation<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class FS) |
| PE-Conductor | Double concentric control/PE wire spinning in outer interstices |
| Insulation | PROTOLON,<br>Basic material EPR, compound type: 3GI3 |
| Electrical field control | Cold strippable outer layer of semiconductive rubber compound |
| Core identification | Main cores: Natural color<br>Control cores: Blue |
| Core arrangement | Three main cores laid-up, with double concentric control/PE conductor elements in the outer interstice |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Armouring | Closed-lay spinning of steel/copper wires between inner and outer sheath |
| Outer sheath | PROTOFIRM, Basic material: synthetic elastomer compound e.g. CM, Compound type: 5GM5, Color: Red |

### Electrical parameters

| | | |
|---|---|---|
| Rated voltage | 1.8/3 kV | 3.6/6 kV |
| Max. permissible operating voltage AC | 2.1/3.6 kV | 4.2/7.2 kV |
| Max. permissible operating voltage DC | 2.7/5.4 kV | 5.4/10.8 kV |
| AC test voltage | 6 kV | 11 kV |
| AC test voltage - control cores | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60322-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3<br>2.3 x D at a tensile load of max. 5 N/mm² |
| Min. distance with S-type directional changes | 20 x D |

## PROTOMONT(V) NTSKCGECWOEU 1.8/3 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.8/3 kV NTSKCGECWOEU. three-core design | | | | | | | | | | | | |
| 3x25+3x(1,5STKON + 16/3KON)+UELKON | | | 7.1 | 40.1 | 43.1 | 3100 | 1125 | 0.795 | 0.33 | 0.32 | 131 | 3.58 |
| 3x35+3x(1,5STKON + 25/3KON)+UELKON | 20016353 | 5DM1556 | 8.4 | 44.3 | 47.3 | 3970 | 1575 | 0.565 | 0.38 | 0.3 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON)+UELKON | 20024209 | 5DM1550 | 10.1 | 49.7 | 52.7 | 4900 | 2250 | 0.393 | 0.44 | 0.29 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON)+UELKON | 20005071 | 5DM1557 | 11.9 | 53.2 | 57.2 | 6020 | 3150 | 0.277 | 0.5 | 0.27 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON)+UELKON | 20005051 | 5DM1108 | 14 | 58.6 | 62.6 | 7450 | 4275 | 0.21 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x(1,5STKON + 70/3KON)+UELKON | 20005072 | 5DM1558 | 15.5 | 62.9 | 66.9 | 9060 | 5400 | 0.164 | 0.58 | 0.27 | 352 | 17.16 |
| 3x150+3x(1,5STKON + 70/3KON)+UELKON | 20007583 | 5DM1559 | 17.2 | 69 | 73 | 10820 | 6750 | 0.132 | 0.64 | 0.26 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON)+UELKON | 20007584 | 5DM1584 | 19.1 | 73.2 | 77.2 | 12530 | 8325 | 0.108 | 0.7 | 0.25 | 461 | 26.46 |
| 3x240+3x(1,5STKON + 120/3KON)+UELKON | 20008325 | 5DM1586 | 22 | 80.7 | 85.7 | 15700 | 10800 | 0.0817 | 0.79 | 0.25 | 540 | 34.32 |

## PROTOMONT(V) NTSKCGECWOEU 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.6/6 kV NTSKCGECWOEU three control cores | | | | | | | | | | | | |
| 3x25+3x(1,5STKON + 16/3KON)+UELKON | | | 7.1 | 45 | 48 | 3600 | 1125 | 0.795 | 0.34 | 0.33 | 131 | 3.58 |
| 3x35+3x(1,5STKON + 25/3KON)+UELKON | 20005070 | 5DM1548 | 8.4 | 48.3 | 51.3 | 4360 | 1575 | 0.565 | 0.38 | 0.31 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON)+UELKON | 20048331 | 5DM1549 | 10.1 | 51.4 | 55.4 | 5320 | 2250 | 0.393 | 0.43 | 0.3 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON)+UELKON | 20005068 | 5DM1541 | 11.9 | 56.7 | 60.7 | 6560 | 3150 | 0.277 | 0.49 | 0.29 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON)+UELKON | 20005069 | 5DM1542 | 14 | 61.2 | 65.2 | 7890 | 4275 | 0.21 | 0.55 | 0.28 | 301 | 13.59 |
| 3x120+3x(1,5STKON + 70/3KON)+UELKON | 20008860 | 5DM1581 | 15.5 | 67.3 | 71.3 | 9780 | 5400 | 0.164 | 0.6 | 0.27 | 352 | 17.16 |
| 3x150+3x(1,5STKON + 70/3KON)+UELKON | 20042611 | 5DM1588 | 17.2 | 71.7 | 75.7 | 11300 | 6750 | 0.132 | 0.64 | 0.26 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON)+UELKON | 20005079 | 5DM1585 | 19.1 | 75.1 | 79.1 | 12790 | 8325 | 0.108 | 0.69 | 0.25 | 461 | 26.46 |
| 3x240+3x(1,5STKON + 120/3KON)+UELKON | | | 22 | 82.7 | 87.7 | 15900 | 10800 | 0.0817 | 0.77 | 0.25 | 540 | 34.32 |
| 3.6/6 kV NTSKCGECWOEU six control cores | | | | | | | | | | | | |
| 3x35+3x(2x1,5ST + 25/3KON)+UELKON | 20273411 | 5DM1589 | 8.4 | 49 | 53 | 4620 | 1575 | 0.565 | 0.38 | 0.31 | 162 | 5.01 |
| 3x50+3x(2x1,5ST + 25/3KON)+UELKON | | 5DM1590 | 10.1 | 53.9 | 57.9 | 5550 | 2250 | 0.393 | 0.43 | 0.3 | 202 | 7.15 |
| 3x70+3x(2x1,5ST + 35/3KON)+UELKON | 20266205 | 5DM1569 | 11.9 | 56.7 | 60.7 | 6760 | 3150 | 0.277 | 0.49 | 0.39 | 250 | 10.01 |
| 3x95+3x(2x1,5ST + 50/3KON)+UELKON | 20226751 | 5DM1*** | 14 | 62 | 66 | 7900 | 4275 | 0.21 | 0.55 | 0.28 | 301 | 13.59 |
| 3x120+3x(2x1,5ST + 70/3KON)+UELKON | | | 15.5 | 67.3 | 71.3 | 9800 | 5400 | 0.164 | 0.6 | 0.27 | 352 | 17.16 |
| 3x150+3x(2x1,5ST + 70/3KON)+UELKON | | | 17.2 | 71 | 75 | 11100 | 6750 | 0.132 | 0.64 | 0.26 | 404 | 21.45 |
| 3x185+3x(2x1,5ST + 95/3KON)+UELKON | | | 19.1 | 75.1 | 79.1 | 13000 | 8325 | 0.108 | 0.69 | 0.25 | 461 | 26.46 |
| 3x240+3x(2x1,5ST + 120/3KON)+UELKON | | | 22 | 82.7 | 87.7 | 16000 | 10800 | 0.0817 | 0.77 | 0.25 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(VO) (N)TSKCGEWOEU 3 kV

## Coal cutter cables for chain operation

### Application

Used as power supply connection cable for mobile equipment and machines in underground mining applications, such as coal cutting machines, etc. (VO)-Coal-Cutter cables are designed for use in cable protection chains(cable handler), which are trailed behind the machine and which absorb the thereby occuring tensile forces.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(VO) |
| Type designation | (N)TSKCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MA – China<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely-stranded copper conductor, tinned (class FS) |
| PE-Conductor | 3 Double-concentric control / PE conductor elements in the outer interstices |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Cold strippable outer layer of semiconductive rubber compound |
| Core identification | Main cores: Natural color<br>Control cores: Blue |
| Core arrangement | Three main cores laid-up, with double concentric control / PE conductor elements in the outer interstices |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: better GM1B |
| Outer sheath | PROTOFIRM, Basic material: synthetic elastomer compound e.g. CM, Compound type: 5GM5, Color: Red |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 1.8/3 kV |
| Max. permissible operating voltage AC | 2.1/3.6 kV |
| Max. permissible operating voltage DC | 2.7/5.4 kV |
| AC test voltage | 6 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60322-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3<br>2.3 x D at a tensile load of max. 5 N/mm² |
| Min. distance with S-type directional changes | 20 x D |

## PROTOMONT(VO) (N)TSKCGEWOEU 1.8/3 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,8/3 kV (N)TSKCGEWOEU, three control cores | | | | | | | | | | | | |
| 3x25+3x(1,5STKON + 16/3KON) | | | 7.1 | 37.8 | 40.8 | 2500 | 1125 | 0.795 | 0.28 | 0.34 | 131 | 3.58 |
| 3x35+3x(1,5STKON + 16/3KON) | | | 8.4 | 42 | 45 | 3150 | 1575 | 0.565 | 0.31 | 0.33 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON) | | | 10.1 | 45.7 | 48.7 | 3950 | 2250 | 0.393 | 0.36 | 0.31 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON) | | | 11.9 | 50.9 | 54.9 | 5000 | 3150 | 0.277 | 0.42 | 0.3 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON) | 20271649 | 5DM1603 | 14 | 58.2 | 62.2 | 6310 | 4275 | 0.21 | 0.45 | 0.29 | 301 | 13.59 |
| 3x120+3x(1,5STKON + 70/3KON) | 20069403 | 5DM1602 | 15.5 | 60.1 | 64.1 | 7690 | 5400 | 0.164 | 0.49 | 0.28 | 352 | 17.16 |
| 3x150+3x(1,5STKON + 70/3KON) | 20069404 | 5DM1601 | 17.2 | 65.6 | 69.6 | 9150 | 6750 | 0.132 | 0.54 | 0.28 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON) | 20026143 | 5DM1600 | 19.1 | 69.7 | 73.7 | 10800 | 8325 | 0.108 | 0.59 | 0.27 | 461 | 26.46 |
| 3x240+3x(1,5STKON + 120/3KON) | 20070763 | 5DM1599 | 22 | 78.9 | 82.9 | 13940 | 10800 | 0.0817 | 0.67 | 0.26 | 540 | 34.32 |
| 3x300+3x(1,5STKON + 150/3KON) | 20233044 | 5DM1*** | 24.8 | 83.4 | 88.4 | 17000 | 13500 | 0.0654 | 0.74 | 0.25 | 620 | 42.9 |
| 1,8/3 kV (N)TSKCGEWÖU, six control cores | | | | | | | | | | | | |
| 3x95+3x(2x1,5ST + 50/3KON) | | | 14 | 57.2 | 62.2 | 6350 | 4275 | 0.21 | 0.45 | 0.29 | 301 | 13.59 |
| 3x120+3x(2x1,5ST + 70/3KON) | | | 15.5 | 62.8 | 66.8 | 7950 | 5400 | 0.164 | 0.49 | 0.28 | 352 | 17.16 |
| 3x150+3x(2x1,5ST + 70/3KON) | 20160149 | 5DM1*** | 17.2 | 66.2 | 70.2 | 9100 | 6750 | 0.132 | 0.54 | 0.28 | 404 | 21.45 |
| 3x185+3x(2x1,5ST + 95/3KON) | | | 19.1 | 70.4 | 74.4 | 10750 | 8325 | 0.108 | 0.59 | 0.27 | 461 | 26.46 |
| 3x240+3x(2x1,5ST + 120/3KON) | | | 22 | 78.9 | 82.9 | 13650 | 10800 | 0.0817 | 0.67 | 0.26 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# TENAX-CTE NSSHKCGEOEU 1 kV

## Coal cutter cable for chain operation

### Application

For the connection of mobile machines under very high mechanical loads, predominantly for underground mining applications, e.g. for coal-cutting machines, particularly suitable for extreme bending loads under low tensile stress, if the cable is protected against high tensile forces by the cable chain.

### Global data

| | |
|---|---|
| Brand | TENAX-CTE |
| Type designation | NSSHKCGEOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded conductor of tinned copper wires (0,3mm) in special flexible design |
| PE-Conductor | Distributed as a spinning of tinned copper wires and a conductive tape |
| Insulation | rubber compound EPR-3GI3, colored |
| Core identification | Main cores: Black, Grey, Brown<br>Control cores: Blue |
| Pilot conductor | Pilot cores with copper/steel conductors capable of expansion and compression, EPR-insulation |
| Core arrangement | Cores cabled around semi-conductive cradle |
| Inner sheath | Made of semi-conductive rubber |
| Torsion protection | Polyester anti-torsion braid |
| Outer sheath | Rubber compound type: 5GM5, acc. to DIN VDE 0207 part 21, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40°C; max 80°C |
| Ambient temperature in fully flexible operation | min -20°C; max 60°C |

### Mechanical parameters

| | |
|---|---|
| Bending radii min. | 5 x D at a tensile load of max. 15 N/mm²<br>2.3 x D at a tensile load of max. 5 N/mm² |

## TENAX-CTE NSSHKCGEOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x(1,5ST + 16/3) | | 7 | 36 | 40 | 2790 | 1125 | 0.795 | 0.52 | 0.29 | 131 | 3.58 |
| 3x35 + 3x(1,5ST + 16/3) | 20076049 | 8.2 | 38 | 42 | 2620 | 1575 | 0.565 | 0.59 | 0.28 | 162 | 5.01 |
| 3x50 + 3x(1,5ST + 25/3) | 20076047 | 10.2 | 43 | 48 | 3600 | 2250 | 0.393 | 0.62 | 0.27 | 202 | 7.15 |
| 3x70 + 3x(1,5ST + 35/3) | 20099802 | 12.2 | 44 | 49 | 4180 | 3150 | 0.277 | 0.72 | 0.26 | 250 | 10.01 |
| 3x95 + 3x(1,5ST + 50/3) | 20099803 | 13.2 | 53 | 57 | 5490 | 4275 | 0.21 | 0.69 | 0.26 | 301 | 13.59 |
| 3x120 + 3x(1,5ST + 70/3) | | 15.2 | 58 | 63 | 8300 | 5400 | 0.164 | 0.86 | 0.25 | 352 | 17.16 |
| 3x150 + 3x(1,5ST + 70/3) | | 17.1 | 62 | 68 | 9300 | 6750 | 0.132 | 0.78 | 0.25 | 404 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(Z) NSSHKCGEOEU 1 kV

## Coal cutter cables for trailing operations

### Application

Used as power supply connection cable for mobile equipment in underground machine applications, such ascoal shearer, roadheader, TBM`s or scoops (LHDs). (Z)-Coal-Cutter cables are designed for free trailing operation and due to their special construction may be trailed for considerable distances behind the machine during operation.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(Z) |
| Type designation | NSSHKCGEOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MSHA P-189-4<br>BAS Bosnia-Herzegovina<br>TR-Certificate<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Very finely stranded copper conductor, tinned (class FS) |
| PE-Conductor | Double-concentric control/PE wire spinning in the outer interstice |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Main cores: Colored, Black, Grey, Brown; Control cores: Blue |
| Core arrangement | Three main conductors laid-up, with double-concentric control/PE conductor elements in the outer interstice |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Armouring | Braid of steel strands in a vulcanized bond between inner and outer sheath |
| Outer sheath | PROTOFIRM, Basis:synthetic elastomer compound e.g. CM, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40°C; max +80°C |
| Ambient temperature in fully flexible operation | min -20°C; max +60°C |

### Mechanical parameters

| | |
|---|---|
| Minimum Breaking load of steel braid | 45 kN |
| Max. tensile load on the conductor | 40 N/mm² |
| Torsional stress +/- | 10 °/m |
| Travel speed | 150 m/min |

## PROTOMONT(Z) NSSHKCGEOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x(1,5STKON + 16/3KON) | | | 7.1 | 39.2 | 42.2 | 2700 | 3000 | 0.795 | 0.37 | 0.33 | 131 | 3.58 |
| 3x35+3x(1,5STKON + 16/3KON) | | | 8.4 | 40.8 | 43.8 | 3100 | 4200 | 0.565 | 0.42 | 0.3 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON) | | | 10.1 | 46.2 | 49.2 | 4000 | 6000 | 0.393 | 0.45 | 0.28 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON) | | | 11.9 | 49.6 | 53.6 | 5100 | 8400 | 0.277 | 0.52 | 0.27 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON) | | | 14 | 56.8 | 60.8 | 6700 | 11400 | 0.21 | 0.55 | 0.27 | 301 | 13.59 |
| 3x120+3x(1,5STKON + 70/3KON) | | | 15.5 | 60.6 | 64.6 | 8000 | 14400 | 0.164 | 0.59 | 0.26 | 352 | 17.16 |
| 3x150+3x(1,5STKON + 70/3KON) | 20235364 | 5DM1516 | 17.6 | 67 | 71 | 9620 | 18000 | 0.132 | 0.61 | 0.26 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON) | | | 19.1 | 72 | 76 | 11500 | 22200 | 0.108 | 0.63 | 0.26 | 461 | 26.46 |
| 3x240+3x(1,5STKON + 120/3KON) | | | 22 | 80.4 | 85.4 | 14600 | 28800 | 0.0817 | 0.67 | 0.25 | 540 | 34.32 |
| 3x300+3x(1,5STKON + 150/3KON) | | | 24.8 | 89.1 | 94.1 | 18700 | 36000 | 0.0654 | 0.7 | 0.25 | 620 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# TENAX-LK NTSKCGEWOEU 1 kV

## Loader reeling cable with pilot cores, twist protection and central strain relief element

### Application

These cables are intended for mining reeling applications under very high mechanical loads, e.g. fast moving machines like shuttle cars etc. where frequent winding and unwinding is required during operation, in particular with simultaneous tensile strain and/or torsion stress and/or forced guidance of the cable.

### Global data

| | |
|---|---|
| Brand | TENAX-LK |
| Type designation | NTSKCGEWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Tinned copper, extra finely stranded (class 5), according to DIN VDE 0295 |
| Insulation | Rubber compound type 3GI3 acc. to DIN VDE 0207 part 20<br>Separator: Polyester tape |
| Special Pilot / PE element | Copper and steel conductor capable of expansion and compression covert with EPR insulation.<br>Earth core as a spinning of tinned copper bunches covered with semi-conductive tape. |
| Core identification | Core colors: Brown, Black, Grey<br>Control core: Blue |
| Core arrangement | Cores laid up around conductive central cradle separator with aramid rope |
| Inner sheath | Semi conductive inner sheath |
| Torsion protection | Extremely tear-resistant reinforcing tape, which prevents sheath movement. |
| Outer sheath | Outer sheath of black chlorinated rubber compound 5GM5, abrasion and tear-resistant, oil-resistant and flame retardant |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 30 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Travel speed | max. 160 m/min |

## TENAX-LK NTSKCGEWOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x(1,5ST+16/3) | 20074226 | 5 | 30.1 | 32.6 | 1525 | 720 | 1.24 | 1.5 | 0.23 | 99 | 2.29 |
| 3x25 + 3x(1,5ST + 16/3) | 20271566 | 6.2 | 37 | 39.5 | 2150 | 1125 | 0.8 | 1.56 | 0.22 | 131 | 3.58 |
| 3x35 + 3x(1,5ST + 25/3) | | 7.5 | 39.8 | 42.3 | 2575 | 1575 | 0.565 | 1.67 | 0.22 | 162 | 5.01 |
| 3x50 + 3x(1,5ST + 25/3) | | 9 | 42.9 | 45.4 | 3150 | 2250 | 0.393 | 1.79 | 0.22 | 202 | 7.15 |
| 3x70 + 3x(1,5ST + 35/3) | | 10.6 | 46.4 | 48.9 | 4000 | 3150 | 0.277 | 1.92 | 0.22 | 250 | 10.01 |
| 3x95 + 3x(1,5ST + 50/3) | | 12.6 | 53.2 | 56.7 | 5525 | 4275 | 0.21 | 1.84 | 0.22 | 301 | 13.59 |
| 3x16+2x10+1x1,5ST | 20135821 | 5 | 32 | 36 | 1900 | 720 | 1.24 | 1.36 | 0.23 | 99 | 2.29 |
| 3x25+2x10+1x1,5ST | | 6.2 | 36 | 40 | 2350 | 1125 | 0.8 | 1.52 | 0.22 | 131 | 3.58 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(S) (N)SSHCGEOEU 1 kV

## Underground reeling cable


### Application

For frequently changing dynamic loads, such as reeling cables for scoops (LHDs) in underground mines, suitable for mono-spiral reels and cylincrical reels. High tensile strength through central reinforcement element and very high abrasion and tear resistance of the outer sheath.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(S) |
| Type designation | (N)SSHCGEOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | MA - China<br>TR-Certificate<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, tinned, very finely stranded (class FS) |
| PE-Conductor | Double concentric control/earth wire spinning in outer interstices |
| Insulation | Basic material: EPR, Compound type: 3GI3 |
| Core identification | Black, Brown, Grey |
| Core arrangement | Three main cores stranded with three control/earth cores in outer interstices |
| Support element | Central support element made of aramid yarns embedded in cradle separator |
| Inner sheath | Basic material: EPR, Compund type: GM1B |
| Torsion protection | Reinforced braid of polyester threads in a vulcanized bond between inner and outer sheath, Surface covered: approx. 25% |
| Outer sheath | Basic material: Synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 30 N/mm² |
| Torsional stress +/- | 50 °/m |
| Bending radii min. | 4 x D |
| Min. distance with S-type directional changes | 20 x D |
| Travel speed | Max. 160 m/min |
| Additional tests | Reversed bending test, roller bending test |

## PROTOMONT(S) (N)SSHCGEOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16 + 3x(1,5STKON + 10/3KON) | 20025111 | 5DM1150 | 5.8 | 31.1 | 34.4 | 1820 | 1440 | 1.24 | 0.5 | 0.3 | 99 | 2.29 |
| 3x25 + 3x(1,5STKON + 16/3KON) | 20025108 | 5DM1151 | 7.3 | 36.3 | 39.3 | 2500 | 2250 | 0.795 | 0.52 | 0.29 | 131 | 3.58 |
| 3x35 + 3x(1,5STKON + 16/3KON) | 20165213 | 5DM1142 | 8.4 | 41.2 | 44.2 | 2990 | 3150 | 0.565 | 0.6 | 0.28 | 162 | 5.01 |
| 3x50 + 3x(1,5STKON + 25/3KON) | 20218401 | 5DM1*** | 10.3 | 44.5 | 47.5 | 3800 | 4500 | 0.393 | 0.61 | 0.27 | 202 | 7.15 |
| 3x70 + 3x(1,5STKON + 35/3KON) | 20236433 | 5DM1*** | 12 | 47.3 | 50.3 | 4500 | 6300 | 0.277 | 0.7 | 0.26 | 250 | 10.01 |
| 3x95 + 3x(1,5STKON + 50/3KON) | 20230582 | 5DM1*** | 14 | 54.8 | 58.8 | 5300 | 8550 | 0.21 | 0.72 | 0.26 | 301 | 13.59 |
| 3x120 + 3x(1,5STKON + 70/3KON) | | 5DM1*** | 15.8 | 58.7 | 62.7 | 6100 | 10800 | 0.164 | 0.79 | 0.25 | 352 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# CORDAFLEX(S) NSHTOEU 1kV

## LHD-cables for scoop operations


### Application

For frequently changing dynamic loads, such as reeling cables for scoops (LHDs) in underground mines, suitable for mono-spiral reels and cylindrical reels.

### Global data

| | |
|---|---|
| Brand | CORDAFLEX(S) |
| Type designation | NSHTOEU |
| Standard | DIN VDE 0250-814 |
| Certifications / Approvals | MSHA P-189-3<br>TR-Certificate<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Electrolytic copper, very finely stranded (class FS) |
| Insulation | Basic material: EPR, Compound type: 3GI3 |
| Core identification | Power cores: Black, Grey, Brown or natural coloring with black figures;<br>Protective earth: Green-Yellow |
| Support element | Central support element made of aramid yarns with rubber covering |
| Inner sheath | Compound type: 5GM5, Color: Yellow or Orange |
| Torsion protection | Reinforced braid of polyester threads in a vulcanized bond between inner and outer sheath,<br>Surface covered: approx. 25% |
| Outer sheath | Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5,<br>Color: Yellow or Orange |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 2.5 kV (5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | EN 60332-1-2, IEC 60332-1-2 |
| Resistance to oil | EN 60811-404, IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 30 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20xD |
| Travel speed | max. 160 m/min |
| Additional tests | Reversed bending test, roller bending test |

## CORDAFLEX(S) NSHTOEU 0.6/1kV

| Number of cores x cross section | Colour | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4x16(6kN) | or | 20004221 | 5DH3951 | 5.8 | 28 | 31 | 1450 | 1920 | 1.24 | 0.5 | 0.3 | 99 | 2.29 |
| 4x16(6kN) | ye | | 5DH3951 | 5.8 | 28 | 31 | 1450 | 1920 | 1.24 | 0.5 | 0.3 | 99 | 2.29 |
| 4x25(6kN) | ye | 20041914 | 5DH3967 | 7.3 | 34 | 37 | 2260 | 3000 | 0.795 | 0.54 | 0.29 | 131 | 3.58 |
| 4x35(12kN) | ye | 20151818 | 5DH3952 | 8.4 | 38 | 41 | 2930 | 4200 | 0.565 | 0.6 | 0.28 | 162 | 5.01 |
| 4x50(12kN) | ye | | 5DH3953 | 10.3 | 44.8 | 47.8 | 4000 | 6000 | 0.393 | 0.62 | 0.27 | 202 | 7.15 |
| 4x50(30kN) | ye | 20004210 | 5DH3842 | 10.3 | 42 | 44 | 3660 | 6000 | 0.393 | 0.62 | 0.27 | 202 | 7.15 |
| 4x70(20kN) | ye | 20004222 | 5DH3959 | 12 | 48.3 | 51.3 | 5050 | 8400 | 0.277 | 0.71 | 0.26 | 250 | 10.01 |
| 4x95(50kN) | ye | 20004219 | 5DH3942 | 14 | 51 | 53 | 6030 | 11400 | 0.21 | 0.72 | 0.26 | 301 | 13.59 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT(M+) (N)SHOEU-J 1 kV

## Reeling cables for drills and LHD

### Application

PROTOMONT(M+) reeling cables are used as power supply cables for the use with underground mining equipment. The cables are designed for frequently changing dynamic loads, such as reeling cables for drills and LHD's. The cables withstand high mechanical stress caused by reeling application and the abrasion to be expected in trailing operations. PROTOMONT(M+) is suitable for use with mono-spiral reels and cylindrical reels.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(M) |
| Type designation | (N)SHOEU-J |
| Standard | Based on DIN VDE 0250 part 812 |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Natural colouring with black digits printed consecutively |
| Core arrangement | Three main conductors laid-up together with the protective-earth conductor, from 50 mm² with protective-earth conductor split into three in the outer interstices |
| Inner sheath | Basic material: EPR, Special compound |
| Outer sheath | Basic material: Chlorinated rubber, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 |
| AC test voltage - main cores | 3 kV (5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | EN 60332-1-2, IEC 60332-1-2 |
| Resistance to oil | EN 60811-404, IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Travel speed | max. 60 m/min |

## PROTOMONT(M+) (N)SHOEU-J 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x50+3x25/3 | 20221569 | 5DL4*** | 9.4 | 30.3 | 33.3 | 2320 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20016040 | 5DL4536 | 11.1 | 36.2 | 39.2 | 3430 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3 | 20015116 | 5DL4527 | 12.9 | 40.9 | 43.9 | 4480 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20008590 | 5DL4528 | 14.6 | 45 | 48 | 5610 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | | 5DL4*** | 16.5 | 50.8 | 54.8 | 6930 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20273440 | 5DL4*** | 17.9 | 54.6 | 58.6 | 8100 | 8325 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20008475 | 5DL4529 | 20.7 | 62.2 | 66.2 | 10740 | 10800 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 3x300+3x150/3 | | 5DL4*** | 23.5 | 68.7 | 72.7 | 12900 | 13500 | 0.064 | 0.78 | 0.23 | 620 | 42.9 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT NTSKCGECWOEU – Festoon 6 kV

## Underground festoon cable


### Application

As power feeder cable in underground mines and in tunnel sites. The cables are used in underground festoon systems for the power supply of mobile transformer and shiftable units in underground mining applications.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NTSKCGECWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MA – China<br>WUG - Poland<br>BAS-Certificate<br>Fire Certificate of Russian Federation<br>GOST-R/-B/-K |

### Design features

| | |
|---|---|
| Conductor | Finely standed copper conductor, tinned (Class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Inner semiconductive layer of semiconductive rubber, outer semiconductive layer of tapes |
| Core identification | Power cores: Natural color, Control cores: Blue |
| Arrangement of PE-conductor | Concentric spinning of copper wires over each control core element in the outer interstices |
| Inner sheath | Basic material: EPR, Compound type: GM1B |
| Monitoring conductor | Semi-conductive tape and open-lay spinning of steel/copper wires |
| Outer sheath | PROTOFIRM, Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Red |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 3.6/6 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV |
| AC test voltage | 11 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404. |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NTSKCGECWOEU – Festoon 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+3x(1,5STKON + 25/3KON)+UELKON | 20005043 | 5DM1078 | 8.2 | 47.6 | 50.6 | 3870 | 1575 | 0.565 | 0.28 | 0.3 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON)+UELKON | 20005040 | 5DM1069 | 9.8 | 50.6 | 54.6 | 4600 | 2250 | 0.393 | 0.33 | 0.29 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON)+UELKON | 20005041 | 5DM1070 | 11.3 | 55 | 59 | 5640 | 3150 | 0.277 | 0.37 | 0.28 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON)+UELKON | 20005042 | 5DM1076 | 13.4 | 60.3 | 64.3 | 6910 | 4275 | 0.21 | 0.42 | 0.27 | 301 | 13.59 |
| 3x120 + 3x(1,5STKON + 70/3KON) + 6ÜLKON | 20007844 | 5DM1085 | 15.1 | 65.8 | 69.8 | 8410 | 5400 | 0.164 | 0.46 | 0.26 | 352 | 17.16 |
| 3x150 + 3x(1,5STKON + 70/3KON) + 6ÜLKON | 20053570 | 5DM1089 | 16.8 | 69.7 | 73.7 | 9700 | 6750 | 0.132 | 0.51 | 0.25 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON)+UELKON | 20080424 | 5DM1187 | 19 | 70 | 74 | 12770 | 8325 | 0.108 | 0.59 | 0.25 | 461 | 26.46 |
| NTSKCGECWOEU 3.6/6kV, six-cores design | | | | | | | | | | | | |
| 6X35+6X35/6E + 1X(6X1,5ST)+UELKON | 20227551 | 5DM1191 | 8.2 | 60.2 | 64.2 | 6180 | 3150 | 0.565 | 0.34 | 0.44 | 110 | 5.01 |
| 6X50+6X50/6E + 1X(6X1,5ST)+UELKON | 20269961 | 5DM1192 | 9.8 | 67.2 | 71.2 | 7870 | 4500 | 0.393 | 0.45 | 0.39 | 137 | 7.15 |
| 6X70+6X70/6E + 1X(6X1,5ST)+UELKON | 20111554 | 5DM1193 | 11.3 | 71.4 | 75.4 | 9670 | 6300 | 0.277 | 0.58 | 0.35 | 170 | 10.01 |
| 6X95+6X95/6E + 1X(6X1,5ST)+UELKON | | 5DM1*** | 13.4 | 80.2 | 84.2 | 11900 | 8550 | 0.21 | 0.7 | 0.33 | 205 | 13.59 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# SUPROMONT (N)3GHSSYCY 6 kV – 30 kV

## Rubber insulated MV flexible cables for underground use

### Application

As feeder cable for power supply of shiftable MV equipment, e.g. compressure resistant transformers, for underground mining applications as well as for tunnel sites.

