At its best under pressure.

With our submersible pump cables, being in deep water's a breeze.

Prysmian
Group

Prysmian Group

Linking the future

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

With this in mind, we provide major global organisations in many industries with best-in-class cable solutions, based on state-of-the-art technology. Through three renowned commercial brands – Prysmian, Draka and General Cable – based in almost 50 countries, we're constantly close to our customers, enabling them to further develop the world's energy and telecoms infrastructures, and achieve sustainable, profitable growth.

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

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

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

Submersible pump cables

From high power pumping systems to portable pumps, we offer a complete range of high performance and reliable cable solutions for waste, drinking as well as hot water. The cables can be used permanently in water at depths down to 2,000 meters. We ensure a long lifetime, compliance with the most demanding standards for drinking water and invulnerability to aggressive chemical and environmental agents. Or in other words: there's no need to hold your breath when plunging it in from top to bottom.

Introduction

For fluids to flow they must be pumped. And for these pumps to operate continually, cables are critical and must resist to hydrocarbons, oils, acids, chlorine, sulphates and many other chemical substances. Whether for a high-power pumping system or a portable pump, we offer a complete range of high performance and reliable solutions that ensure a long lifetime, compliance with the most demanding standards for drinking water, invulnerability to aggressive chemical and environmental agents as well as rubber cables with extremely low diameter tolerance. The high reliability and service life of our submersible cables are thanks to our extensive know-how of the special operational conditions, gained from working in close cooperation with all significant pump manufacturers across the world for generations.

Application

From farm fields and your garden's irrigation equipment, to municipal water systems, industrial wastewater disposal systems, dewatering of mines, ecological renovation, purification plants, preventions of buildings and structures, exploitation of thermal water, water conditioning systems and more; all require the use of electrical pumps, installed in extreme environmental conditions.

COMMITTED TO SERVICE

Effective and efficient production secures the demands for cables

By making recurring investments in our plants, we are always ready to provide customers and communities worldwide with cable solutions based on state-of-the-art technology, consistent excellence in execution and in-depth understanding of the needs of an evolving market. When the tough gets going you can rest assured, we are ready to deliver.

One-stop shop

We deliver your overall demand for submersible cables.

Drinking water

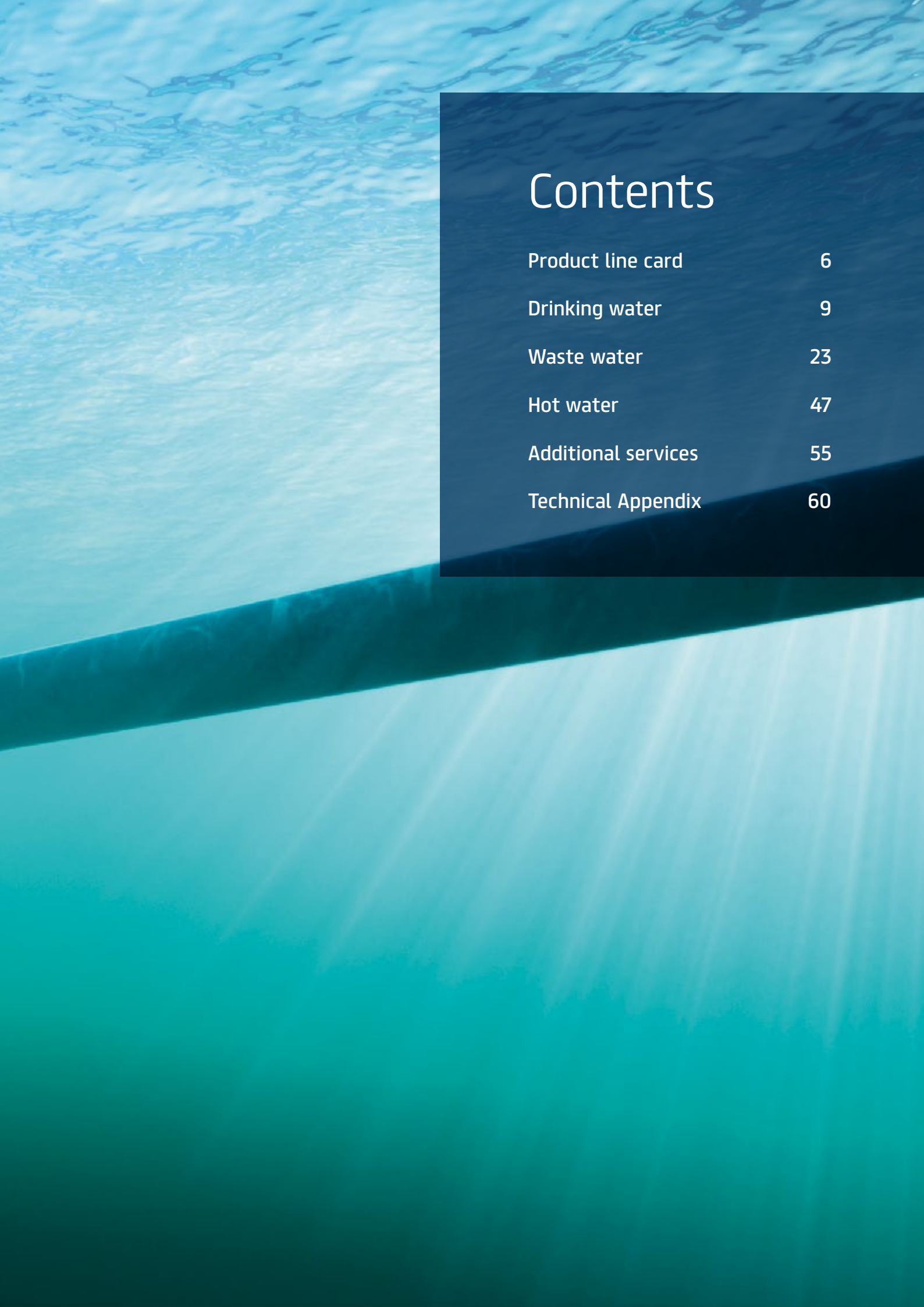
We offer both round and flat power and control cables for drinking water pumps. They are available in screened and standard versions and for MV pumps and approved for the most common national requirements.

Waste water

Our submersible cables for waste water are highly resistant to chemicals and oil. They are available as power and control cables as well as tailormade hybrid cables according to customer needs. Available for FC drives, in medium voltage and in halogen-free versions.

Hot water

Our pump cables for hot water applications can resist temperatures up to 120 °C with the highest needed lifetime. They are available in round and in flat designs.



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Waste water 23

Hot water 47

Additional services 55

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Product line card

Cable	Product line	Designation	Voltage range	Shape
Drinking water				
	TML	TML Type B	0.6/1 kV	○
		TML Type B	0.6/1 kV	▭
	HYDROFIRM(T)	S07BB-F	450/750 V	○
		S07BBH2-F	450/750 V	▭
		S1BB-F	0.6/1 kV	○
		S1BBH2-F	0.6/1 kV	▭
	POTAFLEX		0.6/1 kV	○
	HYDROFIRM(T) EMV-FC	S05BC4B-F	300/500 V	○
		S07BC4B-F	450/750 V	○
		S1BC4B-F	0.6/1 kV	○
	MS-HYDROFIRM(T)	(N)TSW	3.6/6 kV	○
Waste water				
	OZOFLEX (PLUS)	H07RN8-F	450/750 V	○
		S07HXHX	450/750 V	○
		S07RN8H2-F	450/750 V	▭
	OZOFLEX (FC+)	S07RC4N8-F	450/750 V	○
		S07HXCHX	450/750 V	○
	TECWATER	S1BN8-F	0.6/1 kV	○
		Li-09YSCH PiMF-100	100/100 V	○
		HYBRID	300/500 V	○
		S1BZ-F	0.6/1 kV	○
	TECWATER EMV-FC	S1BC4N8-F	0.6/1 kV	○
	MS-TECWATER	(N)TSWOEU	3.6/6 kV	○
		(N)TSCGECWOEU	3.6/6 kV – 6/10 kV	○
	ATON	H07RN-F	450/750 V	○
	ATON EMC	VSCCB	0.6/1 kV	○
	PROTOMONT	NSSHOEU	0.6/1 kV	○
		NSHXOEU	0.6/1 kV	○
		NSSHOEU / 3E	0.6/1 kV	○
		(N)SSHCOEU	0.6/1 kV	○
	PROTOLON(ST)	NTSWOEU	1.8/3 kV – 3.6/6 kV	○
		NTSCGEWOEU	1.8/3 kV – 18/30 kV	○
		NTSCGEWOEU / 3E	1.8/3 kV – 18/30 kV	○
	PROTOLON(M)-F	(N)TSCGEWOEU	1.8/3 kV – 18/30 kV	○
Hot water				
	HYDROFIRM	TGSH	450/750 V	○
		TGSH2G	450/750 V	○
		TGFLSH	450/750 V	▭
		TGFLSH2G	450/750 V	▭
	MS-HYDROFIRM	(N)TS-TGSH	3.6/6 kV	○

Approvals: UBA, DVE, c UL us, ACS, KTW

EX acc.
DIN EN 60079-14-9

Screen	Water temperature max.	Submersing depth max.	Cross section	Number of cores	Page
–	60 °C	2,000 m	up to 185 mm²	1 – 4	10
–	60 °C	2,000 m	up to 50 mm²	3 – 4	11
–	60 °C	2,000 m	up to 400 mm²	1 – 7	12
–	60 °C	2,000 m	up to 240 mm²	3 – 4	13
–	60 °C	2,000 m	up to 500 mm²	1 – 8	14
–	60 °C	2,000 m	up to 185 mm²	3 – 4	15
–	50 °C	150 m	up to 2.5 mm²	3 – 4	16
●	60 °C	500 m	up to 2.5 mm²	1 – 4	17
●	60 °C	2,000 m	up to 70 mm²	1 – 6	18
●	60 °C	2,000 m	up to 120 mm²	3 – 4	19
–	60 °C	2,000 m	up to 70 mm²	1 – 4	20
–	40 °C	2,000 m	up to 300 mm²	1 – 12	24
–	40 °C	500 m	up to 300 mm²	1 – 12	25
–	40 °C	500 m	up to 185 mm²	3 – 4	26
●	40 °C	500 m	up to 95 mm²	4 – 12	27
●	40 °C	500 m	up to 95 mm²	4 – 12	28
–	40 °C	2,000 m	up to 500 mm²	1 – 12	29
●	40 °C	500 m		4 x 2	30
●	40 °C	500 m	up to 1.5 mm²	2 x 2 + 4	31
–	40 °C	500 m	up to 240 mm²	1 – 4	32
●	40 °C	2,000 m	up to 300 mm²	1 – 12	33
–	40 °C	2,000 m	up to 70 mm²	1 – 4	34
●	40 °C	2,000 m	up to 240 mm²	1 – 4	35
–	40 °C	500 m	up to 240 mm²	1 – 12	36
●	40 °C	500 m	up to 240 mm²	1 – 12	37
–	40 °C	2,000 m	up to 400 mm²	1 – 24	38
–	40 °C	500 m	up to 400 mm²	1 – 24	39
–	40 °C	500 m	up to 240 mm²	4 – 5	40
●	40 °C	500 m	up to 240 mm²	4	41
–	40 °C	500 m	up to 70 mm²	1 – 4	42
●	40 °C	500 m	up to 240 mm²	4	43
●	40 °C	500 m	up to 240 mm²	4	44
●	40 °C	500 m	up to 240 mm²	4	45
–	110 °C	2,000 m	up to 70 mm²	1 – 12	48
–	120 °C	2,000 m	up to 70 mm²	1 – 12	49
–	110 °C	2,000 m	up to 240 mm²	3 – 4	50
–	120 °C	2,000 m	up to 240 mm²	3 – 4	51
–	110 °C	2,000 m	up to 70 mm²	1 – 4	52

Other cross sections and number of cores available upon request.

Drinking water

TML

Type B round 0.6/1 kV 10
Type B flat 0.6/1 kV 11

HYDROFIRM(T)

S07BB-F 450/750 V 12
S07BBH2-F 450/750 V 13
S1BB-F 0.6/1 kV 14
S1BBH2-F 0.6/1 kV 15

POTAFLEX

0.6/1 kV 16

HYDROFIRM(T) EMV-FC

S05BC4B-F 300/500 V 17
S07BC4B-F 450/750 V 18
S1BC4B-F 0.6/1 kV 19

MS-HYDROFIRM(T)

(N)TSW 3.6/6 kV 20

TML
Type B round 0.6/1 kV

Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

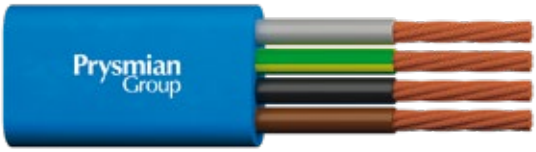
Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

TML Type B round 0.6/1 kV	
Global data	
Brand	TML
Model	Round
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (5 min.)

TML Type B round 0.6/1 kV	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TML
Type B flat 0.6/1 kV



Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

TML Type B flat 0.6/1 kV	
Global data	
Brand	TML
Model	Flat
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (5 min.)

TML Type B flat 0.6/1 kV	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T)
S07BB-F 450/750 V

Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

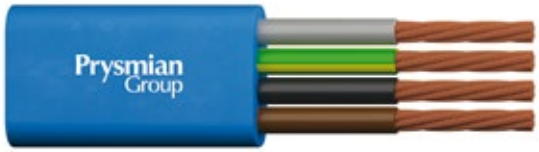
For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) S07BB-F 450/750 V	
Global data	
Brand	HYDROFIRM(T)
Type designation	S07BB-F
Model	Round
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM(T) S07BB-F 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T)
S07BBH2-F 450/750 V



Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) S07BBH2-F 450/750 V	
Global data	
Brand	HYDROFIRM(T)
Type designation	S07BBH2-F
Model	Flat
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM(T) S07BBH2-F 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T)
S1BB-F 0.6/1 kV

Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

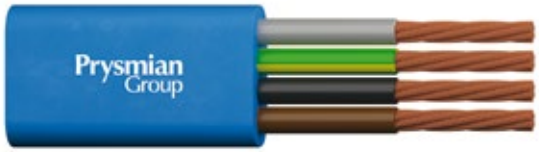
For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) S1BB-F 0.6/1 kV	
Global data	
Brand	HYDROFIRM(T)
Type designation	S1BB-F
Model	Round
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)

HYDROFIRM(T) S1BB-F 0.6/1 kV	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T)
S1BBH2-F 0.6/1 kV



Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) S1BBH2-F 0.6/1 kV	
Global data	
Brand	HYDROFIRM(T)
Type designation	S1BBH2-F
Model	Flat
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)

HYDROFIRM(T) S1BBH2-F 0.6/1 kV	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

POTAFLEX
0.6/1 kV

KTW

Drinking water cable with KTW certification.

