PRYSMIAN

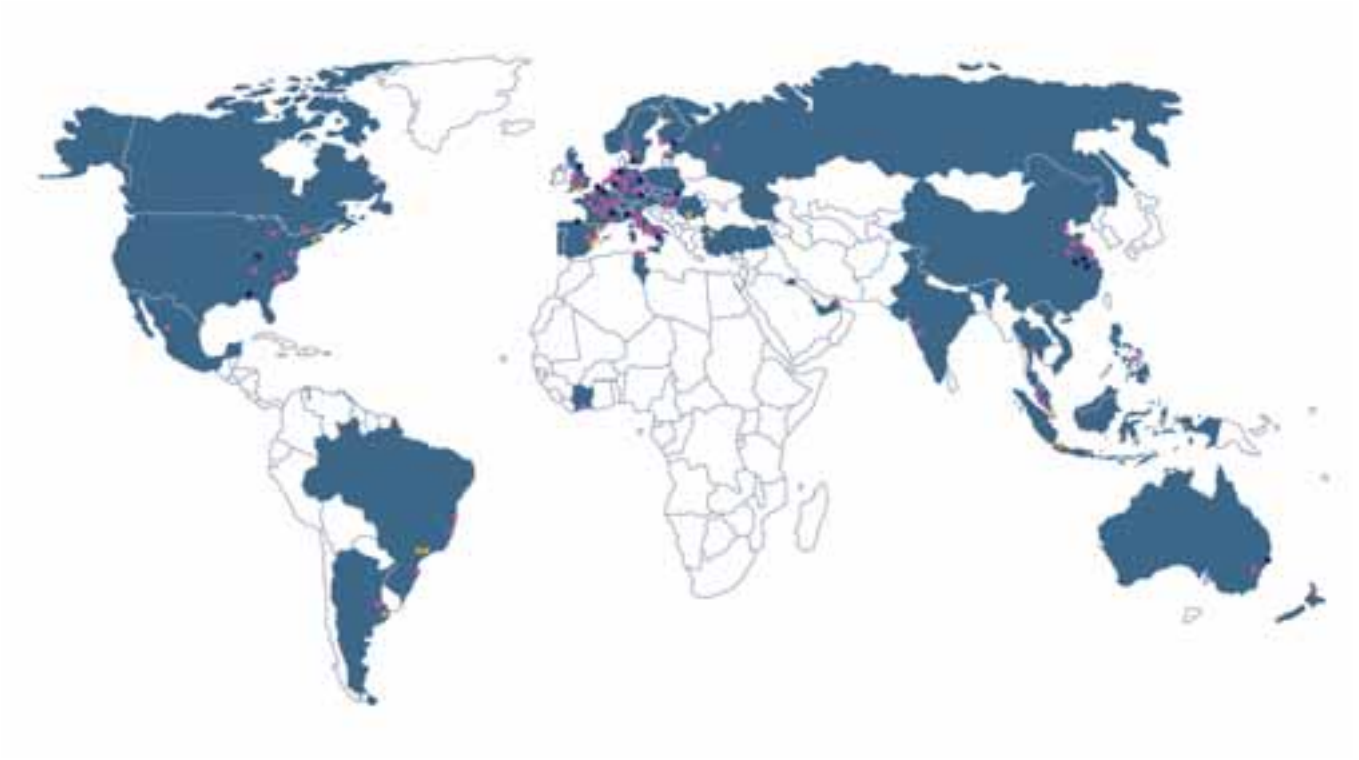
Mining Cables

A brand of the

Prysmian Group

Contents

Introduction



Prysmian Group

PRYSMIAN

Draka

ONE LEADER, TWO BRANDS

The world's largest cable company, the Prysmian Group, consists of Prysmian and Draka which are two of the world's most respected commercial brands in the industry. With subsidiaries in 50 countries, almost 100 manufacturing plants, 17 Research & Development Centres and around 22,000 employees, the Prysmian Group is truly a global company.

Proudly manufacturing in Australia since 1940, Prysmian understands local standards and conditions and our products are designed and developed accordingly. Prysmian specialises in integrated, added value cabling solutions highly customised to the individual specifications of customers. Prysmian operates a Quality Management System compliant with the requirements of ISO 9001:2008 and products are fully supported by the global technical and production capabilities of the Prysmian Group.

Prysmian understands local standards and conditions and our products are designed and developed accordingly.

Certified System

Quality
ISO 9001
SAI GLOBAL

Cable Components

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 Australia, 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.

CONDUCTORS

The important flexibility, strength and electrical properties of mining and industrial cables are mainly derived from the particular conductor design used, and any armouring or reinforcement. Conductors used in these cables are to Australian and International Standards, and usually employ tinned annealed copper wires stranded to provide optimum flexibility. Flexibility is influenced by the number of individual wires for a given size, the lay length of bunches and strands, and the geometric arrangement of the strands.

A simple examination of wires and their size is not a reliable guide to their flexibility or endurance, since special designs are often developed to suit particular applications. These would include cables for heavy-duty reeling or flexing such as ship-loader or longwall shearer applications. The use of specially designed power, earth or pilot conductors, and their locations in the cable provide a good example of this.

CORE ASSEMBLY LAY LENGTH

This is a vital factor affecting cable life when the cable is subjected to repeated reeling, especially under tension. A ratio of cable lay length (pitch) to pitch circle diameter (the diameter of a circle passing through the mid points of the cores) is commonly used to specify lay lengths suited to various applications. For moderate duty reeling cables, this value should be less than 12.5, and for trailing cables it should be less than 17.

INSULATION

In the past fifty years, natural rubber insulation has been replaced by synthetic polymeric compounds with inherently superior properties. Ethylene-propylene copolymer (EPR) and terpolymer (EPDM) are most common on flexible cables, offering excellent thermal durability, corona resistance, and electrical characteristics. Cross linked polyethylene (XLPE) insulation has found limited use in fixed applications.

Insulation materials are chosen for optimum dielectric characteristics, and resistance to deterioration through heat, oxidation, salts and copper compounds. Inert fillers are used for maximum electrical stability and low moisture absorption.

PILOT

The resistance between mining equipment and earth is usually high, and dangerous voltages can be present. To prevent hazards from shock, ground fault currents are controlled by various systems, including neutral resistance grounding. To ensure the integrity of this safety circuit, a small independent current may be passed through a pilot conductor to the load centre and return through the earth conductor. If this current is interrupted through breakage, then the circuit breaker will automatically trip and remove power from the cable. Australian mining regulatory authorities require the inclusion of an extensible central pilot conductor (for monitoring circuit integrity). This is specially designed and manufactured to restrict extensibility in service. The cores of each underground coal mining cable must also be electrically symmetrical for added safety.