### Global data

| | |
|---|---|
| Brand | SUPROMONT |
| Type designation | (N)3GHSSYCY |
| Standard | based on DIN VDE 0250 part 605 |
| Certifications / Approvals | VDE certificate of conformity |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individually laid-up concentrically around each main core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer semiconductive layer of semiconductive rubber, for 6kV outer semiconductive layer only |
| Core identification | Main cores: Natural color with black semiconductive layer, Control cores: Black with white digits |
| Core arrangement | Three main cores laid-up, one control core in each outer interstice |
| Inner sheath | PVC based plastic compound, type: DMV6 |
| Monitoring conductor | Conductive tape and overall concentric copper wire spinning |
| Intermediate sheath | PVC based plastic compound, type: DMV6 |
| Armouring | Braid of galvanized steel wires |
| Outer sheath | PVC-based thermoplastic compound, type: DMV6, Color: Red |

### Electrical parameters

| | | | | | | |
|---|---|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV | 14/25 kV | 18/30 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV | 22.5/45 kV | 27/54 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV | 29 kV | | 43 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Weather resistance | Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min 5 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## SUPROMONT (N)3GHSSYCY 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20161631 | 5DM2031 | 6.4 | 42.7 | 45.7 | 3180 | 1125 | 0.78 | 0.36 | 0.32 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20112385 | 5DM2032 | 7.6 | 45.3 | 48.3 | 3700 | 1575 | 0.554 | 0.41 | 0.3 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20042591 | 5DM2033 | 9.1 | 49.5 | 53.5 | 4730 | 2250 | 0.386 | 0.47 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20203072 | 5DM2034 | 10.8 | 53.2 | 57.2 | 5720 | 3150 | 0.272 | 0.53 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20049961 | 5DM2035 | 12.7 | 58.2 | 62.2 | 7010 | 4275 | 0.206 | 0.61 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20203073 | 5DM2036 | 14.3 | 62.7 | 66.7 | 8311 | 5400 | 0.161 | 0.67 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 16 | 67.6 | 71.6 | 9634 | 6750 | 0.129 | 0.74 | 0.25 | 404 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 71.7 | 75.7 | 11202 | 8325 | 0.106 | 0.8 | 0.25 | 461 | 26.46 |

## SUPROMONT (N)3GHSSYCY 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20156248 | 5DM2121 | 6.4 | 45.7 | 48.7 | 3580 | 1125 | 0.78 | 0.32 | 0.33 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20005081 | 5DM2122 | 7.6 | 47.8 | 50.8 | 4130 | 1575 | 0.554 | 0.36 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20005082 | 5DM2123 | 9.1 | 50.8 | 54.8 | 4890 | 2250 | 0.386 | 0.42 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20133422 | 5DM2124 | 10.8 | 55.1 | 59.1 | 5680 | 3150 | 0.272 | 0.47 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20005083 | 5DM2125 | 12.7 | 60 | 64 | 7130 | 4275 | 0.206 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20005084 | 5DM2126 | 14.3 | 63.9 | 67.9 | 8450 | 5400 | 0.161 | 0.59 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20275552 | 5DM2*** | 16 | 68.9 | 72.9 | 9840 | 6750 | 0.129 | 0.66 | 0.25 | 404 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 73 | 77 | 11408 | 8325 | 0.106 | 0.74 | 0.25 | 461 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSYCY 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | | 5DM2131 | 6.4 | 49.1 | 53.1 | 3985 | 1125 | 0.78 | 0.22 | 0.36 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | | 5DM2132 | 7.6 | 50.4 | 54.4 | 4481 | 1575 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20194633 | 5DM2133 | 9.1 | 53.9 | 57.9 | 5300 | 2250 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20227835 | 5DM2134 | 10.8 | 57.6 | 61.6 | 6380 | 3150 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | | 5DM2135 | 12.7 | 63.1 | 67.1 | 7652 | 4275 | 0.206 | 0.43 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20181158 | 5DM2136 | 14.3 | 67.4 | 71.4 | 8940 | 5400 | 0.161 | 0.47 | 0.28 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20269302 | 5DM2*** | 16 | 72 | 76 | 10400 | 6750 | 0.129 | 0.54 | 0.27 | 428 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 75.6 | 79.6 | 11865 | 8325 | 0.106 | 0.58 | 0.26 | 488 | 26.46 |

## SUPROMONT (N)3GHSSYCY 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20137435 | 5DM2211 | 6.4 | 52.6 | 56.6 | 3900 | 1575 | 0.554 | 0.2 | 0.37 | 172 | 5.01 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20015843 | 5DM2212 | 7.6 | 53.6 | 57.6 | 5090 | 1125 | 0.7839 | 0.25 | 0.35 | 139 | 3.58 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20007713 | 5DM2213 | 9.1 | 56.8 | 60.8 | 5730 | 2250 | 0.386 | 0.28 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20217439 | 5DM2214 | 10.8 | 61 | 65 | 6840 | 3150 | 0.272 | 0.32 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20111613 | 5DM2215 | 12.7 | 66 | 70 | 8080 | 4275 | 0.206 | 0.36 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20113362 | 5DM2216 | 14.3 | 69.9 | 73.9 | 9650 | 5400 | 0.161 | 0.39 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20135152 | 5DM2*** | 16 | 71 | 75 | 10932 | 6750 | 0.129 | 0.43 | 0.28 | 428 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 78.7 | 82.7 | 12417 | 8325 | 0.106 | 0.47 | 0.27 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSYCY 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+3x16/3E + 3x2,5ST+UEL | | 5DM2 | 7.6 | 57.6 | 61.6 | 5502 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20292042 | 5DM2 | 9.1 | 61.4 | 65.4 | 6517 | 2250 | 0.386 | 0.24 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | | 5DM2 | 10.8 | 65 | 69 | 7526 | 3150 | 0.272 | 0.27 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | | 5DM2 | 12.7 | 70 | 73.9 | 8790 | 4275 | 0.206 | 0.3 | 0.32 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 14.3 | 73.9 | 77.8 | 10137 | 5400 | 0.161 | 0.33 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 16 | 78.9 | 82.8 | 11679 | 6750 | 0.129 | 0.36 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 82.5 | 86.4 | 13095 | 8325 | 0.106 | 0.39 | 0.29 | 488 | 26.46 |

## SUPROMONT (N)3GHSSYCY 18/30 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x50+3x25/3E + 3x2,5ST+UEL | 5DM2 | 9.1 | 67.4 | 71.4 | 7487 | 2250 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 5DM2 | 10.8 | 71.1 | 75.1 | 8549 | 3150 | 0.272 | 0.22 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 5DM2 | 12.7 | 76.5 | 80.4 | 10091 | 4275 | 0.206 | 0.25 | 0.34 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 5DM2 | 14.3 | 79.9 | 83.8 | 11268 | 5400 | 0.161 | 0.27 | 0.33 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 5DM2 | 16 | 84.4 | 89.3 | 12887 | 6750 | 0.129 | 0.29 | 0.31 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# SUPROMONT (N)3GHSSHCH 6 kV – 20 kV

## Halogen-free rubber insulated MV flexible cables for underground use

### Application

As feeder cable for power supply of shiftable MV equipment, e.g. compressure resistant transformers, for underground mining applications as well as for tunnel sites.

### Global data

| | |
|---|---|
| Brand | SUPROMONT |
| Type designation | (N)3GHSSHCH |
| Standard | based on DIN VDE 0250 part 605 |
| Certifications / Approvals | VDE certificate of conformity |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individually laid-up concentrically around each main core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer semiconductive layer of semiconductive rubber, for 6kV outer semiconductive layer only |
| Core identification | Main cores: Natural color with black semiconductive layer, Control cores: Black with white digits |
| Core arrangement | Three main cores laid-up, one control core in each outer interstice |
| Inner sheath | Thermoplastic compound, type: HM4 |
| Monitoring conductor | Conductive tape and overall concentric copper wire spinning |
| Intermediate sheath | Thermoplastic compound, type: HM4 |
| Armouring | Braid of galvanized steel wires |
| Outer sheath | Thermoplastic compound, type: HM4, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV | 29 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Weather resistance | Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min 5 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## SUPROMONT (N)3GHSSHCH 3.6/6 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 5DM2*** | 6.4 | 42.7 | 45.7 | 3178 | 1125 | 0.78 | 0.36 | 0.32 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 5DM2*** | 7.6 | 45.3 | 48.3 | 3696 | 1575 | 0.554 | 0.41 | 0.3 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 5DM2*** | 9.1 | 48.5 | 52.5 | 4508 | 2250 | 0.386 | 0.47 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 5DM2*** | 10.8 | 52.1 | 56.1 | 5437 | 3150 | 0.272 | 0.53 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 5DM2*** | 12.7 | 56.6 | 60.6 | 6638 | 4275 | 0.206 | 0.61 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 5DM2*** | 14.3 | 60.5 | 64.5 | 7953 | 5400 | 0.161 | 0.67 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 5DM2*** | 16.1 | 65 | 71 | 9150 | 6750 | 0.129 | 0.74 | 0.25 | 404 | 21.45 |

## SUPROMONT (N)3GHSSHCH 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | | 5DM2*** | 6.4 | 44.7 | 48.7 | 3586 | 1125 | 0.78 | 0.32 | 0.33 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20148151 | 5DM2*** | 7.6 | 48.7 | 51.7 | 4020 | 1575 | 0.554 | 0.36 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20067203 | 5DM2233 | 9.1 | 50.7 | 54.7 | 4840 | 2250 | 0.386 | 0.42 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | | 5DM2*** | 10.8 | 55.1 | 59.1 | 5680 | 3150 | 0.272 | 0.47 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20067204 | 5DM2235 | 12.7 | 59.5 | 63.5 | 7090 | 4275 | 0.206 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20275531 | 5DM2*** | 14.3 | 63.9 | 67.9 | 8460 | 5400 | 0.161 | 0.59 | 0.26 | 352 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSHCH 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20204583 | 5DM2*** | 6.4 | 49.1 | 53.1 | 3985 | 1125 | 0.78 | 0.26 | 0.35 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20149013 | 5DM2*** | 7.6 | 52.1 | 56.1 | 4636 | 1575 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | | 5DM2*** | 9.1 | 53.9 | 57.9 | 5410 | 2250 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20227836 | 5DM2*** | 10.8 | 57.6 | 61.6 | 6200 | 3150 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x95+3x95/3E + 3x2,5ST+UEL | 20204584 | 5DM2*** | 12.7 | 63.6 | 67.6 | 7660 | 4275 | 0.206 | 0.43 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | | 5DM2*** | 14.3 | 67 | 71 | 8991 | 5400 | 0.161 | 0.47 | 0.28 | 371 | 17.16 |

## SUPROMONT (N)3GHSSHCH 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E + 3x2,5ST+UEL | | 5DM2*** | 6.4 | 52.6 | 56.6 | 4501 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20112422 | 5DM2242 | 7.6 | 53.6 | 57.6 | 4850 | 1575 | 0.554 | 0.25 | 0.35 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20060690 | 5DM2243 | 9.1 | 56.8 | 60.8 | 5630 | 2250 | 0.385 | 0.28 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20112425 | 5DM2244 | 10.8 | 61 | 65 | 6740 | 3150 | 0.272 | 0.32 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20129798 | 5DM2245 | 12.7 | 66 | 70 | 8150 | 4275 | 0.206 | 0.36 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20182384 | 5DM2*** | 14.3 | 70.5 | 74.5 | 9502 | 5400 | 0.161 | 0.39 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20163741 | 5DM2*** | 16.5 | 76.5 | 80.5 | 10900 | 6750 | 0.129 | 0.44 | 0.28 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# Notes

# PROTOMONT(MT) (N)SSHOEU 1 kV

## Low Voltage light and flexible rubber cable

### Application

Rubber-sheated flexible cables for mining and tunneling application, under heavy mechanical stress. Suitable for laying alongside conveyor belts and tunnel walls, on material handling equipment, e.g. as connection between upper and lower cars, and on movable equipment. The cables can be used indoor as well as outdoor, in explosion-hazard areas, in industry and in agriculture.
The cables are water resistant up to 10m water depth.
In other respects the specifications of DIN VDE 0298 part 3 applies.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(MT) |
| Type designation | (N)SSHOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | VDE-REG F546 |

### Notes on installation

| | |
|---|---|
| Notes on installation | Max. submersing depth 10m |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound better 3GI3 |
| Core identification | Light gray with black digits |
| Inner sheath | Basic material: EPR, Compound type: Special compound |
| Outer sheath | Basic material: Chlorinated rubber, Compound type: Special compound, 5GM5<br>Colour: yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3,5 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Max. permissible water temperature | 40 °C (At higher water temperatures, a shortened cable service life is to be expected) |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 1x16 | 20265363 | 5.2 | 9.5 | 11.1 | 230 | 240 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 1x25 | 20265364 | 6.4 | 11 | 12.6 | 335 | 375 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 1x35 | 20265365 | 7.5 | 12.3 | 13.9 | 435 | 525 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 1x50 | 20265366 | 9 | 14.5 | 16.5 | 615 | 750 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 1x70 | 20265367 | 11.1 | 16.4 | 18.4 | 830 | 1050 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 1x95 | 20265369 | 12.8 | 18.5 | 20.5 | 1060 | 1425 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 1x120 | 20265370 | 14.5 | 20.4 | 22.4 | 1300 | 1800 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 1x150 | 20265372 | 16.5 | 22.8 | 24.8 | 1600 | 2250 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 1x185 | 20265373 | 17.9 | 24.7 | 27.7 | 2020 | 2775 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 1x240 | 20265374 | 21.2 | 27.6 | 30.6 | 2548 | 3600 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 1x300 | 20265377 | 23.6 | 31.6 | 34.6 | 3200 | 4500 | 0.0641 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 2x1,5 | 20265378 | 1.6 | 9.8 | 11.4 | 150 | 45 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 2x2,5 | 20265379 | 2 | 10.7 | 12.3 | 185 | 75 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 2x4 | | 2.4 | 11.9 | 13.5 | 220 | 120 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 3x2,5 | 20265395 | 2 | 11.1 | 12.7 | 210 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265396 | 2.4 | 12.1 | 13.7 | 271 | 180 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 3x6 | 20265397 | 2.9 | 13.2 | 14.8 | 350 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 3x10 | 20265398 | 3.9 | 16.1 | 18.1 | 505 | 450 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 3x16 | 20265399 | 5.2 | 19 | 21 | 775 | 720 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 3x25 | 20265400 | 6.4 | 22.9 | 24.9 | 1160 | 1125 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 3x35 | 20265401 | 7.5 | 24.9 | 27.9 | 1550 | 1575 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 3x50 | 20265402 | 9 | 29.4 | 32.4 | 2180 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70 | 20265403 | 11.1 | 34.8 | 37.8 | 3020 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95 | 20265405 | 12.8 | 40.9 | 43.9 | 3810 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120 | 20265406 | 14.4 | 44.7 | 47.7 | 4970 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150 | 20265407 | 16.1 | 50 | 54 | 6290 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185 | 20265408 | 17.9 | 54.6 | 58.6 | 7470 | 8325 | 0.106 | 0.95 | 0.22 | 461 | 26.46 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x1,5 | 20265409 | 1.6 | 10.2 | 11.8 | 170 | 68 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 3x2,5 | 20265410 | 2 | 11.1 | 12.7 | 220 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265411 | 2.4 | 12.1 | 13.7 | 290 | 180 | 4.95 | 0.27 | 0.31 | 41 | 0.57 |
| 3x6 | 20265412 | 2.9 | 13.2 | 14.8 | 360 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 4x1,5 | 20265413 | 1.6 | 11 | 12.6 | 204 | 90 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 4x2,5 | 20265414 | 2 | 12 | 13.6 | 270 | 150 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 4x4 | 20265415 | 2.4 | 13 | 14.6 | 338 | 240 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 4x6 | 20265416 | 2.9 | 14.9 | 16.9 | 450 | 360 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 4x10 | 20265417 | 3.9 | 17.4 | 19.4 | 690 | 600 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 4x16 | 20265418 | 5.2 | 21 | 23 | 980 | 960 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 4x25 | 20265419 | 6.4 | 24.5 | 27.5 | 1490 | 1500 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 4x35 | 20265420 | 7.5 | 28.4 | 31.4 | 1870 | 2100 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

Continued from previous page.

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4x50 | 20265421 | 9 | 33.6 | 36.6 | 2570 | 3000 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 4x70 | 20265423 | 10.6 | 39.5 | 42.5 | 3920 | 4200 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 4x95 | 20265424 | 12.8 | 44.8 | 47.8 | 5040 | 5700 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 4x120 | 20265425 | 14.4 | 49.8 | 53.8 | 6200 | 7200 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 4x150 | | 16.1 | 54.9 | 58.9 | 7578 | 9000 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x50+3x25/3 | 20278765 | 9 | 29.4 | 32.4 | 2350 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20268926 | 10.6 | 35.1 | 38.1 | 3220 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95/50 | 20220195 | 12.1 | 44.8 | 47.8 | 4400 | 4275 | 0.206 | 0.6 | 0.24 | 301 | 13.59 |
| 3x95+3x50/3 | 20268927 | 12.8 | 40.7 | 43.7 | 4300 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20268929 | 14.4 | 44.5 | 47.5 | 5370 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20278766 | 16.5 | 51.6 | 55.6 | 6950 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20278767 | 17.9 | 54.5 | 58.5 | 8150 | 8325 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20278768 | 20.6 | 62.2 | 66.2 | 10700 | 10800 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 3x300+3x150/3 | 20278769 | 23.4 | 70.3 | 74.3 | 13300 | 13500 | 0.064 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 5x1,5 | 20278770 | 1.6 | 11.9 | 13.5 | 240 | 113 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 5x2,5 | 20278771 | 2 | 12.9 | 14.5 | 310 | 188 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 5x4 | 20268918 | 2.4 | 14.7 | 16.7 | 420 | 300 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 5x6 | 20268919 | 2.9 | 16.1 | 18.1 | 530 | 450 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 5x10 | 20268772 | 3.9 | 19 | 21 | 795 | 750 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 5x16 | 20268920 | 5.2 | 22.8 | 24.8 | 1180 | 1200 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 5x25 | 20278773 | 6.4 | 28 | 31 | 1880 | 1875 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 5x35 | 20278774 | 7.5 | 34.5 | 37.5 | 2650 | 2625 | 0.554 | 0.46 | 0.25 | 162 | 5.01 |
| PROTOMONT(MT) (N)SSHOEU-O Control cables | | | | | | | | | | | |
| 12x4 | 20278807 | 2.4 | 20.8 | 22.8 | 870 | 720 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 12x6 | 20278808 | 2.9 | 23.4 | 26.4 | 1150 | 1080 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J Control cables | | | | | | | | | | | |
| 7x1,5 | 20278776 | 1.6 | 12.9 | 14.5 | 300 | 158 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 8x1,5 | | 1.6 | 13.8 | 15.4 | 325 | 180 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 10x1,5 | | 1.6 | 15.5 | 17.5 | 400 | 225 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 12x1,5 | 20278777 | 1.6 | 15.8 | 17.8 | 500 | 270 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 14x1,5 | | 1.6 | 16.8 | 18.8 | 495 | 315 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 18x1,5 | 20278778 | 1.6 | 18.5 | 20.5 | 610 | 405 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 19x1,5 | 20278779 | 1.6 | 18.9 | 20.9 | 650 | 428 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 24x1,5 | 20278780 | 1.6 | 20 | 22 | 800 | 540 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 7x2,5 | 20278801 | 2 | 14.9 | 16.9 | 450 | 263 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 8x2,5 | 20278802 | 2 | 15.8 | 17.8 | 480 | 300 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 10x2,5 | | 2 | 16.4 | 18.4 | 500 | 375 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 12x2,5 | 20278803 | 2 | 18 | 20 | 600 | 450 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 15x2,5 | 20278804 | 2 | 20.7 | 22.7 | 780 | 563 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 18x2,5 | 20278805 | 2 | 21.2 | 23.2 | 850 | 675 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 19x2,5 | | 2 | 22.3 | 24.3 | 900 | 713 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 24x2,5 | 20278806 | 2 | 22.8 | 24.8 | 1070 | 900 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 37x2,5 | | 2 | 29 | 31 | 1600 | 1388 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

# Notes

# PROTOMONT NSSHOEU .../3E 1 kV

## Rubber-sheathed flexible cable with copper core shield


### Application

The cables are suitable for fixed installation and flexible operation as power supply cables to motors, distribution boards, pumps, drilling rigs, etc., for underground mining applications, for tunnel building applications, for open-cast mining applications, for use in quarries and similar applications. Permitted for applications according to DIN VDE 0118.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NSSHOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MA – China (special design)<br>MSHA P-189-3<br>BAS Bosnia-Herzegovina<br>TR-Certificate<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individual-concentric or overall concentric spinning of untinned copper wires |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Up to 5 cores colored, Core colors: Blue, Brown,Black, Grey, Black |
| Core arrangement | Three, four of five cores laid-up |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, Basic material: Chlorinated rubber, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | DIN EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NSSHOEU .../3E 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT NSSHOEU.../3E | | | | | | | | | | | | |
| 3x1,5+3x1,5/3E | 20005094 | 5DM4604 | 1.6 | 12.5 | 14.1 | 280 | 68 | 13.3 | 0.21 | 0.33 | 23 | 0.22 |
| 3x2,5+3x2,5/3E | 20005095 | 5DM4605 | 2 | 13.6 | 15.2 | 340 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4+3x4/3E | 20039860 | 5DM4606 | 2.4 | 16.1 | 18.1 | 480 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6+3x6/3E | 20005096 | 5DM4607 | 2.9 | 17.4 | 19.4 | 570 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 3x10+3x10/3E | 20005097 | 5DM4610 | 4 | 20.3 | 22.3 | 820 | 450 | 1.91 | 0.33 | 0.28 | 74 | 1.43 |
| 3x16+3x16/3E | 20005098 | 5DM4612 | 5 | 23.9 | 25.9 | 1180 | 720 | 1.21 | 0.4 | 0.27 | 99 | 2.29 |
| 3x25+3x16/3E | 20040501 | 5DM4613 | 6.4 | 27.7 | 30.7 | 1640 | 1125 | 0.78 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3E | 20039858 | 5DM4614 | 6.5 | 30.1 | 33.1 | 1990 | 1575 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3E | 20008752 | 5DM4615 | 9 | 35.9 | 38.9 | 2840 | 2250 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3E | 20007207 | 5DM4616 | 10.7 | 40.6 | 43.6 | 3780 | 3150 | 0.272 | 0.6 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3E | 20005099 | 5DM4617 | 12.3 | 45.5 | 48.5 | 4880 | 4275 | 0.206 | 0.61 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3E | 20015058 | 5DM4618 | 14.3 | 51.9 | 55.9 | 6340 | 5400 | 0.161 | 0.7 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3E | 20006978 | 5DM4620 | 16 | 56.2 | 60.2 | 7500 | 6750 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3E | 20006979 | 5DM4627 | 17.7 | 62.8 | 66.8 | 9300 | 8325 | 0.106 | 0.7 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3E | 20006980 | 5DM4628 | 20.3 | 69.6 | 73.6 | 11790 | 10800 | 0.08 | 0.71 | 0.22 | 540 | 34.32 |
| PROTOMONT NSSHOEU.../3E+ST | | | | | | | | | | | | |
| 3x2,5 + 3x2,5/3E + 3x1,5ST | 20005100 | 5DM4624 | 2 | 17.1 | 19.1 | 510 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4+3x4/3E +3x1,5ST | 20025110 | 5DM4626 | 2.4 | 17.8 | 19.8 | 580 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6+3x6/3E +3x1,5ST | 20005101 | 5DM4630 | 2.9 | 18.4 | 20.4 | 640 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 3x10 + 3x10/3E + 3x2,5ST | 20005102 | 5DM4631 | 4 | 22.1 | 24.1 | 960 | 450 | 1.91 | 0.33 | 0.28 | 74 | 1.43 |
| 3x16 + 3x16/3E + 3x2,5ST | 20005103 | 5DM4632 | 5 | 23.9 | 25.9 | 1250 | 720 | 1.21 | 0.4 | 0.27 | 99 | 2.29 |
| 3x25 + 3x16/3E + 3x2,5ST | 20005104 | 5DM4633 | 6.4 | 27.7 | 30.7 | 1690 | 1125 | 0.78 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35 + 3x16/3E + 3x2,5ST | 20005105 | 5DM4634 | 7.5 | 30.1 | 33.1 | 2040 | 1575 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | 20005106 | 5DM4635 | 9 | 35.9 | 38.9 | 2890 | 2250 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 20005107 | 5DM4636 | 10.7 | 40.6 | 43.6 | 3870 | 3150 | 0.272 | 0.6 | 0.24 | 250 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 20005108 | 5DM4637 | 12.3 | 45.5 | 48.5 | 4970 | 4275 | 0.206 | 0.61 | 0.24 | 301 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | 20005109 | 5DM4638 | 14.3 | 51.9 | 55.9 | 6430 | 5400 | 0.161 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | 20060692 | 5DM4642 | 16 | 56.2 | 60.2 | 7330 | 6750 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST | 20007785 | 5DM4644 | 17.7 | 62.8 | 66.8 | 9390 | 8325 | 0.106 | 0.7 | 0.23 | 461 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST | 20100480 | 5DM4651 | 20.3 | 69.6 | 73.6 | 11810 | 10800 | 0.08 | 0.71 | 0.22 | 540 | 34.32 |
| PROTOMONT NSSHOEU.../KON | | | | | | | | | | | | |
| 3x1,5/1,5KON | 20161197 | 5DL2404 | 1.6 | 12.4 | 14 | 270 | 68 | 13.7 | 0.21 | 0.33 | 23 | 0.22 |
| 3x2,5/2,5KON | 20004908 | 5DL2405 | 1.9 | 13.7 | 15.3 | 350 | 113 | 8.21 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4/4KON | | | 2.4 | 16.1 | 18.1 | 450 | 180 | 5.09 | 0.27 | 0.3 | 41 | 0.57 |
| 4x6/6KON | 20198030 | 5DL2507 | 2.9 | 18.8 | 20.8 | 645 | 360 | 3.39 | 0.32 | 0.29 | 53 | 0.86 |
| 4x10/10KON | 20168272 | 5DL2508 | 4.8 | 23.1 | 25.1 | 1010 | 600 | 1.95 | 0.34 | 0.28 | 74 | 1.43 |
| 4x16/16KON | | | 5.7 | 27.1 | 30.1 | 1520 | 960 | 1.24 | 0.44 | 0.26 | 99 | 2.29 |
| 5x2,5/2,5KON | 20004909 | 5DL2605 | 1.9 | 16.4 | 18.4 | 490 | 188 | 8.21 | 0.24 | 0.32 | 30 | 0.36 |
| 5x4/4KON | 20004910 | 5DL2606 | 2.4 | 18.2 | 20.2 | 620 | 300 | 5.09 | 0.27 | 0.3 | 41 | 0.57 |
| 5x6/6KON | 20024743 | 5DL2607 | 2.9 | 21.3 | 23.3 | 850 | 450 | 3.39 | 0.32 | 0.29 | 53 | 0.86 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT EMV-FC (N)SSHCOEU 1 kV

## Cables for Variable Frequency Converter

### Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining industry, on construction sites and similar applications, with heavy mechanical stresses. For laying on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car). Can be applied in water up to 40°C, approximately up to 10 m depth.

### Global data

| | |
|---|---|
| Brand | PROTOMONT EMV-FC |
| Type designation | (N)SSHCOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | MSHA P-189-3<br>EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) according to DIN EN 60228 |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Natural coloring with black figures |
| Core arrangement | Three power cores laid up with the protective earth conductors split into three in the outer interstices |
| Screen | EMC optimized, concentric braid of tinned copper wires |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 5 kV ( 5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT EMV-FC (N)SSHCOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x2,5 | 20004904 | 5DL2108 | 5.4 | 24.4 | 27.4 | 1190 | 720 | 1.24 | 0.42 | 0.26 | 99 | 2.29 |
| 3x25+3x4 | 20016716 | 5DL2107 | 6.3 | 28.2 | 31.2 | 1680 | 1125 | 0.795 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3 | 20004903 | 5DL2106 | 7.5 | 30.5 | 33.5 | 2000 | 1575 | 0.565 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3 | 20004902 | 5DL2105 | 8.9 | 36 | 39 | 2820 | 2250 | 0.393 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20004901 | 5DL2104 | 10.6 | 41.2 | 44.2 | 3800 | 3150 | 0.277 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3 | 20004900 | 5DL2103 | 12.1 | 45.7 | 48.7 | 4760 | 4275 | 0.21 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20001453 | 5DL2100 | 14.1 | 48.7 | 52.7 | 5890 | 5400 | 0.164 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20004899 | 5DL2101 | 16 | 55.7 | 59.7 | 7230 | 6750 | 0.132 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20004905 | 5DL2109 | 17.8 | 60.4 | 64.4 | 8640 | 8325 | 0.108 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20008903 | 5DL2102 | 20.2 | 68.2 | 72.2 | 11100 | 10800 | 0.0817 | 0.73 | 0.23 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# Tunnelling

## Index

# Product overview

| TBM REELING | | | |
|---|---|---|---|
| | PROTOMONT TBM (N)TSCGECWOEU | PROTOMONT TBM (N)TSCGECWHXOEU | TENAX-HTT |
| Application | Reeling | Reeling | Reeling |
| Cable design | Based on VDE, double screen technology | Based on VDE, double screen technology, halogen-free | Acc. to VDE, single screen technology |
| Travel speed max. m/min | 30 | 30 | 30 |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Stability against torsion (°/m) | +/- 25 | +/- 25 | +/- 100 |
| Sheath quality | 5GM5 | 5GM3 | 5GM5 |
| Sheath abrasion against surface | +++ | ++ | +++ |
| Reversed bending stability | +++ | +++ | +++ |
| Temperature range in fully flexible operation (°C) | -20 to +60 | -20 to +60 | -20 to +60 |
| Cold removable semicon screens | +++ | +++ | +++ |
| Approvals | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B | Fire certificate, Gost -R/-K/-B |

| CABLES FOR SEMI-FIXED INSTALLATION | | | |
|---|---|---|---|
| | PROTOMONT Festoon | SUPROMONT (N)3GHSSYCY | SUPROMONT (N)3GHSSHCH |
| Application | MV semi-fixed | MV semi-fixed | MV semi-fixed |
| Cable design | Acc. to VDE | Based on VDE | Based on VDE |
| Special design features | Double screen technology | Double screen technology | Double screen technology, halogen-free |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Sheath quality | 5GM5 | PVC YM5 | HM4 |
| Reversed bending stability | +++ | ++ | ++ |
| Temperature range in fully flexible operation (°C) | -25 to +60 | +5 to +60 | +5 to +60 |
| Approvals | MA – China, WUG - Poland, BAS-Certificate, Fire certificate, Gost -R/-B/-K | VDE certificate of conformity | VDE certificate of conformity |

| | PROTOMONT(MT) (N)SSHOEU | PROTOMONT NSSHOEU../3E | PROTOMONT EMV-FC |
|---|---|---|---|
| Application | LV semi-fixed | LV semi-fixed | LV frequency converter cable |
| Cable design | Based on VDE | Acc. to VDE | Acc. to VDE |
| Special design features | | Concentric core screens | Excellent EMC properties |
| Permissible tensile force (N/mm²) | 15 | 15 | 15 |
| Stability against torsion (°/m) | | +/- 25 | +/- 25 |
| Sheath quality | 5GM5 | 5GM5 | 5GM5 |
| Reversed bending stability | ++ | +++ | ++ |
| Temperature range in fully flexible operation (°C) | -25 to +60 | -25 to +60 | -25 to +60<br>-45 to +60 |
| Approvals | VDE-REG F546 | MA-China, MSHA P-189-3, BAS-certificate, EAC certificate | MSHA P-189-3, EAC certificate |


1000 V
Abgang K111 95qmm
Bohrwagenstation
Abgang K211
60m 3x35qmm
K313

# PROTOMONT TBM (N)TSCGECWOEU 10 kV – 30 kV

## MV reeling cables for TBMs


### Application

The cables are suitable for use as reeling power supply cables for tunnel boring machines (TBM) in underground mines and for tunnel construction sites.