Application

The cable may be used in direct contact with drinking water, such as in food production and drinking water pumps. The cable is designed for industry and OEM.

The cable complies with the positive list of EC Directive 2002/72/EC, has been certified by KIWA according to the KTW requirements of the German Umwelt Bundesamt, and can be used in the food zone.

This innovative cable with KTW certificate has flexible cores with PVC insulation and a PE outer sheath which is non-toxic, does not release toxic substances, and is easy to clean.

The bright blue sheath colour (Blue Label) makes the cable easy to recognise and any cable particles will be easier to detect and remove.

POTAFLEX PVC 0.6/1 kV	
Global data	
Brand	POTAFLEX
Model	Round
Certifications / Approvals	KTW (kiwa)
Design features	
Conductor	Bare copper, flexible Class 5
Core identification	acc. to HD 308 S2
Outer sheath	PE, blue
Application properties	
Nominal voltage U0	600 V
Nominal voltage U	1,000 V
Test voltage	3.5 kV
Max. conductor temperature	70 °C
Min. outer temperature, fixed installation	-40 °C
Max. outer temperature, fixed installation	50 °C
UV resistant	Yes
Outdoor installation	Yes

POTAFLEX PVC 0.6/1 kV	
Min. outer temperature during installation	0 °C
Max. outer temperature during installation	40 °C
Underground installation	Yes
Fire properties	
Insulation integrity (acc. IEC 60331)	No
Flame retardant	No
Halogen free	No
Low smoke	No

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T) EMV-FC
S05BC4B-F 300/500 V

Screened rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 500 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

S05BC4B-F 300/500 V	
Global data	
Brand	HYDROFIRM(T) EMV-FC
Type designation	S05BC4B-F
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Screen	Braiding of tinned copper wires between cores and outer sheath
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.3/0.5 kV
Max. permissible operating voltage AC	0.318/0.55 kV
Max. permissible operating voltage DC	0.413/0.825 kV
AC test voltage – main cores	2 kV (15 min.)

S05BC4B-F 300/500 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25°C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T) EMV-FC S07BC4B-F 450/750 V

Screened rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 500 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) EMV-FC S07BC4B-F 450/750 V	
Global data	
Brand	HYDROFIRM(T) EMV-FC
Type designation	S07BC4B-F
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV

HYDROFIRM(T) EMV-FC S07BC4B-F 450/750 V	
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM(T) EMV-FC S1BC4B-F 0.6/1 kV

Screened rubber-sheathed drinking water cables.

Application

These screened rubber-sheathed drinking water cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 500 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

HYDROFIRM(T) EMV-FC S1BC4B-F 0.6/1 kV	
Global data	
Brand	HYDROFIRM(T) EMV-FC
Type designation	S1BC4B-F
Standard	Based on EN 50525-2-21
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV

HYDROFIRM(T) EMV-FC S1BC4B-F 0.6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

MS-HYDROFIRM(T) (N)TSW 3.6/6 kV

Rubber-sheathed drinking water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications, for protected fixed installation in pipes, equipment, as rotor connections to motors or in well systems.

Possible water types: drinking-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

The outer sheath fulfils the Elastomer Guideline (ELL) of the German Federal Environmental Agency (UBA) and the requirements of the "Attestation de Conformité Sanitaire" (ACS) from France.

In addition, general terms of DIN VDE 0298-3 apply.

This wall-thickness- and outer-diameter-optimized 6 kV-concept offers further solutions for exteme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case. Hazardous areas and chlorine contents of more than 0.5 mg/l must be excluded.

MS-HYDROFIRM(T) (N)TSW 3.6/6 kV	
Global data	
Brand	MS-HYDROFIRM(T)
Type designation	(N)TSW
Model	Round
Standard	Based on DIN VDE 0250-813
Certifications / Approvals	ELL ACS
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Electrical field control	Inner layer of semiconductive rubber compound
Core identification	Numbering
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	3.6/6 kV

MS-HYDROFIRM(T) (N)TSW 3.6/6 kV	
Max. permissible operating voltage AC	4.2/7.2 kV
Max. permissible operating voltage DC	5.4/10.8 kV
AC test voltage – main cores	11 kV (5 min.)
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	60 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

Notes

Waste water

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(N)TSCGEWOEU 3.6/6 kV – 18/30 kV 45

OZOFLEX(PLUS)
H07RN8-F 450/750 V

Rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

OZOFLEX(PLUS) H07RN8-F 450/750 V	
Global data	
Brand	OZOFLEX(PLUS)
Type designation	H07RN8-F
Model	Round
Standard	Based on EN 50525-2-21
Certifications / Approvals	UL- and cUL-Recognition – File E 42183
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EPDM
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV

OZOFLEX(PLUS) H07RN8-F 450/750 V	
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

OZOFLEX(PLUS)
S07HXHX 450/750 V

Halogen-free rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Necessary for applications where in case of fire low smoke and zero halogens are required.

In case of a fire and contact with water these cables will not, contrary to chlorides including compound concepts like PVC, create acids that can damage control electronics or emit toxics which are dangerous to inhale.

OZOFLEX(PLUS) S07HXHX 450/750 V	
Global data	
Brand	OZOFLEX(PLUS)
Type designation	S07HXHX
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV

OZOFLEX(PLUS) S07HXHX 450/750 V	
AC test voltage – main cores	2.5 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

ÖZOFLEX(PLUS)
S07RN8H2-F 450/750 V

Rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

ÖZOFLEX(PLUS) S07RN8H2-F 450/750 V	
Global data	
Brand	ÖZOFLEX(PLUS)
Type designation	S07RN8H2-F
Model	Flat
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound CPE
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

ÖZOFLEX(PLUS) S07RN8H2-F 450/750 V	
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

OZOFLEX(FC+)
S07RC4N8-F 450/750 V

Screened rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

OZOFLEX(FC+) S07RC4N8-F 450/750 V	
Global data	
Brand	OZOFLEX(FC+)
Type designation	S07RC4N8-F
Model	Round
Standard	Based on EN 50525-2-21
Certifications / Approvals	UL- and cUL-Recognition – File E 42183
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound CPE
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV

OZOFLEX(FC+) S07RC4N8-F 450/750 V	
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

OZOFLEX(FC+)
S07HXCHX-F 450/750 V

Screened halogen-free rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Necessary for applications where in case of fire low smoke and zero halogens are required.

In case of a fire and contact with water these cables will not, contrary to chlorides including compound concepts like PVC, create acids that can damage control electronics or emit toxics which are dangerous to inhale.

OZOFLEX(FC+) S07HXCHX-F 450/750 V	
Global data	
Brand	OZOFLEX(FC+)
Type designation	S07HXCHX-F
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV

OZOFLEX(FC+) S07HXCHX-F 450/750 V	
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TECWATER
S1BN8-F 0.6/1 kV

Rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster or hoisting gears. Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

TECWATER S1BN8-F 0.6/1 kV	
Global data	
Brand	TECWATER
Type designation	S1BN8-F
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound CPE
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)

TECWATER S1BN8-F 0.6/1 kV	
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TECWATER DATA
Li-09YSCH PiMF-100 Cat. 5 100/100 V

Screened copolymer-sheathed waste water data cables.

Application

These cables are suitable for connections of electrical equipment and transmission of data signals of modern pumps, which include sensor technology and can be submerged in contaminated water under medium mechanical stress. To ensure effective shielding, electro-magnetic compatibility (EMC) and its requirements, both ends must have a good shield contact to ground. Further potential application fields are fire- and explo-sion-hazard areas acc. DIN EN 60079, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, sewage water tanks, on plaster or hoisting gears.

Water types are defined in accordance with DIN 4045 and DIN 4046, e.g. process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

TECWATER DATA Li-09YSCH PiMF-100 Cat. 5 100/100 V	
Global data	
Brand	TECWATER DATA
Type designation	Li-09YSCH PiMF-100 Cat. 5
Model	Round
Standard	Based on EN 50525-2-21 and transmission class D according to EN 50173-1 (with transmission characteristics for a frequency band (channel) up to 100 Mhz)
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Tinned copper, finely stranded class 6, in accordance with DIN EN 60228
Insulation	Polypropylen, foam skin
Core identification	Pair 1: WH/OG Pair 2: WH/GN Pair 3: WH/BN Pair 4: WH/BU
Screen	1. Single pairs screened with aluminium coated foils 2. Overall braiding of tinned copper wires
Outer sheath	XL Copolymer
Electrical parameters	
Rated voltage	100/100 V
Max. permissible operating voltage AC	300 V

TECWATER DATA Li-09YSCH PiMF-100 Cat. 5 100/100 V	
AC test voltage – main cores	1,000 V (1 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TECWATER Hybrid DATA
Hybrid 300/500 V

Screened copolymer-sheathed hybrid waste water data cables.

Application

These cables are suitable for connections of electrical equipment and transmission of data- and control signals of modern pumps, which include sensor technology and can be submerged in contaminated water under medium mechanical stress. To ensure effective shielding, electromagnetic compatibility (EMC) and its requirements, all ends must have a good shield contact to ground. Further potential application fields are fire- and explosion-hazard areas acc. DIN EN 60079, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, sewage water tanks, on plaster or hoisting gears.

Water types are defined in accordance with DIN 4045 and DIN 4046, e.g. process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

TECWATER Hybrid DATA 300/500 V	
Global data	
Brand	TECWATER
Type designation	Hybrid DATA
Model	Round
Standard	Based on EN 50525-2-21 and transmission class D according to EN 50173-1 (with transmission characteristics for a frequency band (channel) up to 100Mhz)
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	–
Insulation	Data: Polyethylene Control: EPR
Core identification	Data: orange, white, yellow, blue Control: Numbering
Inner sheath	Data: TPU Control: Filler
Screen	1. Data: overall aluminium coated foil and braiding of tinned copper wires 2. Overall braiding of tinned copper wires
Outer sheath	XL Copolymer

TECWATER Hybrid DATA 300/500 V	
Electrical parameters	
Rated voltage	0.3/0.5 kV
Max. permissible operating voltage	AC: 0.318/0.55 kV DC: 0.413/0.825 kV
AC test voltage – main cores	2 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TECWATER-OR
S1BZ-F 0.6/1 kV

Halogen-free rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster or hoisting gears. Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

TECWATER-OR S1BZ-F 0.6/1 kV	
Global data	
Brand	TECWATER-OR
Type designation	S1BZ-F
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)

TECWATER-OR S1BZ-F 0.6/1 kV	
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

TECWATER EMV-FC
S1BC4N8-F 0.6/1 kV

Screened rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster or hoisting gears.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

Due to usage of high performance EPR within this 1 kV-concept, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

TECWATER EMV-FC S1BC4N8-F 0.6/1 kV	
Global data	
Brand	TECWATER EMV-FC
Type designation	S1BC4N8-F
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound CPE
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV

TECWATER EMV-FC S1BC4N8-F 0.6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

MS-TECWATER
(N)TSWOEU 3.6/6 kV

Rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster or hoisting gears. Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN VDE 0298-3 apply.

This wall-thickness- and outer-diameter-optimized 6 kV-concept offers further solutions for exteme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

MS-TECWATER (N)TSWOEU 3.6/6 kV	
Global data	
Brand	MS-TECWATER
Type designation	(N)TSWOEU
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound HEPR
Electrical field control	Inner layer of semiconductive rubber compound
Core identification	Numbering
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound CPE
Electrical parameters	
Rated voltage	3.6/6 kV
Max. permissible operating voltage AC	4.2/7.2 kV
Max. permissible operating voltage DC	5.4/10.8 kV
AC test voltage – main cores	11 kV (5 min.)

MS-TECWATER (N)TSWOEU 3.6/6 kV	
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-40 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

MS-TECWATER
(N)TSCGECWOEU 3.6/6 kV – 6/10 kV

Screened rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster or hoisting gears. Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN VDE 0298-3 apply.

This wall-thickness- and outer-diameter-optimized 6 kV-concept offers further solutions for exteme tight spaces and seals on pumps.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

MS-TECWATER (N)TSCGECWOEU 3.6/6 kV – 6/10 kV		
Global data		
Brand	MS-TECWATER EMV-FC	
Type designation	(N)TSCGECWOEU	
Model	Round	
Standard	Based on EN 50525-2-21	
Notes on installation		
Maximum submersing depth	500 meters	
Design features		
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228	
PE-Conductor	Plain copper, outer layer of semi-conductive rubber compound	
Insulation	Rubber compound HEPR	
Electrical field control	Inner and outer layer of semi-conductive rubber compound	
Core identification	Numbering	
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles	
Screen	Braiding of tinned copper wires between inner and outer sheath	
Outer sheath	Rubber compound CPE	
Electrical parameters		
Rated voltage	3.6/6 kV	6/10 kV
Max. permissible operating voltage AC	4.2/7.2 kV	6.9/12 kV

MS-TECWATER (N)TSCGECWOEU 3.6/6 kV – 6/10 kV		
Max. permissible operating voltage DC	5.4/10.8 kV	9/18 kV
AC test voltage – main cores (5 min.)	11 kV	17 kV
Chemical parameters		
Performance against fire	DIN EN 60332-1-2	
Resistance to oil	DIN EN 60811-404	
Water resistance	DIN EN 50525-2-21	
Thermal parameters		
Max. operating temperature of the conductor	90 °C	
Max. short circuit temperature of the conductor	250 °C	
Max. permissible water temperature	40 °C	
Ambient temperature for fixed installation min.	-40 °C	
Ambient temperature in fully flexible operation min.	-25 °C	
Mechanical parameters		
Max. tensile load on the conductor	15 N/mm²	
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation	

Available cross sections are part of the standard.
Detailed datasheets available upon request.

