FIRE PERFORMANCE CABLE

prysmian

The planet's pathways

Connecting people and businesses everywhere

150
Years of Experience

+50
Countries

33k
Employees

+15B
Sales in Euros

Sustainability-driven innovation to lead the energy transition and digital transformation

With a legacy spanning over 150 years, Prysmian is a global leader in energy and telecom cable solutions, driving innovation and sustainability. In 2023, we achieved over €15 billion in sales, supported by our 33,000 employees, 82 manufacturing plants, and operations in more than 50 countries worldwide.

We offer the broadest range of cutting-edge products, services, and technologies tailored to meet the evolving needs of our customers. From enabling the energy transition with our pioneering E-Path sustainable cable solution, to supporting critical telecom infrastructure, Prysmian plays a pivotal role in building resilient and efficient systems across the globe.

Our commitment to work closely with our customers ensures that we deliver solutions to help them expand energy and telecom networks, achieving sustainable, profitable growth while addressing the challenges of a rapidly changing world. Together, we're shaping the future of connectivity and electrification.

Our world-leading cable solutions

Transmission

- Submarine power and telecom systems
- Marine installation through inhouse fleet
- Underground interconnectors up to 525kV DC
- Complete solutions provider:
  - Turn-key execution approach
  - Continuous monitoring
  - Post-installation maintenance

Power Grid

- HV/EHV AC systems supply and installation
- MV and HV/EHV Network Components (NWC) up to 500kV
- Power Distribution cables' solutions from LV to MV (and up to 69kV)
- Data-driven permanent monitoring systems for power networks

Electrification

- Renewables
- Specialties & OEM
  - (Railway, Marine, Crane, Mining, Nuclear, Rolling Stock, Defence, Electro medical, other infrastructure)
- Data Centres
- Energy Storage Systems
- OGP Onshore/Offshore & SURF
- Elevators
- Other Industrial
- Residential, Hospitals & Commercial constructions

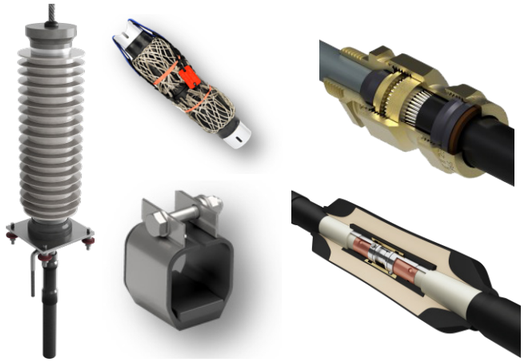
Digital Solutions

- Commercial Buildings
  - Passive Optical Cabling
  - Structured Cabling System
  - Building Management
- Data Centre
- Mission Critical and Harsh Environment
- Broadcast and Studio
- Marine & Shipboard

Network components

Empowering Reliable Grids with Comprehensive Network Components

We go beyond cables to deliver complete solutions for your transmission and distribution needs. Our extensive portfolio of network components and accessories—including joints, terminations, connectors, and glands—ensures seamless integration with power systems, whether for new installations or upgrades to existing grids. Engineered to the highest standards, our components provide reliability, safety, and performance, supporting utilities in building efficient and robust power networks.



We offer tailored solutions across all voltage classes, including innovative designs for optical fiber integration and asset monitoring systems, reflecting our commitment to sustainability and innovation. Our advanced technologies, such as pre-expanded and cold-shrink options, enable faster, easier installations, reducing downtime and ensuring operational excellence.

Backed by Prysmian's global reach and local expertise, we provide dedicated engineering support and customized designs to meet specific project needs. Together, let's build the future of power systems with network components that are as reliable and innovative as our cables.

Asset monitoring & systems

PRY-CAM

Advanced Sensing Solutions for Proactive Asset Management

Prysmian's Electronic and Optical Sensing Solutions (EOSS) are at the forefront of system integrity monitoring, offering cutting-edge tools to safeguard your critical assets. Our comprehensive platform integrates partial discharge (PD) detection, distributed temperature sensing (DTS), and distributed acoustic sensing (DAS) to provide real-time insights into your system's health. With Pry-Cam solutions for both portable, spot analysis and permanent installation for continuous monitoring, you hold the power to act proactively, ensuring safety, reliability, and costefficiency.

Our systems deliver precise data on temperature variations, partial discharge activity, and acoustic anomalies, enabling informed decision-making to prevent costly repairs or unplanned downtime. Scalable and flexible, the modular design adapts to your evolving needs, while user-friendly interfaces streamline monitoring and analysis.

With EOSS, Prysmian elevates monitoring from reactive to preventive, helping utilities and industries achieve enhanced operational reliability. Discover how EOSS and Pry-Cam can transform your approach to asset management, ensuring the safety and longevity

Prysmian in the region

Prysmian operates extensively across the Asia Pacific region, supported by a robust infrastructure that includes 13 manufacturing plants across China, Malaysia, Indonesia, the Philippines, and Thailand. Our regional distribution center in Singapore serves as a strategic hub, ensuring seamless delivery of cutting-edge cable solutions for the energy, infrastructure, and telecom markets.

In Asia Pacific, Prysmian is proud to be a part of landmark projects that showcase our expertise and commitment to innovation. These include addressing the complex cable requirements of iconic developments like Marina Bay Sands in Singapore and supporting the ambitious South Vietnam submarine cable projects, which strengthen regional connectivity. Additionally, Prysmian's advanced solutions have contributed to offshore wind farm developments, highlighting our pivotal role in accelerating the region's transition to renewable energy.

With a clear focus on sustainability and a strong local presence, Prysmian is well-positioned to meet the demands of Asia Pacific's rapidly growing markets. We remain dedicated to delivering innovative technologies that empower our partners and drive the region's progress towards a more connected and

Our corporate brand

Prysmian has a multi-brand architecture made of three levels: a strong Corporate Brand, Prysmian, which stands for the whole organization. It is the umbrella brand under which all the initiatives regarding the Company worldwide are carried out.

The second level is represented by the three well-known Commercial Brands: Prysmian, Draka and General Cable.

The third level encompasses the wide range of product brands that serve all the markets and applications in which the Company operates.

Content

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Fire Demands Performance

In any infrastructure, safety features designed to mitigate loss of human life and damage to property are not just required by regulations worldwide, but represent the gold standard in construction. One of these staple features supplied by Prysmian are Fire Performance cables, which connect critical building systems such as fire alarms, emergency lighting, PA & CCTV systems, emergency power supplies and smoke & fire shutters.

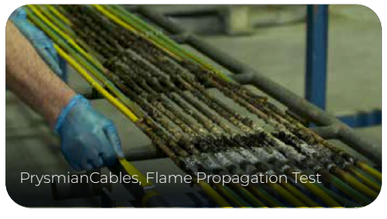
Fire Performance cables are crucial in an emergency situation, ensuring that under mechanical stress and high heat, these systems will continue to operate to effectively conduct an orderly evacuation of the premise and aid emergency services in gaining quick & effective entry to deal with the hazard.

Prysmian Group has been manufacturing the widest range of industry-leading Fire Performance cables, known as MAX FOH™ in ASEAN, for over twenty years.

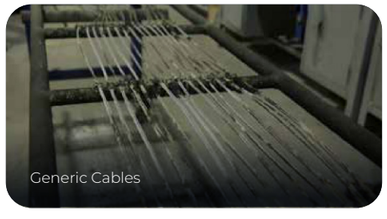
Prysmian Means Performance

6 advantages of buying MAX-FOH over OEM & substitutes:

1. **Original manufacturer certification** eliminates OEM-related problems like consistency and warranty.
2. **Full-sized conductors, insulation and sheathing** are used; that means no cutting corners with cheaper undersized ones.
3. **Multi-layered Mica fire barrier tape** meets industry standards, exceeds those of competitor makes.
4. Insulated by **Low Smoke Halogen Free (LSHF) material, an industry standard** for flame retardant cables.
5. Only the **best flame and smoke suppressants** are used. Cheap polymers save cost, but are not worth **the safety risk**.
6. All MAX-FOH products undergo **recognised 3rd party standards and approvals**, meeting various International Electrotechnical Commission and British Standards.

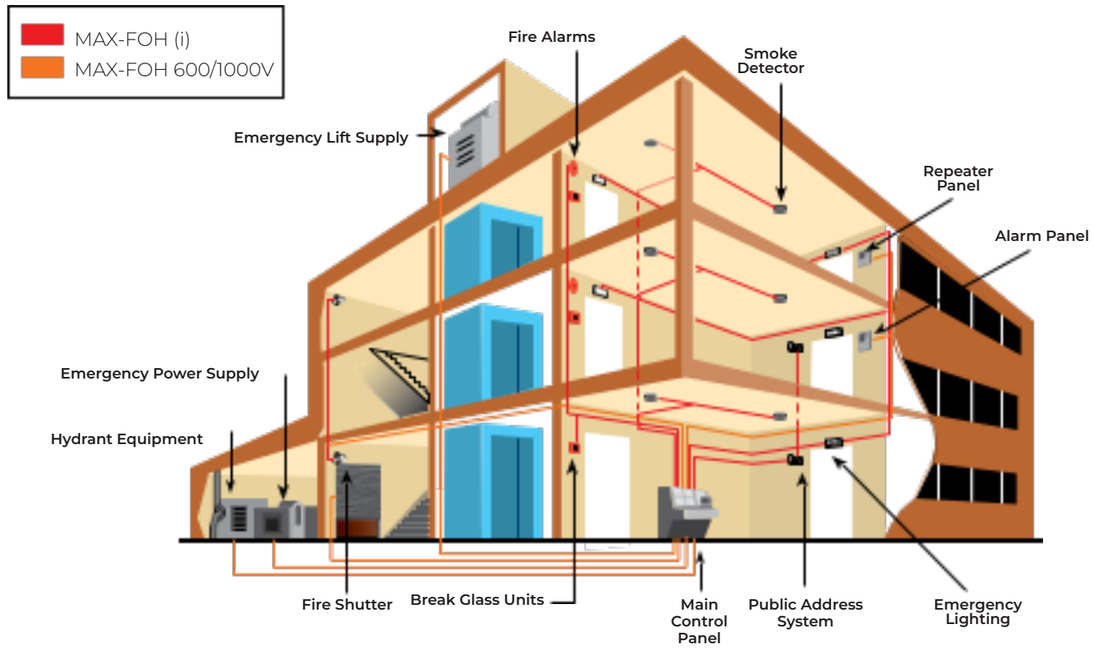


PrysmianCables, Flame Propagation Test



Generic Cables

Applications

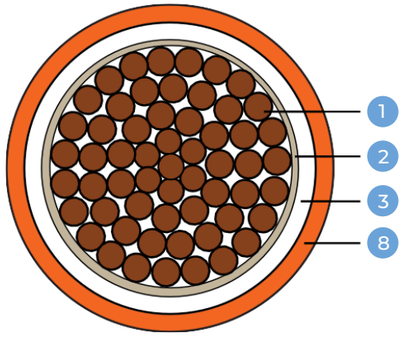


MAX-FOH cables are specially designed to facilitate a quick and orderly evacuation of the building occupants in the event of an emergency. Purpose-designed to maintain circuit integrity within a system of critical safety devices from emergency power supply to fire alarms, MAX-FOH cables are a vital component of building safety.