### Global data

| | |
|---|---|
| Brand | PROTOMONT TBM |
| Type designation | (N)TSCGECWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) |
| PE-Conductor | Single concentric copper/textile mixed braid over every core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: special compound |
| Electrical field control | Inner and outer protective layer of semiconductive rubber compound |
| Core identification | Main cores: Natural coloring with black semiconductive rubber, Control cores: Black |
| Core arrangement | Three main conductors laid-up with three control cores in the outer interstice |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Monitoring conductor | Overall concentric lay of copper wire spinning |
| Outer sheath | PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Red |

### Electrical parameters

| | | | | | |
|---|---|---|---|---|---|
| Rated voltage | 6/10 kV | 8.7/15 kV | 12/20 kV | 14/25 kV | 18/30 kV |
| Max. permissible operating voltage AC | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| Max. permissible operating voltage DC | 9/18 kV | 13.5/27 kV | 18/36 kV | 22.5/45 kV | 27/54 kV |
| AC test voltage | 17 kV | 24 kV | 29 kV | 36 kV | 43 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load | For reeling application: max. 15 N/mm²<br>For TBM application: max. 30 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |
| Travel speed | max. 30 m/min |

## PROTOMONT TBM (N)TSCGECWOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | 20005060 | 5DM1328 | 6.4 | 43 | 46 | 3030 | 1125 | 0.795 | 0.31 | 0.33 | 131 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 20005061 | 5DM1331 | 7.6 | 45.7 | 48.7 | 3600 | 1575 | 0.565 | 0.35 | 0.32 | 162 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | 20008789 | 5DM1332 | 9.1 | 47.9 | 51.9 | 4190 | 2250 | 0.393 | 0.4 | 0.3 | 202 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | 20008855 | 5DM1333 | 10.9 | 54.6 | 58.6 | 5550 | 3150 | 0.277 | 0.46 | 0.29 | 250 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 20008403 | 5DM1334 | 12.6 | 58.3 | 62.3 | 6630 | 4275 | 0.21 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | 20160785 | 5DM1355 | 14.2 | 62.1 | 66.1 | 7840 | 5400 | 0.164 | 0.57 | 0.27 | 352 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST + 6UELKON | 20173765 | 5DM1*** | 15.8 | 66.6 | 70.6 | 8490 | 6750 | 0.129 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST + 6UELKON | 20215162 | 5DM1369 | 17.8 | 73.1 | 77.1 | 10860 | 8325 | 0.106 | 0.64 | 0.26 | 461 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST + 6UELKON | 20215163 | 5DM1370 | 20.4 | 80.7 | 84.7 | 13820 | 10800 | 0.0801 | 0.64 | 0.25 | 540 | 34.32 |

## PROTOMONT TBM (N)TSCGECWOEU 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 6.4 | 46.4 | 49.4 | 3210 | 1125 | 0.795 | 0.24 | 0.36 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 20267018 | 5DM1*** | 7.6 | 48.7 | 52.7 | 3730 | 1575 | 0.565 | 0.27 | 0.34 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 9.1 | 53.7 | 57.7 | 4700 | 2250 | 0.393 | 0.3 | 0.32 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | 20024471 | 5DM1360 | 10.9 | 58 | 62 | 5990 | 3150 | 0.277 | 0.34 | 0.31 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 20040372 | 5DM1361 | 12.6 | 61.6 | 65.6 | 7080 | 4275 | 0.21 | 0.38 | 0.29 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 14.2 | 67.2 | 71.2 | 8490 | 5400 | 0.164 | 0.42 | 0.29 | 371 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOMONT TBM (N)TSCGECWOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | 20005062 | 5DM1335 | 6.4 | 48.8 | 52.8 | 3740 | 1125 | 0.795 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 20005063 | 5DM1336 | 7.6 | 51.3 | 55.3 | 4270 | 1575 | 0.565 | 0.24 | 0.35 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | 20005064 | 5DM1354 | 9.1 | 56.7 | 60.7 | 5270 | 2250 | 0.393 | 0.27 | 0.33 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | 20081491 | 5DM1337 | 10.9 | 61.3 | 65.3 | 6390 | 3150 | 0.277 | 0.31 | 0.32 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 20113405 | 5DM1338 | 12.6 | 66.4 | 70.4 | 7770 | 4275 | 0.21 | 0.34 | 0.3 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | 20015054 | 5DM1340 | 14.2 | 70.2 | 74.2 | 9160 | 5400 | 0.164 | 0.38 | 0.29 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST + 6UELKON | 20052428 | 5DM1341 | 15.8 | 71.1 | 75.1 | 9820 | 6750 | 0.129 | 0.42 | 0.28 | 428 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 17.8 | 71.2 | 75.2 | 10200 | 8325 | 0.106 | 0.64 | 0.26 | 488 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 20.4 | 74.5 | 78.5 | 11800 | 10800 | 0.0801 | 0.69 | 0.25 | 574 | 34.32 |

## PROTOMONT TBM (N)TSCGECWOEU 14/25 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | 5DM1*** | 6.4 | 54.6 | 58.6 | 4100 | 1125 | 0.795 | 0.19 | 0.4 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 5DM1*** | 7.6 | 57.1 | 61.1 | 4640 | 1575 | 0.565 | 0.21 | 0.37 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | 5DM1*** | 9.1 | 61 | 65 | 5550 | 2250 | 0.393 | 0.23 | 0.35 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | 5DM1*** | 10.9 | 66.6 | 70.6 | 6860 | 3150 | 0.277 | 0.26 | 0.33 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 5DM1*** | 12.6 | 70.2 | 74.2 | 8110 | 4275 | 0.21 | 0.29 | 0.32 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | 5DM1*** | 14.2 | 73.9 | 77.9 | 9450 | 5400 | 0.164 | 0.32 | 0.31 | 371 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## PROTOMONT TBM (N)TSCGECWOEU 18/30 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | 5DM1*** | 6.4 | 58 | 62 | 4490 | 1125 | 0.795 | 0.17 | 0.42 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 5DM1*** | 7.6 | 60.7 | 64.7 | 5060 | 1575 | 0.565 | 0.18 | 0.39 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | 5DM1*** | 9.1 | 66.1 | 70.1 | 6220 | 2250 | 0.393 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | 5DM1*** | 10.9 | 70 | 74 | 7330 | 3150 | 0.277 | 0.23 | 0.35 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 5DM1*** | 12.6 | 73.9 | 77.9 | 8660 | 4275 | 0.21 | 0.25 | 0.33 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | 5DM1*** | 14.2 | 78.6 | 83.6 | 10250 | 5400 | 0.164 | 0.27 | 0.32 | 371 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# PROTOMONT TBM (N)TSCGECWHXOEU 10 kV – 20 kV

## Halogen-free MV reeling cables for TBM


### Application

These halogen-free cables are intended for use as reeling power supply cables for tunnel boring machines (TBM) in underground mines and for tunnel construction sites.

### Global data

| | |
|---|---|
| Brand | PROTOMONT TBM |
| Type designation | (N)TSCGECWHXOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST-R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) |
| PE-Conductor | Single concentric copper/textile mixed braid over every core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: special compound |
| Electrical field control | Inner and outer protective layer of semiconductive rubber compound |
| Core identification | Main cores: Natural coloring with black semiconductive rubber, Control cores: Black |
| Core arrangement | Three main conductors laid-up with three control cores in the outer interstice |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Monitoring conductor | Overall concentric lay of copper wire spinning |
| Outer sheath | Synthetic halogen-free elastomer compound EVA, type: 5GM3 |
| Outer sheath colour | Red |

### Electrical parameters

| | | |
|---|---|---|
| Rated voltage | 6/10 kV | 12/20 kV |
| Max. permissible operating voltage AC | 6,9/12 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 9/18 kV | 18/36 kV |
| AC test voltage | 17 kV | 29 kV |
| AC test voltage - control cores | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -20 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load | For reeling application: max. 15 N/mm²<br>For TBM application: max. 30 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Min. distance with S-type directional changes | 20 x D |
| Travel speed | max. 30 m/min |

## PROTOMONT TBM (N)TSCGECWHXOEU 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 6.4 | 42.9 | 45.9 | 2880 | 1125 | 0.795 | 0.31 | 0.33 | 131 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 7.6 | 45.6 | 48.6 | 3440 | 1575 | 0.565 | 0.35 | 0.32 | 162 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | | 5DM1332 | 9.1 | 48.3 | 52.3 | 3850 | 2250 | 0.393 | 0.4 | 0.3 | 202 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | | 5DM1333 | 10.9 | 54.5 | 58.5 | 5350 | 3150 | 0.277 | 0.46 | 0.29 | 250 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 20261201 | 5DM1*** | 12.6 | 58.2 | 62.2 | 6550 | 4275 | 0.21 | 0.52 | 0.27 | 301 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | 20271793 | 5DM1430 | 14.2 | 62.1 | 66.1 | 7870 | 5400 | 0.164 | 0.57 | 0.27 | 352 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 15.8 | 66.6 | 70.6 | 8490 | 6750 | 0.129 | 0.63 | 0.26 | 404 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 17.8 | 67.2 | 71.2 | 9600 | 8325 | 0.106 | 0.64 | 0.26 | 461 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 20.4 | 70.5 | 74.5 | 11200 | 10800 | 0.0801 | 0.64 | 0.25 | 540 | 34.32 |

## PROTOMONT TBM (N)TSCGECWHXOEU 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25 + 3x16/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 6.4 | 48.7 | 52.7 | 3540 | 1125 | 0.795 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST + 6UELKON | 20111560 | 5DM1435 | 7.6 | 51.1 | 55.1 | 4310 | 1575 | 0.565 | 0.24 | 0.35 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST + 6UELKON | 20121232 | 5DM1436 | 9.1 | 56.7 | 60.7 | 5310 | 2250 | 0.393 | 0.27 | 0.33 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 10.9 | 61.2 | 65.2 | 6150 | 3150 | 0.277 | 0.31 | 0.32 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST + 6UELKON | 20121231 | 5DM1438 | 12.6 | 66.4 | 70.4 | 7820 | 4275 | 0.21 | 0.34 | 0.3 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 14.2 | 70.1 | 74.1 | 8580 | 5400 | 0.164 | 0.38 | 0.29 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 15.8 | 70.8 | 74.8 | 9492 | 6750 | 0.129 | 0.42 | 0.28 | 428 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 17.8 | 71.2 | 75.2 | 10200 | 8325 | 0.106 | 0.64 | 0.26 | 488 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST + 6UELKON | | 5DM1*** | 20.4 | 74.5 | 78.5 | 11800 | 10800 | 0.0801 | 0.69 | 0.25 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# TENAX-HTT (N)TSCGEWOEU 10 kV – 30 kV

## MV reeling cables for use on TBMs

### Application

For the connection of electrical equipment, in mines and underground excavations with hazardous environments under particularly high mechanical loads, e.g. high-voltage transformers on power lines in underground mining and tunneling.The flexible cable design allows for movement of the equipment during operation and even slow reeling operations

### Global data

| | |
|---|---|
| Brand | TENAX-HTT |
| Type designation | (N)TSCGEWOEU |
| Standard | Based on DIN VDE 0250-813 |
| Certifications / Approvals | Fire Certificate of Russian Federation<br>GOST -R/-K/-B |

### Design features

| | |
|---|---|
| Conductor | Bare copper conductor, finely stranded (class 5) |
| PE-Conductor | Concentric spinning of tinned annealed copper wires over each core |
| Insulation | Rubber, Compound type: 3GI3 according to DIN VDE 0207 part 20 |
| Core identification | According to DIN VDE 0250 Pt. 813, Natural colour |
| Inner sheath | Rubber, Compound type: GM1B according to DIN VDE 0207 part 21 |
| Torsion protection | Polyester anti-torsion braid between the jackets embedded |
| Outer sheath | Rubber, Compound type: 5GM5 according to DIN VDE 0207 part 21, Color: Red |

### Electrical parameters

| | | | | | |
|---|---|---|---|---|---|
| Rated voltage | 6/10 kV | 8.7/15 kV | 12/20 kV | 14/25 kV | 18/30 kV |
| Max. permissible operating voltage AC | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| Max. permissible operating voltage DC | 9/18 kV | 13.5/27 kV | 18/36 kV | 22.5/45 kV | 27/54 kV |
| AC test voltage | 17 kV | 24 kV | 29 kV | 36 kV | 43 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | EN 60332-1-2, IEC 60332-1-2 |
| Resistance to oil | EN 60811-404, IEC 60811-404 |

### Thermal parameters

| | |
|---|---|
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |
| Travel speed | max. 30 m/min |

## TENAX-HTT (N)TSCGEWOEU 6/10 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25x3x16/3E | | 6.2 | 45.6 | 49.1 | 2975 | 1125 | 0.78 | 0.23 | 0.37 | 131 | 3.58 |
| 3x35+3x25/3E | | 7.8 | 50.8 | 55.3 | 3825 | 1575 | 0.554 | 0.27 | 0.34 | 162 | 5.01 |
| 3x50+3x25/3E | | 9.6 | 54.7 | 59.2 | 4525 | 2250 | 0.386 | 0.31 | 0.32 | 202 | 7.15 |
| 3x70+3x35/3E | | 10.6 | 56.9 | 61.4 | 5325 | 3150 | 0.272 | 0.34 | 0.31 | 250 | 10.01 |
| 3x95+3x50/3E | | 12.6 | 63.4 | 67.9 | 7075 | 4275 | 0.206 | 0.38 | 0.29 | 301 | 13.59 |
| 3x120+3x70/3E | 20196517 | 14.8 | 68.6 | 73.1 | 8550 | 5400 | 0.161 | 0.44 | 0.28 | 352 | 17.16 |
| 3x150+3x70/3E | 20275551 | 16 | 71.1 | 75.6 | 9300 | 6750 | 0.129 | 0.46 | 0.28 | 404 | 21.45 |
| 3x25x3x16/3E + 3x2,5ST | | 6.2 | 45.6 | 49.1 | 2975 | 1125 | 0.78 | 0.23 | 0.37 | 131 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST | | 7.8 | 50.8 | 55.3 | 3825 | 1575 | 0.554 | 0.27 | 0.34 | 162 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | | 9.6 | 54.7 | 59.2 | 4525 | 2250 | 0.386 | 0.31 | 0.32 | 202 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 20197569 | 10.6 | 56.9 | 61.4 | 5325 | 3150 | 0.272 | 0.34 | 0.31 | 250 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 20197565 | 12.6 | 63.4 | 67.9 | 7075 | 4275 | 0.206 | 0.38 | 0.29 | 301 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | | 14.8 | 68.6 | 73.1 | 8550 | 5400 | 0.161 | 0.44 | 0.28 | 352 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | | 16 | 71.1 | 75.6 | 9300 | 6750 | 0.129 | 0.46 | 0.28 | 404 | 21.45 |

## TENAX-HTT (N)TSCGEWOEU 8.7/15 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25x3x16/3E | | 6.2 | 51.7 | 56.2 | 3625 | 1125 | 0.78 | 0.19 | 0.39 | 139 | 3.58 |
| 3x35+3x25/3E | | 7.8 | 55.2 | 59.7 | 4275 | 1575 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x50+3x25/3E | | 9.6 | 59.1 | 63.6 | 5050 | 2250 | 0.386 | 0.25 | 0.34 | 215 | 7.15 |
| 3x70+3x35/3E | | 10.6 | 63.4 | 67.9 | 6250 | 3150 | 0.272 | 0.27 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3E | 20179572 | 12.6 | 68.2 | 72.7 | 8260 | 4275 | 0.206 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120+3x70/3E | 20079289 | 14.8 | 71.5 | 76 | 8490 | 5400 | 0.161 | 0.35 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3E | 20173116 | 16 | 77.7 | 82.2 | 10630 | 6750 | 0.129 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3E | 20183101 | 17.7 | 78 | 82 | 12680 | 8325 | 0.106 | 0.4 | 0.29 | 488 | 26.46 |
| 3x240+3x120/3E | 20183102 | 18.7 | 79.5 | 84.5 | 13700 | 10800 | 0.0801 | 0.44 | 0.28 | 574 | 34.32 |
| 3x25x3x16/3E + 3x2,5ST | | 6.2 | 51.7 | 56.2 | 3675 | 1125 | 0.78 | 0.19 | 0.39 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST | | 7.8 | 55.2 | 59.7 | 4325 | 1575 | 0.554 | 0.22 | 0.36 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | | 9.6 | 59.1 | 63.6 | 5100 | 2250 | 0.386 | 0.25 | 0.34 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | | 10.6 | 63.4 | 67.9 | 6300 | 3150 | 0.272 | 0.27 | 0.33 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | | 12.6 | 68.2 | 72.7 | 7825 | 4275 | 0.206 | 0.31 | 0.31 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | | 14.8 | 75.2 | 79.7 | 9725 | 5400 | 0.161 | 0.35 | 0.3 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | | 16 | 77.7 | 82.2 | 10425 | 6750 | 0.129 | 0.37 | 0.29 | 428 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST | | 17.7 | 78 | 82 | 12730 | 8325 | 0.106 | 0.4 | 0.29 | 488 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST | | 18.7 | 79.5 | 84.5 | 13750 | 10800 | 0.0801 | 0.44 | 0.28 | 574 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## TENAX-HTT (N)TSCGEWOEU 12/20 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25x3x16/3E | | 6.2 | 56 | 60.5 | 4125 | 1125 | 0.78 | 0.17 | 0.41 | 139 | 3.58 |
| 3x35+3x25/3E | | 7.8 | 59.9 | 64.4 | 4875 | 1575 | 0.554 | 0.19 | 0.38 | 172 | 5.01 |
| 3x50+3x25/3E | | 9.6 | 65.6 | 70.1 | 5950 | 2250 | 0.386 | 0.22 | 0.36 | 215 | 7.15 |
| 3x70+3x35/3E | | 10.6 | 68.2 | 72.7 | 6925 | 3150 | 0.272 | 0.23 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3E | 20213199 | 12.6 | 74.3 | 78.8 | 9230 | 4275 | 0.206 | 0.26 | 0.33 | 319 | 13.59 |
| 3x120+3x70/3E | | 14.8 | 79.5 | 84 | 10400 | 5400 | 0.161 | 0.29 | 0.31 | 371 | 17.16 |
| 3x150+3x70/3E | | 16 | 82 | 86.5 | 11175 | 6750 | 0.129 | 0.31 | 0.31 | 428 | 21.45 |
| 3x25x3x16/3E + 3x2,5ST | | 6.2 | 56 | 60.5 | 4175 | 1125 | 0.78 | 0.17 | 0.41 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST | | 7.8 | 59.9 | 64.4 | 4925 | 1575 | 0.554 | 0.19 | 0.38 | 172 | 5.01 |
| 3x50+3x25/3E +3x2,5ST | 20227840 | 9.6 | 65.5 | 70 | 6820 | 2250 | 0.386 | 0.22 | 0.36 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 20197567 | 10.6 | 68.2 | 72.7 | 6930 | 3150 | 0.272 | 0.23 | 0.35 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 20197566 | 12.6 | 74.3 | 78.8 | 8780 | 4275 | 0.206 | 0.26 | 0.33 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | | 14.8 | 79.5 | 84 | 10450 | 5400 | 0.161 | 0.29 | 0.31 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | | 16 | 82 | 86.5 | 11225 | 6750 | 0.129 | 0.31 | 0.31 | 428 | 21.45 |

## TENAX-HTT (N)TSCGEWOEU 14/25 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25x3x16/3E | 6.2 | 63.5 | 68 | 5150 | 1125 | 0.78 | 0.15 | 0.44 | 139 | 3.58 |
| 3x35+3x25/3E | 7.8 | 67.3 | 71.8 | 5975 | 1575 | 0.554 | 0.17 | 0.41 | 172 | 5.01 |
| 3x50+3x25/3E | 9.6 | 71.2 | 75.7 | 6850 | 2250 | 0.386 | 0.19 | 0.38 | 215 | 7.15 |
| 3x70+3x35/3E | 10.6 | 75.6 | 80.1 | 8150 | 3150 | 0.272 | 0.2 | 0.37 | 265 | 10.01 |
| 3x95+3x50/3E | 12.6 | 79.9 | 84.4 | 9800 | 4275 | 0.206 | 0.22 | 0.35 | 319 | 13.59 |
| 3x120+3x70/3E | 14.8 | 86.9 | 91.4 | 11875 | 5400 | 0.161 | 0.25 | 0.33 | 371 | 17.16 |
| 3x150+3x70/3E | 16 | 89.4 | 93.9 | 12700 | 6750 | 0.129 | 0.27 | 0.32 | 428 | 21.45 |
| 3x25x3x16/3E + 3x2,5ST | 6.2 | 63.5 | 68 | 5200 | 1125 | 0.78 | 0.15 | 0.44 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST | 7.8 | 67.3 | 71.8 | 6025 | 1575 | 0.554 | 0.17 | 0.41 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | 9.6 | 71.2 | 75.7 | 6900 | 2250 | 0.386 | 0.19 | 0.38 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 10.6 | 75.6 | 80.1 | 8200 | 3150 | 0.272 | 0.2 | 0.37 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 12.6 | 79.9 | 84.4 | 9850 | 4275 | 0.206 | 0.22 | 0.35 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | 14.8 | 86.9 | 91.4 | 11925 | 5400 | 0.161 | 0.25 | 0.33 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | 16 | 89.4 | 93.9 | 12750 | 6750 | 0.129 | 0.27 | 0.32 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

## TENAX-HTT (N)TSCGEWOEU 18/30 kV

| Number of cores x cross section | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|
| 3x25x3x16/3E | 6.2 | 68.6 | 73.1 | 5950 | 1125 | 0.78 | 0.13 | 0.46 | 139 | 3.58 |
| 3x35+3x25/3E | 7.8 | 74.3 | 78.8 | 7125 | 1575 | 0.554 | 0.15 | 0.43 | 172 | 5.01 |
| 3x50+3x25/3E | 9.6 | 78.2 | 82.7 | 8050 | 2250 | 0.386 | 0.17 | 0.4 | 215 | 7.15 |
| 3x70+3x35/3E | 10.6 | 80.8 | 85.3 | 9100 | 3150 | 0.272 | 0.18 | 0.39 | 265 | 10.01 |
| 3x95+3x50/3E | 12.6 | 86.9 | 91.4 | 11150 | 4275 | 0.206 | 0.2 | 0.37 | 319 | 13.59 |
| 3x120+3x70/3E | 14.8 | 91.7 | 96.2 | 12775 | 5400 | 0.161 | 0.22 | 0.35 | 371 | 17.16 |
| 3x150+3x70/3E | 16 | 94.2 | 98.7 | 13600 | 6750 | 0.129 | 0.23 | 0.34 | 428 | 21.45 |
| 3x25x3x16/3E + 3x2,5ST | 6.2 | 68.6 | 73.1 | 6000 | 1125 | 0.78 | 0.13 | 0.46 | 139 | 3.58 |
| 3x35 + 3x25/3E + 3x2,5ST | 7.8 | 74.3 | 78.8 | 7175 | 1575 | 0.554 | 0.15 | 0.43 | 172 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | 9.6 | 78.2 | 82.7 | 8100 | 2250 | 0.386 | 0.17 | 0.4 | 215 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 10.6 | 80.8 | 85.3 | 9150 | 3150 | 0.272 | 0.18 | 0.39 | 265 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 12.6 | 86.9 | 91.4 | 11200 | 4275 | 0.206 | 0.2 | 0.37 | 319 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | 14.8 | 91.7 | 96.2 | 12825 | 5400 | 0.161 | 0.22 | 0.35 | 371 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | 16 | 94.2 | 98.7 | 13650 | 6750 | 0.129 | 0.23 | 0.34 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15).
For derating-factors see tables in Technical Appendix

# PROTOMONT NTSKCGECWOEU – Festoon 3.6/6 kV

## Underground festoon cable


### Application

As power feeder cable in underground mines and in tunnel sites. The cables are used in underground festoon systems for the power supply of mobile transformer and shiftable units in underground mining applications.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NTSKCGECWOEU |
| Standard | DIN VDE 0250-813 |
| Certifications / Approvals | MA – China<br>WUG - Poland<br>BAS-Certificate<br>Fire Certificate of Russian Federation<br>GOST-R/-B/-K |

### Design features

| | |
|---|---|
| Conductor | Finely standed copper conductor, tinned (Class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Electrical field control | Inner semiconductive layer of semiconductive rubber, outer semiconductive layer of tapes |
| Core identification | Power cores: Natural color, Control cores: Blue |
| Arrangement of PE-conductor | Concentric spinning of copper wires over each control core element in the outer interstices |
| Inner sheath | Basic material: EPR, Compound type: GM1B |
| Monitoring conductor | Semi-conductive tape and open-lay spinning of steel/copper wires |
| Outer sheath | PROTOFIRM, Basic material: synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Red |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 3.6/6 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV |
| AC test voltage | 11 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404. |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NTSKCGECWOEU – Festoon 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+3x(1,5STKON + 25/3KON)+UELKON | 20005043 | 5DM1078 | 8.2 | 47.6 | 50.6 | 3870 | 1575 | 0.565 | 0.28 | 0.3 | 162 | 5.01 |
| 3x50+3x(1,5STKON + 25/3KON)+UELKON | 20005040 | 5DM1069 | 9.8 | 50.6 | 54.6 | 4600 | 2250 | 0.393 | 0.33 | 0.29 | 202 | 7.15 |
| 3x70+3x(1,5STKON + 35/3KON)+UELKON | 20005041 | 5DM1070 | 11.3 | 55 | 59 | 5640 | 3150 | 0.277 | 0.37 | 0.28 | 250 | 10.01 |
| 3x95+3x(1,5STKON + 50/3KON)+UELKON | 20005042 | 5DM1076 | 13.4 | 60.3 | 64.3 | 6910 | 4275 | 0.21 | 0.42 | 0.27 | 301 | 13.59 |
| 3x120 + 3x(1,5STKON + 70/3KON) + 6ÜLKON | 20007844 | 5DM1085 | 15.1 | 65.8 | 69.8 | 8410 | 5400 | 0.164 | 0.46 | 0.26 | 352 | 17.16 |
| 3x150 + 3x(1,5STKON + 70/3KON) + 6ÜLKON | 20053570 | 5DM1089 | 16.8 | 69.7 | 73.7 | 9700 | 6750 | 0.132 | 0.51 | 0.25 | 404 | 21.45 |
| 3x185+3x(1,5STKON + 95/3KON)+UELKON | 20080424 | 5DM1187 | 19 | 70 | 74 | 12770 | 8325 | 0.108 | 0.59 | 0.25 | 461 | 26.46 |
| NTSKCGECWOEU 3.6/6kV, six-cores design | | | | | | | | | | | | |
| 6X35+6X35/6E + 1X(6X1,5ST)+UELKON | 20227551 | 5DM1191 | 8.2 | 60.2 | 64.2 | 6180 | 3150 | 0.565 | 0.34 | 0.44 | 110 | 5.01 |
| 6X50+6X50/6E + 1X(6X1,5ST)+UELKON | 20269961 | 5DM1192 | 9.8 | 67.2 | 71.2 | 7870 | 4500 | 0.393 | 0.45 | 0.39 | 137 | 7.15 |
| 6X70+6X70/6E + 1X(6X1,5ST)+UELKON | 20111554 | 5DM1193 | 11.3 | 71.4 | 75.4 | 9670 | 6300 | 0.277 | 0.58 | 0.35 | 170 | 10.01 |
| 6X95+6X95/6E + 1X(6X1,5ST)+UELKON | | 5DM1*** | 13.4 | 80.2 | 84.2 | 11900 | 8550 | 0.21 | 0.7 | 0.33 | 205 | 13.59 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# SUPROMONT (N)3GHSSYCY 6 kV – 30 kV

## Rubber insulated MV flexible cables for underground use

### Application

As feeder cable for power supply of shiftable MV equipment, e.g. compressure resistant transformers, for underground mining applications as well as for tunnel sites.

### Global data

| | |
|---|---|
| Brand | SUPROMONT |
| Type designation | (N)3GHSSYCY |
| Standard | based on DIN VDE 0250 part 605 |
| Certifications / Approvals | VDE certificate of conformity |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individually laid-up concentrically around each main core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer semiconductive layer of semiconductive rubber, for 6kV outer semiconductive layer only |
| Core identification | Main cores: Natural color with black semiconductive layer, Control cores: Black with white digits |
| Core arrangement | Three main cores laid-up, one control core in each outer interstice |
| Inner sheath | PVC based plastic compound, type: DMV6 |
| Monitoring conductor | Conductive tape and overall concentric copper wire spinning |
| Intermediate sheath | PVC based plastic compound, type: DMV6 |
| Armouring | Braid of galvanized steel wires |
| Outer sheath | PVC-based thermoplastic compound, type: DMV6, Color: Red |

### Electrical parameters

| | | | | | | |
|---|---|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV | 14/25 kV | 18/30 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV | 17.3/30 kV | 20.8/36 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV | 22.5/45 kV | 27/54 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV | 29 kV | | 43 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Weather resistance | Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min 5 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## SUPROMONT (N)3GHSSYCY 3.6/6 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20161631 | 5DM2031 | 6.4 | 42.7 | 45.7 | 3180 | 1125 | 0.78 | 0.36 | 0.32 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20112385 | 5DM2032 | 7.6 | 45.3 | 48.3 | 3700 | 1575 | 0.554 | 0.41 | 0.3 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20042591 | 5DM2033 | 9.1 | 49.5 | 53.5 | 4730 | 2250 | 0.386 | 0.47 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20203072 | 5DM2034 | 10.8 | 53.2 | 57.2 | 5720 | 3150 | 0.272 | 0.53 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20049961 | 5DM2035 | 12.7 | 58.2 | 62.2 | 7010 | 4275 | 0.206 | 0.61 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20203073 | 5DM2036 | 14.3 | 62.7 | 66.7 | 8311 | 5400 | 0.161 | 0.67 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 16 | 67.6 | 71.6 | 9634 | 6750 | 0.129 | 0.74 | 0.25 | 404 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 71.7 | 75.7 | 11202 | 8325 | 0.106 | 0.8 | 0.25 | 461 | 26.46 |

## SUPROMONT (N)3GHSSYCY 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20156248 | 5DM2121 | 6.4 | 45.7 | 48.7 | 3580 | 1125 | 0.78 | 0.32 | 0.33 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20005081 | 5DM2122 | 7.6 | 47.8 | 50.8 | 4130 | 1575 | 0.554 | 0.36 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20005082 | 5DM2123 | 9.1 | 50.8 | 54.8 | 4890 | 2250 | 0.386 | 0.42 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20133422 | 5DM2124 | 10.8 | 55.1 | 59.1 | 5680 | 3150 | 0.272 | 0.47 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20005083 | 5DM2125 | 12.7 | 60 | 64 | 7130 | 4275 | 0.206 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20005084 | 5DM2126 | 14.3 | 63.9 | 67.9 | 8450 | 5400 | 0.161 | 0.59 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20275552 | 5DM2*** | 16 | 68.9 | 72.9 | 9840 | 6750 | 0.129 | 0.66 | 0.25 | 404 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 73 | 77 | 11408 | 8325 | 0.106 | 0.74 | 0.25 | 461 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSYCY 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | | 5DM2131 | 6.4 | 49.1 | 53.1 | 3985 | 1125 | 0.78 | 0.22 | 0.36 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | | 5DM2132 | 7.6 | 50.4 | 54.4 | 4481 | 1575 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20194633 | 5DM2133 | 9.1 | 53.9 | 57.9 | 5300 | 2250 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20227835 | 5DM2134 | 10.8 | 57.6 | 61.6 | 6380 | 3150 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | | 5DM2135 | 12.7 | 63.1 | 67.1 | 7652 | 4275 | 0.206 | 0.43 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20181158 | 5DM2136 | 14.3 | 67.4 | 71.4 | 8940 | 5400 | 0.161 | 0.47 | 0.28 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20269302 | 5DM2*** | 16 | 72 | 76 | 10400 | 6750 | 0.129 | 0.54 | 0.27 | 428 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 75.6 | 79.6 | 11865 | 8325 | 0.106 | 0.58 | 0.26 | 488 | 26.46 |

## SUPROMONT (N)3GHSSYCY 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20137435 | 5DM2211 | 6.4 | 52.6 | 56.6 | 3900 | 1575 | 0.554 | 0.2 | 0.37 | 172 | 5.01 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20015843 | 5DM2212 | 7.6 | 53.6 | 57.6 | 5090 | 1125 | 0.7839 | 0.25 | 0.35 | 139 | 3.58 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20007713 | 5DM2213 | 9.1 | 56.8 | 60.8 | 5730 | 2250 | 0.386 | 0.28 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20217439 | 5DM2214 | 10.8 | 61 | 65 | 6840 | 3150 | 0.272 | 0.32 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20111613 | 5DM2215 | 12.7 | 66 | 70 | 8080 | 4275 | 0.206 | 0.36 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20113362 | 5DM2216 | 14.3 | 69.9 | 73.9 | 9650 | 5400 | 0.161 | 0.39 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20135152 | 5DM2*** | 16 | 71 | 75 | 10932 | 6750 | 0.129 | 0.43 | 0.28 | 428 | 21.45 |
| 3x185+3x120/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 78.7 | 82.7 | 12417 | 8325 | 0.106 | 0.47 | 0.27 | 488 | 26.46 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSYCY 14/25 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x35+3x16/3E + 3x2,5ST+UEL | | 5DM2 | 7.6 | 57.6 | 61.6 | 5502 | 1575 | 0.554 | 0.21 | 0.37 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20292042 | 5DM2 | 9.1 | 61.4 | 65.4 | 6517 | 2250 | 0.386 | 0.24 | 0.35 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | | 5DM2 | 10.8 | 65 | 69 | 7526 | 3150 | 0.272 | 0.27 | 0.33 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | | 5DM2 | 12.7 | 70 | 73.9 | 8790 | 4275 | 0.206 | 0.3 | 0.32 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 14.3 | 73.9 | 77.8 | 10137 | 5400 | 0.161 | 0.33 | 0.3 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | | 5DM2 | 16 | 78.9 | 82.8 | 11679 | 6750 | 0.129 | 0.36 | 0.29 | 428 | 21.45 |
| 3x185+3x95/3E + 3x2,5ST+UEL | | 5DM2 | 17.7 | 82.5 | 86.4 | 13095 | 8325 | 0.106 | 0.39 | 0.29 | 488 | 26.46 |

## SUPROMONT (N)3GHSSYCY 18/30 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x50+3x25/3E + 3x2,5ST+UEL | 5DM2 | 9.1 | 67.4 | 71.4 | 7487 | 2250 | 0.386 | 0.2 | 0.37 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 5DM2 | 10.8 | 71.1 | 75.1 | 8549 | 3150 | 0.272 | 0.22 | 0.35 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 5DM2 | 12.7 | 76.5 | 80.4 | 10091 | 4275 | 0.206 | 0.25 | 0.34 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 5DM2 | 14.3 | 79.9 | 83.8 | 11268 | 5400 | 0.161 | 0.27 | 0.33 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 5DM2 | 16 | 84.4 | 89.3 | 12887 | 6750 | 0.129 | 0.29 | 0.31 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# SUPROMONT (N)3GHSSHCH 6 kV – 20 kV

## Halogen-free rubber insulated MV flexible cables for underground use

### Application

As feeder cable for power supply of shiftable MV equipment, e.g. compressure resistant transformers, for underground mining applications as well as for tunnel sites.