SCREENS

Bending of conductors under tension accelerates the breakage of individual wires. Partial failure of conductors can lead to wire ends that penetrate through the insulation. Metallic screens over the power cores, or earthing cores associated with semiconductive rubber components are provided to ground such faults through an earth. Besides being part of the earth fault detection circuit, screens relieve non-uniform electrical stresses and provide a uniform capacitance to ground.

Screening is achieved by either a helically applied layer of wires, a composite textile and tinned copper wire braid, semi-conductive elastomer, or a combination of the latter. Medium voltage reeling and trailing cables usually have either individually core composite textile / copper braid or semiconductive rubber screens for minimal fatigue failure. Collective screens of either semiconductive rubber, braids, or pliable steel wire armour with copper wires to achieve the desired conductivity may also be used. The latter types are used in cable constructions for fixed or feeder cable applications.

Semiconductive rubber screens are used in cables connected to systems which are able to limit earth faults to around 500 mA (r.m.s.) within about 10ms. Australian cables have fire propagation resistant semiconductive screens.

ARMOUR & REINFORCEMENT

Prysmian Group trailing cables manufactured to AS/NZS 1802 and AS/NZS 2802 and subjected to harsh wear, employ nylon textile or woven polyester tape, or an open braid of Kevlar® fibre as reinforcement. This enhances the sheath's mechanical strength, and improves the resistance against damage from crushing, stretching, and tear propagation.

Where a very high degree of impact and cut resistance is required, designs will usually have a pliable wire armour. This makes the cable much heavier and more difficult to handle and use. Heavy duty textile reinforcement is preferred form an operational point of view.

SHEATH

The primary role of the cable sheath is to protect the underlying core assembly from mechanical, chemical, or other environmental damage. Polychloroprene (PCP), chlorosulphonated polyethylene (CSP), and chlorinated polyethylene (CPE) are the most commonly used synthetic polymers used in sheaths today. They are commonly filled with other materials to enhance sheath performance.

A properly formulated sheathing compound is essential for a high performance reeling or trailing cable. The higher the tensile strength, the stronger the material is when stretched. As the material gets hotter, tensile strength reduces with a consequent reduction in tear resistance. As cables age, elongation may be reduced (the material becomes brittle).

Cable Handling

Cable Usage Characteristics

AMBIENT TEMPERATURE
Maximum continuous conductor temperature
Minimum continuous conductor temperature

MECHANICAL IMPACT RESISTANCE	
1	Light Impact
2	Moderate Impact
3	Heavy Impact
4	Very Heavy Impact

RESISTANCE TO SOLAR RADIATION AND WEATHER	
Excellent	Permanent
Very Good	Frequent
Good	Occasional
Acceptable	Accidental
Poor	None

BEHAVIOUR IN FLAME AND FIRE	
Reaction To Fire	**Resistant To Fire**
C 1 Fire retardant	CR 1 Fire resistant
C 2 Flame retardant	CR 2 All non CR 1 cables
C 3 No fire performance	

HALOGEN FREE
Halogen free (toxic fume or corrosives) cables

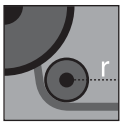
MINIMUM BENDING RADIUS
Minimum bending radius of installed cables

CHEMICAL RESISTANCE	
Excellent	Permanent
Very Good	Frequent
Good	Occasional
Acceptable	Accidental
Poor	None

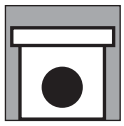
RESISTANCE TO WATER	
Negligible	No humidity
Water Drops	Occasional condensation
Spray	Water run off
Splashes	Exposed to water splashes
Heavy Sea	Exposed to waves
Immersion	Temporarily covered by water
Submersion	Permanently covered by water

FLEXIBILITY	
Rigid	Flexible
Semi-rigid	Very flexible

Laying Conditions



MINIMUM BENDING RADIUS DURING INSTALLATION

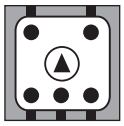


IN TRENCH

IN GROUND

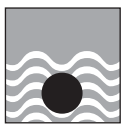
IN DUCT

DOMESTIC APPLIANCES



MACHINES

MOBILE EQUIPMENT



SUBMERGED

OVERHEAD AERIAL

MINIMUM INSTALLATION TEMPERATURE

IN FREE AIR

IN GROUND WITH PROTECTION

IN CONDUIT

OUTDOOR APPLIANCES

FESTOON

INTERNAL WIRING

INDUSTRIAL EQUIPMENT

EXTERNAL BUILDING

Health, Safety and Environment

PEOPLE ARE OUR GREATEST ASSET. WE BELIEVE EVERYONE HAS THE RIGHT TO WORK AND LIVE IN A HEALTHY AND SAFE ENVIRONMENT.

The Prysmian Group maintains our commitment to comply with all relevant Occupational Health, Safety and Environmental legislation, Australian and New Zealand Standards (AS/NZS 4801 and ISO 14001) Licences and Industry Codes of Practices.

Our goal is an environmentally and socially sustainable business and we believe that a safe work environment is a sign of efficiency and quality. Accidents can be prevented and we commit to continually improve, to achieve zero incidents of work related injury, illness and environmental pollution.

We also aim to help our customers fulfil their environmental responsibilities by providing them with cables and associated products that we believe have been manufactured as efficiently, economically sound and environmentally sustainable as possible. As our products are locally designed and manufactured we recognize the importance of risk assessment and mitigation in all mining operations.

For additional support in this area we have dedicated technical staff available to provide specific product information and guidelines for use please contact: **sales.au@prysmiangroup.com**

Quick Reference Guide

Standard Code	HV Feeder	Section Power	Lighting	Power Tools	Cutter Motor	Conveyor Drive	Longwall Power	Longwall Shearer	Roof Bolter	Mule	Shuttle Car
210.1			●	●	●						
209.1		●			●	●			●	●	
209.3					●		●				
240.1		○			●						
240.3					●		●				
240.11	●										
241.1		●	○		○	○			○	○	
241.3					○		●				
241.11	○										
245.1					○						
245.3					●		○	●			
260.1		●				○					
260.3							●				
260.11	●										
275.1					○				○	○	●
Type 1					○						
Type 2S			●	●	●						
Type A		●									
Type B		●									
409											
412											
440											
441											
450											
451											
455											
450M											

LEGEND: ● Recommended ○ Suitable

Continuous Miner	Road Header	Loader	Continuous Haulage	Ventilation Fan	Drill Rig	Face Shovel	Bucket Wheel	Dragline	Pump	Dredge	Stacker - Reclaimer	Ship Loader	Container Crane
●	●	●	●	●									
●	○	○	○	○									
			●	○									
		○		○									
					●	●	○	●	○				
										●			
					○	○	○	○	●				
					○	○	●	●	○		●	●	●
					○	○	●	●	○				
					●	●	●	●	○		●	●	●
									○		●	●	●
											●	●	●

Underground Mining - Coal

"ELECTRIC CABLES IN UNDERGROUND COAL MINE HAZARDOUS ZONES ARE SUBJECT TO AN EXTREMELY ARDUOUS ENVIRONMENT THAT IS OFTEN VERY WET. IN ADDITION, THEY ARE HANDLED REGULARLY BY MINE WORKERS WHILE ENERGISED."