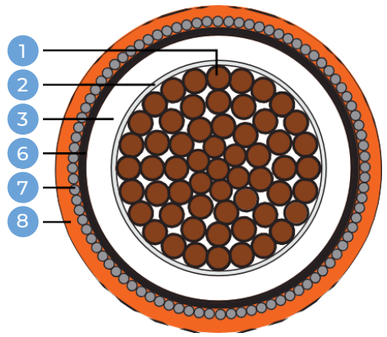
The special characteristics of the MAX-FOH range make it suitable for an almost infinite number of applications and environments.

The diagram below illustrates common safety systems in a building which should be fitted with MAX-FOH cables.

Construction of Cable



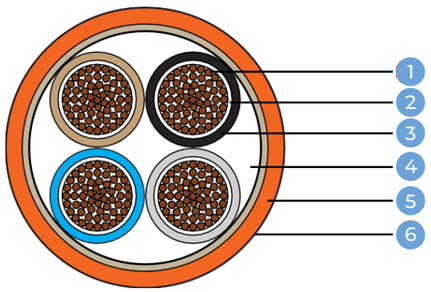
Single core, unarmoured



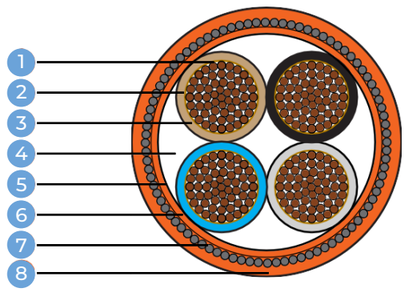
Single core, armoured

#	1	2	3	4*	5*	6*	7*	8*
Construction	Conductor	Fire Barrier	Insulation	Filler	Binder Tape	Bedding	Armour	Sheath
Material	Stranded Annealed Copper	Mica Tape	Low Smoke Halogen-Free (LSHF) / Crosslinked Polyethylene (XLPE) compound	LSHF or Polypropylene Split Yarn	Polyester	LSHF compound	Galvanised Steel or Aluminium Wire (Braiding Optional)	LSHF compound

*optional to cable construction



Multi-core, unarmoured



Multi-core, armoured

Core Numbers	1	2	3	4	5	6 and Above
Color Configurations	White	or	or	or	or	Black with White Numbers

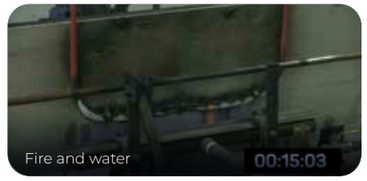
These are standard configurations. Customisations to any component is available upon request.

Standard and Approvals

Draka cables are certified by multiple internationally recognised cable standards. Here are the listed IEC, SS and BS standards categorized by type of fire test.

Fire Resistance Tests

These tests are used to determine if a cable is capable of maintaining circuit integrity under:



These tests use a number of alternative time and temperature parameters and depending on the level achieved by the cable, a corresponding letter is assigned to denote the category that the cable passes.

Standard	Part/Category	Resistance to	Temperatre	Time
IEC 60331	60331-21	Fire	750°C	At least 90 mins
	60331-1	Fire	850°C	At least 120 mins
BS 6387 : 2013	Protocol C	Fire	950°C	For 3 hours
	Protocol W	Fire & Water	650°C	**Fire** for 15 minutes **Fire and water** for 15 minutes
	Protocol Z	Fire with Mechanical Shock	950°C	For 15 minutes, with 30 second hammer blows
SS299 : Part	Category C	Fire	950°C	For 3 hours
	Category W	Fire & Water	650°C	**Fire** for 15 minutes **Fire and water** for 15 minutes
	Category Z	Fire with Mechanical Shock	950°C	For 15 minutes, with 30 second hammer blows

Flame Propagation Tests

This test defines the ability of bunched cables to restrict vertical flame propagation when laid in trunking, cable trays or conduit. The test comprises of 4 categories each determined by the amount of combustible material in a 1 metre sample.

The cable samples are placed vertically next to one another on a vertical ladder where they are exposed to fire from a ribbon gas burner for the pre-arranged times.

After burning, the samples are cleaned to examine for char (the crumbling) on the cable surface. The charring should not have reached a height exceeding 2.5m above the bottom edge of the burner.

Standard	Single / Bunched	Standard & Category	Amount of Combustible Material in 1 metre Sample in Litres	Time of Exposure in Minutes
IEC	Single	60332-1-2	-	-
	Bunched	60332-3-22 Category A	7.0	40
	Bunched	60332-3-22 Category B	3.5	40
	Bunched	60332-3-24 Category C	1.5	20
	Bunched	60332-3-25 Category D	0.5	20
BS	Single	EN 60332-1-2	-	-
	Bunched	EN 60332-3-22 Category A	7.0	40
	Bunched	EN 60332-3-23 Category B	3.5	40
	Bunched	EN 60332-3-24 Category C	1.5	20
	Bunched	EN 60332-3-25 Category D	0.5	20

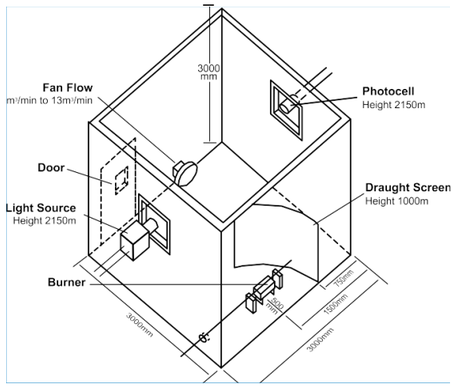
Corrosive & Acid Gas Emission Test

To address the concerns of toxic acid gases which could be produced when cables are burnt, this international test was developed to determine the amount of gas evolved by burning cables.

The recommended values of the test state that the weighted pH value should be more than 4.3, with relation of 1 litre of water. The weighted value of conductivity should not exceed 10μS/cm.

Standard	Test Item	Standard	Requirement
IEC	Acid Gas Emission	60754-1 60754-2	≤ 0.5% HCl
	Fluorine Content	60684-2	≤ 0.1%
	pH Conductivity	EN 60754-2	pH ≥ 4.3 Conductivity ≤ 10 μ S/mm
BS	Corrosive & Acid Gas	EN 60754-1 EN 60754-2	≤ 0.5% HCl

Smoke Emission Tests



The test is aimed at determining the density of smoke in the process of cable burning under defined conditions

Standard	Standard	Requirement
IEC	61034-2	≥ 60%

MAX-FOH-I 0.6/1kV, insulated, non-sheathed

Conductor
Plain annealed copper
Class 2
Circular or compact

Insulation
XLEVA Compound

Fire Barrier
Mica Glass Tape

Application & Features

For use in most power and control circuits. Halogen-free replacement for PVC insulation to reduce hazardous gas emission and secondary damage.

Thermal Characteristics

Operating Temperature
-15°C to 110°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Insulation color

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
6 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1
BS 7211

Circuit Integrity:
IEC 60331
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Flame Retardant:
IEC 60332-1, 60332-3

Halogen-free:
IEC 60754-1

Corrosive gas-free:
IEC 60754-2

Low Smoke Density:
IEC 61034-2

Cable Size	Insulation Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	kg/mm	ohm/km
1x1.5	0.7	3.8	28	12.10
1x2.5	0.8	4.4	41	7.41
1x4	0.8	5.0	57	4.61
1x6	0.8	5.5	78	3.08
1x10	1.0	6.8	120	1.83
1x16	1.0	7.8	180	1.15
1x25	1.2	9.6	280	0.727
1x35	1.2	10.8	370	0.524
1x50	1.4	12.6	500	0.387
1x70	1.4	14.3	690	0.268
1x95	1.6	16.6	950	0.193
1x120	1.6	18.1	1100	0.153
1x150	1.8	20.2	1400	0.124
1x185	2.0	22.4	1800	0.0991
1x240	2.2	25.3	2300	0.0754
1x300	2.4	28.4	2900	0.0601
1x400	2.6	31.7	3700	0.047
1x500	2.8	35.3	4700	0.0366
1x630	2.8	39.1	6000	0.0283

MAX-FOH-0.6/1kV, insulated, sheathed

Conductor
Plain annealed copper
Class 2
Circular or compact

Sheath
LSHF Compound

Insulation
XLEVA Compound

Fire Barrier
Mica Glass Tape

Application & Features

For use in most power and control circuits. Features XLPE Insulation for high operating temperatures, thermal short circuit rating and durability.

Thermal Characteristics

Operating Temperature
-15°C to 90°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Outer Sheath

Insulation color

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
6 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1
BS 7211

Circuit Integrity:
IEC 60331
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Flame Retardant:
IEC 60332-1, 60332-3

Halogen-free:
IEC 60754-1

Corrosive gas-free:
IEC 60754-2

Low Smoke Density:
IEC 61034-2

Cable Size	Insulation Thickness	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
1x1.5	0.7	1.4	6.7	63	12.10
1x2.5	0.7	1.4	7.1	75	7.41
1x4	0.7	1.4	7.1	96	4.61
1x6	0.7	1.4	8.2	110	3.08
1x10	0.7	1.4	9.1	160	1.83
1x16	0.7	1.4	10.2	220	1.15
1x25	0.9	1.4	11.9	330	0.727
1x35	0.9	2.0	14.4	460	0.524
1x50	1.0	2.0	15.9	600	0.387
1x70	1.1	2.1	18.1	810	0.268
1x95	1.1	2.2	20.2	1000	0.193
1x120	1.2	2.3	22.0	1300	0.153
1x150	1.4	2.4	24.4	1600	0.124
1x185	1.6	2.5	26.7	1900	0.0991
1x240	1.7	2.6	29.6	2500	0.0754
1x300	1.8	2.7	31.7	3200	0.0601
1x400	2.0	2.9	36.4	4000	0.047
1x500	2.2	3.1	40.4	5000	0.0366
1x630	2.4	3.3	45.1	6400	0.0283

MAX-FOH 0.6/1kV, multi-core insulated, sheathed

Conductor
Plain annealed copper
Class 2
Circular or compact

Sheath
LSHF Compound

Insulation
XLEVA Compound

Fire Barrier
Mica Glass Tape

Application & Features

For use in most power and control circuits. Features XLPE Insulation for high operating temperatures, thermal short circuit rating and durability.