### Global data

| | |
|---|---|
| Brand | SUPROMONT |
| Type designation | (N)3GHSSHCH |
| Standard | based on DIN VDE 0250 part 605 |
| Certifications / Approvals | VDE certificate of conformity |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individually laid-up concentrically around each main core |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3 |
| Electrical field control | Inner and outer semiconductive layer of semiconductive rubber, for 6kV outer semiconductive layer only |
| Core identification | Main cores: Natural color with black semiconductive layer, Control cores: Black with white digits |
| Core arrangement | Three main cores laid-up, one control core in each outer interstice |
| Inner sheath | Thermoplastic compound, type: HM4 |
| Monitoring conductor | Conductive tape and overall concentric copper wire spinning |
| Intermediate sheath | Thermoplastic compound, type: HM4 |
| Armouring | Braid of galvanized steel wires |
| Outer sheath | Thermoplastic compound, type: HM4, Color: Red |

### Electrical parameters

| | | | | |
|---|---|---|---|---|
| Rated voltage | 3.6/6 kV | 6/10 kV | 8.7/15 kV | 12/20 kV |
| Max. permissible operating voltage AC | 4.2/7.2 kV | 6,9/12 kV | 10.4/18 kV | 13.9/24 kV |
| Max. permissible operating voltage DC | 5.4/10.8 kV | 9/18 kV | 13.5/27 kV | 18/36 kV |
| AC test voltage | 11 kV | 17 kV | 24 kV | 29 kV |
| AC test voltage - control cores | 2 kV | 2 kV | 2 kV | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Weather resistance | Unrestricted use indoors and in underground mines according to DIN VDE 0118, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min 5 °C ; max +80 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## SUPROMONT (N)3GHSSHCH 3.6/6 kV

| Number of cores x cross section | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 5DM2*** | 6.4 | 42.7 | 45.7 | 3178 | 1125 | 0.78 | 0.36 | 0.32 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 5DM2*** | 7.6 | 45.3 | 48.3 | 3696 | 1575 | 0.554 | 0.41 | 0.3 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 5DM2*** | 9.1 | 48.5 | 52.5 | 4508 | 2250 | 0.386 | 0.47 | 0.29 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 5DM2*** | 10.8 | 52.1 | 56.1 | 5437 | 3150 | 0.272 | 0.53 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 5DM2*** | 12.7 | 56.6 | 60.6 | 6638 | 4275 | 0.206 | 0.61 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 5DM2*** | 14.3 | 60.5 | 64.5 | 7953 | 5400 | 0.161 | 0.67 | 0.26 | 352 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 5DM2*** | 16.1 | 65 | 71 | 9150 | 6750 | 0.129 | 0.74 | 0.25 | 404 | 21.45 |

## SUPROMONT (N)3GHSSHCH 6/10 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | | 5DM2*** | 6.4 | 44.7 | 48.7 | 3586 | 1125 | 0.78 | 0.32 | 0.33 | 131 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20148151 | 5DM2*** | 7.6 | 48.7 | 51.7 | 4020 | 1575 | 0.554 | 0.36 | 0.31 | 162 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20067203 | 5DM2233 | 9.1 | 50.7 | 54.7 | 4840 | 2250 | 0.386 | 0.42 | 0.3 | 202 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | | 5DM2*** | 10.8 | 55.1 | 59.1 | 5680 | 3150 | 0.272 | 0.47 | 0.28 | 250 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20067204 | 5DM2235 | 12.7 | 59.5 | 63.5 | 7090 | 4275 | 0.206 | 0.54 | 0.27 | 301 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20275531 | 5DM2*** | 14.3 | 63.9 | 67.9 | 8460 | 5400 | 0.161 | 0.59 | 0.26 | 352 | 17.16 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

## SUPROMONT (N)3GHSSHCH 8.7/15 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x16/3E + 3x2,5ST+UEL | 20204583 | 5DM2*** | 6.4 | 49.1 | 53.1 | 3985 | 1125 | 0.78 | 0.26 | 0.35 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20149013 | 5DM2*** | 7.6 | 52.1 | 56.1 | 4636 | 1575 | 0.554 | 0.29 | 0.33 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | | 5DM2*** | 9.1 | 53.9 | 57.9 | 5410 | 2250 | 0.386 | 0.33 | 0.31 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20227836 | 5DM2*** | 10.8 | 57.6 | 61.6 | 6200 | 3150 | 0.272 | 0.38 | 0.3 | 265 | 10.01 |
| 3x95+3x95/3E + 3x2,5ST+UEL | 20204584 | 5DM2*** | 12.7 | 63.6 | 67.6 | 7660 | 4275 | 0.206 | 0.43 | 0.29 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | | 5DM2*** | 14.3 | 67 | 71 | 8991 | 5400 | 0.161 | 0.47 | 0.28 | 371 | 17.16 |

## SUPROMONT (N)3GHSSHCH 12/20 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x25+3x25/3E + 3x2,5ST+UEL | | 5DM2*** | 6.4 | 52.6 | 56.6 | 4501 | 1125 | 0.78 | 0.22 | 0.37 | 139 | 3.58 |
| 3x35+3x16/3E + 3x2,5ST+UEL | 20112422 | 5DM2242 | 7.6 | 53.6 | 57.6 | 4850 | 1575 | 0.554 | 0.25 | 0.35 | 172 | 5.01 |
| 3x50+3x25/3E + 3x2,5ST+UEL | 20060690 | 5DM2243 | 9.1 | 56.8 | 60.8 | 5630 | 2250 | 0.385 | 0.28 | 0.33 | 215 | 7.15 |
| 3x70+3x35/3E + 3x2,5ST+UEL | 20112425 | 5DM2244 | 10.8 | 61 | 65 | 6740 | 3150 | 0.272 | 0.32 | 0.31 | 265 | 10.01 |
| 3x95+3x50/3E + 3x2,5ST+UEL | 20129798 | 5DM2245 | 12.7 | 66 | 70 | 8150 | 4275 | 0.206 | 0.36 | 0.3 | 319 | 13.59 |
| 3x120+3x70/3E + 3x2,5ST+UEL | 20182384 | 5DM2*** | 14.3 | 70.5 | 74.5 | 9502 | 5400 | 0.161 | 0.39 | 0.29 | 371 | 17.16 |
| 3x150+3x70/3E + 3x2,5ST+UEL | 20163741 | 5DM2*** | 16.5 | 76.5 | 80.5 | 10900 | 6750 | 0.129 | 0.44 | 0.28 | 428 | 21.45 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# Notes

# PROTOMONT(MT) (N)SSHOEU 1 kV

## Low Voltage light and flexible rubber cable

### Application

Rubber-sheated flexible cables for mining and tunneling application, under heavy mechanical stress. Suitable for laying alongside conveyor belts and tunnel walls, on material handling equipment, e.g. as connection between upper and lower cars, and on movable equipment. The cables can be used indoor as well as outdoor, in explosion-hazard areas, in industry and in agriculture.
The cables are water resistant up to 10m water depth.
In other respects the specifications of DIN VDE 0298 part 3 applies.

### Global data

| | |
|---|---|
| Brand | PROTOMONT(MT) |
| Type designation | (N)SSHOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | VDE-REG F546 |

### Notes on installation

| | |
|---|---|
| Notes on installation | Max. submersing depth 10m |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| Insulation | PROTOLON, Basic material: EPR, Compound type: Special compound better 3GI3 |
| Core identification | Light gray with black digits |
| Inner sheath | Basic material: EPR, Compound type: Special compound |
| Outer sheath | Basic material: Chlorinated rubber, Compound type: Special compound, 5GM5<br>Colour: yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | 0.6/1 kV (600/1000V) |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 3,5 kV ( 5 Min.) |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Max. permissible water temperature | 40 °C (At higher water temperatures, a shortened cable service life is to be expected) |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 100 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 1x16 | 20265363 | 5.2 | 9.5 | 11.1 | 230 | 240 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 1x25 | 20265364 | 6.4 | 11 | 12.6 | 335 | 375 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 1x35 | 20265365 | 7.5 | 12.3 | 13.9 | 435 | 525 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 1x50 | 20265366 | 9 | 14.5 | 16.5 | 615 | 750 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 1x70 | 20265367 | 11.1 | 16.4 | 18.4 | 830 | 1050 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 1x95 | 20265369 | 12.8 | 18.5 | 20.5 | 1060 | 1425 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 1x120 | 20265370 | 14.5 | 20.4 | 22.4 | 1300 | 1800 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 1x150 | 20265372 | 16.5 | 22.8 | 24.8 | 1600 | 2250 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 1x185 | 20265373 | 17.9 | 24.7 | 27.7 | 2020 | 2775 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 1x240 | 20265374 | 21.2 | 27.6 | 30.6 | 2548 | 3600 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 1x300 | 20265377 | 23.6 | 31.6 | 34.6 | 3200 | 4500 | 0.0641 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 2x1,5 | 20265378 | 1.6 | 9.8 | 11.4 | 150 | 45 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 2x2,5 | 20265379 | 2 | 10.7 | 12.3 | 185 | 75 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 2x4 | | 2.4 | 11.9 | 13.5 | 220 | 120 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| PROTOMONT(MT) (N)SSHOEU-O | | | | | | | | | | | |
| 3x2,5 | 20265395 | 2 | 11.1 | 12.7 | 210 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265396 | 2.4 | 12.1 | 13.7 | 271 | 180 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 3x6 | 20265397 | 2.9 | 13.2 | 14.8 | 350 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 3x10 | 20265398 | 3.9 | 16.1 | 18.1 | 505 | 450 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 3x16 | 20265399 | 5.2 | 19 | 21 | 775 | 720 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 3x25 | 20265400 | 6.4 | 22.9 | 24.9 | 1160 | 1125 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 3x35 | 20265401 | 7.5 | 24.9 | 27.9 | 1550 | 1575 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |
| 3x50 | 20265402 | 9 | 29.4 | 32.4 | 2180 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70 | 20265403 | 11.1 | 34.8 | 37.8 | 3020 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95 | 20265405 | 12.8 | 40.9 | 43.9 | 3810 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120 | 20265406 | 14.4 | 44.7 | 47.7 | 4970 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150 | 20265407 | 16.1 | 50 | 54 | 6290 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185 | 20265408 | 17.9 | 54.6 | 58.6 | 7470 | 8325 | 0.106 | 0.95 | 0.22 | 461 | 26.46 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x1,5 | 20265409 | 1.6 | 10.2 | 11.8 | 170 | 68 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 3x2,5 | 20265410 | 2 | 11.1 | 12.7 | 220 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 3x4 | 20265411 | 2.4 | 12.1 | 13.7 | 290 | 180 | 4.95 | 0.27 | 0.31 | 41 | 0.57 |
| 3x6 | 20265412 | 2.9 | 13.2 | 14.8 | 360 | 270 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 4x1,5 | 20265413 | 1.6 | 11 | 12.6 | 204 | 90 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 4x2,5 | 20265414 | 2 | 12 | 13.6 | 270 | 150 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 4x4 | 20265415 | 2.4 | 13 | 14.6 | 338 | 240 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 4x6 | 20265416 | 2.9 | 14.9 | 16.9 | 450 | 360 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 4x10 | 20265417 | 3.9 | 17.4 | 19.4 | 690 | 600 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 4x16 | 20265418 | 5.2 | 21 | 23 | 980 | 960 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 4x25 | 20265419 | 6.4 | 24.5 | 27.5 | 1490 | 1500 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 4x35 | 20265420 | 7.5 | 28.4 | 31.4 | 1870 | 2100 | 0.554 | 0.52 | 0.25 | 162 | 5.01 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

Continued from previous page.

## PROTOMONT(MT) (N)SSHOEU 0.6/1 kV

| Number of cores x cross section | Part number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4x50 | 20265421 | 9 | 33.6 | 36.6 | 2570 | 3000 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 4x70 | 20265423 | 10.6 | 39.5 | 42.5 | 3920 | 4200 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 4x95 | 20265424 | 12.8 | 44.8 | 47.8 | 5040 | 5700 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 4x120 | 20265425 | 14.4 | 49.8 | 53.8 | 6200 | 7200 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 4x150 | | 16.1 | 54.9 | 58.9 | 7578 | 9000 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 3x50+3x25/3 | 20278765 | 9 | 29.4 | 32.4 | 2350 | 2250 | 0.386 | 0.54 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20268926 | 10.6 | 35.1 | 38.1 | 3220 | 3150 | 0.272 | 0.61 | 0.24 | 250 | 10.01 |
| 3x95/50 | 20220195 | 12.1 | 44.8 | 47.8 | 4400 | 4275 | 0.206 | 0.6 | 0.24 | 301 | 13.59 |
| 3x95+3x50/3 | 20268927 | 12.8 | 40.7 | 43.7 | 4300 | 4275 | 0.206 | 0.64 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20268929 | 14.4 | 44.5 | 47.5 | 5370 | 5400 | 0.161 | 0.72 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20278766 | 16.5 | 51.6 | 55.6 | 6950 | 6750 | 0.129 | 0.72 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20278767 | 17.9 | 54.5 | 58.5 | 8150 | 8325 | 0.106 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20278768 | 20.6 | 62.2 | 66.2 | 10700 | 10800 | 0.08 | 0.76 | 0.23 | 540 | 34.32 |
| 3x300+3x150/3 | 20278769 | 23.4 | 70.3 | 74.3 | 13300 | 13500 | 0.064 | 0.78 | 0.23 | 620 | 42.9 |
| PROTOMONT(MT) (N)SSHOEU-J | | | | | | | | | | | |
| 5x1,5 | 20278770 | 1.6 | 11.9 | 13.5 | 240 | 113 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 5x2,5 | 20278771 | 2 | 12.9 | 14.5 | 310 | 188 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 5x4 | 20268918 | 2.4 | 14.7 | 16.7 | 420 | 300 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 5x6 | 20268919 | 2.9 | 16.1 | 18.1 | 530 | 450 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| 5x10 | 20268772 | 3.9 | 19 | 21 | 795 | 750 | 1.91 | 0.34 | 0.28 | 74 | 1.43 |
| 5x16 | 20268920 | 5.2 | 22.8 | 24.8 | 1180 | 1200 | 1.21 | 0.44 | 0.26 | 99 | 2.29 |
| 5x25 | 20278773 | 6.4 | 28 | 31 | 1880 | 1875 | 0.78 | 0.45 | 0.26 | 131 | 3.58 |
| 5x35 | 20278774 | 7.5 | 34.5 | 37.5 | 2650 | 2625 | 0.554 | 0.46 | 0.25 | 162 | 5.01 |
| PROTOMONT(MT) (N)SSHOEU-O Control cables | | | | | | | | | | | |
| 12x4 | 20278807 | 2.4 | 20.8 | 22.8 | 870 | 720 | 4.95 | 0.27 | 0.3 | 41 | 0.57 |
| 12x6 | 20278808 | 2.9 | 23.4 | 26.4 | 1150 | 1080 | 3.3 | 0.32 | 0.29 | 53 | 0.86 |
| PROTOMONT(MT) (N)SSHOEU-J Control cables | | | | | | | | | | | |
| 7x1,5 | 20278776 | 1.6 | 12.9 | 14.5 | 300 | 158 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 8x1,5 | | 1.6 | 13.8 | 15.4 | 325 | 180 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 10x1,5 | | 1.6 | 15.5 | 17.5 | 400 | 225 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 12x1,5 | 20278777 | 1.6 | 15.8 | 17.8 | 500 | 270 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 14x1,5 | | 1.6 | 16.8 | 18.8 | 495 | 315 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 18x1,5 | 20278778 | 1.6 | 18.5 | 20.5 | 610 | 405 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 19x1,5 | 20278779 | 1.6 | 18.9 | 20.9 | 650 | 428 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 24x1,5 | 20278780 | 1.6 | 20 | 22 | 800 | 540 | 13.3 | 0.21 | 0.33 | 23 | 0.18 |
| 7x2,5 | 20278801 | 2 | 14.9 | 16.9 | 450 | 263 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 8x2,5 | 20278802 | 2 | 15.8 | 17.8 | 480 | 300 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 10x2,5 | | 2 | 16.4 | 18.4 | 500 | 375 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 12x2,5 | 20278803 | 2 | 18 | 20 | 600 | 450 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 15x2,5 | 20278804 | 2 | 20.7 | 22.7 | 780 | 563 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 18x2,5 | 20278805 | 2 | 21.2 | 23.2 | 850 | 675 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 19x2,5 | | 2 | 22.3 | 24.3 | 900 | 713 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 24x2,5 | 20278806 | 2 | 22.8 | 24.8 | 1070 | 900 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |
| 37x2,5 | | 2 | 29 | 31 | 1600 | 1388 | 7.98 | 0.24 | 0.32 | 30 | 0.31 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix
Halogen-free version with 5GM3 outer sheath available on request

# Notes

# PROTOMONT NSSHOEU .../3E 1 kV

## Rubber-sheathed flexible cable with copper core shield


### Application

The cables are suitable for fixed installation and flexible operation as power supply cables to motors, distribution boards, pumps, drilling rigs, etc., for underground mining applications, for tunnel building applications, for open-cast mining applications, for use in quarries and similar applications. Permitted for applications according to DIN VDE 0118.

### Global data

| | |
|---|---|
| Brand | PROTOMONT |
| Type designation | NSSHOEU |
| Standard | DIN VDE 0250-812 |
| Certifications / Approvals | MA – China (special design)<br>MSHA P-189-3<br>BAS Bosnia-Herzegovina<br>TR-Certificate<br>EAC-Certificate |

### Design features

| | |
|---|---|
| Conductor | Bare electrolytic copper, finely stranded (class 5) |
| PE-Conductor | Individual-concentric or overall concentric spinning of untinned copper wires |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Up to 5 cores colored, Core colors: Blue, Brown,Black, Grey, Black |
| Core arrangement | Three, four of five cores laid-up |
| Inner sheath | Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, Basic material: Chlorinated rubber, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage | 3 kV |
| AC test voltage - control cores | 2 kV |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |
| Water resistance | DIN EN 50525-2-21 |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT NSSHOEU .../3E 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROTOMONT NSSHOEU.../3E | | | | | | | | | | | | |
| 3x1,5+3x1,5/3E | 20005094 | 5DM4604 | 1.6 | 12.5 | 14.1 | 280 | 68 | 13.3 | 0.21 | 0.33 | 23 | 0.22 |
| 3x2,5+3x2,5/3E | 20005095 | 5DM4605 | 2 | 13.6 | 15.2 | 340 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4+3x4/3E | 20039860 | 5DM4606 | 2.4 | 16.1 | 18.1 | 480 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6+3x6/3E | 20005096 | 5DM4607 | 2.9 | 17.4 | 19.4 | 570 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 3x10+3x10/3E | 20005097 | 5DM4610 | 4 | 20.3 | 22.3 | 820 | 450 | 1.91 | 0.33 | 0.28 | 74 | 1.43 |
| 3x16+3x16/3E | 20005098 | 5DM4612 | 5 | 23.9 | 25.9 | 1180 | 720 | 1.21 | 0.4 | 0.27 | 99 | 2.29 |
| 3x25+3x16/3E | 20040501 | 5DM4613 | 6.4 | 27.7 | 30.7 | 1640 | 1125 | 0.78 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3E | 20039858 | 5DM4614 | 6.5 | 30.1 | 33.1 | 1990 | 1575 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3E | 20008752 | 5DM4615 | 9 | 35.9 | 38.9 | 2840 | 2250 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3E | 20007207 | 5DM4616 | 10.7 | 40.6 | 43.6 | 3780 | 3150 | 0.272 | 0.6 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3E | 20005099 | 5DM4617 | 12.3 | 45.5 | 48.5 | 4880 | 4275 | 0.206 | 0.61 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3E | 20015058 | 5DM4618 | 14.3 | 51.9 | 55.9 | 6340 | 5400 | 0.161 | 0.7 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3E | 20006978 | 5DM4620 | 16 | 56.2 | 60.2 | 7500 | 6750 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3E | 20006979 | 5DM4627 | 17.7 | 62.8 | 66.8 | 9300 | 8325 | 0.106 | 0.7 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3E | 20006980 | 5DM4628 | 20.3 | 69.6 | 73.6 | 11790 | 10800 | 0.08 | 0.71 | 0.22 | 540 | 34.32 |
| PROTOMONT NSSHOEU.../3E+ST | | | | | | | | | | | | |
| 3x2,5 + 3x2,5/3E + 3x1,5ST | 20005100 | 5DM4624 | 2 | 17.1 | 19.1 | 510 | 113 | 7.98 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4+3x4/3E +3x1,5ST | 20025110 | 5DM4626 | 2.4 | 17.8 | 19.8 | 580 | 180 | 4.95 | 0.26 | 0.31 | 41 | 0.57 |
| 3x6+3x6/3E +3x1,5ST | 20005101 | 5DM4630 | 2.9 | 18.4 | 20.4 | 640 | 270 | 3.3 | 0.3 | 0.29 | 53 | 0.86 |
| 3x10 + 3x10/3E + 3x2,5ST | 20005102 | 5DM4631 | 4 | 22.1 | 24.1 | 960 | 450 | 1.91 | 0.33 | 0.28 | 74 | 1.43 |
| 3x16 + 3x16/3E + 3x2,5ST | 20005103 | 5DM4632 | 5 | 23.9 | 25.9 | 1250 | 720 | 1.21 | 0.4 | 0.27 | 99 | 2.29 |
| 3x25 + 3x16/3E + 3x2,5ST | 20005104 | 5DM4633 | 6.4 | 27.7 | 30.7 | 1690 | 1125 | 0.78 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35 + 3x16/3E + 3x2,5ST | 20005105 | 5DM4634 | 7.5 | 30.1 | 33.1 | 2040 | 1575 | 0.554 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50 + 3x25/3E + 3x2,5ST | 20005106 | 5DM4635 | 9 | 35.9 | 38.9 | 2890 | 2250 | 0.386 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70 + 3x35/3E + 3x2,5ST | 20005107 | 5DM4636 | 10.7 | 40.6 | 43.6 | 3870 | 3150 | 0.272 | 0.6 | 0.24 | 250 | 10.01 |
| 3x95 + 3x50/3E + 3x2,5ST | 20005108 | 5DM4637 | 12.3 | 45.5 | 48.5 | 4970 | 4275 | 0.206 | 0.61 | 0.24 | 301 | 13.59 |
| 3x120 + 3x70/3E + 3x2,5ST | 20005109 | 5DM4638 | 14.3 | 51.9 | 55.9 | 6430 | 5400 | 0.161 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150 + 3x70/3E + 3x2,5ST | 20060692 | 5DM4642 | 16 | 56.2 | 60.2 | 7330 | 6750 | 0.129 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185 + 3x95/3E + 3x2,5ST | 20007785 | 5DM4644 | 17.7 | 62.8 | 66.8 | 9390 | 8325 | 0.106 | 0.7 | 0.23 | 461 | 26.46 |
| 3x240 + 3x120/3E + 3x2,5ST | 20100480 | 5DM4651 | 20.3 | 69.6 | 73.6 | 11810 | 10800 | 0.08 | 0.71 | 0.22 | 540 | 34.32 |
| PROTOMONT NSSHOEU.../KON | | | | | | | | | | | | |
| 3x1,5/1,5KON | 20161197 | 5DL2404 | 1.6 | 12.4 | 14 | 270 | 68 | 13.7 | 0.21 | 0.33 | 23 | 0.22 |
| 3x2,5/2,5KON | 20004908 | 5DL2405 | 1.9 | 13.7 | 15.3 | 350 | 113 | 8.21 | 0.24 | 0.32 | 30 | 0.36 |
| 3x4/4KON | | | 2.4 | 16.1 | 18.1 | 450 | 180 | 5.09 | 0.27 | 0.3 | 41 | 0.57 |
| 4x6/6KON | 20198030 | 5DL2507 | 2.9 | 18.8 | 20.8 | 645 | 360 | 3.39 | 0.32 | 0.29 | 53 | 0.86 |
| 4x10/10KON | 20168272 | 5DL2508 | 4.8 | 23.1 | 25.1 | 1010 | 600 | 1.95 | 0.34 | 0.28 | 74 | 1.43 |
| 4x16/16KON | | | 5.7 | 27.1 | 30.1 | 1520 | 960 | 1.24 | 0.44 | 0.26 | 99 | 2.29 |
| 5x2,5/2,5KON | 20004909 | 5DL2605 | 1.9 | 16.4 | 18.4 | 490 | 188 | 8.21 | 0.24 | 0.32 | 30 | 0.36 |
| 5x4/4KON | 20004910 | 5DL2606 | 2.4 | 18.2 | 20.2 | 620 | 300 | 5.09 | 0.27 | 0.3 | 41 | 0.57 |
| 5x6/6KON | 20024743 | 5DL2607 | 2.9 | 21.3 | 23.3 | 850 | 450 | 3.39 | 0.32 | 0.29 | 53 | 0.86 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# PROTOMONT EMV-FC (N)SSHCOEU 1 kV

## Cables for Variable Frequency Converter

### Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining industry, on construction sites and similar applications, with heavy mechanical stresses. For laying on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car). Can be applied in water up to 40°C, approximately up to 10 m depth.

### Global data

| | |
|---|---|
| Brand | PROTOMONT EMV-FC |
| Type designation | (N)SSHCOEU |
| Standard | Based on DIN VDE 0250 part 812 |
| Certifications / Approvals | MSHA P-189-3<br>EAC Certificate |

### Design features

| | |
|---|---|
| Conductor | Finely stranded copper conductor, tinned (class 5) according to DIN EN 60228 |
| Insulation | PROTOLON, Basic material: EPR, Compound type: 3GI3 |
| Core identification | Natural coloring with black figures |
| Core arrangement | Three power cores laid up with the protective earth conductors split into three in the outer interstices |
| Screen | EMC optimized, concentric braid of tinned copper wires |
| Inner sheath | Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B |
| Outer sheath | PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Yellow |

### Electrical parameters

| | |
|---|---|
| Rated voltage | Uo/U = 0,6/1 kV, also permitted for Uo/U = 640/1140V |
| Max. permissible operating voltage AC | 0.7/1.2 kV |
| Max. permissible operating voltage DC | 0.9/1.8 kV |
| AC test voltage - main cores | 5 kV ( 5 Min.) |

### Chemical parameters

| | |
|---|---|
| Performance against fire | IEC 60332-1-2 |
| Resistance to oil | IEC 60811-404 |
| Weather resistance | Unrestricted use outdoors and indoors, resistant to ozone and moisture |

### Thermal parameters

| | |
|---|---|
| Max. operating temperature of the conductor | 90 °C |
| Max. short circuit temperature of the conductor | 250 °C |
| Ambient temperature for fixed installation | min -40 °C ; max +80 °C |
| Ambient temperature in fully flexible operation | min -25 °C ; max +60 °C |

### Mechanical parameters

| | |
|---|---|
| Max. tensile load on the conductor | 15 N/mm² |
| Torsional stress +/- | 25 °/m |
| Bending radii min. | Acc. to DIN VDE 0298 part 3 |

## PROTOMONT EMV-FC (N)SSHCOEU 0.6/1 kV

| Number of cores x cross section | Part number | MLFB Number | Conductor diameter max. mm | Outer diameter min. mm | Outer diameter max. mm | Weight (approx.) kg/km | Permissible tensile force max. N | Conductor resistance at 20°C max. Ω/km | Nominal operating capacitance µF/km | Inductance nom. mH/km | Current carrying capacity (1) A | Short Circuit Current (conductor) kA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3x16+3x2,5 | 20004904 | 5DL2108 | 5.4 | 24.4 | 27.4 | 1190 | 720 | 1.24 | 0.42 | 0.26 | 99 | 2.29 |
| 3x25+3x4 | 20016716 | 5DL2107 | 6.3 | 28.2 | 31.2 | 1680 | 1125 | 0.795 | 0.42 | 0.26 | 131 | 3.58 |
| 3x35+3x16/3 | 20004903 | 5DL2106 | 7.5 | 30.5 | 33.5 | 2000 | 1575 | 0.565 | 0.49 | 0.25 | 162 | 5.01 |
| 3x50+3x25/3 | 20004902 | 5DL2105 | 8.9 | 36 | 39 | 2820 | 2250 | 0.393 | 0.51 | 0.25 | 202 | 7.15 |
| 3x70+3x35/3 | 20004901 | 5DL2104 | 10.6 | 41.2 | 44.2 | 3800 | 3150 | 0.277 | 0.59 | 0.24 | 250 | 10.01 |
| 3x95+3x50/3 | 20004900 | 5DL2103 | 12.1 | 45.7 | 48.7 | 4760 | 4275 | 0.21 | 0.6 | 0.24 | 301 | 13.59 |
| 3x120+3x70/3 | 20001453 | 5DL2100 | 14.1 | 48.7 | 52.7 | 5890 | 5400 | 0.164 | 0.69 | 0.23 | 352 | 17.16 |
| 3x150+3x70/3 | 20004899 | 5DL2101 | 16 | 55.7 | 59.7 | 7230 | 6750 | 0.132 | 0.7 | 0.23 | 404 | 21.45 |
| 3x185+3x95/3 | 20004905 | 5DL2109 | 17.8 | 60.4 | 64.4 | 8640 | 8325 | 0.108 | 0.71 | 0.23 | 461 | 26.46 |
| 3x240+3x120/3 | 20008903 | 5DL2102 | 20.2 | 68.2 | 72.2 | 11100 | 10800 | 0.0817 | 0.73 | 0.23 | 540 | 34.32 |

(1) Nominal current carrying capacity for rubber cables laid on a surface, at 30°C ambient temperature (see also VDE 0298-4, Table 15). For derating-factors see tables in Technical Appendix

# Technical appendix

# Type designation

The type designates a group of flexible cables which have the same design features and which are intended for a specific range of technical applications. The type designation is a letter combination in conformity with DIN VDE, which describes the type in coded form.