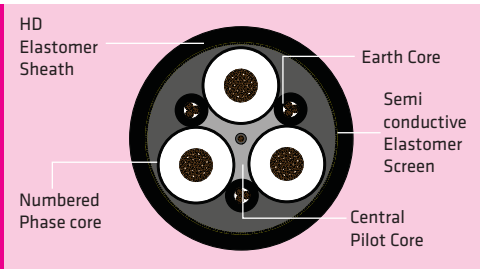
- NSW Government Industry & Investment. Technical Report EES-100.
Electrical Engineering Safety Underground Coal Mine. Electric Cables used in Hazardous Zones

Australian and New Zealand coal mines are some of the safest in the world. This safety record is built on strict controls and legislation to ensure that the cables for mining equipment and in particularly those used in hazardous areas are of particularly high quality.

Our cables listed in this section are compliant with the relevant standards for the differently classified zones of an underground coal mine, including AS/NZS 1802, AS/NZS 1972 and AS/NZS 5000.1. Prysmian cables manufactured to these standards have a proven track record of safe and reliable performance in the harsh environments that exist in underground mines.

We understand that a longwall mining operation may have very different demands on cable performance to a board and pillar or hydraulic monitor operation and our range is tailored to suit the specific challenges that varied mining operations present.

Type 241 and 241SF



SEMICONDUCTIVE SCREENED CABLE FOR GENERAL USE TO AS/NZS 1802

These cables have been designed to operate within the tight bending radii experienced with cable chains used on longwall shearers, and provide additional pilot conductors for modern machine monitoring.

Semiconductive screened power cores, with three earth cones and one extensible pilot. General purpose cable for continuous miners, or feeder cables to pumps. Also commonly used for monorails supplying DCBs and longwalls. Type 241SF cable has special stranding and lay-up. PED ratio to provide maximum flexibility in arduous conditions.

Cable Characteristics


+90˚C
-25˚C


3


Excellent


Immersion


Very Good


C1


V. Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus central pilot
Flexibility:	Very flexible for Type 241SF cable
Maximum Continuous Operating Temperature:	90˚C
Conductor Separator Type:	1.1/1.1kV - polyester where necessary 3.3kV and above - semiconductive screen

INSULATION:

EPR (R-EP-90) core with durably printed core numbers at intervals less than 300mm, on black semiconductive insulation screen for phase identification

SCREEN:

Semiconductive elastomer screen

PILOT:

Single, in centre of cable. Max. D.C. resistance of 5.5 Ω/100m for power cores to 35mm^2, and 3 Ω/100m for power conductors above 35mm^2

EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

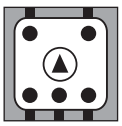
Open weave reinforcement, under heavy duty HD-85-PCP

Installation Conditions


IN FREE AIR


IN DUCT


MOBILE
EQUIPMENT


MACHINES

Type 241SF cable designed for applications requiring maximum flexibility.

Type 241 and 241SF

Physical Characteristics

Cable Type		241	241	241	241	241	241	241SF	241
Prysmian Part Number		**5013597**	**5014150**	**5013078**	**5013627**	**5013191**	**5052343**	**5023237**	**5029697**
Phase Core:									
Cross Sectional Area (Nominal)	mm^2	35	50	95	120	150	185	120	150
Conductor Wire Diameter (Nominal)	mm	0.30	0.30	0.50	0.50	0.50	0.50	0.50	0.50
Conductor Diameter (Nominal)	mm	8.4	9.7	13.3	15.3	17.2	18.8	15.6	17.2
Insulation Thickness (Minimum Average)	mm	1.6	1.7	2.0	2.1	2.3	2.5	3.0	3.0
Sheath Thickness (Minimum Average)	mm	4.4	4.9	5.8	6.3	6.7	7.3	7.2	7.6
Overall Cable Diameter (Approx.)	mm	41.9	46.2	57.0	62.8	68.5	74.3	69.9	74.1
Cable Weight (Approx.):	kg/m	3.09	3.82	6.05	7.46	9.09	10.8	9.04	10.3
Maximum Pulling Tension:									
Cable subjected to repeated reeling or bending whilst under tension	kN	1.58	2.25	4.28	5.40	6.75	8.33	5.40	6.75
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	3.15	4.50	8.55	10.8	13.5	16.7	10.8	13.5
Minimum Bending Radius:									
For Fixed Bend	mm	170	185	230	250	275	295	420	445
For Free Flexing Applications	mm	250	275	340	375	410	445	700	740
For Permanent Repeated Reeling	mm	420	460	570	630	685	745	840	890
For Passing Over Sheaves	mm	420	460	570	630	685	745	1050	1110

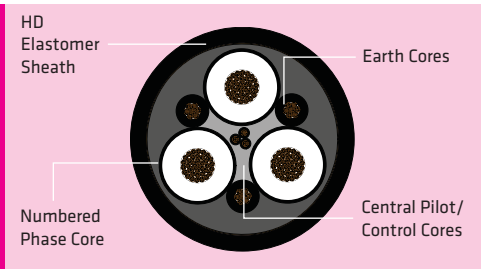
Type 241 and 241SF

Electrical Characteristics

Cable Type		241	241	241	241	241	241	241SF	241
Prysmian Part Number		**5013597**	**5014150**	**5013078**	**5013627**	**5013191**	**5052343**	**5023237**	**5029697**
Rated Voltage (Uo/U)	kV	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	3.3/3.3	3.3/3.3
Maximum Resistance:									
Phase Conductor, dc	Ω/km @20°C	0.547	0.410	0.212	0.164	0.129	0.106	0.164	0.129
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.698	0.523	0.271	0.210	0.166	0.136	0.210	0.165
Earth Conductor (Combined), dc	Ω/km @20°C	1.64	1.23	0.547	0.492	0.387	0.318	0.328	0.258
Pilot Conductor, dc	Ω/km @20°C	55	30	30	30	30	30	30	30
Inductance	mH/km	0.397	0.384	0.357	0.345	0.338	0.334	0.368	0.356
Inductive Reactance	Ω/km	0.125	0.120	0.112	0.108	0.106	0.105	0.116	0.112
Capacitance (Phase to earth)	μF/km	0.474	0.510	0.585	0.634	0.649	0.655	0.516	0.558
3-Phase Voltage Drop	mV/A.m	1.23	0.930	0.508	0.409	0.341	0.298	0.415	0.346
3-Phase Symmetrical Fault Rating	kA for 1sec	5.01	7.15	13.6	17.2	21.5	26.5	17.2	21.5
Continuous Current Rating*:									
Cable Protected From Sun	A	145	170	250	295	340	385	295	340
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	110	125	185	210	245	270	220	240

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Type 245SF



SUPER FLEXIBLE CABLE FOR GENERAL USE TO AS/NZS 1802

These cables have been designed to operate within the tight bending radii experienced with cable chains used on longwall shearers, and provide additional pilot conductors for modern machine monitoring.