Thermal Characteristics

Operating Temperature
-15°C to 90°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Outer Sheath

Core color

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
8 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1

Circuit Integrity:
IEC 60331
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Flame Retardant:
IEC 60332-1, 60332-3

Halogen-free:
IEC 60754-1

Corrosive gas-free:
IEC 60754-2

Low Smoke Density:
IEC 61034-2

Cable Size	Insulation Thickness	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
2x1.5	0.7	1.8	11.3	170	12.10
2x2.5	0.7	1.8	12.1	200	7.41
2x4	0.7	1.8	13.2	260	4.61
2x6	0.7	1.8	14.3	320	3.08
2x10	0.7	1.8	16.2	370	1.83
2x16	0.7	1.8	18.3	510	1.15
2x25	0.9	1.8	21.8	740	0.727
2x35	0.9	2.5	25.8	990	0.524
2x50	1.0	2.6	29.0	1200	0.387
2x70	1.1	2.8	33.4	1700	0.268
2x95	1.1	3.0	37.8	2300	0.193
2x120	1.2	3.1	41.3	2800	0.153
2x150	1.4	3.3	46.0	3500	0.124
2x185	1.6	3.5	50.7	4300	0.0991
2x240	1.7	3.8	56.7	5600	0.0754
2x300	1.8	4.0	62.9	7000	0.0601
2x400	2.0	4.4	70.3	8800	0.047

Cable Size	Insulation Thickness	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
3x1.5	0.7	1.8	11.9	190	12.10
3x2.5	0.7	1.8	12.8	240	7.41
3x4	0.7	1.8	13.9	300	4.61
3x6	0.7	1.8	15.2	380	3.08
3x10	0.7	1.8	17.2	480	1.83
3x16	0.7	1.8	19.5	680	1.15
3x25	0.9	1.8	23.2	1000	0.727
3x35	0.9	2.6	27.6	1300	0.524
3x50	1.0	2.7	31.1	1800	0.387
3x70	1.1	2.9	35.9	2500	0.268
3x95	1.1	3.1	40.4	3300	0.193
3x120	1.2	3.3	44.4	4100	0.153
3x150	1.4	3.5	49.4	5000	0.124
3x185	1.6	3.7	54.4	6200	0.0991
3x240	1.7	4.0	60.9	8100	0.0754
3x300	1.8	4.2	67.5	10000	0.0601
3x400	2.0	4.6	75.4	12000	0.047

Cable Size	Insulation Thickness	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
4x1.5	0.7	1.8	12.9	230	12.10
4x2.5	0.7	1.8	13.9	290	7.41
4x4	0.7	1.8	15.2	370	4.61
4x6	0.7	1.8	16.5	480	3.08
4x10	0.7	1.8	18.8	610	1.83
4x16	0.7	1.8	21.4	880	1.15
4x25	0.9	1.8	25.5	1300	0.727
4x35	0.9	2.7	30.4	1700	0.524
4x50	1.0	2.9	34.5	2300	0.387
4x70	1.1	3.1	39.8	3200	0.268
4x95	1.1	3.3	44.8	4300	0.193
4x120	1.2	3.5	49.2	5400	0.153
4x150	1.4	3.7	54.8	6700	0.124
4x185	1.6	4.0	60.6	8200	0.0991
4x240	1.7	4.3	67.7	10000	0.0754
4x300	1.8	4.6	75.3	13000	0.0601
4x400	2.0	5.0	84.1	16000	0.047

Cable Size	Insulation Thickness	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
5x1.5	0.7	1.8	14.1	230	12.10
5x2.5	0.7	1.8	15.2	300	7.41
5x4	0.7	1.8	16.7	390	4.61
5x6	0.7	1.8	18.2	510	3.08
5x10	0.7	1.8	20.5	720	1.83
5x16	0.7	1.8	23.4	1000	1.15
5x25	0.9	1.8	28.0	1500	0.727
5x35	0.9	2.8	33.5	2200	0.524
5x50	1.0	3.0	38.3	2900	0.387
5x70	1.1	3.2	44.0	4000	0.268
5x95	1.1	3.5	49.7	5400	0.193
5x120	1.2	3.7	54.6	6800	0.153
5x150	1.4	4.0	61.0	8400	0.124

Ambient temperature: 30°C in air

MAX-FOH 125 -0.6/1kV, Insulated, sheathed

Conductor
Circular stranded copper
Class 2
Circular or compact

Sheath
LSHF Compound

Insulation
XLEVA Compound

Fire Barrier
Mica Glass Tape

Application & Features

For fixed installation in cable systems with improved fire performance and circuit integrity. Enhanced with XLEVA insulation for a high temperature rating.
Used for Fire Alarm & Detection circuits, Emergency signal/ Control circuits, Fire fighting systems, Smoke Exhaust Systems

Thermal Characteristics

Maximum operating temperature
110°C

Operating Temperature
-15°C to 110°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Outer Sheath

Insulation

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
8 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Circuit Integrity:
IEC 60331-21

Flame Retardant:
IEC 60332-1,
60332-3-22
60332-3-23
60332-3-24

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

Low Smoke Density:
IEC 61034-2

Cable Size	Nominal Insulation Thickness	Nominal Sheath Thickness	Approx Cable Overall Diameter	Approx Weight	Max Conductor Resistance at 20°C
mm^2	mm	mm	mm	kg/mm	ohm/km
1x1.5	0.7	1.4	6.7	68	12.10
1x2.5	0.7	1.4	7.1	81	7.41
1x4	0.7	1.4	7.1	100	4.61
1x6	0.7	1.4	8.2	120	3.08
1x10	0.7	1.4	9.1	170	1.83
1x16	0.7	1.4	10.2	230	1.15
1x25	0.9	1.4	11.9	350	0.727
1x35	0.9	2.0	14.4	480	0.524
1x50	1.0	2.0	15.9	620	0.387
1x70	1.1	2.1	18.1	840	0.268
1x95	1.1	2.2	20.2	1100	0.193
1x120	1.2	2.3	22.0	1300	0.153
1x150	1.4	2.4	24.4	1700	0.124
1x185	1.6	2.5	26.7	2000	0.0991
1x240	1.7	2.6	29.6	2600	0.0754
1x300	1.8	2.7	31.7	3300	0.0601
1x400	2.0	2.9	36.4	4100	0.047
1x500	2.2	3.1	40.4	5200	0.0366
1x630	2.4	3.3	45.1	6600	0.0283

MAX-FOH-AWA 0.6/1kV, insulated, armoured, and sheathed

Sheath
LSHF

Armouring
Aluminium Wire AWA

Bedding
LSHF

Fire Barrier
Mica Glass Tape

Insulation
XLPE Compound

Conductor
Plain annealed copper
Class 2
Circular or compact

Application & Features

Features Aluminium Wire Armouring, whose non-magnetic properties prevents eddy currents, reducing chances of overheating in AC electrical systems

Thermal Characteristics

Operating Temperature
-15°C to 90°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Outer sheath

Insulation colour

Bedding Colour

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
10 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1
BS 7846

Circuit Integrity:
IEC 60331
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Flame Retardant:
IEC 60332-1, 60332-3

Halogen-free:
IEC 60754-1

Corrosive gas-free:
IEC 60754-2

Low Smoke Density:
IEC 61034-2

Cable Size	Insulation Thickness	Diameter After Bedding	Armour Wire Diameter	Diameter After Armour	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Electrical Resistance
mm^2	mm	mm	mm	mm	mm	mm	kg/km	ohm/km
1x50	1.0	13.9	1.6	17.1	1.5	20.3	820	0.387
1x70	1.1	15.8	1.6	19.0	1.6	22.5	1000	0.268
1x95	1.1	17.7	1.6	20.9	1.6	24.5	1300	0.193
1x120	1.2	19.4	1.6	22.6	1.7	26.3	1600	0.153
1x150	1.4	21.5	1.6	24.7	1.7	28.5	1900	0.124
1x185	1.6	23.7	1.6	26.9	1.8	30.8	2300	0.0991
1x240	1.7	26.4	1.6	29.6	1.9	33.9	2900	0.0754
1x300	1.8	29.3	1.6	32.5	2.0	37.0	3600	0.0601
1x400	2.0	33.0	2.0	37.0	2.1	41.7	4600	0.047
1x500	2.2	36.6	2.0	40.6	2.2	45.5	5700	0.0366
1x630	2.4	40.8	2.0	44.8	2.3	50.0	7100	0.0283

MAX-FOH-SWA 0.6/1kV, multi-core insulated, armoured, and sheathed

Sheath
LSHF

Armouring
Galvanised Steel Wire

Bedding
LSHF Compound

Insulation
XLPE Compound

Fire Barrier
Mica Glass Tape

Conductor
Plain annealed copper
Class 2
Circular or compact

Application & Features

Features galvanised Steel Wire Armour, which enables cable to withstand high pulling loads. Commonly used in a whole range of industries including building and construction, rail and transport and particularly useful in external or underground projects.

Thermal Characteristics

Operating Temperature
-15°C to 90°C

Installation Temperature
0°C to 50°C

Short Circuit Temperature
250°C

Identification

Outer sheath

Bedding Colour

Core Colour

Optional Features

UV Resistance

Anti-Termite

Anti-Rodent

Other Sheath colours are available

Bending Radius

Minimum bending radius
10 x overall diameter

Performance Characteristics

Reference Standard:
IEC 60502-1
BS 7846

Circuit Integrity:
IEC 60331
SS 299-1 Cat C, W, Z
BS 6387 -Cat C, W, Z

Flame Retardant:
IEC 60332-1, 60332-3

Halogen-free:
IEC 60754-2

Corrosive gas-free:
IEC 60754-2

Low Smoke Density:
IEC 61034-2

Cable Size	Insulation Thickness	Diameter After Bedding	Armour Wire Diameter	Diameter After Armour	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Electrical Resistance
mm^2	mm	mm	mm	mm	mm	mm	kg/km	ohm/km
2x1.5	0.7	9.7	0.9	11.4	1.8	15.1	410	12.10
2x2.5	0.7	10.5	0.9	12.3	1.8	16.0	460	7.41
2x4	0.7	11.6	0.9	13.3	1.8	17.0	530	4.61
2x6	0.7	12.7	0.9	14.5	1.8	18.2	620	3.08
2x10	0.7	14.6	1.25	17.0	1.8	20.7	810	1.83
2x16	0.7	16.7	1.25	19.2	1.8	22.9	1000	1.15
2x25	0.9	20.2	1.6	23.3	1.8	27.0	1400	0.727
2x35	0.9	22.7	1.6	25.9	1.8	29.6	1800	0.524
2x50	1.0	25.8	1.6	28.9	1.9	32.9	2200	0.387
2x70	1.1	29.7	1.6	32.9	2.0	37.0	2800	0.268
2x95	1.1	34.1	2.0	38.0	2.1	42.4	3900	0.193
2x120	1.2	37.4	2.0	41.4	2.2	15.1	4600	0.153
2x150	1.4	41.7	2.0	45.7	2.4	16.0	5500	0.124
2x185	1.6	46.4	2.5	51.3	2.5	17.0	7000	0.0991
2x240	1.7	51.9	2.5	56.8	2.7	18.2	8600	0.0754
2x300	1.8	58.0	2.5	63.0	2.9	20.7	10000	0.0601
2x400	2.0	64.6	2.5	69.5	3.1	22.9	11000	0.047

Cable Size	Insulation Thickness	Diameter After Bedding	Armour Wire Diameter	Diameter After Armour	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Electrical Resistance
mm^2	mm	mm	mm	mm	mm	mm	kg/km	ohm/km
3x1.5	0.7	10.3	0.9	12.0	1.8	15.7	440	12.10
3x2.5	0.7	11.2	0.9	12.9	1.8	16.6	510	7.41
3x4	0.7	12.3	0.9	14.1	1.8	17.8	590	4.61
3x6	0.7	13.6	1.25	16.0	1.8	19.7	810	3.08
3x10	0.7	15.6	1.25	18.0	1.8	21.7	960	1.83
3x16	0.7	17.9	1.25	20.3	1.8	24.0	1200	1.15
3x25	0.9	21.6	1.6	24.7	1.8	28.4	1700	0.727
3x35	0.9	24.3	1.6	27.4	1.8	31.2	2200	0.524
3x50	1.0	27.6	1.6	30.7	1.9	34.7	2700	0.387
3x70	1.1	32.5	2.0	36.4	2.1	40.7	3900	0.268
3x95	1.1	36.5	2.0	40.5	2.2	45.0	4900	0.193
3x120	1.2	40.1	2.0	44.0	2.3	48.8	5800	0.153
3x150	1.4	45.2	2.5	50.1	2.5	55.2	7500	0.124
3x185	1.6	49.8	2.5	54.7	2.6	60.0	8800	0.0991
3x240	1.7	56.0	2.5	60.9	2.8	66.7	11000	0.0754
3x300	1.8	62.3	2.5	67.2	3.0	73.3	13000	0.0601
3x400	2.0	69.3	2.5	74.2	3.3	81.0	16000	0.047