The German characters “Ö” and “Ü” are transformed into the international “OE” and “UE”, respectively.

| Type designation | Description |
|---|---|
| NSHTOEU | LHD cables for scoop operations: Tough rubber-sheathed 1 kV flexible reeling cable – CORDAFLEX (S), TENAX LK, PROTOMONT (S). |
| R-(N)TSCGEWOEU | Medium-voltage reeling cable, 6 to 30 kV – PROTOLON (M). |
| F-(N)TSCGEWOEU | Medium-voltage flexible cable, 6 to 30 kV – PROTOLON (M). |
| NTSCGEWOEU | Trailing cables, 3 to 35 kV – PROTOLON and TENAX. |
| (N)SHOEU | Heavy tough rubber-sheathed flexible cable, 1 kV, for applications in open-cast mining, PROTOMONT (M). |
| NSSHOEU | Heavy tough rubber-sheathed flexible cable, 1 kV, for applications in underground mining – PROTOMONT. |
| NSSHCGEOEU | Coal cutter cables for underground mining applications – PROTOMONT(Z), PROTOMONT(V) and TENAX CTE. |
| NTMCGCWOEU/NTMCWOEU | Trailing cables of single-sheath design for medium mechanical stresses. |
| (N)3GHSSYCY | EPR-insulated medium-voltage cables for fixed installation – SUPROMONT. |
| 2YSLGCGOEU | Data, signal and control cable for mining installations – PROTOMONT MSR Mining. |

| The type designation can be deciphered as follows: | |
|---|---|
| ..C.. | Conducting metal casing over the stranded cores or between the inner and outer sheath (shield) |
| (C) | Additional information about the shield for the conductor cross-sections, e.g.:<br>12 x 1 (C) which means 1 mm² individually shielded or<br>6 x (2 x 1) C which means 2 x 1 mm² twisted and shielded pairs |
| ..CE.. | Conducting metal casing over the insulation of the outer conductors |
| ..CG.. | Conducting non-metal casing over the stranded cores or between the inner and outer sheath (shield) |
| ..CGE.. | Conducting non-metal casing over the insulation of the outer conductors |
| F- | Definition of the application: Fixed installation, as supplement to the type designation |
| FM | Telecommunication lines within the cable |
| G | High-voltage (HV) |
| -J | Additional information about the type: With green/yellow marked core |
| ...K... | Rubber cradle separator in the centre of the cables |
| KON | Concentric protective conductor between the inner and outer sheath or concentric control/monitoring conductor |
| L... | Lightweight cable design |
| LWL | Fibre-optic (FO) |
| (M) | Appendix to trademark, "M = Mining" |
| N | Design according to the corresponding standard |
| (N) | Based on standard |
| -O | Additional information about the type – without green/yellow marked core |
| Ö* | Oil-resistant outer sheath (according to DIN VDE 0473, Part -2-1, Para. 10) (OE) |
| R- | Definition of application: Reeling, as appendix to the type designation |
| (SB) | Appendix to trademark: Trailing operation |
| ..SH.. | Heavy tough rubber-sheathed flexible mining-type cable (Rough handling) |
| ...SHT... | 1 kV reeling cable |
| ..SL.. | Control cable |
| ST | Control cores within the cables |
| (ST) | Appendix to trademark to denote water compatibility (submersible pump units) |
| ..T.. | Support element |
| ..TM.. | Trailing cable for medium mechanical stresses |
| ..TS.. | Trailing cables |
| U | Flame-retardant outer sheath (according to EN 60332-1-2) |
| ÜL* | Monitoring conductor within the cable (UEL) |
| (V) | Appendix to trademark for coal cutter cables (V = reinforced) |
| ..W.. | Weather resistant |
| Y | PVC compound |
| (Z) | Appendix to trademark for coal cutter cables (Z=tensile strength optimized) |
| 2Y... | Definition of the insulation material (2Y = PE) |
| /3 | Protective-earth conductor uniformly distributed in the three interstices |
| /3E | Protective-earth conductor uniformly distributed over the insulation of the outer conductor |
| ..3G.. | Definition of the insulating material (3G = EPR) |
| | |
| | |
| | |

*The German characters "Ö" and "Ü" are transformed into the international "OE" and "UE", respectively.

# Approvals/Standards

Flexible electric cables for mining applications have to be able to cope with the expected operation and installation conditions. Details are given in the application and installation guidelines. In addition, flexible electric cables for mining applications are described with regard to designs and tests as laid down in national and international standards (design regulations).

## Application and installation guidelines

- **DIN VDE 0298, Part 3**
  Application of cables and flexible cords in power installations – General information on cables
- **DIN VDE 0298, Part 4**
  Application of cables and flexible cords in power installations – Recommended values for current-carrying capacity of cables
- **DIN VDE 0101**
  Erection of power installations with rated voltages above 1 kV
- **DIN VDE 0118**
  Specification for the erection of electrical installations in underground mines
- **DIN VDE 0168**
  Specification for the erection of electrical installations in open-cast mines, quarries and similar works
- **IEC 621**
  Electrical installations for outdoor sites under heavy conditions (incl. open-cast mines and quarries)

## Design regulations

The summary in the following table shows all the design regulations/standards, according to which the electric cables for mining applications are designed and manufactured.

The following distinctions are made between national and international regulations:

## National standard

- **DIN VDE**
  DIN = German Standards Institute
  VDE = Association of German Electrical Engineers

Germany is one of a few countries which has issued special design regulations for flexible electric cables for mining applications. The 1 kV tough rubber-sheathed flexible reeling cables NSHTOEU, the trailing cables NTS..WOEU and the rubber-sheathed flexible cables NSSHOEU are described and standardised in DIN VDE 0250. This set of standards has found recognition in Europe and in many countries outside Europe and is accepted as or specified as “state-of-the-art”.

No such design regulations exist for the MSR Mining and OPTOFLEX cables. These are Prysmian Group special cables, the design of which is based on existing design regulations or general regulations of DIN VDE.

## International standard

For use on an international level, some design features of flexible electric cables for mining applications covered by DIN VDE are also listed or certified.

- **MSHA**
  Mine Safety and Health Administration, USA
- **MA China**
  Chinese mining approval
- **WUG**
  Approval of the Polish Mining Inspectorate, necessary for use of cables in Polish mines
- **BAS certificate**
  Approval of the Institute for standardization of Bosnia and Herzegovina
- **EAC certificate**
  Safety regulation for LV-cables in Russia, Belarus, Kazakhstan
- **Fire certificate**
  Russian Mining approval
- **Gost -R**
  Mining approval of Russian Federation for cables > 1 kV
- **Gost -B**
  Mining approval of Republic of Belarus for cables > 1 kV
- **Gost -K**
  Mining approval of Kazakhstan for cables > 1 kV

| Design regulations/standards | | | |
|---|---|---|---|
| Flexible cables | Type | German standard DIN VDE | Certificates/Approvals |
| CORDAFLEX(S) | NSHTOEU | DIN VDE 0250-814 | MSHA P-189-3, EAC certificate |
| FELTOFLEX | NTMCWOEU | DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| OPTOFLEX(M) | – | Based on DIN VDE 0888 and DIN VDE 0168 | – |
| PROTOLON single-core | NTMCGCWOEU | DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(M) single-core | (N)TMCGCWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(M) | F-(N)TSCGEWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(M) | R-(N)TSCGEWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(SB) | NTSCGEWOEU | DIN VDE 0250-813 | Gost -R/-K/-B |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(ST) | NTSCGEWOEU .../3E | DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOLON(ST) | NTSCGEWOEU | DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOMONT | NSSHOEU | DIN VDE 0250-812 | MA – China, MSHA P-189-3, EAC certificate |
| PROTOMONT | NSHXOEU | Based on DIN VDE 0250-812 | – |
| PROTOMONT | NSSHOEU .../3E | DIN VDE 0250-812 | MA-China, MSHA P-189-3, BAS certificate, EAC certificate |
| PROTOMONT festoon | NTSKCGECWOEU | DIN VDE 0250-813 | MA – China, WUG – Poland, BAS certificate, Fire certificate, Gost -R/-B/-K |
| PROTOMONT EMV-FC | (N)SSHCOEU | Based on DIN VDE 0250-812 | MSHA P-189-3, EAC certificate |
| PROTOMONT(M+) | (N)SHOEU | Based on DIN VDE 0250-812 | – |
| PROTOMONT(MSR) | 2YSLGCGOEU | Based on DIN VDE 0250-1 | EAC certificate |
| PROTOMONT(MT) | (N)SSHOEU | Based on DIN VDE 0250-812 | VDE-REG F546 |
| PROTOMONT(V) | NSSHCGEOEU | DIN VDE 0250-812 | MA – China, MSHA P-07-KA140034-MSHA, BAS-certificate, EAC certificate |
| PROTOMONT(V) | NTSKCGECWOEU | DIN VDE 0250-813 | MA – China, MSHA P-07-KA140034-MSHA, WUG – Poland (6 kV only), Fire certificate, Gost -R/-K/-B |
| PROTOMONT(VO) | (N)TSKCGEWOEU | Based on DIN VDE 0250-813 | MA – China, Gost -R/-K/-B |
| PROTOMONT(S) | (N)SSHCGEOEU | Based on DIN VDE 0250-812 | MA - China, EAC certificate |
| PROTOMONT(Z) | NSSHKCGEOEU | DIN VDE 0250-812 | MA – China, MSHA P-07-KA140034-MSHA, BAS certificate, EAC certificate |
| PROTOMONT TBM | (N)TSCGECWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| PROTOMONT TBM | (N)TSCGECWHXOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| SUPROMONT | (N)3GHSSYCY | Based on DIN VDE 0250-605 | VDE certificate of conformity |
| SUPROMONT | (N)3GHSSHCH | Based on DIN VDE 0250-605 | VDE certificate of conformity |
| TENAX-CTE | NSSHKCGEOEU | DIN VDE 0250-812 | EAC certificate |
| TENAX-HTT | (N)TSCGEWOEU | Based on DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |
| TENAX-LK | NTSKCGEWOEU | DIN VDE 0250-812 | EAC certificate |
| TENAX-LUMEN | (N)TSCGEH3S | Based on DIN VDE 0250-813 | – |
| TENAX-SAS | NTSCGEWOEU | DIN VDE 0250-813 | Fire certificate, Gost -R/-K/-B |

# Colour coding of fibre-optics

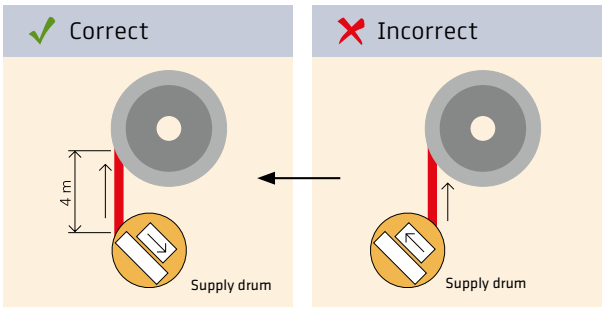
| | No. of fibres | Fibre colours | Buffering tube colours |
|---|---|---|---|
| Monomode design E9/125 µm | 6 x 1E9/125 | OG / BN / WH / RD / BK / **YE** | 6 x nf |
| | 6 x 2E9/125 | OG-PK / BN-PK / WH-PK / RD-PK / BK-PK / **YE**-PK | 6 x nf |
| | 6 x 3E9/125 | BU / OG / GN | **YE** / BK / nf / nf / nf / nf |
| Graded-index fibre design G50/125 µm | 6 x 1G50/125 | OG / **GN** / BN / WH / RD / BK | 6 x nf |
| | 6 x 2G50/125 | OG-PK / **GN**-PK / BN-PK / WH-PK / RD-PK / BK-PK | 6 x nf |
| | 6 x 3G50/125 | BU / OG / GN | **GN** / BK / nf / nf / nf / nf |
| Graded-index fibre design G62.5/125 µm | 6 x 1G62.5/125 | **BU** / OG / BN / WH / RD / BK | 6 x nf |
| | 6 x 2G62.5/125 | **BU**-PK / OG-PK / BN-PK / WH-PK / RD-PK / BK-PK | 6 x nf |
| | 6 x 3G62.5/125 | BU / OG / GN | **BU** / BK / nf / nf / nf / nf |

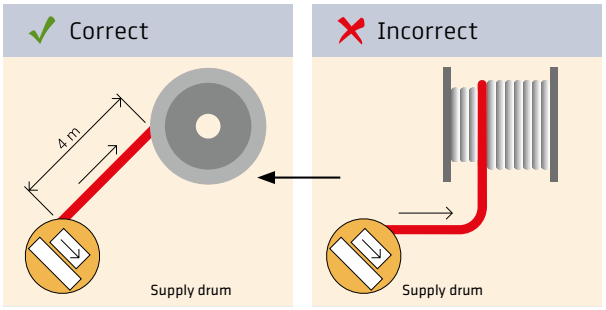
**Bold-faced** colour codings are indices relative to the fibre type.

| Colour code | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BU | OG | GN | BN | WH | RD | BK | YE | VI | PK | TQ | CY | nf |
| Blue | Orange | Green | Brown | White | Red | Black | Yellow | Violet | Pink | Turquoise | Cyan | natural colouring |

# Installation and handling

## Reeling cables




### Winding from supply drum to the operation drum:

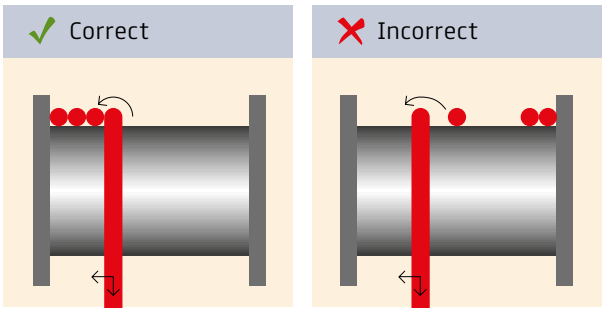
- Supply drum in parallel position to the operation drum
- Min. 4 m between two bendings
- Use operation guiding system to wind the cable on the operation drum
- No S-bendings
- No torsion
- Watch the max. tensile load during the rewinding process

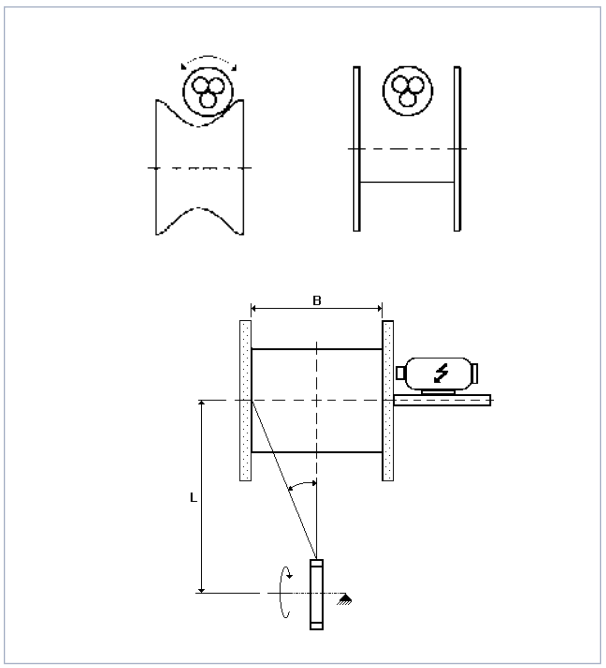



**Note!** Never draw the cable over the flange "head over heels", because this would cause 360° torsion with each loop.

Start winding on cylindrical reels:

- Power cables
  – first loop (winding) at the left flange
- Control cables
  – first loop (winding) at the right flange




### During operation

- Tensile load – the max. tensile load is given in the corresponding cable data sheet
- Bending radii – see table below
- Torsional stress – may be caused by transversal moving in the sheaves or by misaligned guiding systems

| Minimum permissible bending radii (for cable $D_L$ > 20 mm) | |
|---|---|
| Fixed installation | 6 x $D_L$ |
| Fully flexible operation | 10 x $D_L$ |
| Entry e.g. at a centre feeding point | 10 x $D_L$ |
| Forced guidance with reeling operation | 12 x $D_L$ |
| Forced guidance with sheaves | 15 x $D_L$ |

$D_L$ = cable diameter

## Opencast trailing cables

### Transportation on site

- Either on the original supply drum or by using a transportation container or on a truck platform
- By using a transport container or the truck platform the cable has to be inserted in “8-shapes”

### Cable handling on site

- Pulling out of the transportation container and laying on the ground only manually
- Do not drag the cable over the flange when removing from the drum, because this would cause 360 ° torsion with each loop
- Do not undercut the minimum bending radius
- No torsion
- Do not kink the cable
- Watch the max. tensile load during the whole installation process
- **Note!** Never draw or drag the cable by using the excavator or hoist equipment

### During operation

- Use a cable strain relief to fix the cable at the top of the pole
- Use a pulling bow for moving the cable over the ground
- Do not exceed the maximum tensile forces during pulling the cable over ground

### Guidelines for a long lifetime of trailing cables

- Periodical control of the cable with respect to damages, squeezing and crushing
- Damages in the outer sheath should be repaired immediately by using a self-vulcanizing tape in order to avoid moisture penetration into the cable
- Avoid high tensile forces to the cable
- Avoid kinking and twisting the cable

## Underground mining cables

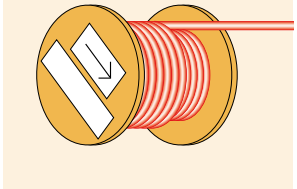
### Transportation to the underground face

- Either on the original supply drum or by using a transportation container
- By using a transport container the cable has to be inserted in “8-shapes”

### Cable handling in the longwall face

- Pulling out of the transportation container and taking into the face only manually
- Don’t undercut the minimum bending radius
- No torsion
- Don’t kink the cable
- Watch the max. tensile load during the whole installation process
- **Note!** Never draw or drag the cable by using the face conveyor or a hoist

✓ Correct



### Integration of PROTOMONT (V); (VO) and TENAX CTE into the cable chain (cable handler)

- The cable should have high latitude (mobility) in the chain along the complete length
- The cable should lay uncongested in the chain: means no clamping along the length. 3 mm to 5 mm distance between cable and chain is required
- Don’t use any cable straps to fix the cable at the chain
- The cable should have only one fixing point in the chain; directly behind the machine

### Guidelines for a long lifetime of chain cables

- Tensile force monitoring or shear pin (bolt) should be used to protect the cable against exceeding tensile forces
- The spill plate should be cleaned periodically from coal and rocks in order to guarantee a free trailing of the cable and the cable handler (cable chain)
- Periodical control of the cable with respect to damages, squeezing and crushing
- Damages in the outer sheath should be repaired immediately by using a self-vulcanizing tape in order to avoid moisture penetration into the cable.

# Laying instructions for OPTOFLEX (M) cables

OPTOFLEX(M) fiber-optic cables are designed for the severe operating conditions prevailing in mining applications. However, maintenance of the desired transmission characteristics is also dependent on a number of factors, which must be taken into account for laying and installation.

### Tensile load

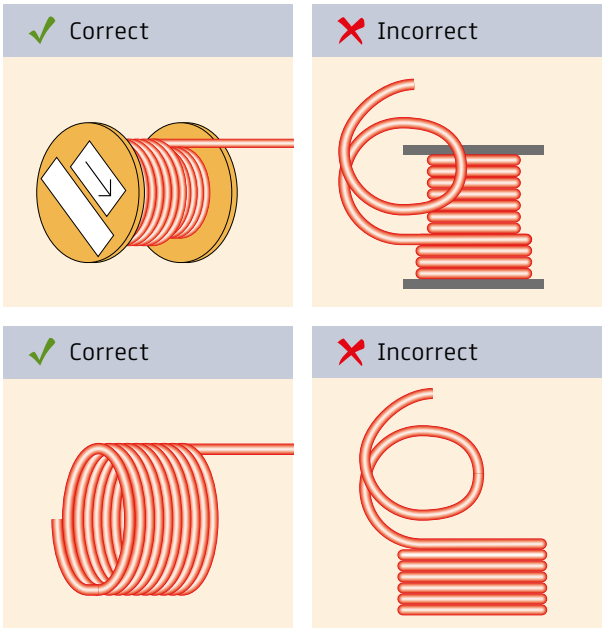
The permissible tensile load of 2000 N may not be exceeded during laying. Special care must be taken, where the cable is supplied in long supply lengths and is pulled off axially from the supply drum. The thereby occuring acceleration forces of the drum must under no circumstances be transmitted through the cable.

### Bending radius

Laying of the cable must be carried out in such a manner that the minimum bending radius of 50 mm is maintained under all circumstances. In particular, on entry into equipment and switchgear cubicles precautions must be taken to ensure that kinking of the cable does not occur.

### Pinching stress

Attention must be paid to ensure that, when the cable is fastened by means of cable clips, cable binding bands, etc., the permissible transverse pressure forces are not exceeded. In the course of appropriate pinching stress tests a limit value of 300 N/cm was determined, up to which value no increase in attenuation was detected.




### Torsional stress

On laying OPTOFLEX cables, care must be taken to ensure that impermissible torsional stresses are not applied to the cables. Under no circumstances may the cable be drawn from the ring or the drum "head over heels", since otherwise a torsion through 360 ° would occur for each turn of the cable.

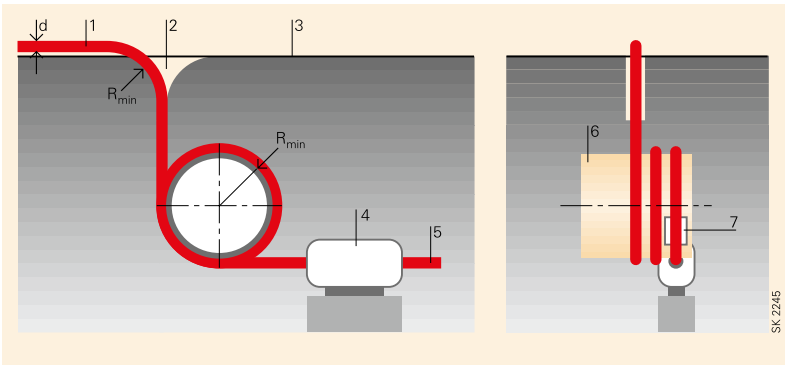
# Centre feeding point

In many installations, e.g. bunkering equipment, the power infeed point is located at the centre of the guideway. The flexible electric reeling cables are normally connected through underfloor infeeds (see picture "Underfloor infeeds").

In order to achieve effective strain relief in conjunction with cable-wear minimising deflection from the infeed point, we recommend the use of underfloor infeeds (see figure). It is important that the specified bending radius is maintained and that the cable is fastened at the compensation cylinder by means of a clip, which, however, should be attached only after the 2nd winding.

Minimum permissible bending radius as a function of the cable diameter:

| Flexible cables | Rated voltage $U_o/U$ | d in mm / $R_{min}$ | | | |
|---|---|---|---|---|---|
| CORDAFLEX / TENAX | Up to 0.6/1 kV | Up to 8 | Above 8 to 12 | Above 12 to 20 | Above 20 |
| | | 3 x d | 4 x d | 5 x d | 5 x d |
| PROTOLON / TENAX | Above 0.6/1 kV | 10 x d | | | |




1. Flexible electric reeling cable
2. Entry bell for infeed
3. Cable tray
4. Cable straight-through joint
5. Buried cable
6. Compensation cylinder
7. Cable clip (large area design)

d = Max. cable diameter

$R_{min}$ = Bending radius of entry bell and bending radius of compensation cylinder

## Determination of the sag on mast mounting

Both in open-cast mines and also in other industrial applications (e.g. construction sites) flexible cables must sometimes be suspended above guideways (see picture below).

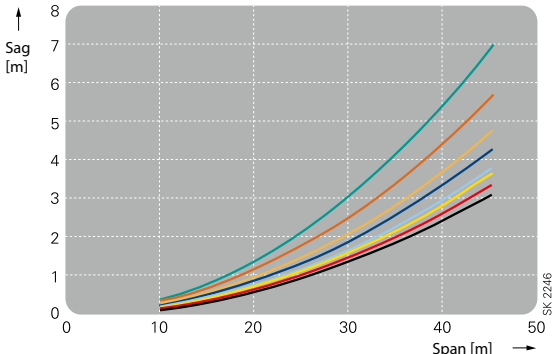



**Fig. 4/11** 3.6/6 kV

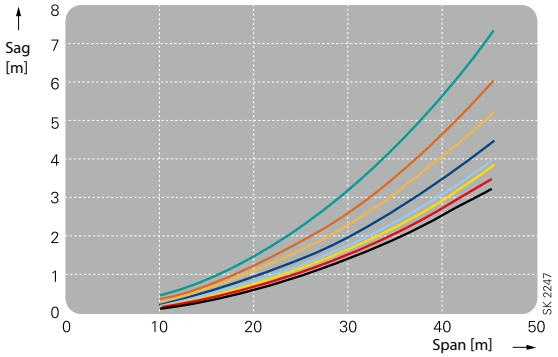



**Fig. 4/12** 6/10 kV

In such cases maintenance of the minimum permissible bending radius at the cable suspension point and of the max. permissible tensile force for each type of cable design must be observed.

For the correct cable installation, the following three diagrams are provided, which depict the sag as a function of the span. In case of PROTOLON trailing cables for the main voltage levels of 3.6/6 kV, 6/10 kV and 8.7/15 kV, the sag should be taken from the diagram for the desired span. A max. permissible tensile load of 15 N/mm² has been incorporated as a parameter in the diagram.

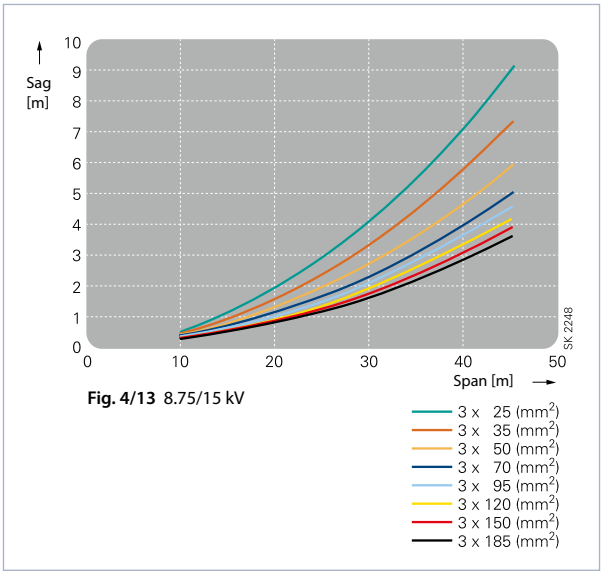



**Fig. 4/13** 8.75/15 kV

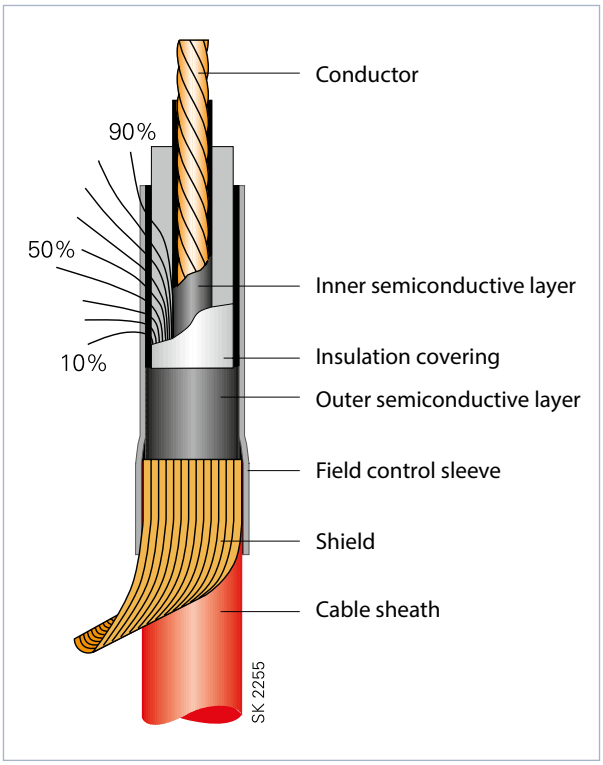
Underfloor infeeds

Cable suspended above guideways

## Electrical field control in hybrid sealing ends

In order to control the electrical field in medium-voltage cables, the use of an inner semiconductive layer is required, which is applied as a smoothing layer directly on the metallic conductor, the insulation covering and the outer semiconductive layer, which is in contact with the protective-earth conductor. In cable systems the sealing ends are assigned the task of containing the electrical field.

Our hybrid sealing ends, which are specially designed for the operational requirements of flexible electric cables for mining applications, operate on the principle of resistive electrical field control, which achieves potential reduction as a result of the ohmic and capacitive characteristics and thus reduces the electrical field strength to an acceptable level over the length of the serving.




## Stripping semiconductive layers

In the case of PROTOLON and TENAX with bright (light grey) core insulation, the semiconductive rubber layer over the insulation must be stripped carefully in order to mount the cable sealing end. To this end, the stripping point is marked and a circular indentation is made on the cable by slightly pressing a pipe cutter (picture 1).

Make a notch at the stripping point by means of a triangular-section file while bending the cable slightly. It is important hereby that the bright core insulation should not be damaged (picture 2).

Carefully cut through approx. 2/3 of the semiconductive rubber layer using between two to four longitudinal cuts. Warm the core end slightly using a propane gas flame and lift off the semiconductive layer at the end of the core using a wood rasp. Strip off the semiconductive layer in strips and remove it completely (picture 3).

**Note!** Problems can arise when stripping off the semiconductive layer due to tearing out of part of the insulation layer. In such case, the stripping procedure must be started from the opposite side. Use a smooth file, where necessary.

### Stripping semiconductive cold-strippable layers (orange insulation color)

The distinguishing feature of these cables is the cold-strippable semiconductive layer. In this case heating by means of a propane gas flame can be omitted completely. The work sequence should otherwise be carried out as described above.



# Sealing ends

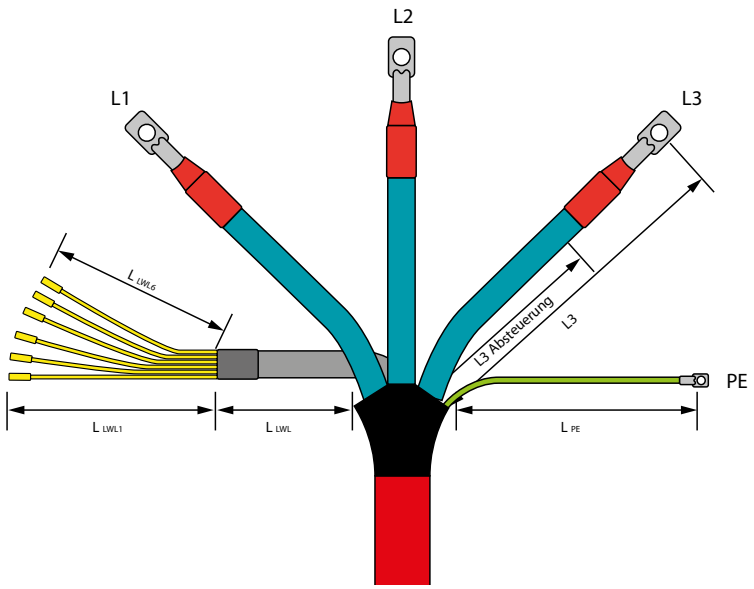
Sealing ends form the termination point of a medium voltage cable and serve as a connection to the electrical equipment (e.g. switchgears etc.).

Sealing ends cover the following objectives:

- Connection of the conductor
- Sealing of the cable end against ambient influences (e.g. ingress of water)
- Controlled decrement of the electrical field strength
- Insulation from earthed parts

For the complete range of PROTOLON, PROTOMONT and TENAX medium voltage mining cables Prysmian Group offers:

- Sealing end material sets for self-installation on site
- Termination in the factory according to customer specification




Core length:

$L_1$:
$L_2$:
$L_3$:
$L_{PE}$:

Borehole cable lug:

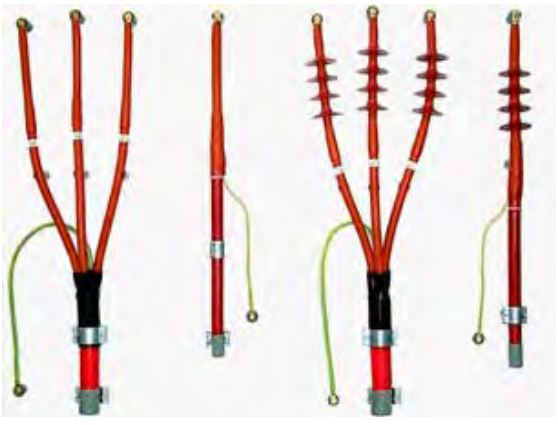
$L_1$ ... $L_3$: 16 Ø mm
PE: 12 Ø mm

FO-plug type:

Length of FO-element (mm)

| | |
|---|---|
| $L_{LWL}$: | $L_{LWL7}$: |
| $L_{LWL1}$: | $L_{LWL8}$: |
| $L_{LWL2}$: | $L_{LWL9}$: |
| $L_{LWL3}$: | $L_{LWL10}$: |
| $L_{LWL4}$: | $L_{LWL11}$: |
| $L_{LWL5}$: | $L_{LWL12}$: |
| $L_{LWL6}$: | |

The distances $L_1$, $L_2$, $L_3$ and PE are calculated between spread head and the center of the borehole cable lug.



Special sealing end termination for connection box.

## Couplers and cable services

For several applications the cables have to be connected by couplers. There is a wide range for underground and opencast couplers available, which our service department can apply to the cable.

Popular coupler-systems are the single core medium voltage connectors (interface A; B or C) e.g. Prysmian Group Formfit.

For outdoor applications (e.g. opencast mines) multicore couplers are available from different manufacturers.