Semiconductive screened power cores, with three earth cores and three extensible pilots for general purpose, and especially for trailing applications in cable chains on Longwall Shearer equipment, and in environments calling for maximum flexibility.

Cable Characteristics


+90˚C
-25˚C


3


Excellent


Immersion


Very Good


C1


V. Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus 3 central pilots
Flexibility:	Very flexible
Maximum Continuous Operating Temperature:	90˚C
Conductor Separator Type:	3.3kV - semiconductive screen

INSULATION:

EPR (R-EP-90) core with durably printed core numbers at intervals less than 300mm, on black semiconductive insulation screen for phase identification

SCREEN:

Semiconductive elastomer screen

PILOT:

3 pilots, in the centre of the cable. Max. D.C. resistance of 3 Ω/100m for all cables

EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

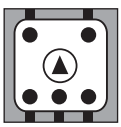
Open weave reinforcement, under heavy duty HD-85-PCP

Installation Conditions


IN FREE AIR


IN DUCT


MOBILE
EQUIPMENT


MACHINES

Cables designed for applications requiring maximum flexibility.

Type 245SF Physical Characteristics

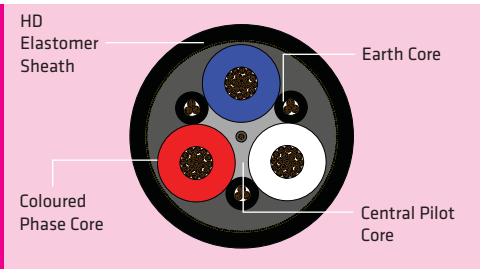
Cable Type		245SF	245SF
Prysmian Part Number		**5014921**	**5023220**
Phase Core:			
Cross Sectional Area (Nominal)	mm	70	95
Conductor Wire Diameter (Nominal)	mm	0.30	0.30
Conductor Diameter (Nominal)	mm	12.2	13.8
Insulation Thickness (Minimum Average)	mm	3.0	3.0
Sheath Thickness (Minimum Average)	mm	6.0	6.4
Overall Cable Diameter (Approx.)	mm	62.5	66.5
Cable Weight (Approx.):	kg/m	6.78	7.91
Maximum Pulling Tension:			
Cable subjected to repeated reeling or bending whilst under tension	kN	3.15	4.28
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	6.30	8.55
Minimum Bending Radius:			
For Fixed Bend	mm	375	400
For Free Flexing Applications	mm	625	665
For Permanent Repeated Reeling	mm	750	800
For Passing Over Sheaves	mm	940	1000

Type 245SF Electrical Characteristics

Cable Type		245SF	245SF
Prysmian Part Number		**5014921**	**5023220**
Rated Voltage (Uo/U)	kV	3.3/3.3	3.3/3.3
Maximum Resistance:			
Phase Conductor, dc	Ω/km @20°C	0.271	0.212
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.346	0.271
Earth Conductor (Combined), dc	Ω/km @20°C	0.542	0.424
Pilot Conductor, dc	Ω/km @20°C	30	30
Inductance	mH/km	0.412	0.394
Inductive Reactance	Ω/km	0.129	0.124
Capacitance (Phase to earth)	µF/km	0.387	0.427
3-Phase Voltage Drop	mV/A.m	0.640	0.516
3-Phase Symmetrical Fault Rating	kA for 1sec	10.0	13.6
Continuous Current Rating*:			
Cable Protected From Sun	A	220	250
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	155	180

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Type 275



SHUTTLE CAR CABLE TO AS/NZS 1802

These cables are used with high-speed reeling equipment employed on shuttle cars, and are subject to the greatest exertion underground. Cable constructions are designed to resist "corkscrewing" in these arduous conditions.

Non-individually screened power cores, three earth cores and one extensible pilot, laid-up in a semiconductive cradle and fill to 1.1/1.1kV application.

Cable Characteristics


+90˚C
-25˚C


3


Excellent


Immersion


Very Good


C1


Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus pilot
Maximum Continuous Operating Temperature:	90˚C

INSULATION:

EPR (R-EP-90) Core Colours Red, White, Blue

PILOT:

1 pilot, in the centre of the cable. Max. D.C. resistance of 5.5 Ω/100m for power conductors up to 35mm^2, and 3 Ω/100m for all larger cables

EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

Semiconductive elastomer filled, with an open weave reinforcement, under a heavy duty HD-85-PCP

Installation Conditions


IN FREE AIR


MOBILE
EQUIPMENT

Type 275 Physical Characteristics

Cable Type		275	275
Prysmian Part Number		**5012705**	**5015065**
Phase Core:			
Cross Sectional Area (Nominal)	mm	35	50
Conductor Wire Diameter (Nominal)	mm	0.40	0.40
Conductor Diameter (Nominal)	mm	8.9	10.2
Insulation Thickness (Minimum Average)	mm	1.6	1.7
Sheath Thickness (Minimum Average)	mm	4.3	4.7
Overall Cable Diameter (Approx.)	mm	38.9	43.2
Cable Weight (Approx.):	kg/m	2.94	3.68
Maximum Pulling Tension:			
Cable subjected to repeated reeling or bending whilst under tension	kN	1.58	2.25
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	3.15	4.50
Minimum Bending Radius:			
For Fixed Bend	mm	155	175
For Free Flexing Applications	mm	235	260
For Permanent Repeated Reeling	mm	390	430
For Passing Over Sheaves	mm	390	430

Type 275 Electrical Characteristics

Cable Type		275	275
Prysmian Part Number		**5012705**	**5015065**
Rated Voltage (Uo/U)	kV	1.1/1.1	1.1/1.1
Maximum Resistance:			
Phase Conductor, dc	Ω/km @20°C	0.547	0.410
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.698	0.523
Earth Conductor (Combined), dc	Ω/km @20°C	1.64	1.23
Pilot Conductor, dc	Ω/km @20°C	55	30
Inductance	mH/km	0.351	0.343
Inductive Reactance	Ω/km	0.110	0.108
Capacitance (Phase to earth)	µF/km	0.502	0.535
3-Phase Voltage Drop	mV/A.m	1.22	0.925
3-Phase Symmetrical Fault Rating	kA for 1sec	5.01	7.15
Continuous Current Rating*:			
Cable Protected From Sun	A	145	170
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	110	125

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Metalliferous Mining

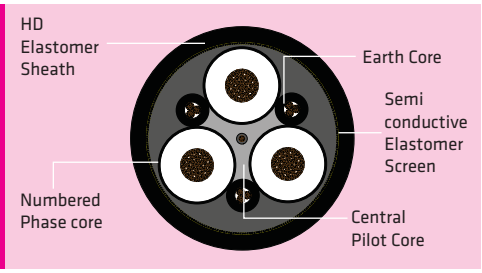
"AS THIS TYPE OF PLANT PRESENTS A HIGH RISK IN RELATION TO ELECTROCUTION, FIRES AND EXPLOSIONS, THE ASSESSMENT OF CABLES AND ANY ASSOCIATED COMPLIANCE STATEMENT NEEDS TO BE HIGHLY CREDIBLE."