ATON
H07RN-F 450/750 V

Rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress. Likewise for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

ATON H07RN-F 450/750 V	
Global data	
Brand	ATON
Type designation	H07RN-F
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EPR
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

ATON H07RN-F 450/750 V	
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

ATON EMC
VSCCB 0.6/1 kV

Screened rubber-sheathed waste water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in contaminated water under medium mechanical stress, for connections to frequency converter controlled AC drives and fulfil electromagnetic compatibility (EMC) and its requirements. To ensure effective shielding, both ends must have a good shield contact to ground. Furthermore, for fire- and explosion-hazard areas acc. DIN EN 60079, explosion-protected pumps, construction sites acc. DIN VDE 0100 Part 704, open-cast mining and quarries acc. DIN VDE 0168, indoor, outdoor, in industry and agriculture, for sewage water tanks, on plaster, excavators or hoisting gears.

Possible water types in accordance with DIN 4045 and DIN 4046, like process-, cooling-, mine surface-, rain-, combined waste-, ground- and sea-water, up to depths of 500 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

ATON EMC VSCCB 0.6/1 kV	
Global data	
Brand	ATON EMC
Type designation	VSCCB
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Plain copper, finely stranded class 5, in accordance with DIN EN 60228; tinned up to and including 6 mm²
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound EPR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPR: special water-proof characteristics, preventing formation of water bubbles
Screen	Braiding of tinned copper wires between inner and outer sheath
Outer sheath	Rubber compound EPR
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV

ATON EMC VSCCB 0.6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (15 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	4x outer diameter max. for fixed installation 6x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOMONT
NSSHOEU 0.6/1 kV

Low Voltage flexible rubber cable.

Application

For flexible use and fixed installation open-cast mining applications, in quarries, on construction sites and similar applications, with heavy mechanical stresses. The cables can be used indoors as well as outdoors, in explosion-hazard areas, in industry and in agriculture. They can be used permanently in waste water up to 40°C at a depth of max. 2,000 m and in industrial water, cooling water, surface water, rainwater and mixed water – and in groundwater and seawater to a more limited extent.

The requirements for accessibility and inspection depend on the consistency of the water. In aggressive water or composed of special substances, the cable's resistance properties should be tested. In other respects the specifications of DIN VDE 0298 part 3 applies.

PROTOMONT NSSHOEU 0.6/1 kV	
Global data	
Brand	PROTOMONT
Type designation	NSSHOEU
Standard	DIN VDE 0250-812
Certifications / Approvals	MA – China MSHA P-189-3 EAC Certificate
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Electrolytic copper, tinned, finely stranded (class 5) acc. to DIN EN 60228 / IEC 60228
Insulation	PROTOLON, Basic material: EPR, Compound type: 3GI3 in accordance with DIN EN 50363
Core identification	Up to 5 cores: colored in accordance with DIN VDE 0293-308 from 6 cores: light colored with black numbers
Inner sheath	Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B in accordance with DIN EN 50363 (not for single-core cables)
Outer sheath	Vulcanized rubber compound, synthetic elastomer compound e.g. CPE, Compound: 5GM5 in accordance with DIN EN 50363, Color: Yellow
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV

PROTOMONT NSSHOEU 0.6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3.5 kV (5 min.)
Chemical parameters	
Performance against fire	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-404
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C (At higher water temperatures, a shortened cable service life is to be expected)
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Torsional stress +/-	100 °/m
Bending radii min.	Acc. to DIN VDE 0298 part 3

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOMONT
NSHXOEU 0.6/1 kV

Flexible rubber cables for use in mining and industries.

Application

For flexible use and fixed installation in underground mining applications, tunnel building applications, open-cast mining applications, in quarries, on construction sites and similar applications, with medium mechanical stresses. The cables can be used indoors as well as outdoors, in explosionhazard areas, in industry and in agriculture. They can be used permanently in waste water up to 40 °C. The cables can also be used in industrial water, cooling water, surface water, rainwater and mixed water – and in groundwater and seawater to a more limited extent.

The requirements for accessibility and inspection are less stringent in such cases at depths greater than 10 m up to 500 m. In other respects the specifications of DIN VDE 0298 part 3 apply.

Necessary for applications where in case of fire low smoke and zero halogens are required.

In case of a fire and contact with water these cables will not, contrary to chlorides including compound concepts like PVC, create acids that can damage control electronics or emit toxics which are dangerous to inhale.

PROTOMONT NSHXOEU 0,6/1 kV	
Global data	
Brand	PROTOMONT
Type designation	NSHXOEU
Standard	Based on DIN VDE 0250 part 812
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Copper, tinned, finely stranded (class 5) in accordance with DIN VDE 0295 / IEC 60228
Insulation	PROTOLON, Basic material: EPR, Compound type: 3GI3, in accordance with DIN VDE 0207
Core identification	Up to 5 cores: colored in accordance with DIN VDE 0293-308 from 6 cores: light with black numbers
Inner sheath	Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B, in accordance with DINVDE 0207 (not for single-core cables)
Outer sheath	Vulcanized rubber compound, basis EVA, compound 5GM3 in accordance with DIN VDE 0207 Colour: yellow
Electrical parameters	
Rated voltage	0.6/1 kV
Max. permissible operating voltage AC	0.7/1.2 kV

PROTOMONT NSHXOEU 0,6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (5 min.)
AC test voltage – control cores	2 kV
Chemical parameters	
Flame propagation	DIN EN 60332-1-2
Resistance to oil	DIN EN 60811-2-1
Water resistance	EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Max. permissible water temperature	40 °C (At higher water temperatures, a shortened cable service life is to be expected)
Ambient temperature for fixed installation	min.-40 °C ; max. +80 °C
Ambient temperature in fully flexible operation	min.-25 °C ; max. +60 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	Acc. to DIN VDE 0298 part 3

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOMONT
NSSHOEU / 3E 0.6/1 kV

Rubber-sheathed flexible cable with copper core shield.

Application

The cables are suitable for fixed installation and flexible operation as power supply cables to motors, distribution boards, pumps, drilling rigs, etc.

They are also suitable for underground mining applications, for tunnel building applications, for open-cast mining applications, for use in quarries and similar applications. Permitted for applications according to DIN VDE 0118.

PROTOMONT NSSHOEU / 3E 0,6/1 kV	
Global data	
Brand	PROTOMONT
Type designation	NSHXOEU
Standard	Based on DIN VDE 0250 part 812
Certifications / Approvals	MA – China (special design) MSHA P-189-3 BAS Bosnia-Herzegovina TR-Certificate EAC-Certificate
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Bare electrolytic copper, finely stranded (class 5)
PE-Conductor	Individual-concentric or overall concentric spinning of untinned copper wires
Insulation	PROTOLON, Basic material: EPR, Compound type: 3GI3
Core identification	Up to 5 cores colored, Core colors: Blue, Brown,Black, Grey, Black
Core arrangement	Three, four of five cores laid-up
Inner sheath	Vulcanized rubber inner sheath, Basic material: EPR, Compound type: GM1B
Outer sheath	PROTOFIRM, Basic material: Chlorinated rubber, Compound type: 5GM5, Color: Yellow
Electrical parameters	
Rated voltage	U_o/U = 0,6/1 kV, also permitted for U_o/U = 640/1140 V
Max. permissible operating voltage AC	0.7/1.2 kV

PROTOMONT NSSHOEU / 3E 0,6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	3 kV (5 min.)
AC test voltage – control cores	2 kV (5 min.)
Chemical parameters	
Performance against fire	IEC 60332-1-2
Resistance to oil	IEC 60811-404
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min.-40 °C ; max. +80 °C
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	Acc. to DIN VDE 0298 part 3

Available cross sections are part of the standard.
Detailed datasheets available upon request.

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

Cables for Variable Frequency Converter.

Application

The cables are suitable for fixed installation and flexible operation as motor power supply cables for frequency converter controlled drives in the mining industry, on construction sites and similar applications, with heavy mechanical stresses.

For laying on material handling equipment (even with continuous movement such as in cable booms or as connection between upper and lower car).

PROTOMONT EMV-FC (N)SSHCOEU 0.6/1 kV	
Global data	
Brand	PROTOMONT EMV-FC
Type designation	(N)SSHCOEU
Standard	Based on DIN VDE 0250 part 812
Certifications / Approvals	MSHA P-189-3 EAC Certificate
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Finely stranded copper conductor, tinned (class 5) according to DIN EN 602
Insulation	PROTOLON, Basic material: EPR, Compound type: 3GI3
Core identification	Natural coloring with black figures
Core arrangement	Three power cores laid up with the protective earth conductors split into three in the outer interstices
Screen	EMC optimized, concentric braid of tinned copper wires
Inner sheath	Vulcanized rubber compound, Basic material: EPR, Compound type: GM1B
Outer sheath	PROTOFIRM, synthetic elastomer compound e.g. CR, Compound type: 5GM5, Color: Yellow
Electrical parameters	
Rated voltage	U_0/U = 0,6/1 kV, also permitted for U_0/U = 640/1140 V
Max. permissible operating voltage AC	0.7/1.2 kV

PROTOMONT EMV-FC (N)SSHCOEU 0.6/1 kV	
Max. permissible operating voltage DC	0.9/1.8 kV
AC test voltage – main cores	5 kV (5 min.)
Chemical parameters	
Performance against fire	IEC 60332-1-2
Resistance to oil	IEC 60811-404
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone and moisture
Thermal parameters	
Max. operating temperature of the conductor	90 °C
Max. short circuit temperature of the conductor	250 °C
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Torsional stress +/-	25 °/m
Bending radii min.	Acc. to DIN VDE 0298 part 3

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOLON(ST)
NTSWOEU 1.8/3 kV – 3.6/6 kV

Medium voltage flexible cables for use in water.

Application

Power supply cable for use in water, e.g. for connection to dredgers, floating docks, pumps, etc., in applications where high mechanical stresses are to be expected.

Also suitable for use in sewage, salt water and brackish water at water depths of up to 500 m.

PROTOLON(ST) NTSWOEU 1.8/3 kV – 3.6/6 kV	
Global data	
Brand	PROTOLON(ST)
Type designation	NTSWOEU
Standard	DIN VDE 0250-813
Certifications / Approvals	MSHA P-189-4, Promatomnadzor - Rep. of Belarus, GOST-R, Rosgortechnadzor
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Electrolytic copper, tinned, finely stranded (class 5)
Insulation	Basic material: EPR, Compound type: 3GI3
Electrical field control	Inner layer of semiconductive rubber compound
Core identification	Power cores: natural colour Earth conductor: green-yellow
Core arrangement	Single-core design (1x..) or three main cores laid up with earth conductor (3x../..)
Inner sheath	EPR inner sheath with special characteristics with respect to water proofing and prevention of formation of water bubbles
Outer sheath	Basic material CM, particularly water-proof, compound type: 5GM3, colour: red

PROTOLON(ST) NTSWOEU 1.8/3 kV – 3.6/6 kV		
Electrical parameters		
Rated voltage	1.8/3 kV	3.6/6 kV
Max. permissible operating voltage AC	2.1/3.6 kV	4.2/7.2 kV
Max. permissible operating voltage DC	2.7/5.4 kV	5.4/10.8 kV
AC test voltage – main cores (5 min.)	6 kV	11 kV
Chemical parameters		
Performance against fire	IEC 60332-1-2	
Resistance to oil	IEC 60811-2-1	
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture	
Water resistance	EN 50525-2-21	
Thermal parameters		
Max. operating temperature of the conductor	90 °C	
Max. short circuit temperature of the conductor	250 °C	
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C	
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C	
Mechanical parameters		
Max. tensile load on the conductor	15 N/mm²	
Bending radii min.	Acc. to DIN VDE 0298 part 3	

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOLON(ST)
NTSCGEWOEU 1.8/3 kV – 18/30 kV

Medium voltage flexible cables for use in water.

Application

Power supply cable for use in water, e.g. for connection to dredgers, floating docks, pumps, etc., in applications where high mechanical stresses are to be expected.

Also suitable for use in sewage, salt water and brackish water at water depths of up to 500 m.

PROTOLON(ST) NTSCGEWOEU 1.8/3 kV – 18/30 kV	
Global data	
Brand	PROTOLON(ST)
Type designation	NTSCGEWOEU
Standard	DIN VDE 0250-813
Certifications / Approvals	MSHA P-189-4, Fire Certificate of Russian Federation, GOST -R/-K/-B
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Electrolytic copper, tinned, finely stranded (class 5)
PE-Conductor	Split into 3 in the outer interstices
Insulation	Basic material: EPR, Compound type: 3GI3
Electrical field control	Inner and outer layer of semiconductive rubber compound
Core identification	Natural colouring with black semiconductive rubber
Core arrangement	Three main conductor laid-up with protective-earth conductor split into 3 in the outer interstices
Inner sheath	EPR inner sheath with special water-proof characteristics for prevention of formation of water bubbles, Compound type: GM
Outer sheath	Basic material: synthetic elastomer compound e.g. CM, particularly water-proof, Compound type: 5GM3, color: red

PROTOLON(ST) NTSCGEWOEU 1.8/3 kV – 18/30 kV				
Electrical parameters				
Rated voltage kV	1.8/3	3.6/6	6/10	8.7/15
	12/20	14/25	18/30	
Max. permissible operating voltage AC kV	2.1/3.6	4.2/7.2	6.9/12	10.4/18
	13.9/24	17.3/30	20.8/36	
Max. permissible operating voltage DC kV	2.7/5.4	5.4/10.8	9/18	13.5/27
	18/36	22.5/45	27/54	
AC test voltage – main cores kV (5 min.)	6	11	17	24
	29	36	43	
Chemical parameters				
Performance against fire	IEC 60332-1-2			
Resistance to oil	IEC 60811-404			
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV, and moisture			
Water resistance	EN 50525-2-21			
Thermal parameters				
Max. operating temperature of the conductor	90 °C			
Max. short circuit temperature of the conductor	250 °C			
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C			
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C			
Mechanical parameters				
Max. tensile load on the conductor	15 N/mm²			
Torsional stress +/-	100 °/m			
Bending radii min.	Acc. to DIN VDE 0298 part 3			

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOLON(ST)
NTSCGEWOEU / 3E 1.8/3 kV – 18/30 kV

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

Application

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

This screened cable design is suitable for the use with dredging equipment acc. VDE 0168.