Prysmian Group Formfit medium voltage connectors


## Prysmian Group cable services

- Assembling in the factory
- Delivery of material sets
- Erectors training sessions on site or in the factory
- Vulcanizing system, tools sets and materials for the cable repair

# Monitoring

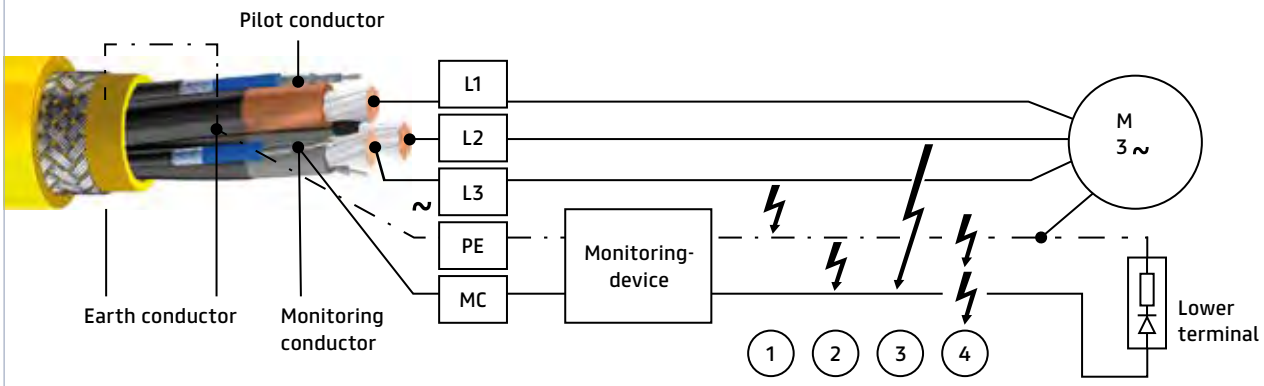
Prysmian Group mining cables are designed for all possibilities of monitoring the cable during operation. Different installation standards in the countries require different levels of monitoring safety.

Below there are two monitoring possibilities using devices such as:

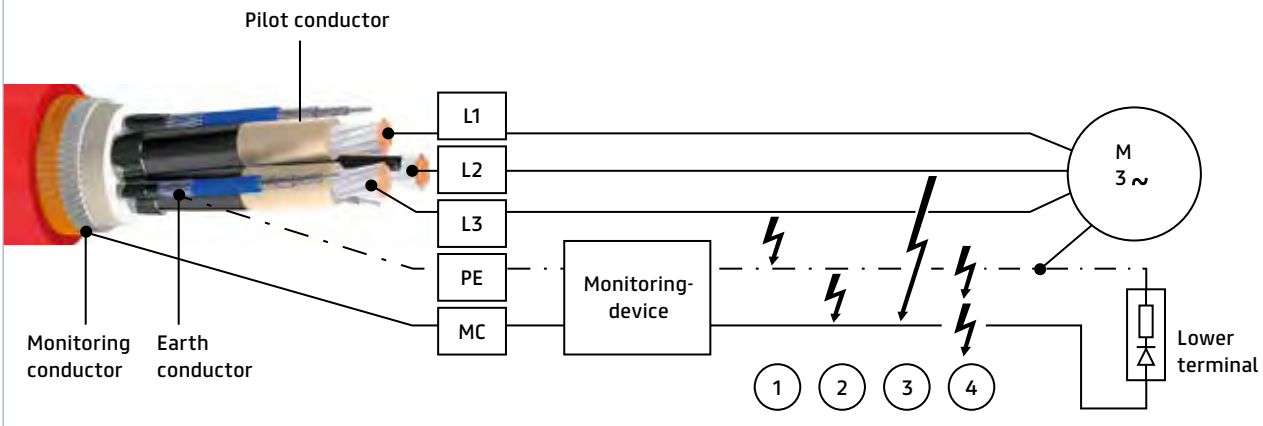
- Loop monitor
- Monitor/earth monitoring device
- Insulation monitor
- High-voltage monitor

All Prysmian Group mining cables may be used with the mentioned monitoring systems.

1. Single screen monitoring




2. Double screen monitoring




① = short circuit phase/protective earth conductor

② = short circuit protective earth conductor/monitoring conductor

③ = short circuit phase/monitoring conductor

④ = break of protective earth or monitoring conductor

# PRY-CAM PORTABLE


### – Portable, wireless and online partial discharge (pd) measurement

PRY-CAM PORTABLE is an integrated portable instrument for the automatic acquisition, processing and classification of pulse signals generated by PD phenomena occurring in insulating materials of medium and high-voltage electrical systems and equipment, such as transformers, electrical machines, cables systems and switchgear.

PRY-CAM PORTABLE allows you to perform accurate diagnostic measurements and continuous monitoring, without the worry of service interruptions.

### Data management

Every single PD measurement can be saved alongside other useful details, such as pictures, recorded messages, GPS coordinates, notes and tags.

### Three operating modes

Seamlessly move between basic, advanced and premium operating modes depending on your information needs and PD expertise. You can temporarily upgrade from BASIC to ADVANCED or PREMIUM modes for more detailed diagnosis as and when you need it.

BASIC – Free use
Your PRY-CAM PORTABLE can be used as a reliable PD surveyor with traffic light and simplified PD pattern (recommended for MV).

ADVANCED– Pay-per-use
Provides you with the PD pattern for simple diagnosis only (recommended for MV + HV).

PREMIUM – Pay-per-use
Provides you with the complete PD pattern, including waveforms and frequency spectrum, for any single PD pulse (recommended for MV + HV).

| PRY-CAM PORTABLE – technical specifications | | | |
|---|---|---|---|
| Sensor type | Electromagnetic, based on a patented Ultra Wide Band antenna, also providing AC synch signal | Interfaces | Wireless 802.11 b/g (WiFi) |
| | | AC external synch | Wireless RF interface @ 868 MHz |
| Bandwidth | 100 MHz | Internal battery | Li-Po 7.4 V, 2200 mAh. Autonomy approx. 6 hours |
| PD sensitivity | Down to 1 pC | Working temperature | From -25 °C to 70 °C |
| Synch frequency | From 10 Hz to 1 kHz | Weight | 400 g |
| Sampling frequency | 200 MS/s | Dimensions | L160 x W120 x H130 mm |
| Processing | Real-time filtering capabilities, ultra-precise time stamping (°10 ns) | Case | Rugged ABS plastic with IP67 protection rating |
| | | | |

## Key features

- Portable
- Wireless technology
- Ultra-wide bandwidth differential field sensor with 0.5 pC sensitivity
- Accurate acquisition of PD and AC sync
- No galvanic connection for maximum safety

### PRY-CAM CLOUD

PRY-CAM CLOUD is the ideal way to empower your business by effectively managing your data. Your measurements, collected by PRY-CAM devices, can be safely stored and protected on the PRY-CAM CLOUD, and used for advanced post processing and learning. So you can easily share measurements, test details and knowledge within your company.

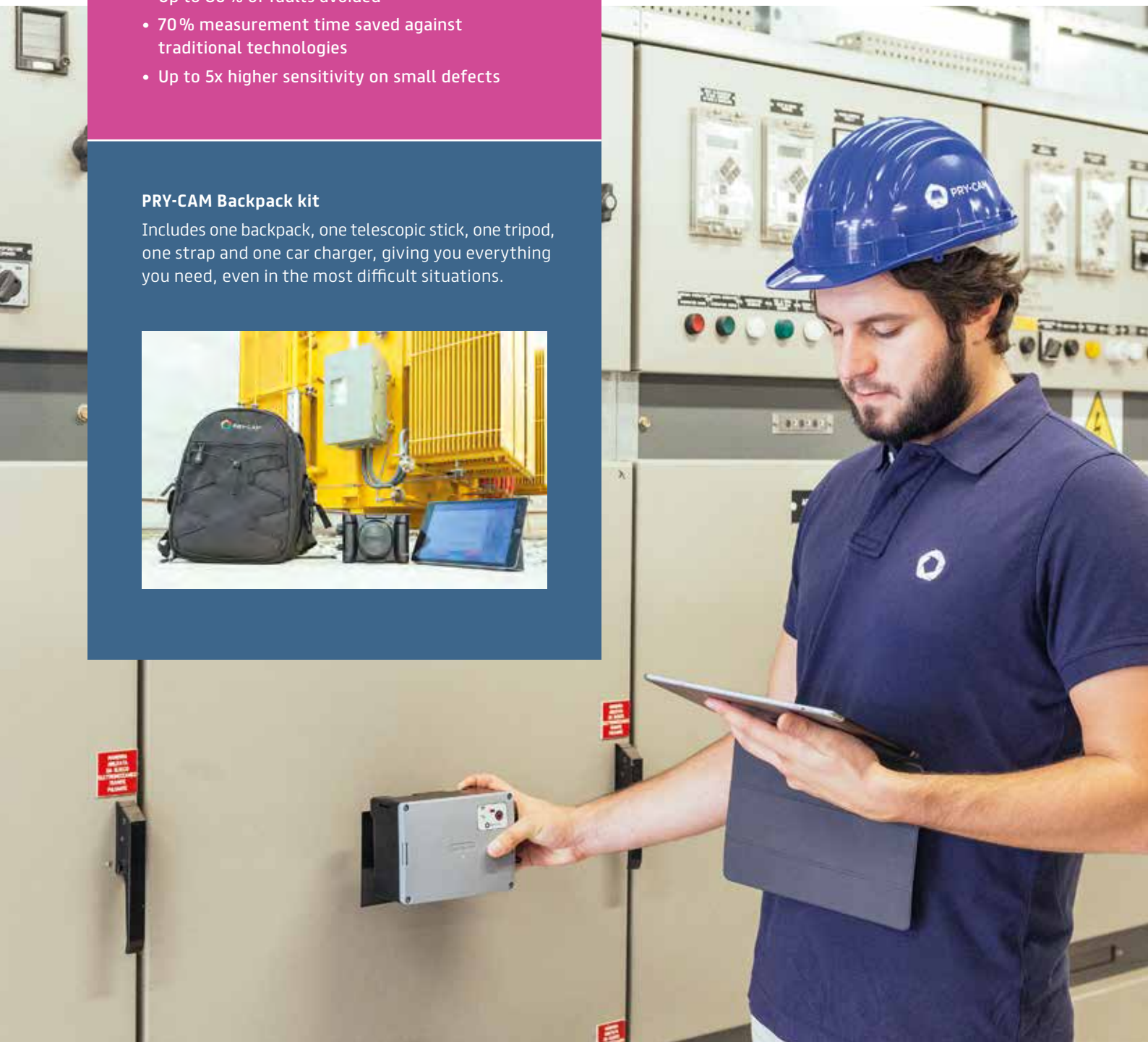
## Why PRY-CAM PORTABLE is better for your business

- 100 % of critical defects detected on HV and MV
- Up to 80 % of faults avoided
- 70 % measurement time saved against traditional technologies
- Up to 5x higher sensitivity on small defects

## PRY-CAM Backpack kit

Includes one backpack, one telescopic stick, one tripod, one strap and one car charger, giving you everything you need, even in the most difficult situations.





# Electrical parameters

## Voltages

For the rated, operating and test voltages of cables, the definitions given in DIN VDE 0298, Part 3, apply. Some of these are mentioned in the following pages.

AC = Alternating Current
DC = Direct Current

### Rated voltage

The rated voltage of an insulated electric cable is the voltage which is used as the basis for the design and the testing of the cable with regard to its electrical characteristics.

The rated voltage is expressed by the two values of power frequency voltage $U_0/U$ in V.

$U_0$ = rms value between one conductor and "Earth"
U = rms value between two conductors of a multi-core cable or of a system of single-core cables

In a system with AC voltage, the rated voltage of a cable must be at least equal to the rated voltage of the system for which it is used. This requirement applies both to the value $U_0$ and the value U.

In a system with DC voltage, its rated voltage must not be more than 1.5 times the value of the rated voltage of the cable.

### Operating voltage

The operating voltage is the voltage applied between the conductors and earth of a power installation with respect to time and place with trouble-free operation.

- Cables with a rated voltage $U_0/U$ up to 0.6/1 kV
  These cables are suitable for use in three-phase AC, single-phase AC and DC installations, the maximum continuously permissible operating voltage of which does not exceed the rated voltage of the cables by more than
  - 10 % for cables with a rated voltage $U_0/U$ up to and including 450/750 V
  - 20 % for cables with a rated voltage $U_0/U$ = 0.6/1 kV
- Cables with a rated voltage $U_0/U$ greater than 0.6/1 kV
  These cables are suitable for use in three-phase and single-phase AC installations, the maximum operating voltage of which does not exceed the rated voltage of the cable by more than 20 %
- Cables in DC installations
  If the cables are used in DC installations, the continuously permissible DC operating voltage between the conductors must not exceed 1.5 times the value of the permissible AC operating voltage. In single-phase earthed DC installations this value should be multiplied by a factor of 0.5.

### Test voltage

Regarding the test voltage of flexible cables, the values given in the corresponding parts of DIN VDE 0250 apply. If the relevant shield is missing, as for example with CORDAFLEX and PROTOMONT cables, "core against core" is tested in appropriate combinations. The values are to be regarded as AC test voltages (unless stated otherwise) for single-phase testing, i.e. the AC test voltage is applied between the core and the corresponding shielding (e.g. semiconductive layer, earth conductor, shield). Telecommunication cores (pairs) and other shielded pairs (e.g. (2x1)C) are tested "core against core" and "core against shield" whereby the test voltages are correspondingly different. With single-core cables without shielding, the corresponding opposite pole is a water bath. See table page 187.

## Short-circuit current-carrying capacity

Permissible short-circuit current at max. permissible short-circuit temperatures of the conductor surface and for a fault duration $t_{kr}$ = 1 s

| Cross-section mm² | 1 | 1.5 | 2.5 | 4 | 6 | 10 | 16 | 25 | 35 |
|---|---|---|---|---|---|---|---|---|---|
| Short-circuit current (kA) | 0.143 | 0.215 | 0.358 | 0.572 | 0.858 | 1.43 | 2.29 | 3.58 | 5.01 |

| Cross-section mm² | 50 | 70 | 95 | 120 | 150 | 185 | 240 | 300 | 400 |
|---|---|---|---|---|---|---|---|---|---|
| Short-circuit current (kA) | 7.15 | 10.01 | 13.6 | 17.16 | 21.45 | 26.46 | 34.32 | 42.9 | 71.5 |

The short-circuit current-carrying capacity $I_{thz}$ for a short-circuit duration $t_k$ deviating from $t_{kr}$ = 1 s, is:

$$I_{thz} = I_{thr} \cdot \sqrt{\frac{t_{kr}}{t_k}}$$

## Voltage drop

$$\Delta U = \sqrt{3} \times I_b \times l \times (R'_{W20} \times \cos\varphi + X'_L \times \sin\varphi)$$

For deviating conductor temperatures (e.g. 90 °C instead of 20 °C) the effective resistance $R'_W$ has to be converted:

$$R'_{W90} = R'_{W20}\,(1 + (0.004 \times 70k))$$

For the practical use a more easier calculation may be sufficient:

$$\Delta U = \sqrt{3} \times I_b \times l \times R'_{W\Theta} \times \cos\varphi$$

$I_b$ = load current [A]

$l$ = cable length [km]

$R'_{W20}$ = effective resistance per unit length and 20 °C [Ω/km]

$X'_L$ = Reactance per unit length [Ω/km]

$\varphi$ = phase-angle

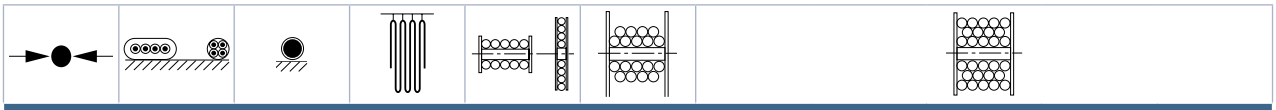
| Test voltage of flexible cables | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Rated voltage | Max. permissible operating voltage | | | Test voltage applied to the complete cable | | | | |
| | In AC systems | In DC systems | | Power cores | | Control cores | Pilot cores | Tele-communication cores |
| | | unearthed | single-phase earthed | | | | | |
| $U_0/U$ | $U_0/U$ | U | U | AC | DC | kV | kV | kV |
| | | kV | kV | kV | kV | | | |
| 250/250 V | 275/275 V | 0.412 | – | 1.5 | 3.75 | – | – | – |
| 300/500 V | 318/550 V | 0.825 | 0.413 | 2 | 5 | – | – | – |
| 450/750 V | 476/825 V | 1 238 | 0.619 | 2.5 | 6.25 | – | – | – |
| 0.6/1 kV | 0.7/1.2 kV | 1.8 | 0.9 | 2.5 | 6.25 | 2 | | |
| 1.8/3 kV | 2.1/3.6 kV | 5.4 | 2.7 | 6 | 15 | 2 | 2 | 1 |
| 3.6/6 kV | 4.2/7.2 kV | 10.8 | 5.4 | 11 | 27.5 | 2 | 2 | 1 |
| 6/10 kV | 6.9/12 kV | 18 | 8 | 17 | 42.5 | 2 | 2 | 1 |
| 8.7/15 kV | 10.4/18 kV | 27 | 14 | 24 | 60.0 | 2 | 2 | 1 |
| 12/20 kV | 13.9/24 kV | 36 | 18 | 29 | 72.5 | 2 | 2 | 1 |
| 14/25 kV | 17.3/30 kV | 45 | 3 | 36 | 90.0 | 2 | 2 | 1 |
| 18/30 kV | 20.8/36 kV | 54 | 27 | 43 | 107.5 | 2 | 2 | 1 |
| 20/35 kV | 24.3/42 kV | 63 | 32 | 50 | 125 | 2 | 2 | 1 |

# Current-carrying capacity

If, after all selection criteria have been taken into account, the type of flexible electric cable to be used for mining applications has been decided on, the necessary cross-section of the conductor can be determined either from the current to be transmitted or from the power.

Installation conditions (stretched laying, suspended freely in the air, reeled), variations in ambient temperature, grouping, type of operation (continuous duty, intermittent periodic duty) and the use of multi-core cables are to be taken into account.

The table below is valid for continuous duty at 30 °C ambient temperature and three loaded cores.



| Current-carrying capacity | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cross-section | Stretched laying | | Suspended freely in air | Reeled in | | | | | | |
| | | | | 1 layer | 2 layers | 3 layers* | 4 layers | 5 layers | 6 layers | 7 layers |
| mm² | A | A | A | A | A | A | A | A | A | A |
| | Factor 1 | Factor 1.36 | 1.05 | 0.8 | 0.61 | 0.49 | 0.42 | 0.38 | 0.27 | 0.22 |
| Rubber-insulated up to 10 kV: CORDAFLEX, FELTOFLEX, PROTOLON, PROTOMONT, SUPROMONT, TENAX | | | | | | | | | | |
| 1 | 18 | 24 | 19 | 14 | 11 | 9 | 8 | 7 | 5 | 4 |
| 1.5 | 23 | 31 | 24 | 18 | 14 | 11 | 10 | 9 | 6 | 5 |
| 2.5 | 30 | 41 | 32 | 24 | 18 | 15 | 13 | 11 | 8 | 7 |
| 4 | 41 | 56 | 43 | 33 | 25 | 20 | 17 | 16 | 11 | 9 |
| 6 | 53 | 72 | 56 | 42 | 32 | 26 | 22 | 20 | 14 | 12 |
| 10 | 74 | 101 | 78 | 59 | 45 | 36 | 31 | 28 | 20 | 16 |
| 16 | 99 | 135 | 104 | 79 | 60 | 49 | 42 | 38 | 27 | 22 |
| 25 | 131 | 178 | 138 | 105 | 80 | 64 | 55 | 50 | 35 | 29 |
| 35 | 162 | 220 | 170 | 130 | 99 | 79 | 68 | 62 | 44 | 36 |
| 50 | 202 | 275 | 212 | 162 | 123 | 99 | 85 | 78 | 55 | 44 |
| 70 | 250 | 340 | 263 | 200 | 153 | 123 | 105 | 95 | 68 | 55 |
| 95 | 301 | 409 | 316 | 241 | 184 | 147 | 126 | 114 | 81 | 66 |
| 120 | 352 | 479 | 370 | 282 | 215 | 172 | 148 | 134 | 95 | 77 |
| 150 | 404 | 549 | 424 | 323 | 246 | 198 | 170 | 154 | 109 | 89 |
| 185 | 461 | 627 | 484 | 369 | 281 | 226 | 194 | 175 | 124 | 101 |
| 240 | 540 | 734 | 567 | 432 | 329 | 265 | 227 | 205 | 146 | 119 |
| 300 | 620 | 843 | 651 | 496 | 378 | 304 | 260 | 236 | 167 | 136 |
| Rubber-insulated from 15 kV: FELTOFLEX, PROTOLON, PROTOMONT, SUPROMONT, TENAX | | | | | | | | | | |
| 16 | 105 | 143 | – | 84 | 64 | 51 | 44 | 40 | 28 | 23 |
| 25 | 139 | 189 | – | 111 | 85 | 68 | 58 | 53 | 38 | 31 |
| 35 | 172 | 234 | – | 138 | 105 | 84 | 72 | 65 | 46 | 38 |
| 50 | 215 | 292 | – | 172 | 131 | 105 | 90 | 82 | 58 | 47 |
| 70 | 265 | 360 | – | 212 | 162 | 130 | 111 | 101 | 72 | 58 |
| 95 | 319 | 434 | – | 255 | 195 | 156 | 134 | 121 | 86 | 70 |
| 120 | 371 | 505 | – | 297 | 226 | 182 | 156 | 141 | 100 | 82 |
| 150 | 428 | 582 | – | 342 | 261 | 210 | 180 | 163 | 116 | 94 |
| 185 | 488 | 664 | – | 390 | 298 | 239 | 205 | 185 | 132 | 107 |
| 240 | 574 | 781 | – | 459 | 350 | 281 | 241 | 218 | 155 | 126 |
| 300 | 660 | 889 | – | 528 | 403 | 323 | 277 | 251 | 178 | 145 |
| PE-insulated: MSR-mining | | | | | | | | | | |
|  | | | | | | | | | | |
| 2 x 2 x 1 | 12 | | | | | | | | | |
| 5 x2 x 1 | 8.5 | | | | | | | | | |
| 10 x 2 x 1 | 6.5 | | | | | | | | | |
| 20 x 2 x 1 | 5 | | | | | | | | | |

*The reduction factor is also valid for flat reeling cables (spirally).

# De-rating factors

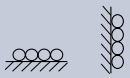
The de-rating factors take into account the installation and operating conditions, such as temperature, grouping, intermittent periodic duty and the number of simultaneously loaded cores. They are to be used for determining the current-carrying capacity in accordance with the table on page 188.

**De-rating factors for varying ambient temperatures**

| Ambient temperature °C | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| 1.15 | 1.12 | 1.08 | 1.04 | 1.0 | 0.96 | 0.91 | 0.87 |

| Ambient temperature °C | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 |
| 0.82 | 0.76 | 0.71 | 0.65 | 0.58 | 0.50 | 0.41 | 0.29 |

**De-rating factors for grouping**

| Arrangement | | Number of multi-core cables or number of single or three-phase circuits made up of single-core cables (2 or 3 loaded conductors) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 18 | 20 |
| Bunched directly at the wall, the floor, in conduit or ducting, on or in the wall |  | 1.0 | 0.8 | 0.7 | 0.65 | 0.6 | 0.57 | 0.54 | 0.52 | 0.5 | 0.48 | 0.45 | 0.43 | 0.41 | 0.39 | 0.38 |
| Single layer on the wall or floor, touching |  | 1.0 | 0.85 | 0.79 | 0.75 | 0.73 | 0.72 | 0.72 | 0.72 | 0.71 | 0.70 | – | – | – | – | – |
| Single layer on the wall or floor, spaced with a clearance of 1 x cable diameter between adjacent cables |  | 1.0 | 0.94 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Single layer under ceiling, touching |  | 0.95 | 0.81 | 0.72 | 0.68 | 0.66 | 0.64 | 0.63 | 0.62 | 0.61 | – | – | – | – | – | – |
| Single layer under ceiling, spaced with a clearance of 1 x cable diameter between adjacent cables |  | 0.95 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |

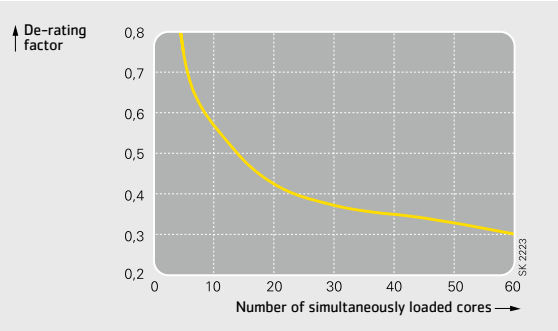
**De-rating factors for intermittent periodic duty**

| Ambient temperatur 30°C / Duty cycle 10 min | | | | |
|---|---|---|---|---|
| Nominal cross-section mm² | Duty factor ED % | | | |
| | 60 | 40 | 25 | 15 |
| 0.75 | 1.00 | 1.00 | 1.00 | 1.00 |
| 1 | 1.00 | 1.00 | 1.00 | 1.00 |
| 1.5 | 1.00 | 1.00 | 1.00 | 1.00 |
| 2.5 | 1.00 | 1.00 | 1.04 | 1.07 |
| 4 | 1.00 | 1.03 | 1.05 | 1.19 |
| 6 | 1.00 | 1.04 | 1.13 | 1.27 |
| 10 | 1.03 | 1.09 | 1.21 | 1.44 |
| 16 | 1.07 | 1.16 | 1.34 | 1.62 |
| 25 | 1.10 | 1.23 | 1.46 | 1.79 |
| 35 | 1.13 | 1.28 | 1.53 | 1.90 |
| 50 | 1.16 | 1.34 | 1.62 | 2.03 |
| 70 | 1.18 | 1.38 | 1.69 | 2.13 |
| 95 | 1.20 | 1.42 | 1.74 | 2.21 |
| 120 | 1.21 | 1.44 | 1.78 | 2.26 |
| 150 | 1.22 | 1.46 | 1.81 | 2.30 |
| 185 | 1.23 | 1.48 | 1.82 | 2.32 |
| 240 | 1.23 | 1.49 | 1.85 | 2.36 |
| 300 | 1.23 | 1.50 | 1.87 | 2.39 |

**De-rating factors for multi-core cables with conductor cross-sections up to 10 mm²**

| Number of loaded cores | | | | | | |
|---|---|---|---|---|---|---|
| 5 | 7 | 10 | 12 | 14 | 18 | 19 |
| 0.75 | 0.65 | 0.55 | 0.53 | 0.50 | 0.44 | 0.45 |

| Number of loaded cores | | | | | | |
|---|---|---|---|---|---|---|
| 24 | 30 | 36 | 40 | 42 | 61 | |
| 0.40 | 0.37 | 0.36 | 0.35 | 0.35 | 0.30 | |



# Thermal parameters

The different temperature limits of the individual flexible electric cables for mining applications are summarised in the table on page 191.

Under no circumstances may the values shown be exceeded due to interaction of internal Joule heat and the ambient temperature.

If cables are exposed to radiation, e.g. sunlight, the temperature of the outer sheath of the flexible electric cable can rise to a level which is significantly higher than the ambient temperature. This situation must be compensated for by corresponding reduction of the current-carrying capacity.

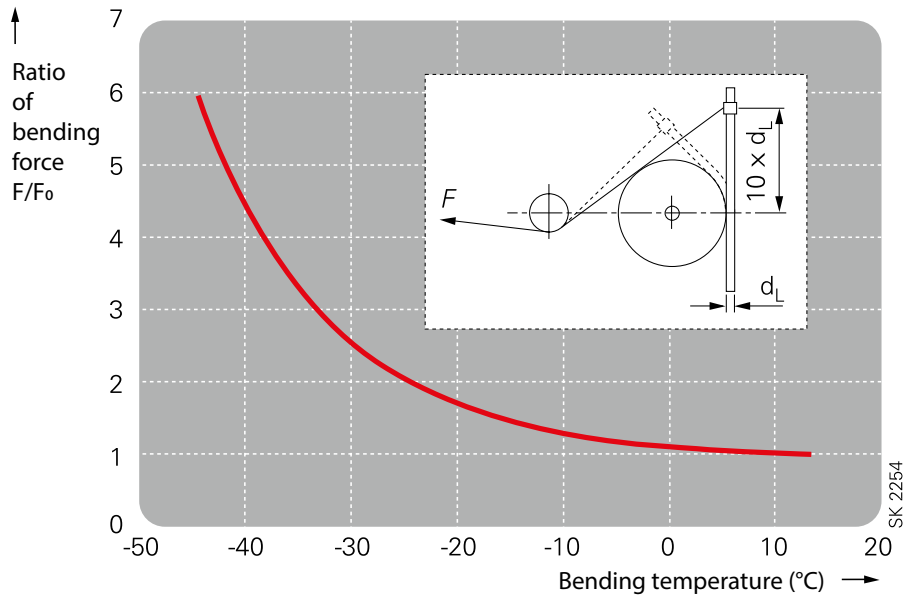
The temperatures on the surface of the cable are limits for the ambient temperature.

All insulating and sheathing compounds of the flexible electric cables become stiffer as the temperature drops. If the temperature falls below the specified limit, a point can be reached below which the compounds used become brittle.

In addition to this, more force (sometimes considerably more) is needed for bending a flexible electric cable due to the increase of stiffness of the insulating and sheathing compounds at lower temperatures. This can create problems in the use of the flexible electric cables (e.g. with the reel drive).

The relationship between the bending stiffness of flexible electric cables for mining applications and the temperature is shown in the figure below.

The ratio of the bending force is given as $F/F_0$, with $F_0 = F_{20°C}$.




$d_L$ = Overall cable diameter

F = Force

The temperature limits on the surface of the cable are specified to ensure problem-free and healthy operation during forced guidance of flexible electric cables for mining applications, especially while trailing over ground and during reeling operation.

Higher temperatures influence the hardness, abrasion, resistance to tear propagation and the transverse pressure stability of the insulating and sheathing compounds and can thus lead to a reduction of their service life.

Flexible electric cables should be selected, installed and operated so that the expected dissipation of Joule heat is not hindered in any way and therefore no risk of fire is incurred.

| Temperature limits of the individual flexible electric cables for mining applications | | | | | |
|---|---|---|---|---|---|
| Flexible cables | Type | Temperature limit during operation, storage, installation and transport (°C) | | | |
| | | of the conductor during operation | of the conductor during short-circuit | on the surface of the cable, fixed installation | on the surface of the cable, fully flexible installation |
| CORDAFLEX(S) | NSHTOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| FELTOFLEX | NTMCWOEU | 90 | 250 | -40 to +80 | -25 to +80 |
| OPTOFLEX(M) | – | – | – | -40 to +80 | – |
| PROTOLON single-core | NTMCGCWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOLON(M) single-core | (N)TMCGCWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOLON(M) | F-(N)TSCGEWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOLON(M) | R-(N)TSCGEWOEU | 90 | 250 | -40 to +80 | -35 to +80 |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | 90 | 250 | -40 to +80 | -35 to +80 |
| PROTOLON(SB) | NTSCGEWOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | 90 | 250 | -40 to +80 | -30 to +60 |
| PROTOLON(ST) | NTSCGEWOEU .../3E | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOLON(ST) | NTSCGEWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT | NSSHOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT | NSHXOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT | NSSHOEU .../3E | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT festoon | NTSKCGECWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT EMV-FC | (N)SSHCOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT(M+) | (N)SHOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT(MSR) | 2YSLGCGOEU | 60 | 150 | -40 to +80 | -25 to +60 |
| PROTOMONT(MT) | (N)SSHOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| PROTOMONT(V) | NSSHCGEOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT(V) | NTSKCGECWOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT(VO) | (N)TSKCGEWOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT(S) | (N)SSHCGEOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT(Z) | NSSHKCGEOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT TBM | (N)TSCGECWOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| PROTOMONT TBM | (N)TSCGECWHXOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| SUPROMONT | (N)3GHSSYCY | 90 | 250 | -40 to +80 | +5 to +60 |
| SUPROMONT | (N)3GHSSHCH | 90 | 250 | -40 to +80 | +5 to +60 |
| TENAX-CTE | NSSHKCGEOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| TENAX-HTT | (N)TSCGEWOEU | 90 | 250 | -40 to +80 | -20 to +60 |
| TENAX-LK | NTSKCGEWOEU | 90 | 250 | -40 to +80 | -25 to +60 |
| TENAX-LUMEN | (N)TSCGEH3S | 90 | 250 | -50 to +80 | -50 to +60 |
| TENAX-SAS | NTSCGEWOEU | 90 | 250 | -50 to +80 | -50 to +60 |

# Mechanical parameters

## Tensile loads

The tensile loads of copper conductors in flexible electric cables for mining applications as specified by DIN VDE 0298, Part 3, should not exceed 15 N/mm². However, higher values are allowed for some cables as shown in the table below. These values refer to tensile load only.

These maximum permissible limits of tensile load are to be regarded as the sum of the static and dynamic loads.

When the permissible tensile force is being calculated, shields, concentric conductors and split protective-earth conductors as well as integrated control cores and monitoring cores of power cables must not be included in the calculation.

For higher tensile loads, appropriate steps have to be taken such as increasing the bending radii or using special cable designs with stress relieving support elements. In some cases, a shorter service life can be expected. In this case, the cable manufacturer should be consulted.