- NSW Department of Primary Industry. Electrical Engineering Safety Decision Sheet 7.1. Evidence of compliance to Standards. Cables for use in hazardous zones

Hard rock or metalliferous mining employs very different mining techniques to that of coal and surface mining. Often exposed to extremes in temperature and longer life cycles when commissioned the cables used in these applications have specific performance requirements.

Compact and light weight design, ultra durable, easy to terminate and repair our hard rock range is designed with consideration for the special requirements which are presented by highly demanding geographically isolated work environments.

Type 241 and 241SF



SEMICONDUCTIVE SCREENED CABLE FOR GENERAL USE TO AS/NZS 1802

These cables have been designed to operate within the tight bending radii experienced with cable chains used on longwall shearers, and provide additional pilot conductors for modern machine monitoring.

Semiconductive screened power cores, with three earth cones and one extensible pilot. General purpose cable for continuous miners, or feeder cables to pumps. Also commonly used for monorails supplying DCBs and longwalls. Type 241SF cable has special stranding and lay-up. PED ratio to provide maximum flexibility in arduous conditions.

Cable Characteristics


+90˚C
-25˚C


3


Excellent


Immersion


Very Good


C1


V. Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus central pilot
Flexibility:	Very flexible for Type 241SF cable
Maximum Continuous Operating Temperature:	90˚C
Conductor Separator Type:	1.1/1.1kV - polyester where necessary 3.3kV and above - semiconductive screen

INSULATION:

EPR (R-EP-90) core with durably printed core numbers at intervals less than 300mm, on black semiconductive insulation screen for phase identification

SCREEN:

Semiconductive elastomer screen

PILOT:

Single, in centre of cable. Max. D.C. resistance of 5.5 Ω/100m for power cores to 35mm^2, and 3 Ω/100m for power conductors above 35mm^2

EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

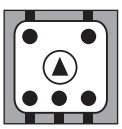
Open weave reinforcement, under heavy duty HD-85-PCP

Installation Conditions


IN FREE AIR


IN DUCT


MOBILE
EQUIPMENT


MACHINES

Type 241SF cable designed for applications requiring maximum flexibility.

Type 241 and 241SF

Physical Characteristics

Cable Type		241	241	241	241	241	241	241SF	241
Prysmian Part Number		**5013597**	**5014150**	**5013078**	**5013627**	**5013191**	**5052343**	**5023237**	**5029697**
Phase Core:									
Cross Sectional Area (Nominal)	mm	35	50	95	120	150	185	120	150
Conductor Wire Diameter (Nominal)	mm	0.30	0.30	0.50	0.50	0.50	0.50	0.50	0.50
Conductor Diameter (Nominal)	mm	8.4	9.7	13.3	15.3	17.2	18.8	15.6	17.2
Insulation Thickness (Minimum Average)	mm	1.6	1.7	2.0	2.1	2.3	2.5	3.0	3.0
Sheath Thickness (Minimum Average)	mm	4.4	4.9	5.8	6.3	6.7	7.3	7.2	7.6
Overall Cable Diameter (Approx.)	mm	41.9	46.2	57.0	62.8	68.5	74.3	69.9	74.1
Cable Weight (Approx.):	kg/m	3.09	3.82	6.05	7.46	9.09	10.8	9.04	10.3
Maximum Pulling Tension:									
Cable subjected to repeated reeling or bending whilst under tension	kN	1.58	2.25	4.28	5.40	6.75	8.33	5.40	6.75
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	3.15	4.50	8.55	10.8	13.5	16.7	10.8	13.5
Minimum Bending Radius:									
For Fixed Bend	mm	170	185	230	250	275	295	420	445
For Free Flexing Applications	mm	250	275	340	375	410	445	700	740
For Permanent Repeated Reeling	mm	420	460	570	630	685	745	840	890
For Passing Over Sheaves	mm	420	460	570	630	685	745	1050	1110

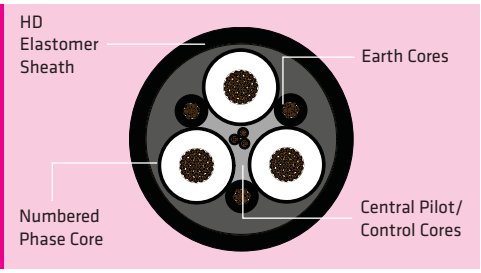
Type 241 and 241SF

Electrical Characteristics

Cable Type		241	241	241	241	241	241	241SF	241
Prysmian Part Number		**5013597**	**5014150**	**5013078**	**5013627**	**5013191**	**5052343**	**5023237**	**5029697**
Rated Voltage (Uo/U)	kV	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	1.1/1.1	3.3/3.3	3.3/3.3
Maximum Resistance:									
Phase Conductor, dc	Ω/km @20°C	0.547	0.410	0.212	0.164	0.129	0.106	0.164	0.129
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.698	0.523	0.271	0.210	0.166	0.136	0.210	0.165
Earth Conductor (Combined), dc	Ω/km @20°C	1.64	1.23	0.547	0.492	0.387	0.318	0.328	0.258
Pilot Conductor, dc	Ω/km @20°C	55	30	30	30	30	30	30	30
Inductance	mH/km	0.397	0.384	0.357	0.345	0.338	0.334	0.368	0.356
Inductive Reactance	Ω/km	0.125	0.120	0.112	0.108	0.106	0.105	0.116	0.112
Capacitance (Phase to earth)	µF/km	0.474	0.510	0.585	0.634	0.649	0.655	0.516	0.558
3-Phase Voltage Drop	mV/A.m	1.23	0.930	0.508	0.409	0.341	0.298	0.415	0.346
3-Phase Symmetrical Fault Rating	kA for 1sec	5.01	7.15	13.6	17.2	21.5	26.5	17.2	21.5
Continuous Current Rating*:									
Cable Protected From Sun	A	145	170	250	295	340	385	295	340
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	110	125	185	210	245	270	220	240

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Type 245SF



SUPER FLEXIBLE CABLE FOR GENERAL USE TO AS/NZS 1802

These cables have been designed to operate within the tight bending radii experienced with cable chains used on longwall shearers, and provide additional pilot conductors for modern machine monitoring.