PROTOLON(ST) NTSCGEWOEU / 3E 1.8/3 kV – 18/30 kV	
Global data	
Brand	PROTOLON(ST)
Type designation	NTSCGEWOEU
Standard	DIN VDE 0250-813
Certifications / Approvals	MSHA P-189-4, Fire Certificate of Russian Federation, GOST -R/-K/-B
Notes on installation	
Maximum submersing depth	500 meters
Design features	
Conductor	Electrolytic copper, tinned, finely stranded (class 5)
Insulation	Basic material EPR, Compound type: 3GI3
Electrical field control	Inner and outer layer of semi-conductive rubber compound and metallic concentric screen on each core
Core identification	Natural coloring with black semiconductive rubber
Core arrangement	Three main conductor laid-up with individual concentric protective-earth conductors distributed over the insulation of the three main cores
Inner sheath	EPR inner sheath with special water-proof characteristics for prevention of formation of water bubbles, Compound type: GM1B
Outer sheath	Basic material: synthetic elastomer compound e.g. CM (particularly water-proof), Compound type: 5GM3, Color: Red

PROTOLON(ST) NTSCGEWOEU / 3E 1.8/3 kV – 18/30 kV				
Electrical parameters				
Rated voltage kV	1.8/3	3.6/6	6/10	8.7/15
	12/20	14/25	18/30	
Max. permissible operating voltage AC kV	2.1/3.6	4.2/7.2	6.9/12	10.4/18
	13.9/24	17.3/30	20.8/36	
Max. permissible operating voltage DC kV	2.7/5.4	5.4/10.8	9/18	13.5/27
	18/36	22.5/45	27/54	
AC test voltage – main cores kV (5 min.)	6	11	17	24
	29	36	43	
Chemical parameters				
Performance against fire	IEC 60332-1-2			
Resistance to oil	IEC 60811-404			
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture			
Water resistance	EN50525-2-21			
Thermal parameters				
Max. operating temperature of the conductor	90 °C			
Max. short circuit temperature of the conductor	250 °C			
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C			
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C			
Mechanical parameters				
Max. tensile load on the conductor	15 N/mm²			
Torsional stress +/-	25 °/m			
Bending radii min.	Acc. to DIN VDE 0298 part 3			

Available cross sections are part of the standard.
Detailed datasheets available upon request.

PROTOLON(M)-F
(N)TSCGEWOEU 3.6/6 kV – 18/30 kV

Medium voltage flexible cables for semiflexible installation.

Application

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

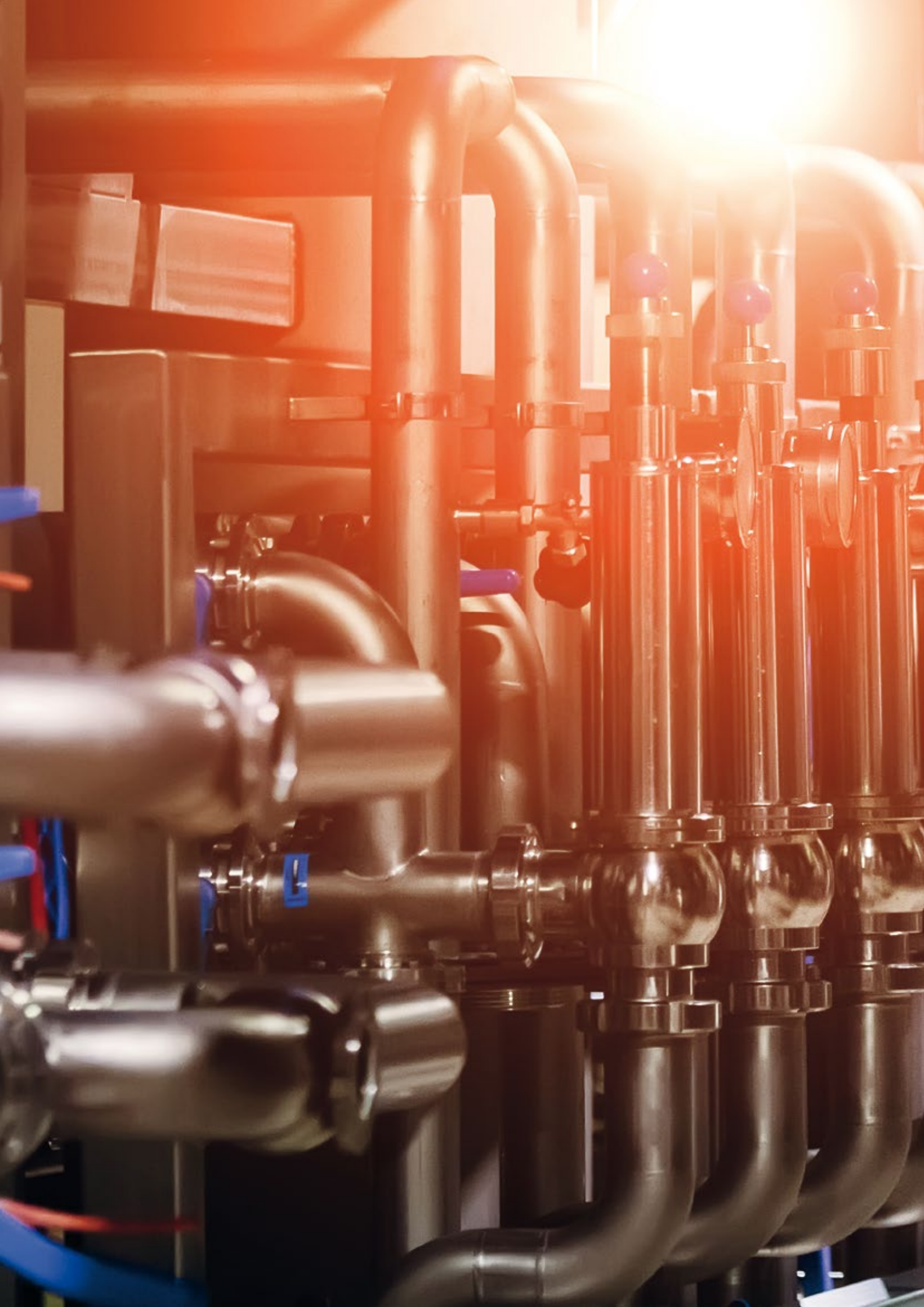
Due to usage of high performance EPR, wall-thicknesses and overall outer-diameters are reduced, while maintaining a higher electrical safety.

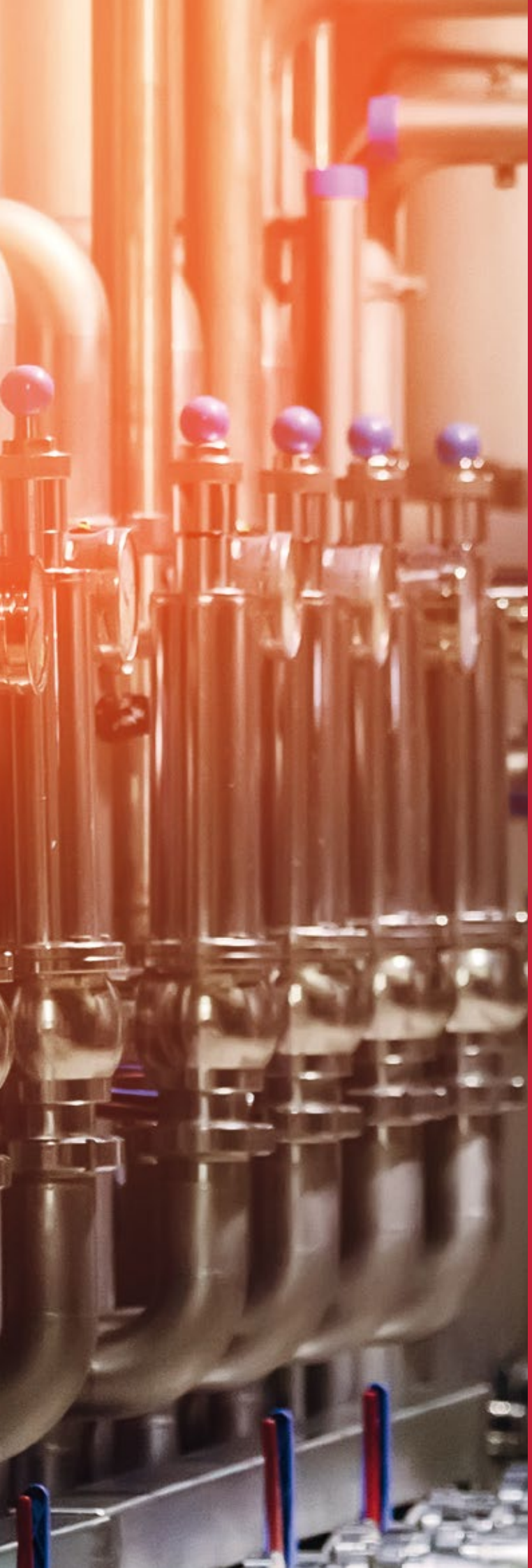
Besides less weight and improved bending radii for easier installations, this offers further opportunities for extreme tight spaces and seals on pumps.

PROTOLON(M)-F (N)TSCGEWOEU 3.6/6 kV – 18/30 kV				
Global data				
Brand	PROTOLON(M)			
Type designation	F-(N)TSCGEWOEU			
Standard	Based on DIN VDE 0250-813			
Certifications / Approvals	Fire Certificate of Russian Federation, GOST -R/-K/-B			
Notes on installation				
Maximum submersing depth	500 meters			
Design features				
Conductor	Electrolytic copper, not tinned, very finely stranded (class 5)			
Insulation	PROTOLON, Basic material: EPR, Compound type: Special compound, better 3GI3			
Electrical field control	Inner and outer layer of semiconductive rubber compound			
Core identification	Natural coloring with black semiconductive rubber on which white digits 1 to 3 are printed			
Core arrangement	Three main conductors laid-up, with protective-earth conductor split into 3 in the outer interstices			
Inner sheath	Basic material: EPR, Compound type: Special compound			
Outer sheath	Basic material: Synthetic elastomer compound e.g. CM, Compound type: better 5GM3, Color: Red			
Electrical parameters				
Rated voltage kV	3.6/6	6/10	8.7/15	12/20
	14/25	18/30		
Max. permissible operating voltage AC kV	4.2/7.2	6.9/12	10.4/18	13.9/24
	17.3/30	20.8/36		

PROTOLON(M)-F (N)TSCGEWOEU 3.6/6 kV – 18/30 kV				
Max. permissible operating voltage DC kV	5.4/10.8	9/18	13.5/27	18/36
	22.5/45	27/54		
AC test voltage – main cores kV (5 min.)	11	17	24	29
	36	43		
Chemical parameters				
Performance against fire	IEC 60332-1-2			
Resistance to oil	IEC 60811-404			
Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture			
Water resistance	EN 50525-2-21			
Thermal parameters				
Max. operating temperature of the conductor	90 °C			
Max. short circuit temperature of the conductor	250 °C			
Ambient temperature for fixed installation	min. -40 °C ; max. +80 °C			
Ambient temperature in fully flexible operation	min. -25 °C ; max. +60 °C			
Mechanical parameters				
Max. tensile load on the conductor	15 N/mm²			
Torsional stress +/-	100 °/m			
Bending radii min.	Acc. to DIN VDE 0298 part 3			
Additional tests	Torsional StressTest, Roller Bending Test Type C			

Available cross sections are part of the standard.
Detailed datasheets available upon request.





Hot water

HYDROFIRM

TGSH 450/750 V 48
TGSH2G 450/750 V 49
TGFLSH 450/750 V 50
TGFLSH2G 450/750 V 51

MS-HYDROFIRM

(N)TS-TGSH 3.6/6 kV 52

HYDROFIRM
TGSH 450/750 V

Halogen-free rubber-sheathed hot water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in hot water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: industrial-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Explosion-hazardous areas must be excluded.

HYDROFIRM TGSH 450/750 V	
Global data	
Brand	HYDROFIRM
Type designation	TGSH
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Tinned copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound SIR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM TGSH 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	130 °C
Max. short circuit temperature of the conductor	350 °C (max. 5 s.)
Max. permissible water temperature	110 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM
TGSH2G 450/750 V

Halogen-free rubber-sheathed hot water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in hot water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: industrial-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Explosion-hazardous areas must be excluded.

HYDROFIRM TGSH2G 450/750 V	
Global data	
Brand	HYDROFIRM
Type designation	TGSH2G
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Tinned copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound SIR
Core identification	DIN EN 50525-1
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound SIR
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM TGSH2G 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	150 °C
Max. short circuit temperature of the conductor	350 °C (max. 5 s.)
Max. permissible water temperature	120 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM
TGFLSH 450/750 V

Halogen-free rubber-sheathed hot water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in hot water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: industrial-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Explosion-hazardous areas must be excluded.

HYDROFIRM TGFLSH 450/750 V	
Global data	
Brand	HYDROFIRM
Type designation	TGFLSH
Model	Flat
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Tinned copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound SIR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM TGFLSH 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	130 °C
Max. short circuit temperature of the conductor	350 °C (max. 5 s.)
Max. permissible water temperature	110 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

HYDROFIRM
TGFLSH2G 450/750 V

Halogen-free rubber-sheathed hot water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in hot water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. If permanently installed in protective conduits, equipment, in well installations or as rotor circuit connections to motors, then with alternating voltage up to 1,000 V or a direct voltage up to 750 V against earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

Possible water types: industrial-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

In addition, general terms of DIN EN 50565-2 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Explosion-hazardous areas must be excluded.

HYDROFIRM TGFLSH2G 450/750 V	
Global data	
Brand	HYDROFIRM
Type designation	TGFLSH2G
Model	Flat
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Tinned copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound SIR
Core identification	DIN EN 50525-1
Outer sheath	Rubber compound SIR
Electrical parameters	
Rated voltage	0.45/0.75 kV
Max. permissible operating voltage AC	0.476/0.825 kV
Max. permissible operating voltage DC	0.619/1.238 kV
AC test voltage – main cores	2.5 kV (15 min.)

HYDROFIRM TGFLSH2G 450/750 V	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	150 °C
Max. short circuit temperature of the conductor	350 °C (max. 5 s.)
Max. permissible water temperature	120 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-50 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	3x outer diameter max. for fixed installation 4x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

MS-HYDROFIRM
(N)TS-TGSH 3.6/6 kV

Halogen-free rubber-sheathed hot water cables.