Cable Size	Insulation Thickness	Diameter After Bedding	Armour Wire Diameter	Diameter After Armour	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Electrical Resistance
mm^2	mm	mm	mm	mm	mm	mm	kg/km	ohm/km
4x1.5	0.7	11.3	0.9	13.0	1.8	16.7	500	12.10
4x2.5	0.7	12.3	0.9	14.0	1.8	17.7	570	7.41
4x4	0.7	13.6	1.25	16.0	1.8	19.7	790	4.61
4x6	0.7	14.9	1.25	17.4	1.8	21.1	930	3.08
4x10	0.7	17.2	1.25	19.6	1.8	23.3	1100	1.83
4x16	0.7	19.8	1.25	22.9	1.8	26.6	1500	1.15
4x25	0.9	23.9	1.6	27.1	1.8	30.8	2100	0.727
4x35	0.9	27.0	1.6	30.1	1.9	34.0	2600	0.524
4x50	1.0	31.1	1.6	35.0	2.1	39.3	3700	0.387
4x70	1.1	36.0	2.0	39.9	2.2	44.5	4700	0.268
4x95	1.1	40.6	2.0	44.5	2.3	49.3	6000	0.193
4x120	1.2	45.0	2.0	49.9	2.5	55.0	7800	0.153
4x150	1.4	50.2	2.5	55.1	2.7	60.6	9400	0.124
4x185	1.6	55.8	2.5	60.7	2.8	66.4	11000	0.0991
4x300	1.8	69.3	2.5	74.2	3.2	80.7	16000	0.0601
4x400	2.0	77.6	3.15	83.8	3.5	90.9	22000	0.047

Cable Size	Insulation Thickness	Diameter After Bedding	Armour Wire Diameter	Diameter After Armour	Sheath Thickness	Cable Overall Diameter	Cable Weight	Max Electrical Resistance
mm^2	mm	mm	mm	mm	mm	mm	kg/km	ohm/km
5Gx1.5	0.7	12.5	0.9	14.2	1.8	17.9	530	12.10
5Gx2.5	0.7	13.6	1.25	16.1	1.8	19.8	720	7.41
5Gx4	0.7	15.1	1.25	17.5	1.8	21.2	850	4.61
5Gx6	0.7	16.6	1.25	19.0	1.8	22.7	1000	3.08
5Gx10	0.7	18.9	1.6	22.0	1.8	25.7	1400	1.83
5Gx16	0.7	21.8	1.6	24.9	1.8	28.6	1800	1.15
5Gx25	0.9	26.4	1.6	29.6	1.9	33.5	2500	0.727
5Gx35	0.9	29.9	1.6	33.0	2.0	37.2	3100	0.524
5Gx50	1.0	34.6	2.0	38.5	2.2	43.1	4300	0.387
5Gx70	1.1	39.9	2.0	43.9	2.3	48.6	5700	0.268
5Gx95	1.1	45.5	2.5	50.4	2.5	55.5	7800	0.193
5Gx120	1.2	50.0	2.5	54.9	2.7	60.4	9400	0.153
5Gx150	1.4	56.2	2.5	61.1	2.8	66.8	11000	0.124

Appendix

Page

Appendix A. Introduction to Cable Materials

Insulation

In the manufacture of electrical cables, safety and reliability are the biggest considerations. The materials that are selected must be stable, reliable, durable, able to withstand the environment and safe to use.
Materials used as insulation for cables must meet the following:

1. Providing safe insulation of the line conductors with minimum loss in electrical energy.
2. Exhibiting stable mechanical properties under normal conditions.
3. Possessing consistent electrical and mechanical properties over long period of use and over wide temperature ranges.
4. Exhibiting inert chemical properties which make it resistant to most chemicals.

Extruded insulation can be classified into two categories, namely Thermoplastic materials and Thermoset materials.
Thermoplastic materials tend to lose their form with continuous heating, while thermoset materials tend to maintain their form. This means that cables with thermoset materials can operate at higher temperatures than thermoplastic cables.

Thermoplastic

Polyvinyl Chloride (PVC) & Polyethylene (PE)

Material	PVC	PE
Features	High Electrical Strength, Insulation Resistance	Excellent electrical insulating properties Stable mechanical characteristic
Resistance	Moisture, abrasions	Chemicals, Moisture
Temperature Ratings	-60°C to 105°C	-60°C to 80°C
Behaviour in high heat environments	Emits smoke & Hydrochloric Acid	Changes shape and consistency, Softens in texture

PVC and PE display good characteristics for cable insulation, and are inherently tough and physically resistant to chemicals, moisture and abrasion. The problems with these materials are apparent when subjected to high and continuous heat:

1. PVC is known to emit smoke and form hydrochloric acid (a highly toxic and corrosive chemical) when they come in contact with water. As such, PVC-free cable insulation is frequently preferred in applications where smoke is a major hazard (notably in tunnels and rapid transit areas).
2. The PE polymer is made up of linear chains of independent PE molecules loosely held together by weak molecular bonds. These weak molecular bonds break when subjected to temperature above 70°C, causing the individual molecules to slide over one another.

The resultant PE polymer starts to change its shape and consistency and become soft and plastic-like in nature. For applications with operating temperatures higher than 70°C, cross-linked polyethylene (XLPE) is preferred.

Thermosets

Cross-linked Polyethylene (XLPE)

The thermoplastic nature of the PE can be converted into a thermally stable thermosetting compound by the process of cross- linking. In the process of cross-linking, perpendicular chemical bonds are formed between parallel chains of the PE molecules. The parallel, loose & twodimensional molecular structure is converted into a cellular, three-dimensional polymeric structure.
XLPE exhibits a durable and excellent insulating material which exhibits the following advantages over conventional PE:

- Suitable for continuous operating temperature up to 90°C.
- High thermal short circuit rating (250°C).
- Excellent electrical properties maintained over the full temperature range.
- Excellent water resistance and low permeability to water.
- Excellent chemical resistance to inorganic salts, oils, alkaline, acids ad organic solvents.
- High durability and long operation life.
- Halogen Free

Cross-linked Ethylene-vinyl Acetate (XLEVA)

Ethylene-vinyl acetate(EVA) is a polymer that has the softness and flexibility elastomeric materials, yet they can be processed like a thermoplastic. These properties are further enhanced to achieve thermal stability by the process of cross-linking to form a cellular three-dimensional polymeric structure.

The resultant XLEVA compound exhibits a more durable and excellent insulating material while maintaining its flexibility. Based on the specific formulation, XLEVA compound can withstand a temperature rating up to 110°C and display an excellent flame retardant capability. It contains no halogens and has a temperature index of more than 250°C, currently the highest among most insulation materials.

Table A1
Comparison for Insulation Materials

Property		Unit	Insulation Materials			
			PVC	PE	XLPE	XLEVA[A]
Chemical Name			Polyvinyl Chloride	Polyethylene	Cross-linked Polyethylene	Cross-linked Ethylene-vinyl Acetate
Max. Rated Temperature	Normal	°C	70	70	90	110[B]
	Short Circuit	°C	160	200	250	250
Density			1.2 - 1.4	0.92 - 0.94	0.92 - 0.95	1.5 - 1.55
Volume Resistivity		Ohm-cm	10E15	10E16	10E16	10E14
Dielectric Constant			3 - 5	2.0 - 2.3	2.3 - 2.5	4 - 6
Tensile Strength		N/mm2	12 - 14	12 - 14	13 - 18	10 - 14
Elongation-at-break		%	200 - 450	500 - 650	200 - 350	110 - 200
Flame Retardant Property			++	+	+	+++
Water resistance			++	+++	+++	+++
Weather resistance			++	++	++	++
Ozone resistance			++	++	++	++
Solvent resistance			---	++	+	+
Resistance to oil			++	+++	+++	++
Resistance to heat deformation			---	+	+++	+++

Note:
[A] Named as LSHF for all non-sheathed cables.
[B] Normal type, high temperature rating available upon request.
--- Poor + Fair ++ Good +++ Excellent

Conclusion
Based on the three salient qualities for fire performance cables, we find that XLPE and XLEVA are the better-performing choices for insulation, which also explains their preference for safety in the industry.

Bedding and Sheathing

Cable jackets, also known as sheaths, serve several purposes:

1. Mechanical, thermal, chemical, and environmental protection to the insulated conductors they enclose
2. Electrical insulation when used over shields or armour.
3. They ease installation and routing concerns by enclosing multiple insulated conductors.

Commonly used jacket materials for low voltage power cables include extrusions of PVC, High Density Polyethylene (HDPE), and Low Smoke Halogen Free (LSHF) materials.
These materials are applied using plastic extrusion lines that heat the compound to melting point and form it over the core. The material is then cooled in water trough and wound onto a reel.

Table A2
Comparison across Bedding and Sheathing Materials

Property	Unit	Bedding / Sheathing Materials		
		PVC	HDPE	LSHF
Chemical Name		Polyvinyl Chloride	High Density Polyethylene	Low Smoke Halogen Free
Density		1.35 - 1.5	0.94 - 0.95	1.4 - 1.6
Halogen Content		>20%	<0.5%	<0.5%
Halogen Free		No	Yes	Yes
Limiting Oxygen Index (LOI)		>22	≤22	>30
Smoke Generation		Dark and dense	Less Smoke	Least Smoke
Tensile Strength	N/mm2	12 - 14	12 - 14	13 - 18
Elongation-at-break	%	200 - 450	500 - 650	200 - 350
Flame Retardant Property		++	---	+++
Water resistance		++	+++	+++
Weather resistance		++	++	++
Ozone resistance		++	++	++
Chemical resistance		++	+++	++
Solvent resistance		++	++	++
Resistance to crude oil		+++	++	+++
Resistance to heat deformation		---	+	+++

Note: Refer to normal PVC that comply with IEC60332-1-2.
Higher grade PVC available upon request. Higher grade of PVC can achieve higher LOI reading.
--- Poor + Fair ++ Good +++ Excellent

Conclusion
Looking on the five salient qualities for fire performance cables, we find that LSHF produces the least smoke, does not emit halogen gases when burnt and has excellent flame retardant ability, making it the best-performing choice for bedding and sheathing fire performance cables.

Appendix B. Selection of Cross-Sectional Area of Conductor

In order to choose the right power cable, one has to consider:

- The current rating
- The installation methods
- Maximum safe length at short circuit
- The voltage drop
- The ambient temperature
- The short circuit ratio
- The frequency and harmonic current

Current Rating

When electric current flows through the conductor of a cable, the electrical resistance of the conductor generates heat. When a temperature greater than that allowed is reached by the cable due to heat generation, a larger conductor size (with lower electrical resistance) has to be selected. Other important considerations are methods of installation of the cable and ambient temperature.

Calculation which takes into account all criteria are described in IEC 60287 and are rather complex. In general, preferences is given to standard current rating tables which are issued by national standardization bureaus.

Voltage Drop

Another important factor for the determination of the conductor size is the voltage drop. The voltage drop of the cable at a given current is caused by losses in the cable. In case of a too high voltage drop, it is necessary to choose a bigger conductor size. The voltage drop in a cable demotes the difference in voltage at the beginning and at the end of the cable. It depends on:

- The current carried
- The power factor
- The length of the cable
- The resistance of the cable
- Reactance of the cable

The permissible voltage drop is usually stated as a percentage of the circuit voltage.