Semiconductive screened power cores, with three earth cores and three extensible pilots for general purpose, and especially for trailing applications in cable chains on Longwall Shearer equipment, and in environments calling for maximum flexibility.

Cable Characteristics


+90˚C
-25˚C


3


Excellent


Immersion


Very Good


C1


V. Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus 3 central pilots
Flexibility:	Very flexible
Maximum Continuous Operating Temperature:	90˚C
Conductor Separator Type:	3.3kV - semiconductive screen

INSULATION:

EPR (R-EP-90) core with durably printed core numbers at intervals less than 300mm, on black semiconductive insulation screen for phase identification

SCREEN:

Semiconductive elastomer screen

PILOT:

3 pilots, in the centre of the cable. Max. D.C. resistance of 3 Ω/100m for all cables

EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

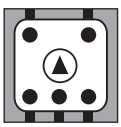
Open weave reinforcement, under heavy duty HD-85-PCP

Installation Conditions


IN FREE AIR


IN DUCT


MOBILE
EQUIPMENT


MACHINES

Cables designed for applications requiring maximum flexibility.

Type 245SF Physical Characteristics

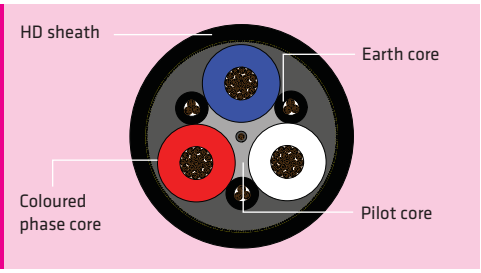
Cable Type		245SF	245SF
Prysmian Part Number		**5014921**	**5023220**
Phase Core:			
Cross Sectional Area (Nominal)	mm	70	95
Conductor Wire Diameter (Nominal)	mm	0.30	0.30
Conductor Diameter (Nominal)	mm	12.2	13.8
Insulation Thickness (Minimum Average)	mm	3.0	3.0
Sheath Thickness (Minimum Average)	mm	6.0	6.4
Overall Cable Diameter (Approx.)	mm	62.5	66.5
Cable Weight (Approx.):	kg/m	6.78	7.91
Maximum Pulling Tension:			
Cable subjected to repeated reeling or bending whilst under tension	kN	3.15	4.28
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	6.30	8.55
Minimum Bending Radius:			
For Fixed Bend	mm	375	400
For Free Flexing Applications	mm	625	665
For Permanent Repeated Reeling	mm	750	800
For Passing Over Sheaves	mm	940	1000

Type 245SF Electrical Characteristics

Cable Type		245SF	245SF
Prysmian Part Number		**5014921**	**5023220**
Rated Voltage (Uo/U)	kV	3.3/3.3	3.3/3.3
Maximum Resistance:			
Phase Conductor, dc	Ω/km @20°C	0.271	0.212
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.346	0.271
Earth Conductor (Combined), dc	Ω/km @20°C	0.542	0.424
Pilot Conductor, dc	Ω/km @20°C	30	30
Inductance	mH/km	0.412	0.394
Inductive Reactance	Ω/km	0.129	0.124
Capacitance (Phase to earth)	µF/km	0.387	0.427
3-Phase Voltage Drop	mV/A.m	0.640	0.516
3-Phase Symmetrical Fault Rating	kA for 1sec	10.0	13.6
Continuous Current Rating*:			
Cable Protected From Sun	A	220	250
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	155	180

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Type 275



SHUTTLE CAR CABLE TO AS/NZS 1802

These cables are used with high-speed reeling equipment employed on shuttle cars, and are subject to the greatest exertion underground. Cable constructions are designed to resist "corkscrewing" in these arduous conditions.

Non-individually screened power cores, three earth cores and one extensible pilot, laid-up in a semiconductive cradle and fill to 1.1/1.1kV application.

Cable Characteristics

+90˚C
-25˚C | 3 | Excellent | Immersion | Very Good | C1 | Flexible

Cable Design

CORE:

Metal:	Tinned Copper, 3 core 3 earths plus pilot
Maximum Continuous Operating Temperature:	90˚C

INSULATION:

EPR (R-EP-90) Core Colours Red, White, Blue

PILOT:

1 pilot, in the centre of the cable. Max. D.C. resistance of 5.5 Ω/100m for power conductors up to 35mm^2, and 3 Ω/100m for all larger cables

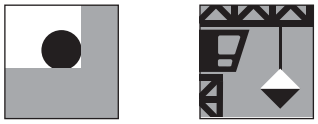
EARTH:

Three semiconductive elastomer covered flexible earths, located in the interstices

SHEATH:

Semiconductive elastomer filled, with an open weave reinforcement, under a heavy duty HD-85-PCP

Installation Conditions



IN FREE AIR | MOBILE EQUIPMENT

Type 275 Physical Characteristics

Cable Type		275	275
Prysmian Part Number		**5012705**	**5015065**
Phase Core:			
Cross Sectional Area (Nominal)	mm	35	50
Conductor Wire Diameter (Nominal)	mm	0.40	0.40
Conductor Diameter (Nominal)	mm	8.9	10.2
Insulation Thickness (Minimum Average)	mm	1.6	1.7
Sheath Thickness (Minimum Average)	mm	4.3	4.7
Overall Cable Diameter (Approx.)	mm	38.9	43.2
Cable Weight (Approx.):	kg/m	2.94	3.68
Maximum Pulling Tension:			
Cable subjected to repeated reeling or bending whilst under tension	kN	1.58	2.25
Cable subjected to straight pull, i.e. without significant bending or flexing	kN	3.15	4.50
Minimum Bending Radius:			
For Fixed Bend	mm	155	175
For Free Flexing Applications	mm	235	260
For Permanent Repeated Reeling	mm	390	430
For Passing Over Sheaves	mm	390	430

Type 275 Electrical Characteristics

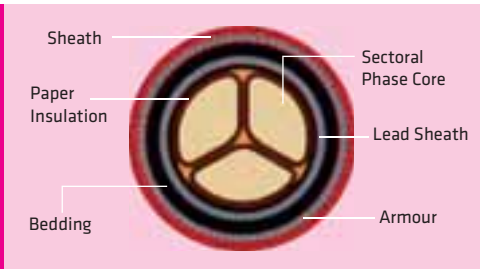
Cable Type		275	275
Prysmian Part Number		**5012705**	**5015065**
Rated Voltage (Uo/U)	kV	1.1/1.1	1.1/1.1
Maximum Resistance:			
Phase Conductor, dc	Ω/km @20°C	0.547	0.410
Phase Conductor, ac @ 50Hz	Ω/km @90°C	0.698	0.523
Earth Conductor (Combined), dc	Ω/km @20°C	1.64	1.23
Pilot Conductor, dc	Ω/km @20°C	55	30
Inductance	mH/km	0.351	0.343
Inductive Reactance	Ω/km	0.110	0.108
Capacitance (Phase to earth)	µF/km	0.502	0.535
3-Phase Voltage Drop	mV/A.m	1.22	0.925
3-Phase Symmetrical Fault Rating	kA for 1sec	5.01	7.15
Continuous Current Rating*:			
Cable Protected From Sun	A	145	170
Cable Exposed To Sun (Solar intensity = 1000W/m)	A	110	125

*In accordance with AS/NZS2802 for single cable in free air condition based on a conductor temperature of 90°C and an ambient air temperature of 40°C. Must consider derating or rating factor(s) for other conditions.