Application

These cables are suitable for connections of electrical equipment, submerged in hot water under medium mechanical stress. Likewise for indoor, outdoor, industrial and agricultural applications. Possible water types: industrial-, cooling-, surface-, rain-, ground- and sea-water, up to a depth of 2,000 meters.

In addition, general terms of DIN VDE 0298-3 apply.

For water with a special composition (aggressive), the resistance of each cable must be checked for each individual case.

Explosion-hazardous areas must be excluded.

MS-HYDROFIRM (N)TS-TGSH 3.6/6 kV	
Global data	
Brand	HYDROFIRM
Type designation	(N)TS-TGSH
Model	Round
Standard	Based on EN 50525-2-21
Notes on installation	
Maximum submersing depth	2,000 meters
Design features	
Conductor	Tinned copper, finely stranded class 5, in accordance with DIN EN 60228
PE-Conductor	G = with gn/ye core
Insulation	Rubber compound SIR
Electrical field control	Inner layer of semiconductive rubber compound
Core identification	Numbering
Inner sheath	If applied, Rubber compound EPDM: special water-proof characteristics, preventing formation of water bubbles
Outer sheath	Rubber compound EVA
Electrical parameters	
Rated voltage	3.6/6 kV
Max. permissible operating voltage AC	4.2/7.2 kV
Max. permissible operating voltage DC	5.4/10.8 kV
AC test voltage – main cores	11 kV (5 min.)

MS-HYDROFIRM (N)TS-TGSH 3.6/6 kV	
Chemical parameters	
Water resistance	DIN EN 50525-2-21
Thermal parameters	
Max. operating temperature of the conductor	130 °C
Max. short circuit temperature of the conductor	350 °C (max. 5 s.)
Max. permissible water temperature	110 °C
Ambient temperature for fixed installation min.	-50 °C
Ambient temperature in fully flexible operation min.	-25 °C
Mechanical parameters	
Max. tensile load on the conductor	15 N/mm²
Bending radii min.	6x outer diameter max. for fixed installation 10x outer diameter max. for flex. installation

Available cross sections are part of the standard.
Detailed datasheets available upon request.

Notes

Additional services

At your service! 56

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At your service!

We have complete set of services for hoisting gear, mining, marine engineering and industry. Being at the forefront of both the energy and telecom evolution, we can put together whatever you need, and have it delivered in no time. Basically, services that ring the bell!

Assembly and termination – we make sure that everything fits

In our factory or on spot – we will make up your special cables (1 – 66 kV AC) ready for connection according to your requirements. We can also supply installation sets designed specifically for your requirements. The laid in earth or in water is not allowed.

- Sealing ends of cast-resin, hybrid and vulcanization type
- Special sealing ends
- Medium and Low Voltage plug-on sealing ends with FO

Customized system concepts – up to the mark right from the start

Right at the very planning stage we are there to help you. We will be pleased to advise you on selection and dimensioning of your cables, on termination methods and on how they should be assembled and made up. If desired, we will supply you with the necessary components and handle subprojects in conjunction with our products.

Fibre-optic measurement – for higher accuracy

We possess all the customary fibre-optic measuring methods, so we can meet all requirements.

- Visual checks
- Attenuation measurement for various wavelengths by the insertion loss technique
- Attenuation measurement and fault location by reflectometry (OTDR)
- Temperature and stress recognition by Brillouin frequency measurement on singlemode fibres throughout the entire run (monitoring / sensoring)

VLF-Testing technology – safe when energized

On site testing with our portable VLF-Testing system.

- VLF CR up to 60 kV
- Test frequency 0.1 Hz
- This proven voltage waveform is recommended by DIN VDE standards
- Max. testing lengths at 240 mm² and Up = 60 kV_{eff} about 5 km

Fibre-optic preassembly and connection – skilled in every method

We will make up glass fibre-optic cable systems for industrial applications, involving all kinds of plug connections.

- With high mechanical strength
- Protected against ingress of moisture
- Of attractive design
- Of compact dimensions
- With fibre number 6, 12, 18 or 24

We connect glass fibre-optic cables and combined cables with integrated optical fibres.

- With splicing box
- Using the fusion splicing method
- In repair work involving combined cables with integrated optical fibre

Repair and connection – always the right connection

In the event of major or minor damage to special cables, we provide quick assistance – at a favourable price. We will repair your rubber-insulated flexible cables either on site or in our factory. We use original materials and work with proven technology. Our qualified expert fitters ensure that the serviceability of our cables is not adversely affected.

You can of course do the repair / connection yourself; we provide all necessary original materials in the form of installation sets.

We make sure that the connection is right between a number of special rubber-insulated cables, or between special cables and fixed-mounted cables. We always adhere to specified criteria.

- To suit the application concerned
- Shrink-on, cast-resin or vulcanization method
- Original materials
- Work done by qualified technicians
- Serviceability upheld

We've put it all together.

Cut at needed lengths, ready to be installed in the pumps and according to individual sketches and designs installed with plugs, lugs, pins and all specified materials. Prysmian Group is ready to offer all needed solutions for the pump industry. For all submersible cables Prysmian Group also offers original rubber in rolls and plates for assembling and connections of the cables with the originally used rubber material.

Cables and harnessing in one complete solution.

Water-proof and hard-nosed.

Our winding wires for submarine motors never turn turtle.

A water pump not only needs power cables to operate, it requires winding wires for the motor, too. And of course, as your friendly one-stop-shop we can offer you that as well.

Our GreenWire winding wires are made of high-quality insulation impervious to liquids. The whole range is made of environmental-friendly polyethylene, free from lead and chlorine. Long-lived and perfectly adapted for its habitat, GreenWire wires are ready to face deep waters.

Find out more at nsw.com


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Technical Appendix

Electrical parameters

Voltages

For the rated, operating and test voltages of cables, the definitions given in DIN VDE 0298, Part 3, apply. Some of these are mentioned in the following pages.

AC = Alternating Current
DC = Direct Current

Rated voltage

The rated voltage of an insulated electric cable is the voltage which is used as the basis for the design and the testing of the cable with regard to its electrical characteristics.

The rated voltage is expressed by the two values of power frequency voltage U_0/U in V.

U_0 = rms value between one conductor and "Earth"
U = rms value between two conductors of a multi-core cable or of a system of single-core cables

In a system with AC voltage, the rated voltage of a cable must be at least equal to the rated voltage of the system for which it is used. This requirement applies both to the value U_0 and the value U.

In a system with DC voltage, its rated voltage must not be more than 1.5 times the value of the rated voltage of the cable.

Operating voltage

The operating voltage is the voltage applied between the conductors and earth of a power installation with respect to time and place with trouble-free operation.

- Cables with a rated voltage U_0/U up to 0.6/1 kV

  These cables are suitable for use in three-phase AC, single-phase AC and DC installations, the maximum continuously permissible operating voltage of which does not exceed the rated voltage of the cables by more than
  - 10 % for cables with a rated voltage U_0/U up to and including 450/750 V
  - 20 % for cables with a rated voltage U_0/U = 0.6/1 kV
- Cables with a rated voltage U_0/U greater than 0.6/1 kV

  These cables are suitable for use in three-phase and single-phase AC installations, the maximum operating voltage of which does not exceed the rated voltage of the cable by more than 20 %
- Cables in DC installations

  If the cables are used in DC installations, the continuously permissible DC operating voltage between the conductors must not exceed 1.5 times the value of the permissible AC operating voltage. In single-phase earthed DC installations this value should be multiplied by a factor of 0.5.

Test voltage

Regarding the test voltage of flexible cables, the values given in the corresponding parts of DIN VDE 0250 apply. If the relevant shield is missing, "core against core" is tested in appropriate combinations. The values are to be regarded as AC test voltages (unless stated otherwise) for single-phase testing, i.e. the AC test voltage is applied between the core and the corresponding shielding (e.g. semiconductive layer, earth conductor, shield). Telecommunication cores (pairs) and other shielded pairs (e.g. (2x1)C) are tested "core against core" and "core against shield" whereby the test voltages are correspondingly different. With single-core cables without shielding, the corresponding opposite pole is a water bath. See table page 61.

Short-circuit current-carrying capacity

Permissible short-circuit current at max. permissible short-circuit temperatures of the conductor surface and for a fault duration t_{kr} = 1 s.

Cross–section mm²	1	1.5	2.5	4	6	10	16	25	35
Short-circuit current (kA)	0.143	0.215	0.358	0.572	0.858	1.43	2.29	3.58	5.01

Cross–section mm²	50	70	95	120	150	185	240	300	400
Short-circuit current (kA)	7.15	10.01	13.6	17.16	21.45	26.46	34.32	42.9	71.5

The short-circuit current-carrying capacity I_{thz} for a short-circuit duration t_k deviating from t_{kr} = 1 s, is:

$$I_{thz} = I_{thr} \cdot \sqrt{\frac{t_{kr}}{t_k}}$$

Voltage drop

$$\Delta U = \sqrt{3} \times I_b \times l \times (R'_{W20} \times \cos\varphi + X'_L \times \sin\varphi)$$

For deviating conductor temperatures (e.g. 90 °C instead of 20 °C) the effective resistance R'_W has to be converted:

$$R'_{W90} = R'_{W20} (1 + (0.004 \times 70k))$$

For the practical use a more easier calculation may be sufficient:

$$\Delta U = \sqrt{3} \times I_b \times l \times R'_{W\Theta} \times \cos\varphi$$

I_b = load current [A]
l = cable length [km]
R'_{W20} = effective resistance per unit length and 20 °C [Ω/km]
X'_L = Reactance per unit length [Ω/km]
φ = phase-angle

Test voltage of flexible cables								
Rated voltage	Max. permissible operating voltage			Test voltage applied to the complete cable				
	In AC systems	In DC systems		Power cores		Control cores	Pilot cores	Tele-communication cores
		unearthed	single-phase earthed					
U_0/U	U_0/U	U	U	AC	DC	kV	kV	kV
		kV	kV	kV	kV			
250/250 V	275/275 V	0.412	–	1.5	3.75	–	–	–
300/500 V	318/550 V	0.825	0.413	2	5	–	–	–
450/750 V	476/825 V	1 238	0.619	2.5	6.25	–	–	–
0.6/1 kV	0.7/1.2 kV	1.8	0.9	2.5	6.25	2		
1.8/3 kV	2.1/3.6 kV	5.4	2.7	6	15	2	2	1
3.6/6 kV	4.2/7.2 kV	10.8	5.4	11	27.5	2	2	1
6/10 kV	6.9/12 kV	18	8	17	42.5	2	2	1
8.7/15 kV	10.4/18 kV	27	14	24	60.0	2	2	1
12/20 kV	13.9/24 kV	36	18	29	72.5	2	2	1
14/25 kV	17.3/30 kV	45	3	36	90.0	2	2	1
18/30 kV	20.8/36 kV	54	27	43	107.5	2	2	1
20/35 kV	24.3/42 kV	63	32	50	125	2	2	1

Current-carrying capacity

If, after all selection criteria have been taken into account, the type of flexible electric cable to be used for industrial applications has been decided on, the necessary cross-section of the conductor can be determined either from the current to be transmitted or from the power.

Installation conditions (stretched laying, suspended freely in the air, reeled), variations in ambient temperature, grouping, type of operation (continuous duty, intermittent periodic duty) and the use of multicore cables are to be taken into account.

Current-carrying capacity in ampere for rubber cables for use in water*												
Installation type	at or on surfaces		free		at or on surfaces		free		at or on surfaces		free	
	in air	in water	in air	in water	in air	in water	in air	in water	in air	in water	in air	in water
Construction	multicore				single core							
No. of loaded cores	3		3		1		1		3x1 bundled		3x1 bundled	
Arrangement												
mm²	A	A	A	A	A	A	A	A	A	A	A	A
0.5	11	13	12	14	15	18	16	19	11	14	12	15
0.75	15	18	16	19	20	24	21	26	16	19	16	20
1	18	22	19	23	24	29	26	31	19	23	20	24
1.5	23	28	24	29	31	38	33	40	24	29	25	30
2.5	30	36	32	38	41	49	43	52	31	38	33	40
4	41	49	43	52	56	67	59	70	43	51	45	54
6	53	64	56	67	72	86	76	91	55	66	58	70
10	74	89	78	93	101	121	106	127	77	93	81	98
16	99	119	104	125	135	162	142	170	103	124	109	131
25	131	157	138	165	178	214	188	225	137	164	144	173
35	162	194	171	205	220	264	232	278	169	203	178	214
50	202	242	213	255	275	330	289	347	211	253	222	266
70	250	300	263	316	340	408	358	429	261	313	275	330
95	301	361	317	380	409	491	431	517	314	377	331	397
120	352	422	371	445	479	574	504	605	367	441	387	464
150	404	485	425	510	549	659	578	694	422	506	444	533
185	461	553	485	582	627	752	660	792	481	577	507	608
240	547	656	576	691	744	893	783	940	571	685	601	721
300	633	760	666	800	861	1033	906	1087	661	793	696	835
400	730	876	768	922	993	1191	1045	1254	762	914	802	963
500	840	1008	884	1061	1142	1371	1203	1443	877	1052	923	1108

* Current-carrying capacity in ampere for rubber cables for use in water
(e.g. HYDROFIRM, OZOFLEX (PLUS), PROTOMONT, PROTOLON, TECWATER; with and without screen);
max. permissible temperature at conductors of 90 °C and frequency of 0 to 60 Hz; ambient temperature 30 °C

The capacity in water is valid for complete immersed cables; it was fixed with 20% over the capacity in air.

For other ambient temperatures, the current-carrying capacities must be converted with the de-rating factors from next page.