According to CP5:1998 regulation 525-01-01, it is stipulated that the total voltage drop for any particular cable run must be such that the voltage drop in the circuit of which the cable forms a part does not exceed 4% of the nominal voltage of the supply.

Selection of Cable based on Voltage Drop and Current using Tables

Since the actual power factor of the load is usually not known, the most practical approach to the question of the voltage drop is to assume the worst conditions, i.e. power factor equal to one and the conductor is at maximum operating temperature. The voltage drop values given in the tables are based on these assumptions.

The values of the voltage drop (Vd) are tabulated for a current of one Ampere for a 1 metre run, the value of voltage drop needs to be multiplied by the length of the run, in metre, and by the current, in Ampere that the cables are to carry.

$$V = V_{drop} \times I \times L$$

Where

V	Voltage (V)
V_{drop}	Approx. Voltage drop (V/Am)
I	Current (A)
L	Route Length (m)

Guided example to using our Current Rating / Voltage Drop Tables

Given that the supply voltage is 415V, 3-phase 50Hz and that the cable used is a 4C MAX-FOH-SWA.

Required cable is to be installed direct in ground and to carry a 250A load per phase over a route length of 100m. Cable installation is to be in compliance with BS 7671-2008 regulation.

Maximum permissible voltage drop

Vmax = 4% of 415V

Vmax = 16.65V

Voltage Drop

$$V_{drop} = \frac{Vmax.}{I \times L} = \frac{16.6V}{250x100} = \mathbf{0.66mV/Am}$$

Select the impedance value z from Table D4 (Voltage Drop for Multi-core Armoured cables) such that the z is equal to, or less than V_{drop} 0.66mV/Am.
It will be seen that the closest value is z(4-core cable) = 0.60 mV/Am, therefore arriving at a required conductor size of 70mm2.

Appendix C. Current Ratings And Voltage Drop Table (Unarmoured Cables)

Single-core cables

Conditions

These tables apply to cables that meet these construction and environment conditions:

Construction	Environment
Thermosetting (XLPE) insulation	Ambient Temperature: 30°C
With or without LSHF sheathing	Conductor Operating Temperature: 90°C

Table C1
Current Rating - Single-core Unarmoured

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross-sectional area	Reference Method A (enclosed in conduit in thermally insulating wall etc.)		Reference Method B (enclosed in conduit on a wall or in trucking etc.)		Reference Method C (clipped direct)		Reference Method F (in free air or on a perforated cable tray etc horizontal or vertical etc) Touching			Reference Method G (in free air) Spaced by one cable diameter	
	2 cables, single phase a.c or d.c	3 or 4 cables, three pha-se a.c.	2 cables, single phase a.c or d.c	3 or 4 cables, three phase a.c.	2 cables, single phase a.c or d.c flat and touching	3 or 4 cables, three phase a.c. flat and touching or trefoil	2 cables, single phase a.c. or d.e. flat	3 cables, three phase a.c. flat	3 cables, three phase a.c. trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three phase a.e. flat	
										Horizontal	Vertical
1	2	3	4	5	6	7	8	9	10	11	12
(mm2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1	14	13	17	15	19	17.5	-	-	-	-	-
1.5	19	17	23	20	25	23	-	-	-	-	-
2.5	26	23	31	28	34	31	-	-	-	-	-
4	35	31	42	37	46	41	-	-	-	-	-
6	45	40	54	48	59	54	-	-	-	-	-
10	61	54	75	66	81	74	-	-	-	-	-
16	81	73	100	88	109	99	-	-	-	-	-
25	106	95	133	117	143	130	161	141	135	182	161
35	131	117	164	144	176	161	200	176	169	226	201
50	158	141	198	175	228	209	242	216	207	275	246
70	200	179	253	222	293	268	310	279	268	353	318
95	241	216	306	269	355	326	377	342	328	430	389
120	278	249	354	312	413	379	437	400	383	500	454
150	318	285	393	342	476	436	504	464	444	577	527
185	362	324	449	384	545	500	575	533	510	661	605
240	424	380	528	450	644	590	679	634	607	781	719
300	486	435	603	514	743	681	783	736	703	902	833
400	-	-	683	584	868	793	940	868	823	1085	1008
500	-	-	783	666	990	904	1083	998	946	1253	1169
630	-	-	900	764	1130	1033	1254	1151	1088	1454	1362
800	-	-	-	-	1288	1179	1358	1275	1214	1581	1485
1000	-	-	-	-	1323	1323	1520	1435	1349	1775	1671

Table C2
Voltage Drop - Single-core Unarmoured

VOLTAGE DROP (per ampere per metre):

Conductor cross-sectional area	2 cables, d.c.	Reference Methods A & B (enclosed in conduit or trunking)			Reference Methods C, F & G (clipped direct on tray or in free air)						Reference Methods A & B (enclosed in conduit or trunking)			Reference Methods C, F & G (clipped direct on tray or in free air)								
					Cables touching			Cables spaced*						Cables spaced*			Cables spaced*			Cables spaced*		
1	2	3			4			5			6			7			8			9		
(mm2)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)		
1	46	46			46			46			40			40			40			40		
1.5	31	31			31			31			27			27			27			27		
2.5	19	19			19			19			16			16			16			16		
4	12	12			12			12			10			10			10			10		
6	7.9	7.9			7.9			7.9			6.8			6.8			6.8			6.8		
10	4.7	4.7			4.7			4.7			4.0			4.0			4.0			4.0		
16			2.9			2.9			2.9			2.5			2.5			2.5			2.5	
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
25	1.85	1.85	0.31	1.90	1.85	0.190	1.85	1.85	0.28	1.85	0.60	0.27	1.65	1.60	0.165	1.60	1.60	0.190	1.60	1.60	0.27	1.65
35	1.35	1.35	0.29	1.35	1.35	0.180	1.35	1.35	0.27	1.35	1.15	0.25	1.15	1.15	0.155	1.15	1.15	0.180	1.15	1.15	0.26	1.20
50	0.99	1.00	0.29	1.05	0.99	0.180	1.00	0.99	0.27	1.00	0.87	0.25	0.90	0.86	0.155	0.87	0.86	0.180	0.87	0.86	0.26	0.89
70	0.68	0.70	0.28	0.75	0.68	0.175	0.71	0.68	0.26	0.73	0.60	0.24	0.65	0.59	0.150	0.61	0.59	0.175	0.62	0.59	0.25	0.65
95	0.49	0.51	0.27	0.58	0.49	0.170	0.52	0.49	0.26	0.56	0.44	0.23	0.50	0.43	0.145	0.45	0.43	0.170	0.46	0.43	0.25	0.49
120	0.39	0.41	0.26	0.48	0.39	0.165	0.43	0.39	0.25	0.47	0.35	0.23	0.42	0.34	0.140	0.37	0.34	0.165	0.38	0.34	0.24	0.42
150	0.32	0.33	0.26	0.43	0.32	0.165	0.36	0.32	0.25	0.41	0.29	0.23	0.37	0.28	0.140	0.31	0.28	0.165	0.32	0.28	0.24	0.37
185	0.25	0.27	0.26	0.37	0.26	0.165	0.30	0.25	0.25	0.36	0.23	0.23	0.32	0.22	0.140	0.26	0.22	0.165	0.28	0.22	0.24	0.33
240	0.190	0.21	0.26	0.33	0.20	0.160	0.25	0.195	0.25	0.31	0.185	0.22	0.29	0.170	0.140	0.22	0.170	0.165	0.24	0.170	0.24	0.29
300	0.155	0.175	0.25	0.31	0.160	0.160	0.22	0.155	0.25	0.29	0.150	0.22	0.27	0.140	0.140	0.195	0.135	0.160	0.21	0.135	0.24	0.27
400	0.120	0.140	0.25	0.29	0.130	0.155	0.20	0.125	0.24	0.27	0.125	0.22	0.25	0.110	0.135	0.175	0.110	0.160	0.195	0.110	0.24	0.26
500	0.093	0.120	0.25	0.28	0.105	0.155	0.175	0.098	0.24	0.26	0.100	0.22	0.24	0.090	0.135	0.160	0.088	0.160	0.180	0.085	0.24	0.25
630	0.072	0.100	0.25	0.27	0.086	0.155	0.175	0.078	0.24	0.25	0.088	0.21	0.23	0.074	0.135	0.150	0.071	0.160	0.170	0.068	0.23	0.24
800	0.056	-	-	-	0.072	0.150	0.170	0.064	0.24	0.25	-	-	-	0.062	0.130	0.145	0.059	0.155	0.165	0.055	0.23	0.24
1000	0.045	-	-	-	0.063	0.150	0.165	0.054	0.24	0.24	-	-	-	0.055	0.130	0.140	0.050	0.155	0.165	0.047	0.23	0.24

Multi-core cables

These tables apply to cables that meet these construction and environment conditions:

Construction	Environment
Thermosetting (XLPE) insulation	Ambient Temperature: 30°C
With or without LSHF sheathing	Conductor Operating Temperature: 90°C

Table C3
Current Rating - Multi-core Unarmoured

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross-sectional area	Reference Method A (enclosed in conduit in thermally insulating wall etc.)		Reference Method B (enclosed in conduit on a wall or in trucking etc.)		Reference Method C (clipped direct)		Reference Method E (in free air or on a perforated cable tray etc horizontal or vertical etc)	
	1 two-core cable*, single phase a.c. or d.c.	1 three- or four-core cable*, three phase a.c.	1 two- core cable*, single phase a.c. or d.c.	1 three- or four-core cable*, three phase a.c.	1 two-core cable*, single phase a.c. or d.c.	1 three- or four-core cable*, three phase a.c.	1 two-core cable*, single phase a.c. or d.c.	1 three- or four-core cable*, three phase a.c.
1	2	3	4	5	6	7	8	9
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1	14.5	13	17	15	19	17	21	18
1.5	18.5	16.5	22	19.5	24	22	26	23
2.5	25	22	30	26	33	30	36	32
4	33	30	40	35	45	40	49	42
6	42	38	51	44	58	52	63	54
10	57	51	69	60	80	71	86	75
16	76	68	91	80	107	96	115	100
25	99	89	119	105	138	119	149	127
35	121	109	146	128	171	147	185	158
50	145	130	175	154	209	179	225	192
70	183	164	221	194	269	229	289	246
95	220	197	265	233	328	278	352	298
120	253	227	305	268	382	322	410	346
150	290	259	334	300	441	371	473	399
185	329	295	384	340	506	424	542	456
240	386	346	459	398	599	500	641	538
300	442	396	532	455	693	576	741	621
400	-	-	625	536	803	667	865	741

*with or without a protective conductor

Table C4
Voltage Drop - Multi-core Unarmoured

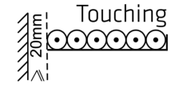
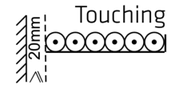
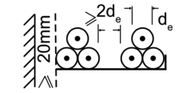
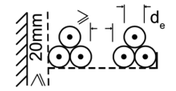
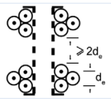
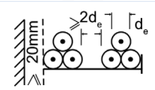
VOLTAGE DROP (per ampere per metre):

Conductor cross-sectional area	Two-core cable, d.c.	Two-core cable, single phase a.c.			Three- or four-core cable, three-phase a.c.		
1	2	3			4		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
1	46	46			40		
1.5	31	31			27		
2.5	19	19			16		
4	12	12			10		
6	7.9	7.9			6.8		
10	4.7	4.7			4.0		
16	2.9	2.9			2.5		
		r	x	z	r	x	z
25	1.85	1.85	0.160	1.90	1.60	0.140	1.65
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15
50	0.98	0.99	0.155	1.00	0.86	0.135	0.87
70	0.67	0.67	0.150	0.69	0.59	0.130	0.60
95	0.49	0.50	0.150	0.52	0.43	0.130	0.45
120	0.39	0.40	0.145	0.42	0.34	0.130	0.37
150	0.31	0.32	0.145	0.35	0.28	0.125	0.30
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26
240	0.195	0.200	0.140	0.24	0.175	0.125	0.21
300	0.155	0.160	0.140	0.21	0.140	0.120	0.185
400	0.120	0.130	0.140	0.190	0.115	0.120	0.165

Correction Factors

These tables are to supplement current ratings for Tables C1 and C3.