Feeder Cables

A range of high/medium voltage cables used in power reticulation throughout a mine for pumps, conveyors, feeder breakers, and lighting.

11/11kV Paper Insulated



3 CORE BELTED PAPER INSULATED CABLE TO AS1026 AND AS/NZS 1972

High voltage feeder cables used in power reticulation throughout the mine. 11/11kV paper insulated, paper belted, lead sheathed, GSW armoured, PVC sheathed cable. Suitable as primary supply for mines and industrial networks, for systems having high earth fault values.

Cable Characteristics


+65˚C
-0˚C


4


Excellent


Immersion


Very Good


C3


Rigid

Cable Design

CORE:

Metal:	Compacted shaped plain annealed copper conductor
Maximum Continuous Operating Temperature:	65˚C
	Semiconductive tape screen

INSULATION:

Impregnated paper tape insulated (numbered), overall paper tape belt insulated

INNER SHEATH:

Lead alloy

BEDDING:

Bitumen impregnated paper and textile tape

ARMOUR:

Galvanised steel wire armour. The armour is designed to provide not less than 50% conductance of the power conductor

OUTER SHEATH:

PVC (red)

Installation Conditions


IN FREE AIR


IN DUCT


BURIED DIRECT

Note: 12.7/22kV XPLE cable can be used as an alternative, with gains in temperature rating generally allowing a reduction in cable size, with consequent savings in cost, size and weight.

11/11kV Paper Insulated

Physical Characteristics

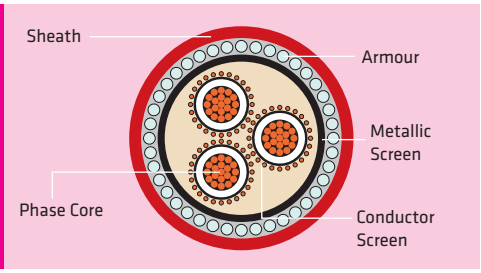
Conductor		Overall Diameter mm	Cable Mass kg/100m	Minimum Installed Bend Radius mm
mm²	shape			
16	Circular	47.6	551	570
25	Circular	49	632	590
35	Circular	50.3	673	600
50	Sector	53	748	640
70	Sector	56.3	873	680
95	Sector	60	1021	720
120	Sector	62.1	1122	750
150	Sector	65.1	1268	780
185	Sector	69.9	1542	840
240	Sector	74.8	1793	900
300	Sector	79.8	2119	960
400	Sector	86.3	2505	1040
500	Sector	92.2	3003	1110

11/11kV Paper Insulated

Electrical Characteristics

Core	Current Rating			Electrical Characteristics					
Area mm²	In Air A	In Ground A	In Ducts A	DC ohm	AC ohm	Inductance	Capacitance	Star Reactance	Volt drop
16	61	75	67	1.15	1.35	0.398	0.165	0.125	2.35
25	79	96	86	0.727	0.856	0.344	0.212	0.108	1.49
35	95	115	102	0.524	0.617	0.323	0.242	0.102	1.08
50	120	143	126	0.387	0.456	0.292	0.29	0.092	0.805
70	149	176	154	0.268	0.316	0.28	0.328	0.088	0.568
95	182	211	185	0.193	0.228	0.27	0.367	0.085	0.421
120	208	240	210	0.153	0.181	0.264	0.398	0.083	0.345
150	236	270	239	0.124	0.147	0.255	0.435	0.08	0.29
185	269	303	269	0.0991	0.118	0.25	0.474	0.078	0.246
240	318	353	313	0.0754	0.091	0.242	0.525	0.076	0.205
300	362	396	351	0.0601	0.073	0.238	0.573	0.075	0.181
400	419	450	398	0.047	0.059	0.234	0.642	0.073	0.162
500	481	509	456	0.0366	0.047	0.229	0.715	0.072	0.149

6.35/11kV Copper



3 CORE COPPER WIRE SCREENED ARMOURED TO AS/NZS 1972

Cable Characteristics

+90˚C -25˚C	12D	4	Very Good	Splashes	Very Good	C2	Rigid

Cable Design

CORE:

Metal:	Plain circular compacted copper
Maximum Continuous Operating Temperature:	90˚C

CONDUCTOR SCREEN:

Extruded semi-conducting compound, bonded to the insulation and applied in the same operation as the insulation

INSULATION:

Cross Linked Polyethylene (XLPE) - standard

INSULATION SCREEN:

Extruded semi-conducting compound

METALLIC SCREEN:

Plain annealed copper wire. Combined screen area is designed to provide not less than 50% conductance of one associated power conductor

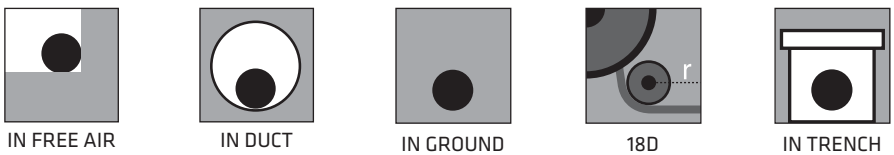
ARMOUR:

Galvanised steel wires

OUTER SHEATH:

Red 5V-90 polyvinyl chloride (PVC)

Installation Conditions



IN FREE AIR | IN DUCT | IN GROUND | 18D | IN TRENCH

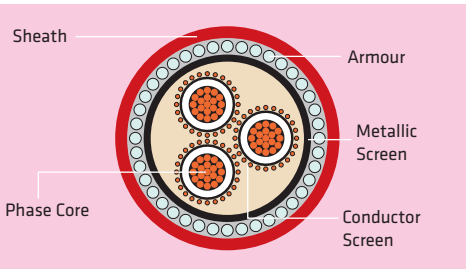
Note: The cables in this brochure are not specifically designed for use as self supporting cables, as submarine cables or where exposure to excessive heat and/or corrosive products is involved. In case of any doubt concerning the suitability of a particular cable type for a particular application, guidance should be sought from the Prysmian Customer Service Team.