Current-carrying capacity in ampere for rubber cables for use in hot water						
	130 °C – HYDROFIRM TGSH			150 °C – HYDROFIRM TGSH2G		
Installation type	at or on surfaces			at or on surfaces		
Construction	multicore	single core		multicore	single core	
No. of loaded cores	3	1	3x1 bundled	3	1	3x1 bundled
Arrangement						
mm²	A	A	A	A	A	A
1.5	13	18	14	16	22	17
2.5	17	24	18	21	29	22
4	24	32	25	29	40	30
6	31	42	32	38	51	39
10	43	58	45	53	71	55
16	57	78	60	70	96	73
25	76	103	79	93	126	97
35	94	128	98	115	156	120
50	117	159	122	143	195	150
70	145	197	151	178	241	185
95	175	237	182	214	291	223
120	204	278	213	250	340	261
150	234	319	245	287	390	299

De-rating factors

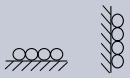
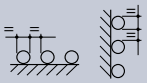
The de-rating factors take into account the installation and operating conditions, such as temperature, grouping, intermittent periodic duty and the number of simultaneously loaded cores. They are to be used for determining the current-carrying capacity in accordance with the table on page 62 and above.

De-rating factors for varying ambient temperatures															
Ambient temperature °C															
10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
1.15	1.12	1.08	1.04	1.0	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41	0.29

Ambient temperature °C – HYDROFIRM TGSH															
80	85	90	95	100	105	110	115	120	125						
1.58	1.50	1.41	1.32	1.22	1.12	1.00	0.87	0.71	0.50						

Ambient temperature °C – HYDROFIRM TGSH2G															
80	85	90	95	100	105	110	115	120	125	130	135	140	145		
1.53	1.47	1.41	1.35	1.29	1.22	1.15	1.08	1.00	0.91	0.82	0.71	0.58	0.41		

De-rating factors for grouping

Arrangement		Number of multi-core cables or number of single or three-phase circuits made up of single-core cables (2 or 3 loaded conductors)														
		1	2	3	4	5	6	7	8	9	10	12	14	16	18	20
Bunched directly at the wall, the floor, in conduit or ducting, on or in the wall		1.0	0.8	0.7	0.65	0.6	0.57	0.54	0.52	0.5	0.48	0.45	0.43	0.41	0.39	0.38
Single layer on the wall or floor, touching		1.0	0.85	0.79	0.75	0.73	0.72	0.72	0.72	0.71	0.70	–	–	–	–	–
Single layer on the wall or floor, spaced with a clearance of 1 x cable diameter between adjacent cables		1.0	0.94	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Single layer under ceiling, touching		0.95	0.81	0.72	0.68	0.66	0.64	0.63	0.62	0.61	–	–	–	–	–	–
Single layer under ceiling, spaced with a clearance of 1 x cable diameter between adjacent cables		0.95	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

De-rating factors for intermittent periodic duty

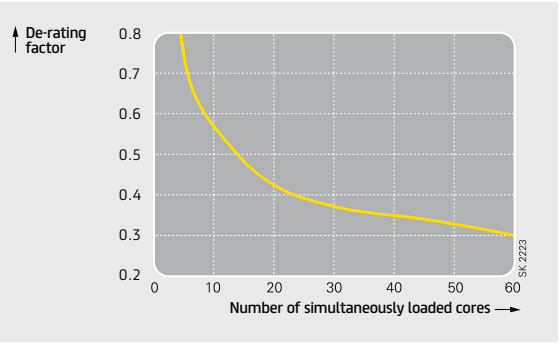
Ambient temperature 30 °C / Duty cycle 10 min.

Nominal cross-section mm²	Duty factor ED %			
	60	40	25	15
0.75	1.00	1.00	1.00	1.00
1	1.00	1.00	1.00	1.00
1.5	1.00	1.00	1.00	1.00
2.5	1.00	1.00	1.04	1.07
4	1.00	1.03	1.05	1.19
6	1.00	1.04	1.13	1.27
10	1.03	1.09	1.21	1.44
16	1.07	1.16	1.34	1.62
25	1.10	1.23	1.46	1.79
35	1.13	1.28	1.53	1.90
50	1.16	1.34	1.62	2.03
70	1.18	1.38	1.69	2.13
95	1.20	1.42	1.74	2.21
120	1.21	1.44	1.78	2.26
150	1.22	1.46	1.81	2.30
185	1.23	1.48	1.82	2.32
240	1.23	1.49	1.85	2.36
300	1.23	1.50	1.87	2.39

De-rating factors for multi-core cables with conductor cross-sections up to 10 mm²

Number of loaded cores						
5	7	10	12	14	18	19
0.75	0.65	0.55	0.53	0.50	0.44	0.45

Number of loaded cores						
24	30	36	40	42	61	
0.40	0.37	0.36	0.35	0.35	0.30	



Notes

EMC-Criteria

Electromagnetic compatibility

Electromagnetic compatibility is the capability of an electrical or electronic device to function correctly in its electromagnetic environment and not to cause interference to the environment to an impermissible degree.

This matter is of immediate concern for all those engaged in planning and manufacturing electrical equipment and installations. On the one hand, the EMC legislation introduced in Germany from 1st January 1996, and, on the other hand, the high processing speed and transmission rates of modern electronics necessitate increased attention being paid to the question of the influence of transmitted and received interference. Non-observance of the currently valid EMC standards can lead to imposition of fines.

Standards

Standards, which directly address the question of cable construction or cable characteristics, do not exist. Whether a cable causes interference or not, is solely dependent on the manner in which it is used. From the point of view of the user, those standards, which specify limit values for permissible levels of interference, are relevant. These refer to equipment, plants or other electrical installations and thus refer indirectly to the cables. Those responsible for erection or manufacture thereof must confirm or prove that their equipment meets the EMC requirements.

The currently valid standards and regulations, which are important for use of insulated cables, are listed below.

Standards and regulations relevant to EMC of cables

- **IEC 60801-3**

  This standard defines electromagnetic compatibility for instrumentation and control equipment for industrial process applications. It describes methods for evaluation of the susceptibility to electromagnetic interference. It further describes tests, by means of which the influence of electromagnetic interference from external sources on the operational behaviour of cables and their maximum achievable transmission rates can be determined.

- **IEC 60801-4**

  Tests based on this standard reveal the maximum loading limits of LAN cables as a result of uniform, random and periodic interference.

- **EN 55011 (DIN VDE 0875, Part 11)**

  In this standard the limit values and measuring procedures for radio frequency interference caused by industrial, scientific and medical high-frequency equipment (ISM devices) are defined.

- **EN 55022**

  This standard corresponds to DIN VDE 0878, Part 3: Limit values and measuring procedures for radio frequency interference caused by information processing equipment (ITE). The radiated energy of a cable can be measured in simulated operation. In addition, the limit value classes A and B for radio frequency interference voltages are defined.

- **Official Journal Regulation 243/1991**

  This regulation of the German Federal Ministry for Post and Telecommunication deals with radio frequency interference and interference voltage emission.

  Information on this subject is also to be found in FTZ TL-6145-3000 issued by the Research and Technology Centre of the German Post Office.

Criteria for EMC cable selection

Selection of the most suitable cable and application/ connection at site from the point of view of EMC can be carried out employing the criteria listed below:

- Use of a cable shield with low transfer impedance
- Symmetrical design and operation of the cable
- Choice of suitable materials by reason of the higher voltage
- Stress of the insulation by reflections at frequencies above 100 MHz; low loss figure
- Large clearance between the interference source and the interference sink (power cables layed spatially separated from the data cables)
- Earthing at both ends and coaxial connection of the shield
- Use of filters
- Laying on earthed surfaces

The design of a cable is of decisive importance for the evaluation of EMC. The most commonly employed constructional designs of power and control cables regarding their EMC characteristics are listed in the table below.

In recent years, a new generation of high-speed switching transistors (IGBT) has been employed for converters for variable-speed motors. Use of such converters results in high rates of voltage rise and high-frequency harmonics. For this reason consequent interference must be taken into account. In order to counteract this interference, special measures are required for the power cables. We recommend the use of TECWATER EMV-FC cables resp. HYDROFIRM EMV-FC cables. As a result of an optimized design regarding shield, materials and geometry, this cable type fulfills all the requirements with respect to mechanical characteristics for cables and is also distinguished by superior shield characteristics.

Consequently interference emission is reduced to an acceptable degree or even completely suppressed. Moreover, the TECWATER EMV-FC cable design resp. HYDROFIRM EMV-FC cable design helps manufacturers and operators of electrical installations to maintain the limit values specified in the EMC legislation.

EMC evaluation			
Construction	Shield	Shield	Evaluation
EMC Power cables			
	Symmetrical 3 + 3	Cu braid (possibly with Cu fleece)	Optimum
	Symmetrical 3-core	Cu braid (single core)	Good
	Unsymmetrical 4-core	Cu braid (possibly with Cu fleece	Good
	Symmetrical 3 + 3	–	Satisfactory
	Unsymmetrical 4-core	–	Mediocre
	Unsymmetrical parallel cores or flat cable	Cu braid	Mediocre
	Unsymmetrical parallel cores or flat cable	–	Poor

EMC evaluation			
Construction	Shield	Shield	Evaluation
EMC Control cables			
	Symmetrical 2-core	Cu braid (possibly with Cu fleece)	Optimum
	Symmetrical 2-core	–	Very good
	Symmetrical 4-core	–	Good (with symmetrical operation)
	Unsymmetrical concentrically stranded	Cu braid overall shield	Often adequate (with adjacent cores)
	Unsymmetrical concentrically stranded	Cu braid individually shielded cores	Often adequate (with adjacent cores)
	Unsymmetrical concentrically stranded	–	Poor

Thermal parameters

Under no circumstances may the values shown be exceeded due to interaction of internal Joule heat and the ambient temperature.

If cables are exposed to radiation, e.g. sunlight, the temperature of the outer sheath of the flexible electric cable can rise to a level which is significantly higher than the ambient temperature. This situation must be compensated for by corresponding reduction of the current-carrying capacity.

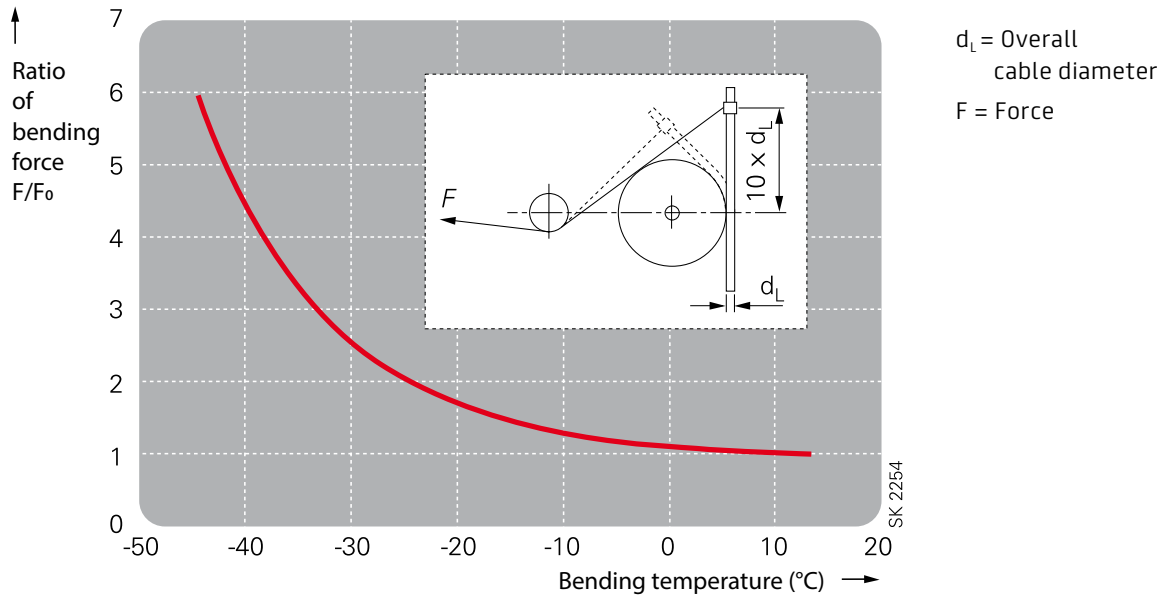
The temperatures on the surface of the cable are limits for the ambient temperature.

All insulating and sheathing compounds of the flexible electric cables become stiffer as the temperature drops. If the temperature falls below the specified limit, a point can be reached below which the compounds used become brittle.

In addition to this, more force (sometimes considerably more) is needed for bending a flexible electric cable due to the increase of stiffness of the insulating and sheathing compounds at lower temperatures. This can create problems in the use of the flexible electric cables (e.g. with the reel drive).

The relationship between the bending stiffness of flexible electric cables for industrial applications and the temperature is shown in the figure below.

The ratio of the bending force is given as F/F_0, with $F_0 = F_{20°C}$.



d_L = Overall cable diameter

F = Force

The temperature limits on the surface of the cable are specified to ensure problem-free and healthy operation during forced guidance of flexible electric cables for industrial applications, especially while trailing over ground and during reeling operation.

Higher temperatures influence the hardness, abrasion, resistance to tear propagation and the transverse pressure stability of the insulating and sheathing compounds and can thus lead to a reduction of their service life.

Flexible electric cables should be selected, installed and operated so that the expected dissipation of Joule heat is not hindered in any way and therefore no risk of fire is incurred.

Mechanical parameters

Tensile loads

The tensile loads of copper conductors in electric cables for flexible applications as specified by DIN VDE 0298, Part 3, should not exceed 15 N/mm². However, higher values are allowed for some cables as shown in the table below. These values refer to tensile load only.

These maximum permissible limits of tensile load are to be regarded as the sum of the static and dynamic loads.

When the permissible tensile force is being calculated, shields, concentric conductors and split protective-earth conductors as well as integrated control cores and monitoring cores of power cables must not be included in the calculation.

For higher tensile loads, appropriate steps have to be taken such as increasing the bending radii or using special cable designs with stress relieving support elements. In some cases, a shorter service life can be expected. In this case, the cable manufacturer should be consulted.

The maximum permissible tensile load for installing fixed laying flexible cables is 15 N/mm² referred to the cross section of the conductor.

Torsional stresses

As a general rule the torsional stresses occurring during operation of electric cables for flexible applications are low. In certain applications, such as for example laying on large mobile equipment (cable booms), torsional stresses are unavoidable.

If the limits are exceeded, this can lead to a reduction in service life. In critical cases, the cable manufacturer should be consulted.

Torsional stresses created by the systems involved (e.g. due to misalignment of cable guidance systems, oblique cable pay out) should be avoided and are not included here.

Additional tests

Adequate testing of the operating characteristics needed for electric cables for flexible applications is not possible with the tests specified by DIN VDE. Our electric cables for flexible applications are therefore subject to additional and continuous mechanical tests at the manufacturer's facilities.