The maximum permissible tensile load for installing fixed laying flexible cables is 15 N/mm² referred to the cross-section of the conductor.

| Maximum tensile loads during installation and operation of flexible electric cables for mining applications | | | |
|---|---|---|---|
| Flexible cables | Type | DIN VDE N/mm² | Prysmian Group N/mm² |
| CORDAFLEX(S) | NSHTOEU | 15 | 30 |
| FELTOFLEX | NTMCWOEU | 15 | 15 |
| OPTOFLEX(M) | – | – | 2000 N for the cable |
| PROTOLON single-core | NTMCGCWOEU | 15 | 15 |
| PROTOLON(M) single-core | (N)TMCGCWOEU | 15 | 15 |
| PROTOLON(M) | F-(N)TSCGEWOEU | 15 | 15 |
| PROTOLON(M) | R-(N)TSCGEWOEU | 15 | static: 20 (dynamic: 25) |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | 15 | static: 20 (dynamic: 25) |
| PROTOLON(SB) | NTSCGEWOEU | 15 | 15 |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | 15 | 20 |
| PROTOLON(ST) | NTSCGEWOEU .../3E | 15 | 15 |
| PROTOLON(ST) | NTSCGEWOEU | 15 | 15 |
| PROTOMONT | NSSHOEU | 15 | 15 |
| PROTOMONT | NSHXOEU | 15 | 15 |
| PROTOMONT | NSSHOEU .../3E | 15 | 15 |
| PROTOMONT festoon | NTSKCGECWOEU | 15 | 15 |
| PROTOMONT EMV-FC | (N)SSHCOEU | 15 | 15 |
| PROTOMONT(M+) | (N)SHOEU | 15 | 15 |
| PROTOMONT(MSR) | 2YSLGCGOEU | 15 | 15 |
| PROTOMONT(MT) | (N)SSHOEU | 15 | 15 |
| PROTOMONT(V) | NSSHCGEOEU | 15 | 15 |
| PROTOMONT(V) | NTSKCGECWOEU | 15 | 15 |
| PROTOMONT(VO) | (N)TSKCGEWOEU | 15 | 15 |
| PROTOMONT(S) | (N)SSHCGEOEU | 15 | 30 |
| PROTOMONT(Z) | NSSHKCGEOEU | 15 | 40 |
| PROTOMONT TBM | (N)TSCGECWOEU | 15 | reeling: 15 (on TMB: 30) |
| PROTOMONT TBM | (N)TSCGECWHXOEU | 15 | reeling: 15 (on TMB: 30) |
| SUPROMONT | (N)3GHSSYCY | 15 | 15 |
| SUPROMONT | (N)3GHSSHCH | 15 | 15 |
| TENAX-CTE | NSSHKCGEOEU | 15 | 15 |
| TENAX-HTT | (N)TSCGEWOEU | 15 | 15 |
| TENAX-LK | NTSKCGEWOEU | 15 | 30 |
| TENAX-LUMEN | (N)TSCGEH3S | 15 | 25 |
| TENAX-SAS | NTSCGEWOEU | 15 | 25 |

## Torsional stresses

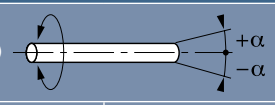
As a general rule the torsional stresses occurring during operation of flexible electric cables for mining applications are low. In certain applications, such as for example laying on large mobile equipment (cable booms), torsional stresses are unavoidable.

The maximum permissible torsional stresses which occur during operation at entries, slewing gears, windmills, etc., are summarised in the table below.

If the limits are exceeded, this can lead to a reduction in service life. In critical cases, the cable manufacturer should be consulted.

Torsional stresses created by the systems involved (e.g. due to misalignment of cable guidance systems, oblique cable pay out) should be avoided and are not included here.

**Maximum torsional stresses during operation of flexible electric cables for mining applications**

| Flexible cables | Type | α (°/m)   | |
|---|---|---|---|
| | | With semi-conductive rubber layer | With copper core shield |
| CORDAFLEX(S) | NSHTOEU | ±25 | – |
| FELTOFLEX | NTMCWOEU | – | ±25 |
| OPTOFLEX(M) | – | ±100 | – |
| PROTOLON single-core | NTMCGCWOEU | – | ±25 |
| PROTOLON(M) single-core | (N)TMCGCWOEU | – | ±25 |
| PROTOLON(M) | F-(N)TSCGEWOEU | ±100 | – |
| PROTOLON(M) | R-(N)TSCGEWOEU | ±100 | – |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | ±100 | – |
| PROTOLON(SB) | NTSCGEWOEU | ±100 | ±25 |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | ±100 | ±25 |
| PROTOLON(ST) | NTSCGEWOEU .../3E | – | ±25 |
| PROTOLON(ST) | NTSCGEWOEU | ±100 | – |
| PROTOMONT | NSSHOEU | ±100 | – |
| PROTOMONT | NSHXOEU | ±100 | – |
| PROTOMONT | NSSHOEU .../3E | – | ±25 |
| PROTOMONT festoon | NTSKCGECWOEU | – | ±25 |
| PROTOMONT EMV-FC | (N)SSHCOEU | – | ±25 |
| PROTOMONT(M+) | (N)SHOEU | ±25 | – |
| PROTOMONT(MSR) | 2YSLGCGOEU | – | ±25 |
| PROTOMONT(MT) | (N)SSHOEU | ±100 | – |
| PROTOMONT(V) | NSSHCGEOEU | ±25 | – |
| PROTOMONT(V) | NTSKCGECWOEU | ±25 | – |
| PROTOMONT(VO) | (N)TSKCGEWOEU | ±50 | – |
| PROTOMONT(S) | (N)SSHCGEOEU | ±50 | – |
| PROTOMONT(Z) | NSSHKCGEOEU | ±10 | – |
| PROTOMONT TBM | (N)TSCGECWOEU | – | ±25 |
| PROTOMONT TBM | (N)TSCGECWHXOEU | – | ±25 |
| SUPROMONT | (N)3GHSSYCY | – | ±25 |
| SUPROMONT | (N)3GHSSHCH | – | ±25 |
| TENAX-CTE | NSSHKCGEOEU | ±50 | – |
| TENAX-HTT | (N)TSCGEWOEU | ±100 | – |
| TENAX-LK | NTSKCGEWOEU | ±100 | – |
| TENAX-LUMEN | (N)TSCGEH3S | ±100 | – |
| TENAX-SAS | NTSCGEWOEU | ±100 | – |

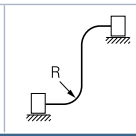
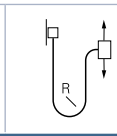
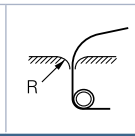
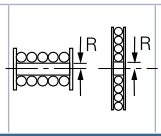
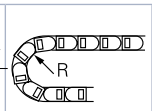
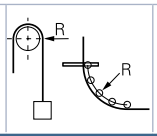
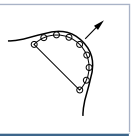
# Minimum bending radii

If the bending radii are smaller than those permitted, a reduced service life can be expected depending on the stress conditions. The values given in the table below should be taken as a basis.

The minimum bending radii are shown as the product of the overall diameter of the cable and a factor, which is dependent on the diameter of the cable (e.g.: 3 x d).

The minimum permissible bending radii are valid within the specified ambient temperature range (see page 191), subject to the provision that the permissible tensile loads are not exceeded (see page 192).

In critical cases, the cable manufacturer should be consulted.

| |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| **Minimum permissible bending radius R** | | | | | | | |
| Fexible cables | Fixed installation | Fully flexible operation | For the entry, e.g. at a centre feed point | For forced guidance with reeling operation | For forced guidance with power tracks | For forced guidance with sheaves | Drawing by means of a roller stirrup |
| Rated voltage $U_0/U$ | | | | | | | |
| up to 0.6/1 kV | 4 x d | 5 x d | 5 x d | 6 x d | 5 x d* | 7.5 x d | 4 x d |
| above to 0.6/1 kV | 6 x d | 10 x d | 10 x d | 12 x d | 10 x d | 15 x d | 8 x d |

d = Max. overall cable diameter. * PROTOMONT (V)/(VO), TENAX CTE at max. 5 N/mm²: 2.3 x d

## Travel speeds

Flexible electric cables for mining applications are intended for use on mobile equipment and are designed to cope with the technical requirements of the application.

In order to collect, release and move flexible electric cables, there are different cable guidance systems such as reels, drum cars, power tracks, sheave guided cable storage systems as well as sheaves and multi-roller guides.

Mining equipment and consequently also the cable guidance systems are operated at different travel speeds and are therefore subject to stress which can vary from low to very high.

During operation of the mobile equipment, the flexible electric cables are subject to stress such as tension, transverse pressure, torsion and bending. Thus, the travel speed and the acceleration are to be considered as indirect criteria for the stresses applied to the flexible electric cables.

The maximum permissible travel speed for the individual flexible electric cables are summarized in the table below.

If the travel-speed limits are exceeded, a reduction in service life cannot be excluded. The cable manufacturer should be consulted.

| Maximum travel speed for flexible electric cables for mining applications | | | | | |
|---|---|---|---|---|---|
| Flexible cables | Type | Material handling equipment on tracks | Material handling equipment on caterpillar-type running gear | Loader operation of tyre mounted equipment | Rewinding with drum car |
| | | m/min | m/min | m/min | m/min |
| CORDAFLEX(S) | NSHTOEU | no application | no application | 160 | 100 |
| PROTOLON(M) | R-(N)TSCGEWOEU | 120 | 10 | 60 | 100 |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | 120 | 10 | 60 | 100 |
| PROTOLON(SB) | NTSCGEWOEU | no application | 10 | no application | 100 |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | no application | 10 | no application | 100 |
| PROTOMONT EMV-FC | (N)SSHCOEU | no application | no application | no application | 100 |
| PROTOMONT(M+) | (N)SHOEU | no application | no application | 60 | 100 |
| PROTOMONT(V) | NSSHCGEOEU | Max. travel speed of the coal cutter 15 m/min | | | |
| PROTOMONT(V) | NTSKCGECWOEU | Max. travel speed of the coal cutter 15 m/min | | | |
| PROTOMONT(VO) | (N)TSKCGEWOEU | Max. travel speed of the coal cutter 15 m/min | | | |
| PROTOMONT(S) | (N)SSHCGEOEU | 160 | 160 | 160 | 100 |
| PROTOMONT(Z) | NSSHKCGEOEU | Max. travel speed of the coal cutter 15 m/min | | | |
| PROTOMONT TBM | (N)TSCGECWOEU | 30 | 30 | no application | 100 |
| PROTOMONT TBM | (N)TSCGECWHXOEU | 30 | 30 | no application | 100 |
| TENAX-CTE | NSSHKCGEOEU | Max. travel speed of the coal cutter 15 m/min | | | |
| TENAX-HTT | (N)TSCGEWOEU | 30 | 30 | no application | 100 |
| TENAX-LK | NTSKCGEWOEU | 160 | 160 | 160 | 160 |
| TENAX-LUMEN | (N)TSCGEH3S | no application | 10 | no application | 100 |
| TENAX-SAS | NTSCGEWOEU | no application | 10 | no application | 100 |

# Additional tests

Adequate testing of the operating characteristics needed for flexible electric cables for mining applications is not possible with the tests specified by DIN VDE. Our flexible electric cables for mining applications are therefore subject to additional and continuous mechanical tests at the manufacturer's facilities.

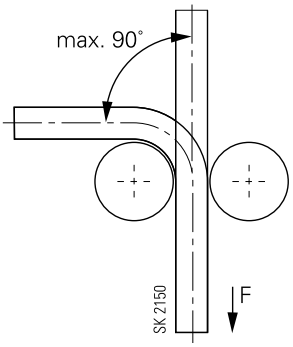
These additional tests facilitate time-compressed examination of the running and service characteristics under different kinds of mechanical stress, such as reserved bending strength, running over sheaves, flexing work and reeling operation in relation to tensile load and bending radii.

### Reversed bending test

Based on DIN VDE 0281, Part 2

Testing of flexible electric cables for mining applications under increased loads.

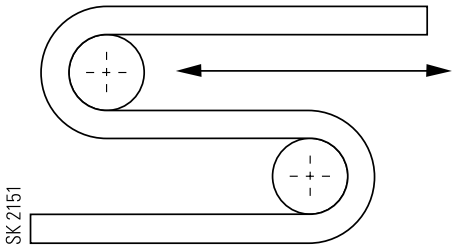
- Cable diameter up to 50 mm, maximum tensile load 3000 N.
- Each movement from one extreme position to another (180°) is counted as a cycle.




### Roller bending test type A

Testing the roller bending characteristics of flexible electric cables for mining applications based on DIN VDE 0282, Part 2.

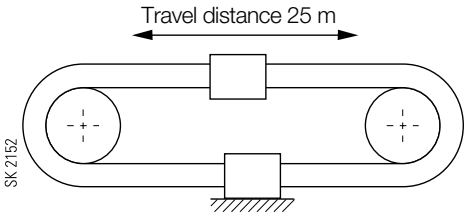
- Cable diameter up to 50 mm.
- Each movement between the extreme position is counted as a cycle.




### Roller bending test type B – Tender test

Practice-oriented testing of flexible electric cables for mining applications with reference to running and service characteristics.

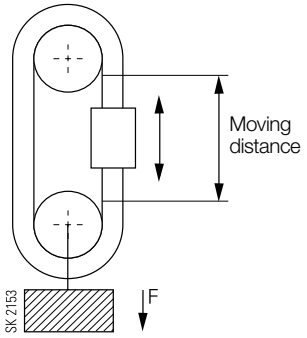
- Cable diameter from 20 up to 60 mm.
- Each movement between the extreme position is counted as a cycle.




### Roller bending test type C – Flexing test

Testing the running characteristics (flexing) of flexible electric cables for mining applications for evaluation of the mechanical service characteristics.

- Cable diameter from 60 up to 120 mm.
- Each movement between the extreme position is counted as a cycle. Moving distance 2 m.

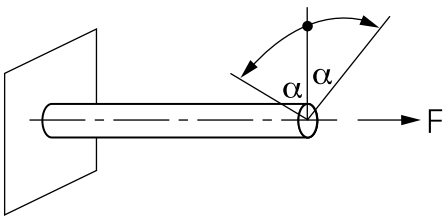


### Torsional stress test

The cable is alternately twisted left and right through an angle α by application of the tensile force F.

| | |
|---|---|
| Torsional angle | max. ± 360° |
| Torsional torque | max. 200 Nm |
| Tensile force | max. 4000 N |

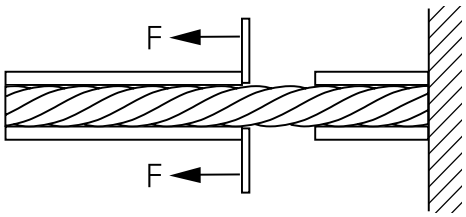
Test duration at temperatures: -40 °C to +50 °C.




### Sheath shifting test

Flexible electric cables for mining applications are generally stressed by dragging over the underground in open-cast mining applications.

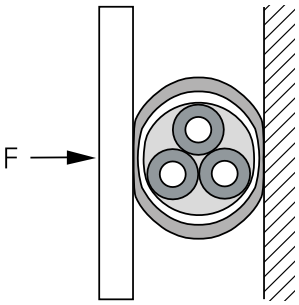
The test determines the magnitude of the force required to slide the sheath along the core.




### Transverse pressure test

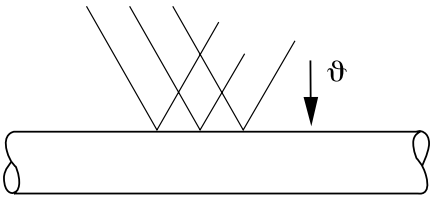
This test demonstrates the behaviour of electric cables subjected to transverse pressure, e.g. as a result of jamming in plant components, being hit by falling stones (blocks of stones), etc.

The test is passed when no electrical event occurs up to the specified value (earth-fault or short-circuit).



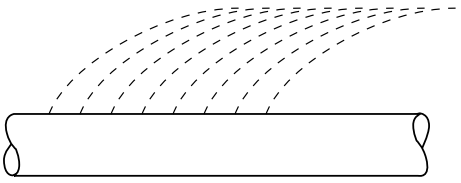

### Welding beads test

During constructional and maintenance work on large mobile equipment such as excavators, putting-down machines, etc., welding beads can fall on previously installed electric cables. This test verifies the resistance of the outer sheath to such stresses.



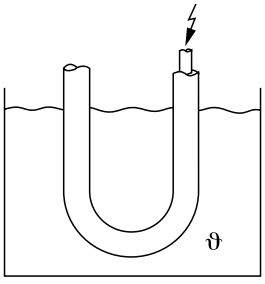

### Brine resistance

Automatic material handling and reloading installations (e.g. bunkering and blending plants) are sprayed with brine to prevent them from freezing in order to guarantee smooth trouble-free operation in winter. This test verifies the resistance of the outer sheath of mining-type cables to such stresses.



### Water resistance

During operation of flexible electric cables for mining applications, the possibility that they will be operated in water over considerable periods of time cannot be excluded. Verification of the resistance to water is carried out according to EN 50525-2-21.



The following tables depicts the test conditions for the individual flexible electric cables for mining applications. Under the severe conditions in mining operation, cables are subjected to considerable mechanical stresses, which by far exceed those defined in the requirement profile according to the VDE standards.

These additional tests assure compliance with the special requirement profile for mining applications and document the suitability of our electric cables for all applications in open-cast and underground mines in a convincing manner.

The tensile loads and the bending and sheave radii are specified and the minimum number of cycles which must be achieved.

The decisive criterion for passing the mechanical test is the number of individual broken wires in the copper conductor and/or non-continuity of the electrical conductor.

In the roller bending tests type A and B, the degree of deformation (cork-screwing effect) is tested additionally.

**Test conditions for the individual flexible electric cables for mining applications – table 1**

| Additional mechanical tests | | PROTOLON(M) R-(N)TSCGEWOEU PROTOLON(M) with F.O. R-(N)TSCGEWOEU | PROTOLON(M) F-(N)TSCGEWOEU | OPTOFLEX(M) | CORDAFLEX(S) NSHTOEU PROTOMONT(S) (N)SSHCGEOEU |
|---|---|---|---|---|---|
| Reversed bending test | Tensile load | 20 N/mm² | 5 N/mm² | 300 N | 20 N/mm² |
| | Bending diameter | 10 x D | 10 x D | 250 mm | 10 x D |
| | Number of cycles | 15 000 | 30 000 | 50 000 | 60 000 |
| Roller bending test (test type A) D < 50 mm | Tensile load | 15 N/mm² | 2.5 N/mm² | 300 N | 5 N/mm² |
| | Bending diameter | 10 x D | 10 x D | 250 mm | 10 x D |
| | Number of cycles | 50 000 | 30 000 | 75 000 | 200 000 |
| Roller bending test (test type B) 20 mm < D < 60 mm | Tensile load | – | – | – | 5 N/mm² |
| | Bending diameter | – | – | – | 320 mm |
| | Number of cycles | – | – | – | 300 000 |
| Roller bending test (test type C) 60 mm < D < 120 mm | Tensile load | 20 N/mm² | 20 N/mm² | – | 20 N/mm² |
| | Bending diameter | 10 x D | 10 x D | – | 10 x D |
| | Number of cycles | 30 000 | 15 000 | – | 30 000 |
| Torsional stress test | Tensile load | 10 N/mm² | 10 N/mm² | 300 N | – |
| | Torsional angle | ± 100 °/m | ± 100 °/m | ± 120 °/m | – |
| | Number of cycles | 50 000 | 50 000 | 50 000 | – |
| Sheath shifting test | Pulling speed | 20 mm/min | 20 mm/min | – | – |
| | Shifting force | > 20 kN | > 10 kN | – | – |
| Transverse pressure test | Pressure force | > 150 kN | > 150 kN | – | – |
| | Degree of deformation | < 50 % | < 50 % | – | – |
| Resistance to welding beads | Testing temperature | 450 °C | 450 °C | 450 °C | 450 °C |
| | Criterion | no damage | no damage | no damage | no damage |
| Brine resistance | Storage in | 27 % brine solution | 27 % brine solution | 27 % brine solution | – |
| | Temperature | 60 °C | 60 °C | 60 °C | – |
| | Duration | 14 days | 14 days | 14 days | – |
| Water compabillity acc. to EN 50525-2-21 | Duration of storage in water | 100 days | 100 days | 100 days | – |
| | Temperature | 50 °C | 50 °C | 50 °C | – |

| Test conditions for the individual flexible electric cables for mining applications – table 2 | | | | | |
|---|---|---|---|---|---|
| Additional mechanical tests | | TENAX-LK NTSKCGEWOEU | PROTOLON(SB) NTSCGEWOEU PROTOLON (SB-SAM) (N)TSCGEWOEU | TENAX-SAS NTSCGEWOEU | TENAX-LUMEN (N)TSCGEH3S |
| Reversed bending test | Tensile load | 20 N/mm² | – | 20 N/mm² | 20 N/mm² |
| | Bending diameter | 10 x D | – | 10 x D | 10 x D |
| | Number of cycles | 60 000 | – | 30 000 | 30 000 |
| Roller bending test (test type A) D < 50 mm | Tensile load | 5 N/mm² | – | – | – |
| | Bending diameter | 10 x D | – | – | – |
| | Number of cycles | 200 000 | – | – | – |
| Roller bending test (test type B) 20 mm < D < 60 mm | Tensile load | 5 N/mm² | – | – | – |
| | Bending diameter | 320 mm | – | – | – |
| | Number of cycles | 300 000 | – | – | – |
| Roller bending test (test type C) 60 mm < D < 120 mm | Tensile load | 20 N/mm² | – | 20 N/mm² | 20 N/mm² |
| | Bending diameter | 10 x D | – | 10 x D | 10 x D |
| | Number of cycles | 30 000 | – | 30 000 | 30 000 |
| Torsional stress test | Tensile load | – | – | – | – |
| | Torsional angle | – | – | – | – |
| | Number of cycles | – | – | – | – |
| Sheath shifting test | Pulling speed | – | 20 mm/min | 20 mm/min | 20 mm/min |
| | Shifting force | – | > 10 kN | > 10 kN | > 10 kN |
| Transverse pressure test | Pressure force | – | – | – | – |
| | Degree of deformation | – | – | – | – |
| Resistance to welding beads | Testing temperature | 450 °C | 450 °C | 450 °C | 450 °C |
| | Criterion | no damage | no damage | no damage | no damage |
| Brine resistance | Storage in | – | – | – | – |
| | Temperature | – | – | – | – |
| | Duration | – | – | – | – |
| Water compabillity acc. to EN 50525-2-21 | Duration of storage in water | – | – | – | – |
| | Temperature | – | – | – | – |

| Test conditions for the individual flexible electric cables for mining applications – table 3 | | | | | |
|---|---|---|---|---|---|
| Additional mechanical tests | | PROTOLON(ST) NTSCGEWOEU …/3E PROTOLON(ST) NTSCGEWOEU | PROTOMONT(Z) NSSHKCGEOEU | PROTOMONT(V) NSSHCGEOEU PROTOMONT(V) NTSKCGECWOEU PROTOMONT(VO) (N)TSKCGEWOEU | TENAX-CTE NSSHKCGEOEU |
| Roller bending test (test type C) 60 mm < D < 120 mm | Tensile load | – | 30 N/mm² | 5 N/mm² | 5 N/mm² |
| | Bending diameter | – | 10 x D | 5 x D | 5 x D |
| | Number of cycles | – | 5 000 | 3 000 | 3 000 |
| Resistance to welding beads | Testing temperature | 450 °C | 450 °C | 450 °C | 450 °C |
| | Criterion | no damage | no damage | no damage | no damage |

# Chemical parameters

## Resistance to chemicals

The individual basic types of materials used for flexible electric cables for mining applications, such as PCP or EPR can be very different from each other in their resistance to chemicals depending on the required properties. Furthermore, the properties of the materials can vary greatly from manufacturer to manufacturer.

Other factors which influence flexible electric cables for mining applications, such as the concentration and degree of wetting of the chemicals, their temperature and the penetration time have different effects on the resistance to chemicals and have to be investigated from case to case.

The chemical industry has drawn up a table which shows a rough summary of the resistance to chemicals of various basic types of material; the overview in the table below is not to be deemed a substitute for a detailed examination.

| Chemical | Material | | | | |
|---|---|---|---|---|---|
| | EPR | PVC | CSM | PCP | PU |
| A | | | | | |
| Acetic acid, 30 % | ● | ● | ● | ● | ● |
| Aceton | ● | ● | ● | ● | ● |
| Aluminium chloride solution | ● | ● | ● | ● | ● |
| Aluminium sulfate solution | ● | ● | ● | ● | ● |
| Ammonia, analhydrous | ● | ● | ● | ● | ● |
| Ammonium chloride solution | ● | ● | ● | ● | ● |
| Ammonium hydroxide solution | ● | ● | ● | ● | ● |
| Ammonium sulfate solution | ● | ● | ● | ● | ● |
| Amyl acetate | ● | ● | ● | ● | ● |
| Aniline | ● | ● | ● | ● | ● |
| Asphalt | ● | ● | ● | ● | ● |
| B | | | | | |
| Benzine | ● | ● | ● | ● | ● |
| Benzole | ● | ● | ● | ● | ● |
| Borax solution | ● | ● | ● | ● | ● |
| Boric acid solution | ● | ● | ● | ● | ● |
| Butyl acetate | ● | ● | ● | ● | ● |
| C | | | | | |
| Calcium bisulphite solution | ● | ● | ● | ● | ● |
| Calcium chloride solution | ● | ● | ● | ● | ● |
| Calcium hydroxide solution | ● | ● | ● | ● | ● |
| Carbon disulphide | ● | ● | ● | ● | ● |
| Carbon tetrachloride | ● | ● | ● | ● | ● |
| Chlorine gas, dry | ● | ● | ● | ● | ● |
| Chlorine gas, wet | ● | ● | ● | ● | ● |
| Chloroacetic acid | ● | ● | ● | ● | ● |
| Chlorobenzene | ● | ● | ● | ● | ● |
| Chloroform | ● | ● | ● | ● | ● |
| Copper chloride solution | ● | ● | ● | ● | ● |
| Copper sulphate solution | ● | ● | ● | ● | ● |
| Cyclohexane | ● | ● | ● | ● | ● |
| D | | | | | |
| Dibutylphtalate | ● | ● | ● | ● | ● |
| Diesel oils | ● | ● | ● | ● | ● |
| E | | | | | |
| Ethyl acetate | ● | ● | ● | ● | ● |
| Ethyl alcohol | ● | ● | ● | ● | ● |
| Ethylene glycol | ● | ● | ● | ● | ● |
| Ethylen oxide | ● | ● | ● | ● | ● |
| F | | | | | |
| Formaldehyde, 10 % | ● | ● | ● | ● | ● |
| Fuel oil | ● | ● | ● | ● | ● |
| G | | | | | |
| Glycerine | ● | ● | ● | ● | ● |
| H | | | | | |
| Hydraulic oils | ● | ● | ● | ● | ● |
| Hydrochloric acid, 20 % | ● | ● | ● | ● | ● |
| Hydrogen sulphide | ● | ● | ● | ● | ● |

| Chemical | Material | | | | |
|---|---|---|---|---|---|
| | EPR | PVC | CSM | PCP | PU |
| K | | | | | |
| Kerosine | ● | ● | ● | ● | ● |
| L | | | | | |
| Lactic acid | ● | ● | ● | ● | ● |
| Linseed oil | ● | ● | ● | ● | ● |
| Lubricating oils | ● | ● | ● | ● | ● |
| M | | | | | |
| Magnesium chloride solution | ● | ● | ● | ● | ● |
| Methanol | ● | ● | ● | ● | ● |
| Methyl alcohol | ● | ● | ● | ● | ● |
| Methyl chloride | ● | ● | ● | ● | ● |
| Methyl ethyl ketone | ● | ● | ● | ● | ● |
| Mineral oil | ● | ● | ● | ● | ● |
| N | | | | | |
| Naphta | ● | ● | ● | ● | ● |
| Naphtalene | ● | ● | ● | ● | ● |
| Nitric acid, 10 % | ● | ● | ● | ● | ● |
| P | | | | | |
| Perchlor ethylene | ● | ● | ● | ● | ● |
| Petroleum | ● | ● | ● | ● | ● |
| Phenol | ● | ● | ● | ● | ● |
| Phosphoric acid | ● | ● | ● | ● | ● |
| Picric acid | ● | ● | ● | ● | ● |
| Potassium chloride | ● | ● | ● | ● | ● |
| Pyridine | ● | ● | ● | ● | ● |
| S | | | | | |
| Soap solution | ● | ● | ● | ● | ● |
| Sodium hydroxide, 25 % | ● | ● | ● | ● | ● |
| Sodium hypochloride | ● | ● | ● | ● | ● |
| Soya bean oil | ● | ● | ● | ● | ● |
| Stearic acid | ● | ● | ● | ● | ● |
| Sulphur | ● | ● | ● | ● | ● |
| Sulphuric acid < 50% | ● | ● | ● | ● | ● |
| Sulphurous acid | ● | ● | ● | ● | ● |
| T | | | | | |
| Toluene | ● | ● | ● | ● | ● |
| Transformer oil | ● | ● | ● | ● | ● |
| Tributyl phosphate | ● | ● | ● | ● | ● |
| Trichlorethylene | ● | ● | ● | ● | ● |
| Triethanolamine | ● | ● | ● | ● | ● |
| Turpentine | ● | ● | ● | ● | ● |
| V/W/X/Y | | | | | |
| Vegetable oils and grease | ● | ● | ● | ● | ● |
| Water | ● | ● | ● | ● | ● |
| Xylene | ● | ● | ● | ● | ● |
| Zinc chloride solution | ● | ● | ● | ● | ● |

● Resistant
● Limited resistance
● Non-resistant
● Not tested

# Construction characteristics

## Conductors

Conductors for flexible electric cables are designed according to DIN EN 60228 (VDE 0295). Nowadays, the conductors are made of copper (Cu). Aluminium and other materials have not found general acceptance.

In many countries, the design of the conductors according to DIN VDE 0295 is accepted. The regulation corresponds to EN 60228 and IEC 60228.

The conductor classes F, FS and FF are employed for flexible electric cables for mining applications.

The conductor classes are divided into nominal cross-sections. The individual conductor classes F, FS and FF and the nominal cross-section are defined by specification of the maximum diameter of the single wires and by the maximum resistance of the conductor at 20 °C (see table).

These flexible conductors are made of bare or tinned annealed copper. The conductors are constructed of many single wires, all of which must have the same diameter.

Overview of common kinds of conductors:

| Abbreviation | Designation | Specification/regulation |
|---|---|---|
| RE conductor | Circular, solid | DIN VDE 0295 Class 1 |
| RM conductor | Circular, stranded | DIN VDE 0295 Class 2 |
| RMV conductor | Circular, stranded, compacted | DIN VDE 0295 Class 2 |
| F conductor | Finley stranded | DIN VDE 0295 Class 5 |
| FS conductor | Very finely stranded | Prysmian specification |
| FF conductor | Extremely finely stranded | DIN VDE 0295 Class 6 |

**Conductors – construction characteristics**

| Nominal cross-section mm² | Max. diameter of the single wires mm | | | Resistance of the conductor at 20 °C Ω/km | |
|---|---|---|---|---|---|
| | F conductor (Class 5) | FS conductor (Prysmian Group) | FF conductor (Class 6) | Bare single wires | Tinned single wires |
| 0.5 | 0.21 | 0.16 | 0.16 | 39 | 40.1 |
| 0.75 | 0.21 | 0.16 | 0.16 | 26 | 26.7 |
| 1 | 0.21 | 0.16 | 0.16 | 19.5 | 20 |
| 1.5 | 0.26 | 0.21 | 0.16 | 13.3 | 13.7 |
| 2.5 | 0.26 | 0.21 | 0.16 | 7.98 | 8.21 |
| 4 | 0.31 | 0.26 | 0.16 | 4.95 | 5.09 |
| 6 | 0.31 | 0.26 | 0.21 | 3.30 | 3.39 |
| 10 | 0.41 | 0.26 | 0.21 | 1.91 | 1.95 |
| 16 | 0.41 | 0.31 | 0.21 | 1.21 | 1.24 |
| 25 | 0.41 | 0.31 | 0.21 | 0.780 | 0.795 |
| 35 | 0.41 | 0.31 | 0.21 | 0.554 | 0.565 |
| 50 | 0.41 | 0.36 | 0.31 | 0.386 | 0.393 |
| 70 | 0.51 | 0.36 | 0.31 | 0.272 | 0.277 |
| 95 | 0.51 | 0.41 | 0.31 | 0.206 | 0.210 |
| 120 | 0.51 | 0.41 | 0.31 | 0.161 | 0.164 |
| 150 | 0.51 | 0.41 | 0.31 | 0.129 | 0.132 |
| 185 | 0.51 | 0.41 | 0.41 | 0.106 | 0.108 |
| 240 | 0.51 | 0.41 | 0.41 | 0.0801 | 0.0817 |
| 300 | 0.51 | 0.41 | 0.41 | 0.0641 | 0.0654 |

## Conductors – summary

The conductors used in flexible electric cables for mining applications are summarised in the table below.