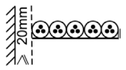
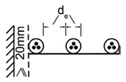
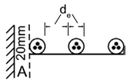
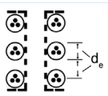
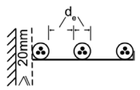
Table C5
Correction factors for multiple single core cables installed in free air

Installation method (See Note 1)			Number of three-phase circuits (Note 4)				Use as a multiplier to rating for
			Number of trays	1	2	3	
Unperforated trays (Note 2)	H		1 2 3	0.95 0.92 0.90	0.90 0.85 0.80	0.85 0.80 0.75	Three cables in horizontal formation
Perforated trays (Note 2)	J		1 2 3	0.95 0.95 0.90	0.90 0.85 0.85	0.85 0.80 0.80	
Vertical perforated trays (Note 3)	K		1 2	0.95 0.90	0.85 0.85	- -	Three cables in vertical formation
Ladder support cleats, etc (Note 2)	L		1 2 3	1.00 0.95 0.95	0.95 0.90 0.90	0.95 0.90 0.85	Three cables in horizontal formation
Unperforated trays (Note 2)	H		1 2 3	1.00 0.95 0.95	0.95 0.90 0.90	0.95 0.85 0.85	Three cables in trefoil formation
Perforated trays (Note 2)	J		1 2 3	1.00 0.95 0.95	1.00 0.95 0.90	0.95 0.90 0.85	
Vertical perforated trays (Note 3)	K		1 2	1.00 1.00	0.90 0.90	0.90 0.85	
Ladder supports, cleats, etc (Note 2)	L		1 2 3	1.00 0.95 0.95	1.00 0.95 0.95	1.00 0.95 0.90	

Notes:

1. Factors are given for single layers of cables (for trefoil groups) as shown in the tables and DO NOT apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.
2. Values are given for a vertical spacing between trays of 300mm. For closer spacing the factors should be reduced.
3. Values are given for a horizontal spacing between trays of 255mm with tray mounted back to back. For closer spacing the factors should be reduced.
4. For circuits having more than one cable in parallel per phase, each set of three conductors should be considered as a circuit for the purposes of this table.

Table C6
Correction factors for multiple multi-core cables

Installation Method			Number of Trays	Number of Cables					
				1	2	3	4	6	9
Unperforated trays (Note 2)	M	 Touching	1 2 3	0.95 0.95 0.95	0.85 0.85 0.85	0.80 0.75 0.75	0.75 0.75 0.70	0.70 0.70 0.65	0.70 0.65 0.60
		 Spaced	1 2 3	1.00 0.95 0.95	0.95 0.95 0.95	0.95 0.90 0.90	0.95 0.90 0.90	0.90 0.85 0.85	- - -
Perforated trays (Note 2)	N	 Touching	1 2 3	1.00 1.00 1.00	0.90 0.85 0.85	0.80 0.80 0.80	0.80 0.75 0.75	0.75 0.75 0.70	0.75 0.70 0.65
		 Spaced	1 2 3	1.00 1.00 1.00	1.00 1.00 1.00	1.00 0.95 0.95	0.95 0.90 0.90	0.90 0.85 0.85	- - -
Vertical perforated trays (Note 3)	O	 Touching	1 2	1.00 1.00	0.90 0.90	0.80 0.80	0.75 0.75	0.75 0.70	0.70 0.70
		 Spaced	1 2	1.00 1.00	0.90 0.90	0.90 0.90	0.90 0.85	0.85 0.85	- -
Ladder support cleats, etc (Note 2)	P	 Touching	1 2 3	1.00 1.00 1.00	0.85 0.85 0.85	0.80 0.80 0.80	0.80 0.80 0.75	0.80 0.75 0.75	0.80 0.75 0.70
		 Spaced	1 2 3	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 0.95	1.00 0.95 0.95	1.00 0.95 0.95	- - -

Notes:

1. Factors apply to single layer groups of cables as shown above and do NOT apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.
2. Values are given for a vertical spacing between trays of 300mm. For closer vertical spacing the factors should be reduced.
3. Values are given for horizontal spacing between trays of 225mm with trays mounted back to back. For closer spacing the factors should be reduced.

Table C7
Correction factors for multiple multi-core cables

Item	Arrangement of Cables		Correction factors													
			Number of circuits or multicore cables													
			1	2	3	4	5	6	7	8	9	10	12	14	16	18	20
1	Bunched on a surface or enclosed in condult or trunking		1.00	0.80	0.70	0.65	0.60	0.55	0.55	0.50	0.50	0.50	0.45	0.45	0.40	0.40	0.40
2	Single-layer wall or floor	Touching	1.00	0.85	0.80	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65
3		Spaced	1.00	0.85	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
4	Single-layer under ceiling	Touching	0.95	0.80	0.70	0.70	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55
5		Spaced	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

Notes:

1. These factors are applicable to uniform groups of cables, equally loaded.
2. Where horizontal clearance between adjacent cables exceeds twice their overall diameter, no reduction factor need to be applied.
3. "Spaced" cables means a clearance between adjacent surfaces of one cable diameter.
4. The same correction factors are applied to:
   - groups of two or three single-core cables;
   - multicore cables.
5. If a system consists of both two and three core cables, the total number of cables is taken as the number of circuits, and the corresponding correction factor is applied to the tables for two loaded conductors for the two-core cables, and to the tables for three loaded conductors for the three-core cables.
6. If a group consists of n loaded single-core cables it may either be considered as n/2 circuits of two loaded conductors or n/3 circuits of three loaded conductors.

Table C8
Correction factors for ambient air temperature other than 30°C

Ambient Temperature °C	10	15	20	25	30	35	40	45	50	55	65	70	75	80
Correction factor	1.15	1.12	1.08	1.04	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41

Appendix D. Current Ratings And Voltage Drop Table (Armoured Cable)

Single-core cables

Conditions

These tables apply to cables that meet these construction and environment conditions:

Construction	Environment
Thermosetting (XLPE) insulation	Ambient Temperature: 30°C
With or without LSHF sheathing	Conductor Operating Temperature: 90°C
Non-Magnectic Armour	

Table D1
Current Rating - Single-core Armoured

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross-sectional area	Reference Method C (clipped firect)		Reference Method F (in free air or on a perforated cable tray, horizontal or vertical)									
	Touching		Touching			Spaced by one cable diameter						
						2 cables, d.c.		2 cables, single phase a.c.		3 or 4 cables, three phase a.c.		
	2 cables, single phase a.c. or d.c. flat	3 or 4 cables, single phase a.c. or d.c. flat	2 cables, single phase a.c. or d.c. flat	3 or 4 cables, single phase a.c. or d.c. flat	3 cables, three phase a.c. trefoil	Horizon-tal	Vertical	Horizon-tal	Vertical	Horizon-tal	Vertical
1	2	3	4	5	6	7	8	9	10	11	12
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
50	237	220	253	232	222	284	270	282	266	288	266
70	303	277	322	293	285	356	349	357	337	358	331
95	367	333	389	352	346	446	426	436	412	425	393
120	425	383	449	405	402	519	497	504	477	485	449
150	488	437	516	462	463	600	575	566	539	549	510
185	557	496	587	524	529	688	660	643	614	618	574
240	656	579	689	612	625	815	782	749	714	715	666
300	755	662	792	700	720	943	906	842	805	810	755
400	853	717	899	767	815	1137	1094	929	889	848	797
500	962	791	1016	851	918	1314	1266	1032	989	923	871
630	1082	861	1146	935	1027	1528	1474	1139	1092	992	940
800	1170	904	1246	987	1119	1809	1744	1204	1155	1042	978
1000	1261	961	1345	1055	1214	2100	2026	1289	1238	1110	1041

Table D2
Voltage Drop - Single-core Armoured

VOLTAGE DROP (per ampere per metre):

Conductor cross-sectional area	2 cables, d.c.	Reference Methods C & F (clipped direct, on tray or in free air)															
		2 cables, single-phase a.c.						3 or 4 cables, three-phase a.c.									
		Touching			Spaced*			Trefoil & Touching			Flat & Touching			Flat & Spaced*			
1	2	3			4			5			6			7			
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	
50	0.98	0.99	0.21	1.00	0.98	0.29	1.00	0.86	0.180	0.87	0.84	0.25	0.88	0.84	0.155	0.90	
70	0.67	0.68	0.200	0.71	0.69	0.29	0.75	0.59	0.170	0.62	0.60	0.25	0.65	0.62	0.150	0.70	
95	0.49	0.51	0.195	0.55	0.53	0.28	0.60	0.44	0.170	0.47	0.46	0.24	0.52	0.49	0.145	0.57	
120	0.39	0.41	0.190	0.45	0.43	0.27	0.51	0.35	0.165	0.39	0.38	0.24	0.44	0.41	0.140	0.51	
150	0.31	0.33	0.185	0.38	0.36	0.27	0.45	0.29	0.160	0.33	0.31	0.23	0.39	0.34	0.140	0.45	
185	0.25	0.27	0.185	0.33	0.30	0.26	0.40	0.23	0.160	0.28	0.26	0.23	0.34	0.29	0.140	0.41	
240	0.195	0.21	0.180	0.28	0.24	0.26	0.35	0.180	0.155	0.24	0.21	0.22	0.30	0.24	0.140	0.37	
300	0.155	0.170	0.175	0.25	0.193	0.25	0.32	0.145	0.150	0.21	0.170	0.22	0.28	0.20	0.140	0.34	
400	0.115	0.145	0.170	0.22	0180	0.24	0.30	0.125	0.150	0.195	0.160	0.21	0.27	0.20	0.135	0.33	
500	0.093	0.125	0.170	0.21	0.165	0.24	0.29	0.105	0.145	0.180	0.145	0.20	0.25	0.190	0.135	0.31	
630	0.073	0.105	0.165	0.195	0.150	0.23	0.27	0.092	0.145	0.170	0.135	0.195	0.24	0.074	0.175	0.29	
800	0.056	0.090	0.160	0.190	0.145	0.23	0.27	0.086	0.140	0.165	0.130	0.180	0.23	0.062	0.175	0.26	
1000	0.045	0.092	0.155	0.180	0.140	0.21	0.25	0.080	0.135	0.155	0.125	0.170	0.21	0.055	0.165	0.24	

Multi-Core Cables

Conditions

These tables apply to cables that meet these construction and environment conditions:

Construction	Environment
Thermosetting (XLPE) insulation	Ambient Temperature: 30°C
With or without LSHF sheathing	Ground ambient temperature: 20°C
	Conductor Operating Temperature: 90°C