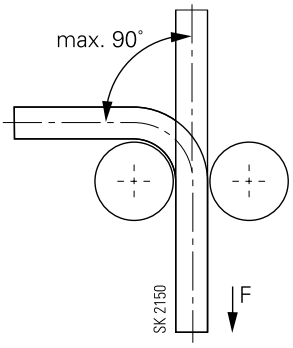
These additional tests facilitate time-compressed examination of the running and service characteristics under different kinds of mechanical stress, such as reversed bending strength, running over sheaves, flexing work and reeling operation in relation to tensile load and bending radii.

Reversed bending test

Based on DIN VDE 0281, Part 2

Testing of electric cables for flexible applications under increased loads.

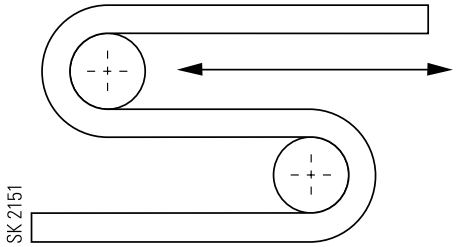
- Cable diameter up to 50 mm, maximum tensile load 3000 N.
- Each movement from one extreme position to another (180°) is counted as a cycle.



Roller bending test type A

Testing the roller bending characteristics of electric cables for flexible applications based on DIN VDE 0282, Part 2.

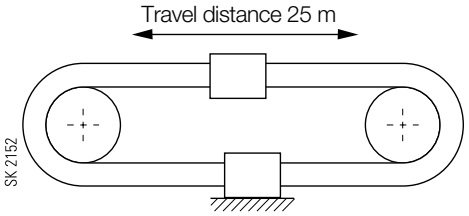
- Cable diameter up to 50 mm.
- Each movement between the extreme position is counted as a cycle.



Roller bending test type B – Tender test

Practice-oriented testing of electric cables for flexible applications with reference to running and service characteristics.

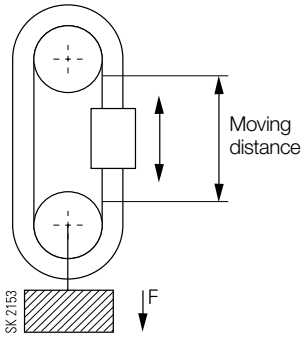
- Cable diameter from 20 up to 60 mm.
- Each movement between the extreme position is counted as a cycle.



Roller bending test type C – Flexing test

Testing the running characteristics (flexing) of electric cables for flexible applications for evaluation of the mechanical service characteristics.

- Cable diameter from 60 up to 120 mm.
- Each movement between the extreme position is counted as a cycle. Moving distance 2 m.

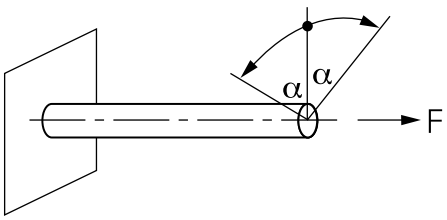


Torsional stress test

The cable is alternately twisted left and right through an angle α by application of the tensile force F.

Torsional angle	max. ± 360°
Torsional torque	max. 200 Nm
Tensile force	max. 4000 N

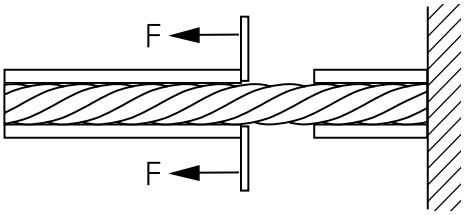
Test duration at temperatures: -40 °C to +50 °C.



Sheath shifting test

Electric cables for flexible applications are generally stressed by dragging over the ground in flexible applications.

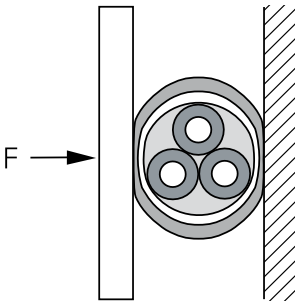
The test determines the magnitude of the force required to slide the sheath along the core.



Transverse pressure test

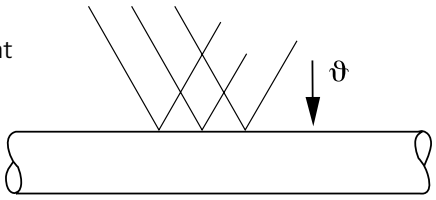
This test demonstrates the behaviour of electric cables subjected to transverse pressure, e.g. as a result of jamming in plant components, being hit by falling stones (blocks of stones), etc.

The test is passed when no electrical event occurs up to the specified value (earth-fault or short-circuit).



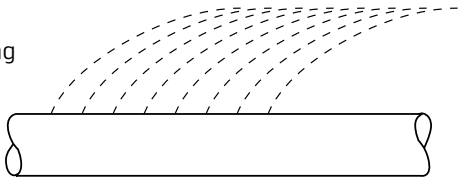
Welding beads test

During constructional and maintenance work on large mobile equipment such as excavators, putting-down machines, etc., welding beads can fall on previously installed electric cables. This test verifies the resistance of the outer sheath to such stresses.



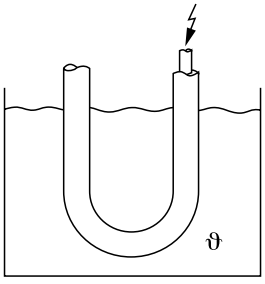
Brine resistance

Automatic material handling and reloading installations (e.g. bunkering and blending plants) are sprayed with brine to prevent them from freezing in order to guarantee smooth trouble-free operation in winter. This test verifies the resistance of the outer sheath of flexible cables to such stresses.



Water resistance

During operation of electric cables for flexible applications, the possibility that they will be operated in water over considerable periods of time cannot be excluded. Verification of the resistance to water is carried out according to EN 50525-2-21.



Chemical parameters

Resistance to chemicals

The individual basic types of materials used for electric cables for flexible applications, such as PCP or EPR can be very different from each other in their resistance to chemicals depending on the required properties. Furthermore, the properties of the materials can vary greatly from manufacturer to manufacturer.

Other factors which influence electric cables for flexible applications, such as the concentration and degree of wetting of the chemicals, their temperature and the penetration time have different effects on the resistance to chemicals and have to be investigated from case to case.

The chemical industry has drawn up a table which shows a rough summary of the resistance to chemicals of various basic types of material; the overview in the table below is **not** to be deemed a substitute for a detailed examination.

Chemical	Material				
	EPR	PVC	CSM	PCP	PU
A					
Acetic acid, 30 %	●	●	●	●	●
Aceton	●	●	●	●	●
Aluminium chloride solution	●	●	●	●	●
Aluminium sulfate solution	●	●	●	●	●
Ammonia, analhydrous	●	●	●	●	●
Ammonium chloride solution	●	●	●	●	●
Ammonium hydroxide solution	●	●	●	●	●
Ammonium sulfate solution	●	●	●	●	●
Amyl acetate	●	●	●	●	●
Aniline	●	●	●	●	●
Asphalt	●	●	●	●	●
B					
Benzine	●	●	●	●	●
Benzole	●	●	●	●	●
Borax solution	●	●	●	●	●
Boric acid solution	●	●	●	●	●
Butyl acetate	●	●	●	●	●
C					
Calcium bisulphite solution	●	●	●	●	●
Calcium chloride solution	●	●	●	●	●
Calcium hydroxide solution	●	●	●	●	●
Carbon disulphide	●	●	●	●	●
Carbon tetrachloride	●	●	●	●	●
Chlorine gas, dry	●	●	●	●	●
Chlorine gas, wet	●	●	●	●	●
Chloroacetic acid	●	●	●	●	●
Chlorobenzene	●	●	●	●	●
Chloroform	●	●	●	●	●
Copper chloride solution	●	●	●	●	●
Copper sulphate solution	●	●	●	●	●
Cyclohexane	●	●	●	●	●
D					
Dibutylphtalate	●	●	●	●	●
Diesel oils	●	●	●	●	●
E					
Ethyl acetate	●	●	●	●	●
Ethyl alcohol	●	●	●	●	●
Ethylene glycol	●	●	●	●	●
Ethylen oxide	●	●	●	●	●
F					
Formaldehyde, 10 %	●	●	●	●	●
Fuel oil	●	●	●	●	●
G					
Glycerine	●	●	●	●	●
H					
Hydraulic oils	●	●	●	●	●
Hydrochloric acid, 20 %	●	●	●	●	●
Hydrogen sulphide	●	●	●	●	●

Chemical	Material				
	EPR	PVC	CSM	PCP	PU
K					
Kerosine	●	●	●	●	●
L					
Lactic acid	●	●	●	●	●
Linseed oil	●	●	●	●	●
Lubricating oils	●	●	●	●	●
M					
Magnesium chloride solution	●	●	●	●	●
Methanol	●	●	●	●	●
Methyl alcohol	●	●	●	●	●
Methyl chloride	●	●	●	●	●
Methyl ethyl ketone	●	●	●	●	●
Mineral oil	●	●	●	●	●
N					
Naphta	●	●	●	●	●
Naphtalene	●	●	●	●	●
Nitric acid, 10 %	●	●	●	●	●
P					
Perchlor ethylene	●	●	●	●	●
Petroleum	●	●	●	●	●
Phenol	●	●	●	●	●
Phosphoric acid	●	●	●	●	●
Picric acid	●	●	●	●	●
Potassium chloride	●	●	●	●	●
Pyridine	●	●	●	●	●
S					
Soap solution	●	●	●	●	●
Sodium hydroxide, 25 %	●	●	●	●	●
Sodium hypochloride	●	●	●	●	●
Soya bean oil	●	●	●	●	●
Stearic acid	●	●	●	●	●
Sulphur	●	●	●	●	●
Sulphuric acid < 50%	●	●	●	●	●
Sulphurous acid	●	●	●	●	●
T					
Toluene	●	●	●	●	●
Transformer oil	●	●	●	●	●
Tributyl phosphate	●	●	●	●	●
Trichlorethylene	●	●	●	●	●
Triethanolamine	●	●	●	●	●
Turpentine	●	●	●	●	●
V/W/X/Y					
Vegetable oils and grease	●	●	●	●	●
Water	●	●	●	●	●
Xylene	●	●	●	●	●
Zinc chloride solution	●	●	●	●	●

● Resistant
● Limited resistance
● Non-resistant
● Not tested

Construction characteristics

Conductors

Conductors for flexible electric cables are designed according to DIN EN 60228 (VDE 0295). Nowadays, the conductors are made of copper (Cu). Aluminium and other materials have not found general acceptance.

In many countries, the design of the conductors according to DIN VDE 0295 is accepted. The regulation corresponds to EN 60228 and IEC 60228.

The conductor classes F, FS and FF are employed for flexible electric cables for industrial applications.

The conductor classes are divided into nominal cross-sections. The individual conductor classes F, FS and FF and the nominal cross-section are defined by specification of the maximum diameter of the single wires and by the maximum resistance of the conductor at 20 °C (see table).

These flexible conductors are made of bare or tinned annealed copper. The conductors are constructed of many single wires, all of which must have the same diameter.

Overview of common kinds of conductors:

Abbreviation	Designation	Specification/regulation
RE conductor	Circular, solid	DIN VDE 0295 Class 1
RM conductor	Circular, stranded	DIN VDE 0295 Class 2
RMV conductor	Circular, stranded, compacted	DIN VDE 0295 Class 2
F conductor	Finley stranded	DIN VDE 0295 Class 5
FS conductor	Very finely stranded	Prysmian specification
FF conductor	Extremely finely stranded	DIN VDE 0295 Class 6

Conductors – construction characteristics

Nominal cross-section mm²	Max. diameter of the single wires mm			Resistance of the conductor at 20 °C Ω/km	
	F conductor (Class 5)	FS conductor (Prysmian Group)	FF conductor (Class 6)	Bare single wires	Tinned single wires
0.5	0.21	0.16	0.16	39	40.1
0.75	0.21	0.16	0.16	26	26.7
1	0.21	0.16	0.16	19.5	20
1.5	0.26	0.21	0.16	13.3	13.7
2.5	0.26	0.21	0.16	7.98	8.21
4	0.31	0.26	0.16	4.95	5.09
6	0.31	0.26	0.21	3.30	3.39
10	0.41	0.26	0.21	1.91	1.95
16	0.41	0.31	0.21	1.21	1.24
25	0.41	0.31	0.21	0.780	0.795
35	0.41	0.31	0.21	0.554	0.565
50	0.41	0.36	0.31	0.386	0.393
70	0.51	0.36	0.31	0.272	0.277
95	0.51	0.41	0.31	0.206	0.210
120	0.51	0.41	0.31	0.161	0.164
150	0.51	0.41	0.31	0.129	0.132
185	0.51	0.41	0.41	0.106	0.108
240	0.51	0.41	0.41	0.0801	0.0817
300	0.51	0.41	0.41	0.0641	0.0654

Insulating and sheathing compounds

The table below gives an overview of all common compounds used for flexible electric cables. A basic distinction is made between thermoplastics and elastomers:

- Thermoplastics, generally known as plastic, are usually not cross-linked
- Elastomers, generally known as rubber, are always cross-linked

Compounds used for flexible electric cables				
Serial no.	Material	Abbreviation	Type designation*	
			VDE	Harm.
Thermoplastics				
1	Polyvinyl chloride	PVC	Y	V
2	Cross-linked polyvinyl chloride	PVC	X	V4
3	Polyethylenen	PE	2Y	E
4	Cross-linked polyethylenen	XLPE	2X	X
5	Low-pressure polyethylene	PE	2Yn	E2
6	Foam polyethylene	PE	02Y	
7	Polystyrene	PS	3Y	Q3
8	Polyamide	PA	4Y	Q4
9	Polyetrafluor ethylene	PTFE	5Y	E4
10	Perfluor ethylene propylene	PEP	6Y	E5
11	Ethylene tetrafluor ethylene	ETFE	7Y	E6
12	Polyimide	PI	8Y	Q5
13	Polypropylene	PP	9Y	E7
14	Polyvinylidene fluoride	PVDF	10Y	Q6
15	Polyurethane	TPU/PU	11Y	Q
16	Polyterephthalic acid ester	PETP	12Y	Q2
17	Polyester thermoplastic	–	13Y	
18	Perfluor ethylene oxyalkane	PFA	14Y	
19	Polychlorotrifluor ethylene	ECTFE	15Y	
Elastomers				
20	Natural rubber	NR	G	R
21	Synthetic rubber	SR	G	R
22	Styrene-butadiene rubber	SBR	G	R
23	Silicon rubber	SIR	2G	S
24	Isobuthylene-isoprene rubber	IIR	3G	B3
25	Ethylene-propylene rubber	EPR/EPDM	3G	B
26	Ethylene vinylacetate	EVA	4G	G
27	Chloroprene rubber	CR	5G	N
28	Chlorosulfonated polyethylene	CSM	6G	N4
29	Fluor elastomers		7G	
30	Nitrile butadiene rubber	NBR	8G	N5
31	Chlorated polyethylene	CM/CPE	9G	

***Type designation:**

Y: Type designation for a thermoplastic material.
G: Type designation for an elastomeric material.
X: Type designation for a cross-linked thermoplastic material (the letter "X" replaces the "Y" in "2X" for cross-linked polyethylene).
0: Additional designation for foam materials (the zero is placed in front of the relevant type designation, e.g. "02Y" for foamed PE).