6.35/11kV Copper

Characteristics

Product Code	25XFED3C11	35XFED3C11	50XFED3C11	70XFED3C11	95XFED3C11	120XFED3C11	150XFED3C11	185XFED3C11	240XFED3C11
Nominal Conductor Area mm^2	25	35	50	70	95	120	150	185	240
Nominal Conductor Diameter mm	6.1	7.0	8.2	9.8	11.5	12.9	14.3	16.0	18.2
Nominal Wire Armour Diameter mm	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.15	3.15
Nominal Diameter mm	51.3	53.5	56.3	60.4	64.4	67.9	71.3	79.5	85.1
Nominal Mass kg/100m	425	475	539	646	778	888	101	129	153
Pulling Tension: Cond(s) kN	5.3	7.4	10.5	14.7	20.0	25.0	25.0	25.0	25.0
Pulling Tension: Stocking kN	5.3	7.4	10.5	12.4	14.2	15.8	17.4	22	25
Pulling Tension: Armour Wires kN	10.4	11.4	12.6	14.6	16.8	18.5	20.6	25.0	25.0
Min Bending Radius During Install mm	920	960	1010	1090	1160	1220	1280	1430	1530
Min Bending Radius Set In Position mm	620	640	680	720	770	810	860	950	1020
Rdc @ Ref Temp: Phase Cond Ohm/km	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754
Rac @ Oper Temp: Phase Conductor	0.927	0.668	0.494	0.342	0.247	0.196	0.159	0.128	0.0983
Inductance mH/km	0.415	0.397	0.379	0.349	0.333	0.319	0.310	0.309	0.298
Inductance Reactance Ohm/km	0.130	0.124	0.119	0.109	0.104	0.100	0.097	0.097	0.0914
Zo @ Ref temp: Ro Ohm/km	4.00+j0.078	3.51+j0.018	2.51+j0.073	1.76+j0.063	1.29+j0.059	1.02+j0.054	0.82+j0.051	0.66+j0.050	0.52+j0.047
Capacitance: Phase To Earth uF/km	0.211	0.230	0.254	0.289	0.324	0.353	0.382	0.418	0.463
Capacitance: Charging curr. per phase A/km	0.42	0.46	0.51	0.58	0.65	0.70	0.76	0.83	0.92
ISC: Phase Cond. kA, 1 sec	3.6	5.0	7.2	10.0	13.6	17.2	21.5	26.5	34.3
In ground, direct buried A	140	165	195	235	290	330	370	410	475
In ground, in duct A	120	145	170	205	245	280	310	350	410
In free air A	135	160	190	235	295	345	385	440	520

12.7/22kV Copper



3 CORE COPPER WIRE SCREENED ARMOURED TO AS/NZS 1972

Cable Characteristics

+90˚C -25˚C	12D	4	Very Good	Splashes	Very Good	C2	Rigid

Cable Design

CORE:

Metal:	Plain circular compacted copper
Maximum Continuous Operating Temperature:	90˚C

CONDUCTOR SCREEN:

Extruded semi-conducting compound, bonded to the insulation and applied in the same operation as the insulation

INSULATION:

Cross Linked Polyethylene (XLPE) - standard

INSULATION SCREEN:

Extruded semi-conducting compound

METALLIC SCREEN:

Plain annealed copper wire. Combined screen area is designed to provide not less than 50% conductance of one associated power conductor

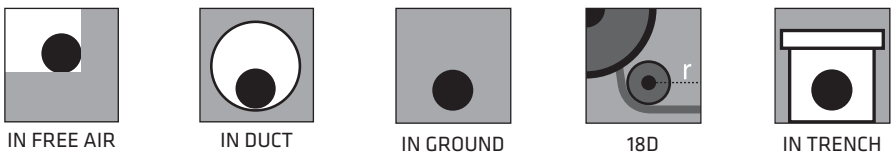
ARMOUR:

Galvanised steel wires

OUTER SHEATH:

Red 5V-90 polyvinyl chloride (PVC)

Installation Conditions



IN FREE AIR | IN DUCT | IN GROUND | 18D | IN TRENCH

Note: The cables in this brochure are not specifically designed for use as self supporting cables, as submarine cables or where exposure to excessive heat and/or corrosive products is involved. In case of any doubt concerning the suitability of a particular cable type for a particular application, guidance should be sought from the Prysmian Customer Service Team.

12.7/22kV Copper

Characteristics

Product Code	35XFED3C22	50XFED3C22	70XFED3C22	95XFED3C22	120XFED3C22	150XFED3C22	185XFED3C22	240XFED3C22
Nominal Conductor Area mm^2	35	50	70	95	120	150	185	240
Nominal Conductor Diameter mm	7.0	8.2	9.8	11.5	12.9	14.3	16.0	18.2
Nominal Wire Armour Diameter mm	2.5	2.5	2.5	2.5	3.15	3.15	3.15	3.15
Nominal Diameter mm	63.6	66.5	70.4	74.5	79.4	83.0	89.8	95.1
Nominal Mass kg/100m	603	660	776	902	1110	1245	1449	1699
Pulling Tension: Cond(s) kN	7.4	10.5	14.7	20.0	25.0	25.0	25.0	25.0
Pulling Tension: Stocking kN	7.4	10.5	14.7	18.9	21.5	24.0	25.0	25.0
Pulling Tension: Armour Wires kN	16.3	17.8	20.0	22.5	25.0	25.0	25.0	25.0
Min Bending Radius During Install mm	1140	1195	1265	1340	1430	1490	1615	1710
Min Bending Radius Set In Position mm	760	795	840	890	950	995	1075	1140
Rdc @ Ref Temp: Phase Cond Ohm/km	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754
Rac @ Oper Temp: Phase Conductor	0.668	0.494	0.342	0.247	0.196	0.159	0.128	0.098
Inductance mH/km	0.438	0.418	0.385	0.367	0.351	0.340	0.336	0.323
Inductance Reactance Ohm/km	0.137	0.131	0.121	0.115	0.110	0.107	0.106	0.102
Zo @ Ref temp: Ro Ohm/km	2.87+j0.092	2.57+j0.085	1.76+j0.075	1.28+j0.069	1.02+j0.065	0.82+j0.061	0.66+j0.059	0.53+j0.055
Capacitance: Phase To Earth uF/km	0.164	0.179	0.200	0.223	0.241	0.259	0.282	0.311
Capacitance: Charging curr. per phase A/km	0.65	0.71	0.80	0.89	0.96	1.03	1.12	1.24
ISC: Phase Cond. kA, 1 sec	5.0	7.2	10.0	13.6	17.2	21.5	26.5	34
In ground, direct buried A	165	190	235	290	330	365	410	465
In ground, in duct A	145	170	205	245	285	320	360	400
In free air A	160	190	240	305	350	390	445	535

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