Table D3
Current Rating - Multi-core Armoured

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross-sectional area	Reference Method C (clipped firect)		Reference Method E (in free air or on a perforated cable tray etc, horizontal or vertical)		Reference Method D (direct in ground or in ducing in ground, in or around buildings)	
	two-core cable, single phase a.c. or d.c.	three- or four-core cable, three phase a.c.	two-core cable, single phase a.c. or d.c.	three- or four-core cable, three phase a.c.	two-core cable, single phase a.c. or d.c.	three- or four-core cable, three phase a.c.
1	2	3	4	5	6	7
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)
1.5	27	23	29	25	25	21
2.5	36	31	39	33	33	28
4	49	42	52	44	43	36
6	62	53	66	56	53	44
10	85	73	90	78	71	58
16	110	94	115	99	91	75
25	146	124	152	131	116	96
35	180	154	188	162	139	115
50	219	187	228	197	164	135
70	279	238	291	251	203	167
95	338	289	354	304	239	197
120	392	335	410	353	271	223
150	451	386	472	406	306	251
185	515	441	539	463	343	281
240	607	520	636	546	395	324
300	698	599	732	628	446	365
400	787	673	847	728	-	-

Table D4
Voltage Drop - Multi-core Armoured

VOLTAGE DROP (per ampere per metre):

Conductor cross-sectional area	Two-core cable, d.c.	Two-core cable, single phase a.c.			Three- or four-core cable, three-phase a.c.		
1	2	3			4		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
1.5	31	31			27		
2.5	19	19			16		
4	12	12			10		
6	7.9	7.9			6.8		
10	4.7	4.7			4.0		
16	2.9	2.9			2.5		
		r	x	z	r	x	z
25	1.85	1.85	0.160	1.90	1.60	0.140	1.65
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15
50	0.98	0.99	0.155	1.00	0.86	0.135	0.87
70	0.67	0.67	0.150	0.69	0.59	0.130	0.60
95	0.49	0.50	0.150	0.52	0.43	0.130	0.45
120	0.39	0.40	0.145	0.42	0.34	0.130	0.30
150	0.31	0.32	0.145	0.35	0.28	0.125	0.30
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26
240	0.195	0.20	0.140	0.24	0.175	0.125	0.21
300	0.155	0.16	0.140	0.21	0.140	0.120	0.185
400	0.120	0.13	0.140	0.190	0.115	0.120	0.165

Correction Factors

These correction factors are to supplement Table D1 and D3

Table D5

Correction factors for more than one circuit, cables laid directly in the ground

Number of circuits	Cable to cables clearance (a)				
	Nil (cables touching)	One cable diameter	0.215m	0.25m	0.5m
2	0.75	0.80	0.85	0.90	0.90
3	0.65	0.70	0.15	0.80	0.85
4	0.60	0.60	0.70	0.75	0.80
5	0.55	0.55	0.65	0.70	0.80
6	0.50	0.55	0.60	0.70	0.80

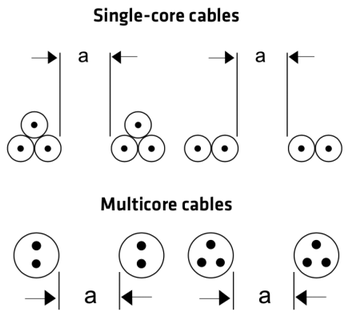
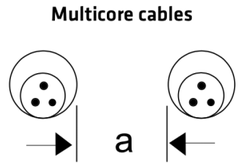


Table D6

Correction factors for more than one circuit, cables laid directly in ducts in the ground

A - Multicore cables in single-way ducts

Number of cables	Duct to duct clearance (a)			
	Nil (cables touching)	0.25m	0.5m	1.0m
2	0.85	0.90	0.95	0.95
3	0.75	0.85	0.90	0.95
4	0.70	0.80	0.85	0.90
5	0.65	0.80	0.80	0.90
6	0.60	0.80	0.80	0.90



B - Single-core cables in single-way ducts

Number of single-core circuits of two or three cables	Duct to duct clearance (a)			
	Nil (cables touching)	0.25m	0.5m	1.0m
2	0.80	0.90	0.90	0.95
3	0.70	0.80	0.85	0.90
4	0.65	0.70	0.80	0.90
5	0.60	0.70	0.80	0.90
6	0.60	0.70	0.80	0.90

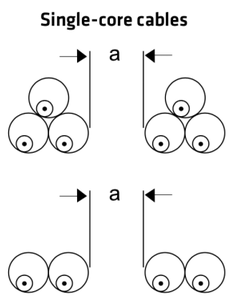


Table D7

Maximum Conductor Resistance

Cross Section Area (S) (mm2)	Conductor for fixed wiring Class 1 (solid) Class 2 (stranded) ohm/km at 20°C
0.50	36.0
0.75	24.5
1.00	18.1
1.50	12.1
2.50	7.41
4	4.61
6	3.08
10	1.83
16	1.15
25	0.727
35	0.524
50	0.387
70	0.268
95	0.193
120	0.153
150	0.124
185	0.0991
240	0.0754
300	0.0601
400	0.0470
500	0.0366
630	0.0283
800	0.0221
1000	0.0176

Table D8

Electrical Characteristics

Conductor Resistance Temperature Correction Factors			
Temp°C	Factor	Temp°C	Factor
10	0.961	25	1.020
11	0.965	30	1.039
12	0.969	35	1.059
13	0.972	40	1.079
14	0.976	45	1.098
15	0.980	50	1.118
16	0.984	55	1.138
17	0.988	60	1.157
18	0.992	65	1.177
19	0.996	70	1.196
20	1.000	75	1.216
21	1.004	80	1.236
22	1.008	85	1.255
23	1.012	90	1.275
24	1.016	-	-

Appendix E. Short Circuit Ratings

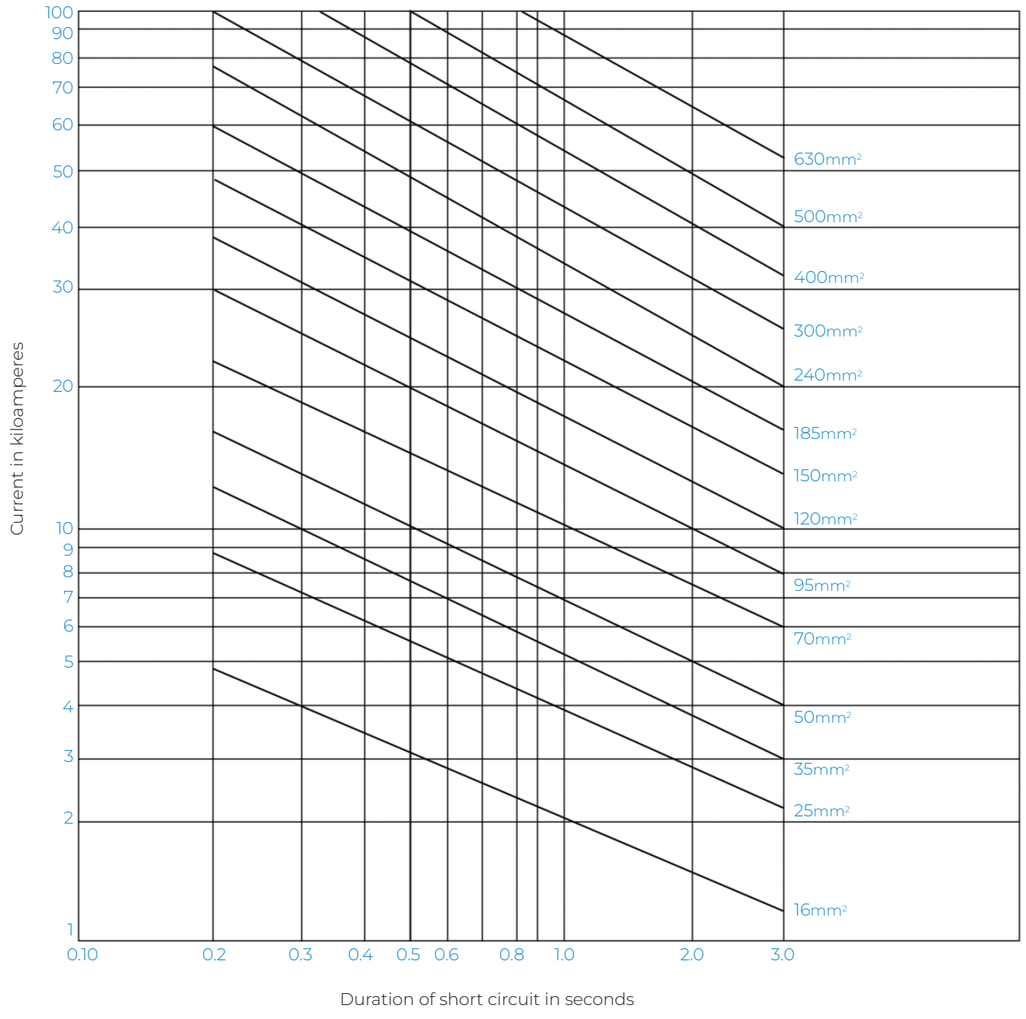
Another important factor for the determining the right conductor size is the maximum allowable current during a short circuit, when the maximum allowable conductor temperature is higher than during normal operation.

The maximum permissible short circuit current of XLPE cables up to 1 kV with copper conductors can be calculated with following formula:

$$1k = \frac{S}{\sqrt{t}} \cdot K$$

1k Maximum permissible short circuit current
(A) S Conductor area (mm2)
t Duration of short circuit process (s). Maximum value for t is 5 seconds
K Constant of 143 for copper conductors and temperature rising 90°C to 250°C

Cooper Conductors



Appendix F. Cables & Drum Handling and Storage Procedure

Minimum bending radius

Types of cable	Unarmoured		Armoured
Number of cores	Single core	Multicore	
300 / 500V and 600 / 1000V cable	8ø	6ø	10ø

Calculating side wall pressure to cable

Permissible maximum side wall pressure to the cable at bending point during installation is 500kgf/m.

$$\text{Side wall pressure to cable} = \frac{\text{Pulling tension (kgf)}}{\text{Bending radius (m)}} = \frac{T}{R}$$

Permissable maximum pulling tension **T** for copper conductor cables:
T = 7 x (# of cores) x (conductor cross-sectional area)

Drum handling

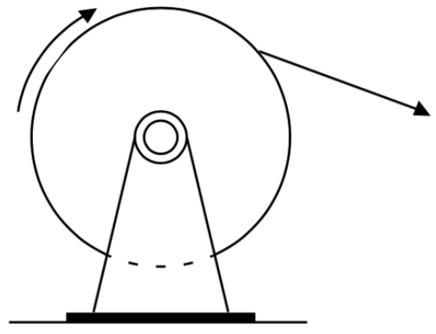
Always handle the drums with care. Here are two points how:

1. Always use a fork-lift truck or crane when removing drums from the vehicle.
2. Always take care to lower the drums into an upright position on their flanges.

Unwinding Cables

DO:

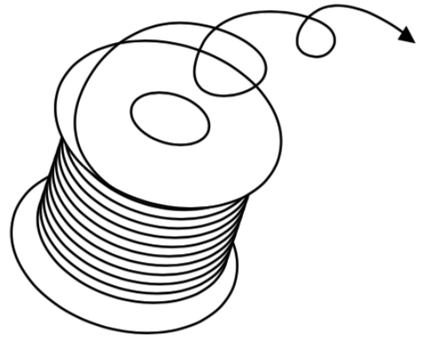
Unwind from the top of the drum.