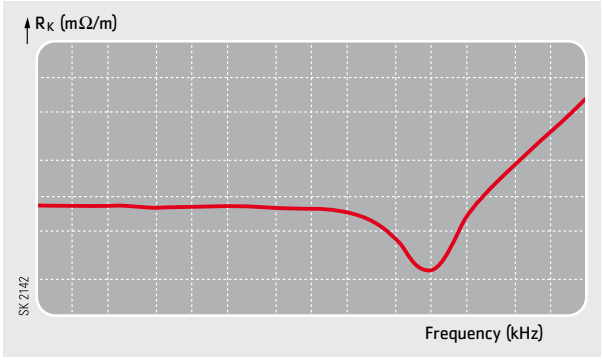
The insulating and sheathing compounds, which are employed in electric cables for flexible applications constructed according to the existing VDE standards listed below, are compared with respect to the individual requirements in the table below.
The characteristics are specified in DIN VDE 0207 or EN 50290 and allow a preliminary estimation of the properties of these compounds.

Characteristics of insulating and sheathing compounds						
Requirements		Unit	Compound			
			Sheath			Insulation
			CR/MR		SR	EPR
			5GM3	5GM5	GM1b	3GI3
Max. permissible operating temperature at the conductor		°C	90	90	90	90
Tensile strength before ageing	min.	N/mm²	10.0	15.0	4.2	4.2
Elongation at break before ageing	min.	%	300	300	200	200
Ageing	at	°C	100 ±2	100 ±2	100 ±2	135 ±2
	over	d	7.0	7.0	7.0	7.0
Change in tensile strength after ageing	max.	%	±30	±30	–	±30
Elongation at break after ageing	min.	%	250	250	200	–
Change in elongation at break after ageing	max.	%	±40	±40	–	±30
Abrasion	max.	mm³	–	300	–	–
Resistance to tear propagation	min.	N/mm	–	30	–	–
Thermal expansion	at	°C	100 ±2	100 ±2	–	200 ±3
	over	min.	15	15	15	15
	with	N/cm²	20	20	20	20
	loaded max.	%	175	175	175	175
	relieved max.	%	25	25	25	25
Resistance to oil (ASTM Oil no. 2)	at	°C	100 ±2	100 ±2	–	127 ±1
	over	h	24	24	–	40
	with	bar	–	–	–	5.5 ±1
Change in tensile strength	max.	N/mm²	±40	±40	–	±30
Change in elongation at break	max.	%	±40	±40	–	±30
Surface resistance at 20 °C	min.	Ω	10^9	10^9	10^9	–
Volume resistance at 20 °C	min.	Ω x cm	–	–	–	10^{12}

Shield

The shield is a “barrier” against - fields and protects electric signals against external signals. The aim is to weaken or stop unwanted signals to such an extent that the wanted data signals can be transmitted without interference in the endangered signalling conductor. There are three basic types of shield structure:

- Overall shield over several cores
- Shielded pairs
- Individually shielded cores.



An overall sheath over several cores, which as a rule is situated between the inner and outer sheath of a cable, has not found general acceptance for reeling cables, because as a result of frequent bending the tensile and pressure forces within the cable lead to premature destruction of the shields and to failure of the cable.

Shielded pairs and individually shielded cores, on the other hand, have proven themselves in practice and are successfully used in Prysmian Group cables.

Braided screens are characterized by their transfer impedance which is defined as the ratio of the voltage drop along the shield on the interfered side to the parasitic current on the other side. The transfer impedance R_K (DIN 40500) is given for a specific frequency in mΩ/m and is usually plotted with respect to frequency. The lower the transfer impedance of a shield, the better the screening effect. The transfer impedance of the braided screens usually used for electric cables for flexible applications is optimized at 30 MHz and is therefore focussed on data-processing quality.

A typical transfer impedance characteristic is shown in the diagram to the left.

Support elements

Electric cables for flexible applications should not be stressed above the limits for the permissible tensile forces. If higher tensile forces are expected, support elements have to be provided as part of the structure of the cable. There are several possibilities for integration of support elements in cables.

Two variants are normally used:

- A support element located in the centre of the cable or
- A braid between the inner and outer sheath

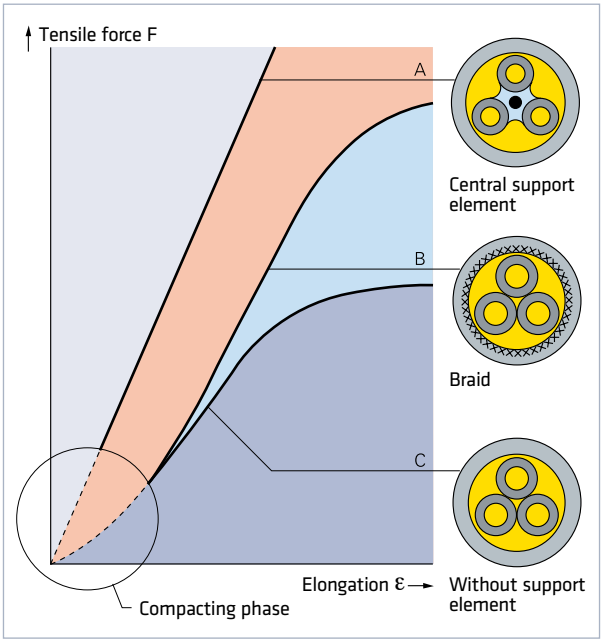
The force/elongation diagram in the figure shows the characteristic of these cables with different arrangements of support elements as compared to a cable without a support element.

After a compacting phase, in which the individual cable elements are initially pulled together, until the copper conductor begins to bear the tensile force, the cable without a support element remains linear in the first section of the curve (curve C). In the next phase, elongation increases considerably on a slight increase of force.

Cables with a braid as a support element between the inner and outer sheath behave in the first section of the curve (curve B) in a similar manner to cables without a support element. The braid becomes effective as a support element and bears the applied force only after the force and the consequent elongation have increased over a certain period of time. The tensile force, which is borne, increases with less elongation than that of the cable without a support element. The braid as a support element can prevent the cable, e.g. from tearing.

Cables with a central support element behave differently provided that the support element was correctly dimensioned. The support element bears the tensile forces from the very beginning and thus relieves the copper conductor (curve A).

The force/elongation characteristics of the support elements and of the copper conductors are decisive for correct design of the support element and dimensioning of the flexible cables. The actual design should be worked out in close co-operation with the cable manufacturer.

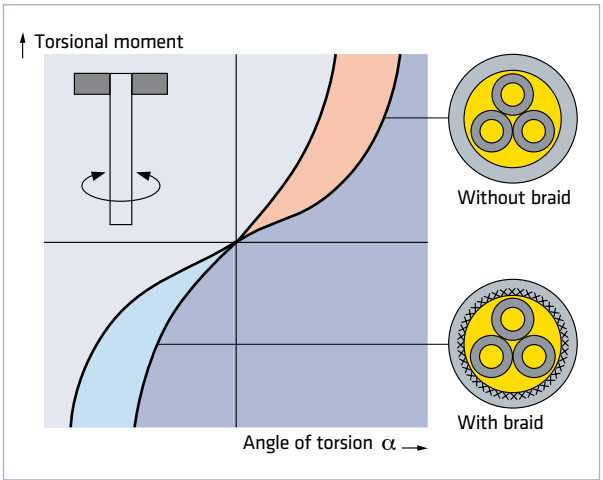


Anti-torsion braid

Electric cables for flexible applications are often fitted with an anti-torsion braid between the inner and outer sheath in order to minimize twisting under torsional loads.

The effect of an anti-torsion braid on the angle of torsion angle α with increasing torsional moment for comparable cables with and without an anti-torsion braid is shown in the figure.

The flexible cable with anti-torsion braid tends to twist less than the flexible cable without a braid for the same torsional moment.



Cable drum overview

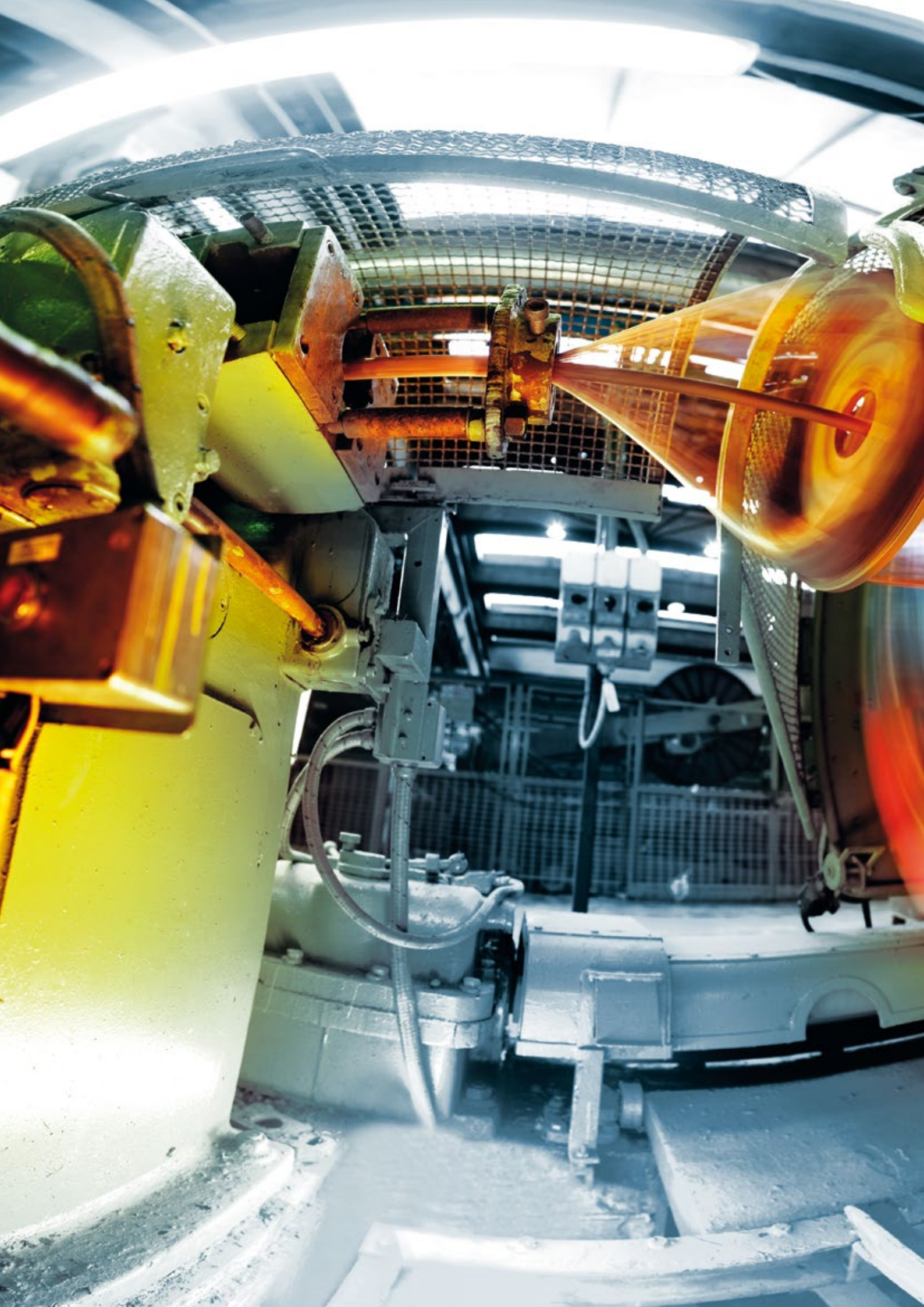
Cable drums			
Drum size	Weight kg	Dimensions Ø x width cm	Volume m^3
051	9	50x46	0.09
071	23	71x48	0.19
081	28	80x48	0.26
091	43	90x64	0.45
101	50	100x64	0.70
121	125	125x76	1.09
141	145	140x95	1.37
161	210	160x95	2.01
181	280	180x110	2.80
200	380	200x110	4.24
220	500	224x138	5.44
224	700	240x138	7.26
281	900	280x138	10.10
300	1,100	300x170	12.14
320	1,200	320x170	18.10
340	1,400	340x220	20.43

Local standards

Comparison AWG

AWG (American Wire Gage)		
AWG size	Equivalent cross-section (mm^2)	Closest metrical cross-section (mm^2)
18	0.823	1.0
16	1.31	1.5
14	2.08	2.5
12	3.31	4.0
10	5.26	6.0
8	8.37	10.0
6	13.30	16.0
4	21.15	25.0
2	33.63	35.0
1/0	53.48	50.0
2/0	67.43	70.0
3/0	85.01	95.0

AWG (American Wire Gage)		
AWG size	Equivalent cross-section (mm^2)	Closest metrical cross-section (mm^2)
250 MCM	107.20	120.0
300 MCM	152.00	150.0
350 MCM	177.35	185.0
400 MCM	202.71	185.0
500 MCM	253.35	240.0
600 MCM	303.96	300.0
750 MCM	379.95	400.0
1000 MCM	506.71	500.0



Linking the future

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