The conductor for flexible electric cables is designed acc. to EN 60228 (VDE 0295), as described in the table below and especially in the table on the previous page.

The construction of the conductor itself and its design features are open to variation.

| Conductors used in flexible electric cables for mining applications – summary | | | | |
|---|---|---|---|---|
| Flexible cables | Type | Conductor | | |
| | | Class | Design | |
| CORDAFLEX(S) | NSHTOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| FELTOFLEX | NTMCWOEU | F | Electrolytic copper, tinned | Finely stranded |
| OPTOFLEX(M) | – | Fibre-optics, no copper conductors | | |
| PROTOLON single-core | NTMCGCWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOLON(M) single-core | (N)TMCGCWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOLON(M) | F-(N)TSCGEWOEU | F | Bare electrolytic copper | Finely stranded |
| PROTOLON(M) | R-(N)TSCGEWOEU | FS | Bare electrolytic copper | Very finely stranded |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | FS | Bare electrolytic copper | Very finely stranded |
| PROTOLON(SB) | NTSCGEWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | F | Bare electrolytic copper | Finely stranded |
| PROTOLON(ST) | NTSCGEWOEU .../3E | F | Electrolytic copper, tinned | Finely stranded |
| PROTOLON(ST) | NTSCGEWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT | NSSHOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT | NSHXOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT | NSSHOEU .../3E | F | Bare electrolytic copper | Finely stranded |
| PROTOMONT festoon | NTSKCGECWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT EMV-FC | (N)SSHCOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT(M+) | (N)SHOEU | F | Bare electrolytic copper | Finely stranded |
| PROTOMONT(MSR) | 2YSLGCGOEU | F | Bare electrolytic copper | Finely stranded |
| PROTOMONT(MT) | (N)SSHOEU | F | Bare electrolytic copper | Finely stranded |
| PROTOMONT(V) | NSSHCGEOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| PROTOMONT(V) | NTSKCGECWOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| PROTOMONT(VO) | (N)TSKCGEWOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| PROTOMONT(S) | (N)SSHCGEOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| PROTOMONT(Z) | NSSHKCGEOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| PROTOMONT TBM | (N)TSCGECWOEU | F | Electrolytic copper, tinned | Finely stranded |
| PROTOMONT TBM | (N)TSCGECWHXOEU | F | Electrolytic copper, tinned | Finely stranded |
| SUPROMONT | (N)3GHSSYCY | F | Bare electrolytic copper | Finely stranded |
| SUPROMONT | (N)3GHSSHCH | F | Bare electrolytic copper | Finely stranded |
| TENAX-CTE | NSSHKCGEOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| TENAX-HTT | (N)TSCGEWOEU | F | Bare electrolytic copper | Finely stranded |
| TENAX-LK | NTSKCGEWOEU | FS | Electrolytic copper, tinned | Very finely stranded |
| TENAX-LUMEN | (N)TSCGEH3S | F | Electrolytic copper, tinned | Finely stranded |
| TENAX-SAS | NTSCGEWOEU | F | Electrolytic copper, tinned | Finely stranded |

## Design elements

Figure 1 shows the design elements of a conductor for flexible electric cables for mining applications.

Depending on the cross-section of the conductor, a flexible conductor consists of one or more strands which are laid up around a central strand in several layers. In the diagram, six individual strands (second layer) are laid up around a central strand (first layer). A third layer would then be made from 6 + 6 = 12 individual strands, arranged around the second layer.

The strands of the flexible conductors consist of many single wires bunched together. The single wires can be laid up (bunched) to the right or left, thus determining the direction of lay. This is shown in figure 2 as the Z direction of lay (right) or the S direction of lay (left). This also applies to a conductor which is laid up of single strands.

## Conductor design

The conductor design and the nominal cross-section of the flexible F, FS and FF conductors for flexible electric cables are usually as shows in the table “Conductor design”.

## Conductor types

Depending on the combination of the individual design elements of a conductor, there are three basic types of conductors (see table “Conductor types”).

The main advantage of the uniform-lay conductor is its high flexibility. As a result of its design, the conductor also has a smaller diameter than other types of conductors.

Disadvantages are its susceptibility to torsional loads (unstable) and its poor resistance to axial compression and sharp bending. The uniform-lay conductor is used for all TENAX cables.

The alternating-lay conductor is very stable with respect to torsional loads and is not sensitive to axial compression and sharp bending. A disadvantage is its relatively low flexibility. As a result of its design the many crossing points of the single wires cause a lot of friction, which can lead to early breaking of the conductor, as compared to the other two types of conductors. The alternating-lay conductor has the largest diameter compared to the other two types of conductors.

The design of the opposite-lay conductor best meets the requirements of flexible electric cables for mining applications. It combines the advantages of both the uniform-lay conductor and the alternating-lay conductor without any of their disadvantages. The conductor is highly flexible, remains stable with respect to torsional loads and exhibits high axial compression and sharp bending strength. It has proven its excellent characteristics in many years of practice. The opposite-lay conductor is used for CORDAFLEX, PROTOMONT, SUPROMONT and PROTOLON.

Figure 1

S Length of lay
$D_L$ Diameter of conductor
$d_L$ Diameter of strands
$d_{ED}$ Diamater of single wires

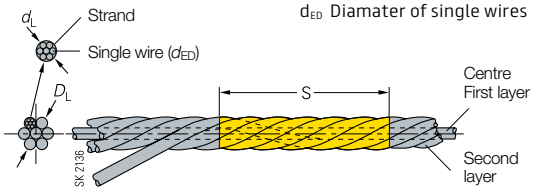
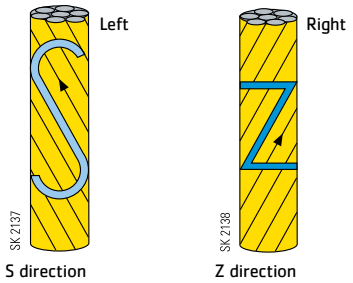



Figure 2




**Conductor design**

| | | F conductor | FS conductor | FF conductor |
|---|---|---|---|---|
| Bunched |  | up to 10 mm² | up to 2.5 mm² | up to 2.5 mm² |
| Stranded |  | from 16 mm² | from 4 mm² | from 4 mm² |

**Conductor types**

| | | Design | Strand | Layer |
|---|---|---|---|---|
| Uniform-lay conductor |  | Centre | Z | |
| | | 2nd layer | Z | Z |
| | | 3rd layer | Z | Z |
| Alternating-lay conductor |  | Centre | Z | |
| | | 2nd layer | S | Z |
| | | 3rd layer | Z | S |
| Opposite-lay conductor |  | Centre | S | |
| | | 2nd layer | S | Z |
| | | 3rd layer | S | Z |

## Insulating and sheathing compounds

The table below gives an overview of all common compounds used for flexible electric cables. A basic distinction is made between thermoplastics and elastomers:

- Thermoplastics, generally known as plastic, are usually not cross-linked
- Elastomers, generally known as rubber, are always cross-linked

| Compounds used for flexible electric cables | | | | |
|---|---|---|---|---|
| Serial no. | Material | Abbreviation | Type designation* | |
| | | | VDE | Harm. |
| Thermoplastics | | | | |
| 1 | Polyvinyl chloride | PVC | Y | V |
| 2 | Cross-linked polyvinyl chloride | PVC | X | V4 |
| 3 | Polyethylenen | PE | 2Y | E |
| 4 | Cross-linked polyethylenen | XLPE | 2X | X |
| 5 | Low-pressure polyethylene | PE | 2Yn | E2 |
| 6 | Foam polyethylene | PE | 02Y | |
| 7 | Polystyrene | PS | 3Y | Q3 |
| 8 | Polyamide | PA | 4Y | Q4 |
| 9 | Polyetrafluor ethylene | PTFE | 5Y | E4 |
| 10 | Perfluor ethylene propylene | PEP | 6Y | E5 |
| 11 | Ethylene tetrafluor ethylene | ETFE | 7Y | E6 |
| 12 | Polyimide | PI | 8Y | Q5 |
| 13 | Polypropylene | PP | 9Y | E7 |
| 14 | Polyvinylidene fluoride | PVDF | 10Y | Q6 |
| 15 | Polyurethane | TPU/PU | 11Y | Q |
| 16 | Polyterephthalic acid ester | PETP | 12Y | Q2 |
| 17 | Polyester thermoplastic | – | 13Y | |
| 18 | Perfluor ethylene oxyalkane | PFA | 14Y | |
| 19 | Polychlorotrifluor ethylene | ECTFE | 15Y | |
| Elastomers | | | | |
| 20 | Natural rubber | NR | G | R |
| 21 | Synthetic rubber | SR | G | R |
| 22 | Styrene-butadiene rubber | SBR | G | R |
| 23 | Silicon rubber | SIR | 2G | S |
| 24 | Isobuthylene-isoprene rubber | IIR | 3G | B3 |
| 25 | Ethylene-propylene rubber | EPR/EPDM | 3G | B |
| 26 | Ethylene vinylacetate | EVA | 4G | G |
| 27 | Chloroprene rubber | CR | 5G | N |
| 28 | Chlorosulfonated polyethylene | CSM | 6G | N4 |
| 29 | Fluor elastomers | | 7G | |
| 30 | Nitrile butadiene rubber | NBR | 8G | N5 |
| 31 | Chlorated polyethylene | CM/CPE | 9G | |

***Type designation:**

Y: Type designation for a thermoplastic material.

G: Type designation for an elastomeric material.

X: Type designation for a cross-linked thermoplastic material (the letter "X" replaces the "Y" in "2X" for cross-linked polyethylene).

0: Additional designation for foam materials (the zero is placed in front of the relevant type designation, e.g. "02Y" for foamed PE).

The insulating and sheathing compounds, which are employed in flexible electric cables for mining applications constructed according to the existing VDE standards listed below, are compared with respect to the individual requirements in the table below.

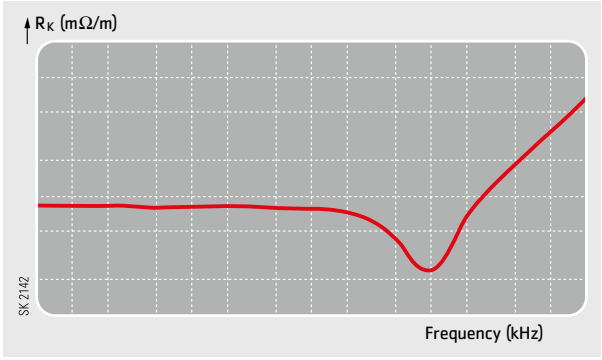
The characteristics are specified in DIN VDE 0207 or EN 50290 and allow a preliminary estimation of the properties of these compounds.

| Characteristics of insulating and sheathing compounds | | | | | | |
|---|---|---|---|---|---|---|
| Requirements | | Unit | Compound | | | |
| | | | Sheath | | | Insulation |
| | | | CR/MR | | SR | EPR |
| | | | 5GM3 | 5GM5 | GM1b | 3GI3 |
| Max. permissible operating temperature at the conductor | | °C | 90 | 90 | 90 | 90 |
| Tensile strength before ageing | min. | N/mm² | 10.0 | 15.0 | 4.2 | 4.2 |
| Elongation at break before ageing | min. | % | 300 | 300 | 200 | 200 |
| Ageing | at | °C | 100 ±2 | 100 ±2 | 100 ±2 | 135 ±2 |
| | over | d | 7.0 | 7.0 | 7.0 | 7.0 |
| Change in tensile strength after ageing | max. | % | ±30 | ±30 | – | ±30 |
| Elongation at break after ageing | min. | % | 250 | 250 | 200 | – |
| Change in elongation at break after ageing | max. | % | ±40 | ±40 | – | ±30 |
| Abrasion | max. | mm³ | – | 300 | – | – |
| Resistance to tear propagation | min. | N/mm | – | 30 | – | – |
| Thermal expansion | at | °C | 100 ±2 | 100 ±2 | – | 200 ±3 |
| | over | min. | 15 | 15 | 15 | 15 |
| | with | N/cm² | 20 | 20 | 20 | 20 |
| | loaded max. | % | 175 | 175 | 175 | 175 |
| | relieved max. | % | 25 | 25 | 25 | 25 |
| Resistance to oil (ASTM Oil no. 2) | at | °C | 100 ±2 | 100 ±2 | – | 127 ±1 |
| | over | h | 24 | 24 | – | 40 |
| | with | bar | – | – | – | 5.5 ±1 |
| Change in tensile strength | max. | N/mm² | ±40 | ±40 | – | ±30 |
| Change in elongation at break | max. | % | ±40 | ±40 | – | ±30 |
| Surface resistance at 20 °C | min. | Ω | $10^9$ | $10^9$ | $10^9$ | – |
| Volume resistance at 20 °C | min. | Ω x cm | – | – | – | $10^{12}$ |

## Shield

The shield is a "barrier" against electromagnetic fields and protects electric signals against external signals. The aim is to weaken or stop unwanted signals to such an extent that the wanted data signals can be transmitted without interference in the endangered signalling conductor. There are three basic types of shield structure:

- Overall shield over several cores
- Shielded pairs
- Individually shielded cores.




An overall sheath over several cores, which as a rule is situated between the inner and outer sheath of a cable, has not found general acceptance for reeling cables, because as a result of frequent bending the tensile and pressure forces within the cable lead to premature destruction of the shields and to failure of the cable.

Shielded pairs and individually shielded cores, on the other hand, have proven themselves in practice and are successfully used in Prysmian Group cables.

Braided screens are characterized by their transfer impedance which is defined as the ratio of the voltage drop along the shield on the interfered side to the parasitic current on the other side. The transfer impedance $R_K$ (DIN 40500) is given for a specific frequency in mΩ/m and is usually plotted with respect to frequency. The lower the transfer impedance of a shield, the better the screening effect. The transfer impedance of the braided screens usually used for flexible electric cables for mining applications is optimized at 30 MHz and is therefore focussed on data-processing quality.

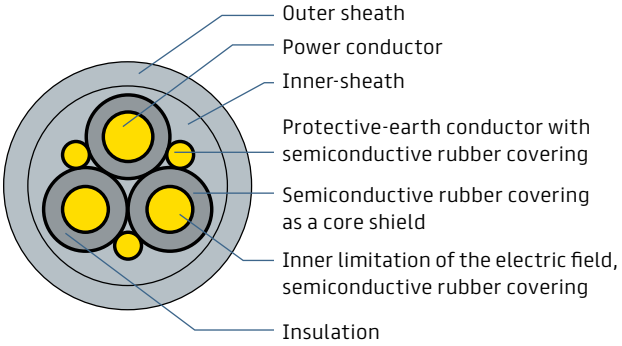
A typical transfer impedance characteristic is shown in the diagram to the left.

## Electrical field control with cables

The cores of MV-reeling and trailing cables of voltage level 6 kV and above are always equipped with inner and outer semiconductive layers made of semiconductive rubber.

The inner and outer semiconductive layers are extruded with the insulation in a single-pass operation. Secure bonding to the insulation is obtained as a result of this method of extrusion.

The inner semiconductive layer prevents build-up of excessive electrical field strength at the individual wires of the flexible conductor and partial discharges between the conductor and the insulation.




The outer semiconductive layer serves as a core shield and performs the following tasks:

- Protection against electric shock
- Avoidance of partial discharges in the conductor assembly
- Generation of the radial electrical field in the insulation
- Discharge of current in the event of a fault.

The core shield is thus an integral component of the protective-earth conductor.

The resistance between the protective-earth conductor and any point on the outer semiconductive layer must not exceed 500 Ω. The protective-earth conductor, which touches the core shield, is covered with semiconductive rubber and ensures longitudinal conductivity of the system. The figure to the left shows the cross-section of a MV-cable with inner and outer semiconductive layers.

In addition to the electrical requirements, the core shield in flexible electric cables for mining applications must also be able to cope with the high (sometimes very high) mechanical stresses.

Metal shields are more liable to become defective when used in flexible electric cables for mining applications and are inferior to shields made of semiconductive rubber material.

## Core arrangement

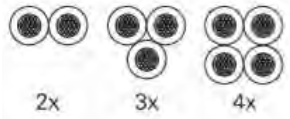
The basic criteria of the core arrangement for flexible electric cables for mining applications are summarised in the table on page 207.

In round flexible electric cables, the individual cores are arranged by laying them up. Up to four cores are laid up without a central element. Five cores and above are laid up around a centre, which can also consist of three-core stranded elements.

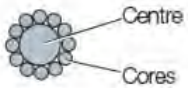
A stretched core in the centre of the flexible cable (as the actual centre or placed in the centre) is not permitted according to the DIN VDE standards. A stretched core at the centre of the flexible cable would quickly result in premature failure of the conductor due to breakage, especially in flexible electric cables for mining applications.

A maximum of three core layers is best for the conductor assembly. Investigations have shown that, if there are more than three layers, the internal stability of the flexible cable and in consequence the service life is reduced as a result of increasing secondary and relative forces between the cores.

Core arrangements in round flexible cables:

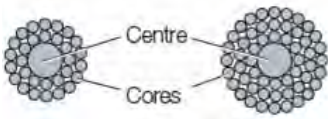



Laying up of two to four cores without a centre.

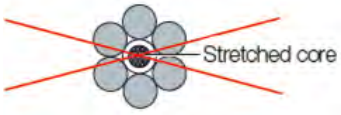



Laying up of five or more cores with centre.

Special design: the centre comprises three cores.

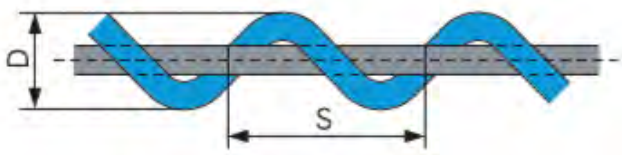



Maximum three-layer design (standard up to 44 cores).




A stretched core in the centre of a flexible cable is not permitted.

The length of lay S is a design feature used for laying up the conductor assembly (see table) and influences the bending flexibility and the bending stability. The length of lay is an important factor for the service life of flexible electric cables for mining applications.




The length of lay S is the length, measured in the direction of the lay, over which a core circumscribes 360° around the laying axis.

It is given as a multiple of the diameter D over the conductor assembly, e.g. S = 8 x D

| Length of lay for flexible electric cables for mining applications | | |
|---|---|---|
| Flexible cables | Type | Length of lay |
| CORDAFLEX(S) | NSHTOEU | 5 x D |
| FELTOFLEX | NTMCWOEU | not applicable |
| OPTOFLEX(M) | – | Especially laid-up around a GFK support element |
| PROTOLON single-core | NTMCGCWOEU | not applicable |
| PROTOLON(M) single-core | (N)TMCGCWOEU | not applicable |
| PROTOLON(M) | F-(N)TSCGEWOEU | 12 x D |
| PROTOLON(M) | R-(N)TSCGEWOEU | 7 x D |
| PROTOLON(M) with F.O. | R-(N)TSCGEWOEU | 7 x D |
| PROTOLON(SB) | NTSCGEWOEU | 10 x D |
| PROTOLON(SB-SAM) | (N)TSCGEWOEU | 10 x D |
| PROTOLON(ST) | NTSCGEWOEU .../3E | 10 x D |
| PROTOLON(ST) | NTSCGEWOEU | 10 x D |
| PROTOMONT | NSSHOEU | Power cable: 15 x D (Control cable: 25 x D) |
| PROTOMONT | NSHXOEU | Power cable: 15 x D (Control cable: 25 x D) |
| PROTOMONT | NSSHOEU .../3E | 20 x D |
| PROTOMONT festoon | NTSKCGECWOEU | 7 x D |
| PROTOMONT EMV-FC | (N)SSHCOEU | 20 x D |
| PROTOMONT(M+) | (N)SHOEU | 10 x D |
| PROTOMONT(MSR) | 2YSLGCGOEU | Laid-up pairs ≥ 25 x D / Laid-up cores ≥ 15 x D |
| PROTOMONT(MT) | (N)SSHOEU | Power cable: 15 x D (Control cable: 25 x D) |
| PROTOMONT(V) | NSSHCGEOEU | 6 x D |
| PROTOMONT(V) | NTSKCGECWOEU | 6 x D |
| PROTOMONT(VO) | (N)TSKCGEWOEU | 6 x D |
| PROTOMONT(S) | (N)SSHCGEOEU | 6 x D |
| PROTOMONT(Z) | NSSHKCGEOEU | 6 x D |
| PROTOMONT TBM | (N)TSCGECWOEU | 12 x D |
| PROTOMONT TBM | (N)TSCGECWHXOEU | 12 x D |
| SUPROMONT | (N)3GHSSYCY | 12 x D |
| SUPROMONT | (N)3GHSSHCH | 12 x D |
| TENAX-CTE | NSSHKCGEOEU | 6 x D |
| TENAX-HTT | (N)TSCGEWOEU | 12 x D |
| TENAX-LK | NTSKCGEWOEU | 7 x D |
| TENAX-LUMEN | (N)TSCGEH3S | 6.5 x D |
| TENAX-SAS | NTSCGEWOEU | 6.5 x D |

## Support elements

Flexible electric cables for mining applications should not be stressed above the limits set out in table "Maximum tensile loads" on page 192 for the permissible tensile forces. If higher tensile forces are expected, support elements have to be provided as part of the structure of the cable. There are several possibilities for integration of support elements in cables.

Two variants are normally used:

- A support element located in the centre of the cable or
- A braid between the inner and outer sheath

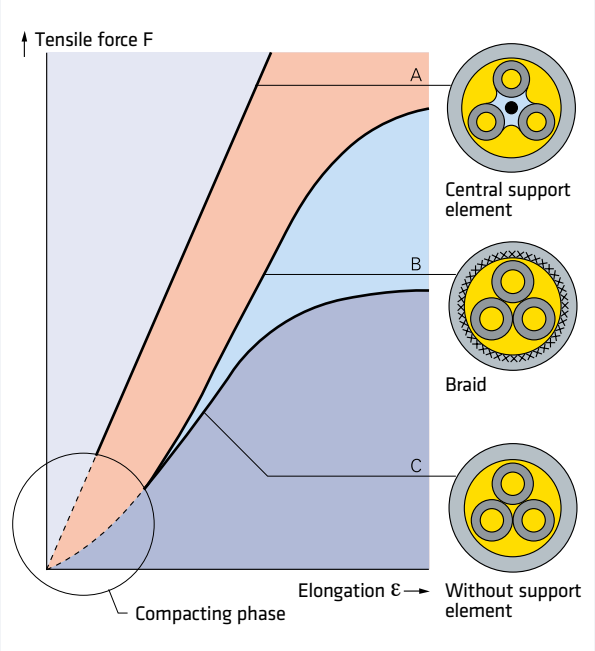
The force/elongation diagram in the figure shows the characteristic of these cables with different arrangements of support elements as compared to a cable without a support element.

After a compacting phase, in which the individual cable elements are initially pulled together, until the copper conductor begins to bear the tensile force, the cable without a support element remains linear in the first section of the curve (curve C). In the next phase, elongation increases considerably on a slight increase of force.

Cables with a braid as a support element between the inner and outer sheath behave in the first section of the curve (curve B) in a similar manner to cables without a support element. The braid becomes effective as a support element and bears the applied force only after the force and the consequent elongation have increased over a certain period of time. The tensile force, which is borne, increases with less elongation than that of the cable without a support element. The braid as a support element can prevent the cable, e.g. from tearing.

Cables with a central support element behave differently provided that the support element was correctly dimensioned. The support element bears the tensile forces from the very beginning and thus relieves the copper conductor (curve A).

The force/elongation characteristics of the support elements and of the copper conductors are decisive for correct design of the support element and dimensioning of the flexible cables. The actual design should be worked out in close co-operation with the cable manufacturer.

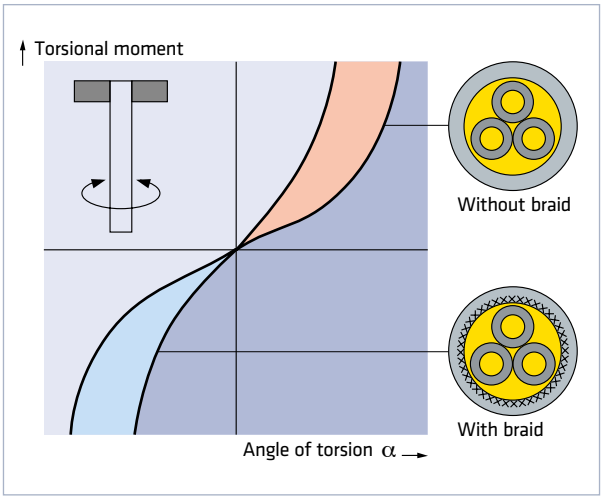



## Anti-torsion braid

Flexible electric cables for mining applications are often fitted with an anti-torsion braid between the inner and outer sheath in order to minimize twisting under torsional loads. This applies to CORDAFLEX(S), PROTOLON(M)-R, TENAX-LK, PROTOMONT(S) and TENAX-SAS.

The effect of an anti-torsion braid on the angle of torsion angle α with increasing torsional moment for comparable cables with and without an anti-torsion braid is shown in the figure.

The flexible cable with anti-torsion braid tends to twist less than the flexible cable without a braid for the same torsional moment.



# Cable drum overview

| Cable drums | | | |
|---|---|---|---|
| Drum size | Weight (kg) | Dimensions Ø x width (cm) | Volume ($m^3$) |
| 051 | 9 | 50 x 46 | 0.09 |
| 071 | 23 | 71 x 48 | 0.19 |
| 081 | 28 | 80 x 48 | 0.26 |
| 091 | 43 | 90 x 64 | 0.45 |
| 101 | 50 | 100 x 64 | 0.70 |
| 121 | 125 | 125 x 76 | 1.09 |
| 141 | 145 | 140 x 95 | 1.37 |
| 161 | 210 | 160 x 95 | 2.01 |
| 181 | 280 | 180 x 110 | 2.80 |
| 200 | 380 | 200 x 110 | 4.24 |
| 220 | 500 | 224 x 138 | 5.44 |
| 224 | 700 | 240 x 138 | 7.26 |
| 281 | 900 | 280 x 138 | 10.10 |
| 300 | 1100 | 300 x 170 | 12.14 |
| 320 | 1200 | 320 x 170 | 18.10 |
| 340 | 1400 | 340 x 220 | 20.43 |

# Local standards

## Comparison AWG

| AWG (American Wire Gage) | | |
|---|---|---|
| AWG size | Equivalent cross-section ($mm^2$) | Closest metrical cross-section ($mm^2$) |
| 18 | 0.823 | 1.0 |
| 16 | 1.31 | 1.5 |
| 14 | 2.08 | 2.5 |
| 12 | 3.31 | 4.0 |
| 10 | 5.26 | 6.0 |
| 8 | 8.37 | 10.0 |
| 6 | 13.30 | 16.0 |
| 4 | 21.15 | 25.0 |
| 2 | 33.63 | 35.0 |
| 1/0 | 53.48 | 50.0 |
| 2/0 | 67.43 | 70.0 |
| 3/0 | 85.01 | 95.0 |

| AWG (American Wire Gage) | | |
|---|---|---|
| AWG size | Equivalent cross-section ($mm^2$) | Closest metrical cross-section ($mm^2$) |
| 250 MCM | 107.20 | 120.0 |
| 300 MCM | 152.00 | 150.0 |
| 350 MCM | 177.35 | 185.0 |
| 400 MCM | 202.71 | 185.0 |
| 500 MCM | 253.35 | 240.0 |
| 600 MCM | 303.96 | 300.0 |
| 750 MCM | 379.95 | 400.0 |
| 1000 MCM | 506.71 | 500.0 |
| | | |
| | | |
| | | |
| | | |

# Worldwide Prysmian Group mining cables acc. to local standards

| Prysmian Group mining cables | | | | |
|---|---|---|---|---|
| Brandname | Cable type | Standard | Production location | Application |
| Australia – Australian Standard (AS) | | | | |
| MineMaster | Type 209 1.1-11 kV | AS/NZS 1802 | Australia | Underground feeder cable for pumps, fans and crushers |
| MineMaster | Type 210 1.1 kV | AS/NZS 1802 | Australia | Underground cable for hand-held boring machines |
| MineMaster | Type 240 1.1-11 kV | AS/NZS 1802 | Australia | Underground feeder cable for continuous miner |
| MineMaster | Type 241 1.1-11 kV | AS/NZS 1802 | Australia | Underground screened cable for continuous miner and feeder |
| MineMaster | Type 275 1.1 kV | AS/NZS 1802 | Australia | Underground cable for high speed reeling on shuttle cars |
| MineMaster | Type 409 3.3-22 kV | AS/NZS 2802 | Australia | Opencast screened cable for trailing application |
| MineMaster | Type 440 3.3-22 kV | AS/NZS 2802 | Australia | Opencast screened cable for trailing application |
| MineMaster | Type 441 3.3-22 kV | AS/NZS 2802 | Australia | Opencast screened cable for trailing application |
| MineMaster | Type 450 3.3-33 kV | AS/NZS 2802 | Australia | Opencast screened cable for trailing application |
| Czech Republic | | | | |
| | 1-CHBU 0.6/1 kV | Based on DIN VDE 0250 | Germany | Semi-flexible installation |
| | 3-CHBU 1.8/3 kV | Based on DIN VDE 0250 | Germany | Semi-flexible installation |
| | 6-CHBU 3.6/6 kV | Based on DIN VDE 0250 | Germany | Semi-flexible installation |
| | 6-CHCU 3.6/6 kV | Based on DIN VDE 0250 | Germany | Semi-flexible installation along conveyor belts |
| | 6-CHCU-TT 3.6/6 kV | Based on DIN VDE 0250 | Germany | Cable for reeling application |
| | 6-CHCU-TTAR 3.6/6 kV | Based on DIN VDE 0250 | Germany | Cable for reeling and trailing application |
| | 35-CHVU 20/35 kV | Based on DIN VDE 0250 | Germany | Cable for slow reeling and trailing application |
| Great Britain – British Standard (BS) | | | | |
| PROTOMONT | Type 7 - 7M - 7S 1.1 kV | BS 6708 | Germany | Flexible rubber cable for use in underground mines |
| PROTOMONT | Type 307 - 307M - 307S 3.3 kV | BS 6708 | Germany | Flexible rubber cable for use in underground mines |
| PROTOMONT | Type 201 - 211 1.1 kV | BS 6708 | Germany | Pliable wire armoured cables for underground use |
| PROTOMONT | Type 62 - 63 - 64 1.1 kV | BS 6708 | Germany | Pliable wire armoured for use as roadway extension and lighting cables |
| PROTOMONT | Type 321 - 331 3.3 kV | BS 6708 | Germany | MV pliable wired armoured for use as mine roadway extension cables |
| PROTOMONT | Type 631 6.6 kV | BS 6708 | Germany | MV pliable wired armoured for use as mine roadway extension cables |
| PROTOMONT | Type 506 - 512 - 518 - 524 | BS 6708 | Germany | Pliable wire armoured signaling and auxiliary cables |
| India – Indian Standard (IS) | | | | |
| | TYPE FT7 1.1 kV | IS 14494 | Germany | Flexible rubber cable for use in underground mines |
| | TYPE FT10 1.1 kV | IS 14494 | Germany | Flexible rubber cable for use in underground mines |
| | TYPE FT11 1.1 kV | IS 14494 | Germany | Flexible rubber cable for use in underground mines |
| | TYPE PLC2 - PLC3 - PLC4 - PLC5 1.1 kV | IS 14494 | Germany | Pliable wire armoured cables for underground use |
| PROTOMONT | Type 506 - 524 | IS 14494 | Germany | Pliable wire armoured signaling and auxiliary cables |
| Serbia | | | | |
| | EPN 78 | SRPS N.C5.374 | Germany | MV cable for reeling, trailing and semi-flexible application |
| USA | | | | |
| ANACONDA | Type W 2kV | ICEA S-75-381 | USA | Flexible rubber cable for general purpose |
| ANACONDA | Type G - G-GC 2 kV | ICEA S-75-381 | USA | Flexible rubber cable for general purpose |
| ANACONDA | Type SHD-GC 2-25 kV | ICEA S-75-381 | USA | Flexible MV cable for trailing in opencast and undeground mines |
| ANACONDA | Type MP-GC 5-25 kV | ICEA S-75-381 | USA | Semi-flexible installation |

# Linking the future





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