Right!

DON'T:

Pulling like this causes kinking and possible damage to drum and cable.



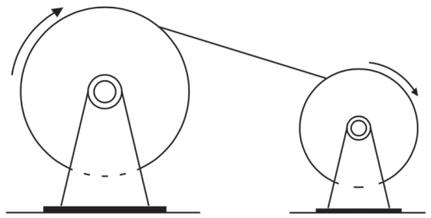
Wrong!

Rewinding Cables/Changing Drums

Rewinding

DO:

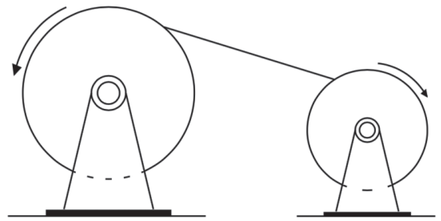
Wind the top part between drums.



Right!

DON’T:

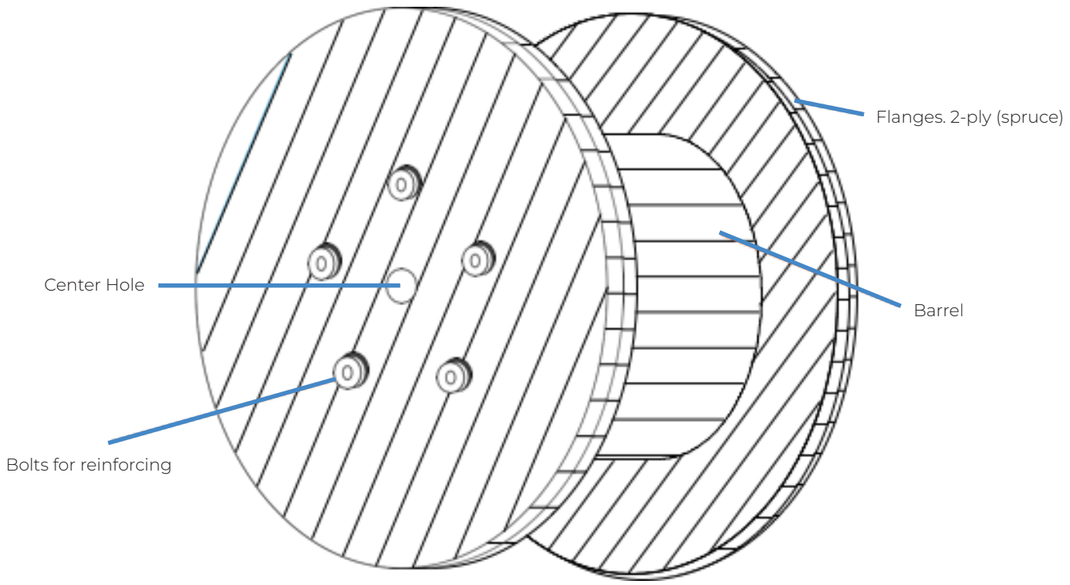
Wind from top to bottom between drums.



Wrong!

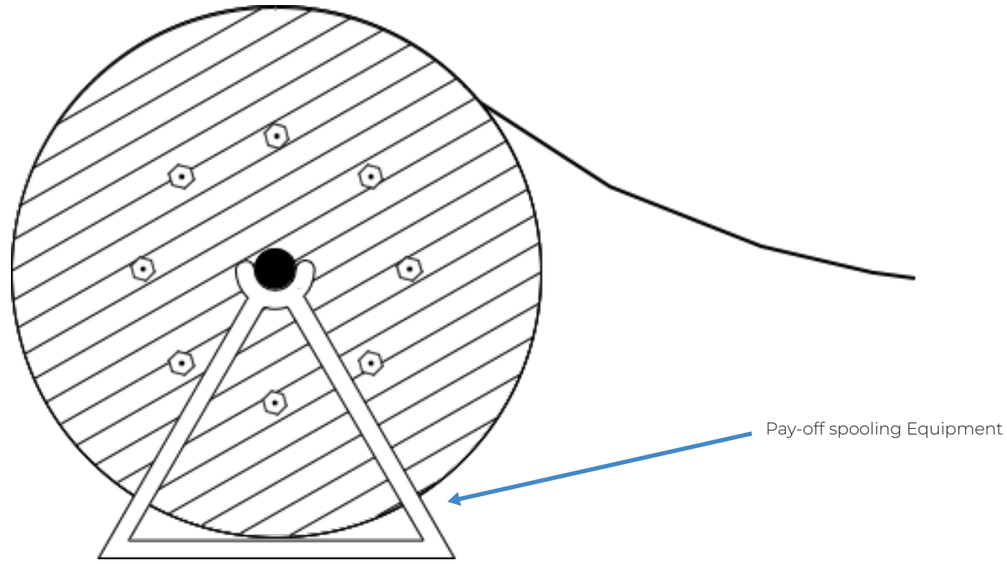
Tightening Drum Flanges

Due to changing weather conditions, wooden drums may slightly shrink or loosen, which requires retightening on the flange bolts, show in diagram.



Proper Spooling Equipment

Although cables are generally tough, they can still be damaged by impact, pinching or abrasion. Pay-off spooling makes for an easy operation. Through faulty handling, cables may slide or ”crawl”. This can result in pinching or locking, which causes damage.



Handling with a forklift

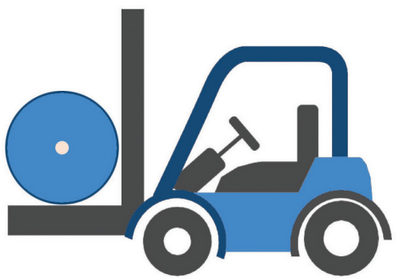
DO:

Face the fork towards the drum front view and across both flanges.

Picture 1a

DON'T:

Fork the drum from the side, as it will cause damage to the cables.

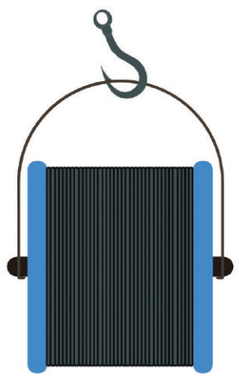


Picture 1b

Handling with a hoist

DO:

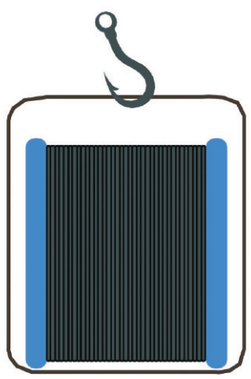
Use a hoist to lift the cable drums, with a steel pipe across the drum centre and a certified sling belt or wire rope.



Picture 2a

DON'T:

Lay the sling belts over the wood battens, causing damage to both wood battens and cable.



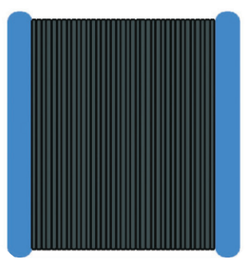
Picture 2b

Storage

1. Cables coiled in the drum must have a minimum 2 inch gap from the flange edge,
2. For open storage, black PVC sheet must be used to wrap and protect the cables.
3. Cable drums must be stored in an upright position.

DO:

Cable drum in upright position, with 2 inch gap from crum flange edge.



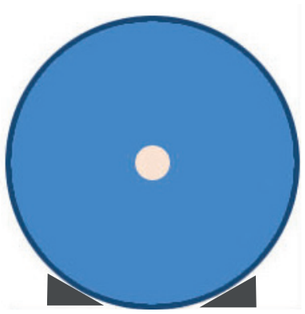
Picture 3a

DON'T:

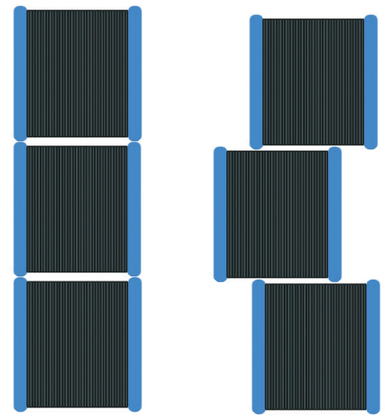
Cable drum laid on one flange side, causing cable sag

Picture 3b

4. Wood chokes should be placed under the flanges to prevent accidental rolling.



5. In vertical storage, drum flanges must be aligned. Misaligned flanges will come into contact with cables, causing damage.

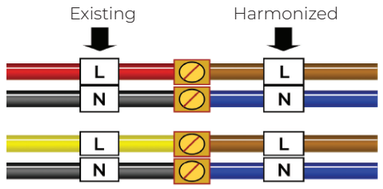


Appendix G. Identification of Cores in Cables

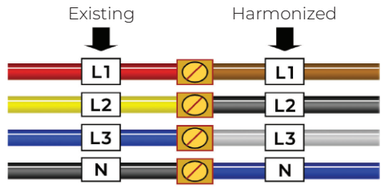
In March 2004, the Amendment No.2: AMD 14905 to BS7671: 2001 (IEE Wiring Rgulations Sixteenth Edition) has been harmonized with the CENELEC Standard HD 384.5.514: Identification including 514.3: Identification of conductor and with CENELEC Harmonization Document HD 308 S2: 2001 Identification of cores in cables and flexible cords.

The change in cable core colours is a major development that will affect the way wiring cable colours are distinguished and installed. Currently, for three phase fixed electrical installations, the wiring cable colours for “line” connections are red, yellow and blue respectively. The new three phase harmonized cable core colours will be brown, black and grey, following that of the new BS 7671: 2008 Requirements for electrical installations, IEE Wiring Regulations, 17th edition. A number of countries in the European Union as well as Hong Kong and Singapore are implementing these harmonized cable core colours.

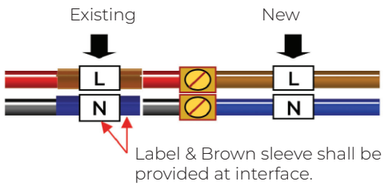
SINGLE-PHASE CIRCUITS



THREE-PHASE CIRCUITS



For any new electrical installation that involved extension from existing wiring system, BS7671 has been modified to align with these cable core colours where suitable marking/ labelling method eg. colour tapes, sleeves, discs, or by alphanumerics (letters and/or numbers) is allowed. See below figure:



Cable Cores Colour Code

Function	Alpha-numeric	Existing Core Colour	New Harmonized Core Colour
Protective conductor		Green / Yellow	Green / Yellow
Functional earthing conductor		Cream	Cream
AC Power Circuit			
- Phase	L	Red	Brown
- Neutral	N	Black	Blue
Three Phase Circuit			
- Phase 1	L1	Red	Brown
- Phase 2	L2	Yellow	Black
- Phase 3	L3	Blue	Grey
- Neutral	N	Black	Blue
DC Two-Wire Unearthed Circuit			
- Positive	L+	Red	Brown
- Negative	L-	Black	Grey
DC Two-Wire Earthed Circuit			
- Positive (of negative earth)	L+	Red	Brown
- Negative (of negative earth)	M	Black	Blue
- Positive (of positive earth)	M	Black	Blue
- Negative (of positive earth)	L-	Blue	Grey
DC Three-Wire Circuit			
- Positive	L+	Red	Brown
- Mid-wire (may be earthed)	M	Black	Blue
- Negative	L-	Blue	Grey

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