



Technical Product Information

Marine Cable

Wiking Kabel GmbH



Materials

Insulation

All marine cables are insulated with Cross-Linked Polyethylene (XLPE) according to IEC 60092-351, type HF-XLPE. This material allows a continuous conductor temperature of 90 °C and withstands a temporary overload temperature of 130 °C and a short-circuit temperature of 250 °C. This material offers good low temperature properties with a brittleness temperature of approximately -50 °C. TKF's XLPE material shows very low dielectric losses when used in power cables and excellent transmission properties for the instrumentation and communication cables. It also has extremely low moisture absorption, and a high resistance to most chemicals. The Fire-Resistant cables have conductors fully wrapped in mica-glass tape before being insulated with XLPE insulation.

Sheathing

Standard TKF marine cables have a SHF1 type, halogen-free, flame retardant, low-smoke sheath. This sheath has very good abrasion resistance, good mechanical properties, low moisture absorption and high resistance to most chemicals.

The material meets the requirements as specified in IEC 6092-359 under type SHF-1 for mechanical properties, as well as the IEC 60811-2-1 for oil-resistance (ASTM oil 2, 4 hours, 70°C)

The selected sheath material makes TKF marine cables are very suitable for installation and usage in areas with low temperatures. If the cables are exposed to direct sunlight protective covering or black outer sheath is recommended

On request special sheath materials can be applied (e.g. TPU or SHF2) for more extreme conditions.

Armouring and Screening

All TKF's braided cables (designated with the "O" in the type designation) have tinned-copper wire braiding with a coverage of at least 90%. The tinned wires give a high corrosion resistance of the braid and offer both mechanical and EMI protection. Screened cables ("af" type designation) offer only EMI protection with alu-PET tapes in combination with a tinned copper drain wire.

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International Standards

The Marine cables in this catalogue are designed and tested in accordance with the following standards, where applicable.

Standard	Description
IEC 60092-350	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications
IEC 60092-351	Insulating materials for shipboard offshore units, power, control, instrumentation, telecommunication and data cables
IEC 60092-352	Electrical installations in ships –Choice and installation of cables for low-voltage power systems
IEC 60092-353	Single and multicore non-radial field power cables with extruded solid insulation for rated voltages 1 kV and 3 kV
IEC 60092-354	Single- and three-core power cables with extruded solid insulation for rated voltages 6 kV ($U_m = 7.2$ kV) up to 30 kV ($U_m = 36$ kV)
IEC 60092-359	Sheathing materials for shipboard power and telecommunication cables
IEC 60092-376	Cables for control and instrumentation circuits 150/250 V (300 V)
IEC 60228	Conductors of insulated cables
IEC 60331-11	Tests for electric cables under fire conditions - circuit integrity - apparatus - fire alone at a flame temperature of at least 750 °C
IEC 60331-21	Tests for electric cables under fire conditions - circuit integrity - procedures and requirements - cables of rated voltage up to and including 0.6/1.0 kV
IEC 60332-1	Tests on electric cables under fire conditions - part 1: test on a single vertical insulated wire or cable
IEC 60332-3-22 - A	Tests on electric cables under fire conditions - part 3-22: test for vertical flame spread of vertically mounted bunched wires or cables - category A
IEC 60754-1	Test on gases evolved during combustion of electric cables - determination of the amount of halogen acid gas
IEC 60811	Common test methods for insulating and sheathing materials of electric cables
IEC 61034 series	Measurement of smoke density of electric cables burning under defined conditions

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Bending Radius

Bending Radii according to IEC 60092-352				
Voltage Rating	Cable Construction	Outer Diameter	Bending Radius	Cable Types
Up to 1.8/ 3 kV	Unarmoured	<25 mm	$R = 4 \times D$	YZp, YZs
	Unarmoured	>25 mm	$R = 6 \times D$	YZp, YZs
	Armoured/Screened	any	$R = 6 \times D$	YOZp, YOZs, YOZc
	Foil screened	any	$R = 8 \times D$	YOZ2c, YZafp, YZafc
≥3.6/6 kV	Single Core	any	$R = 12 \times D$	YOZmv
	Triple Core	any	$R = 9 \times D$	YZOZmv

Current Rating for General Installations

The current ratings are applicable for d.c. and a.c. with a nominal frequency of 50 Hz or 60 Hz and an ambient air temperature of 45° C. For higher frequencies, the current rating shall be calculated with an appropriate method (e.g. IEC 60287). For other ambient air temperatures the correction factors have to be applied. These ratings are applicable, without correction factors, for cables bunched together on cable trays, in cable conduits, pipes or trunking, unless more than six cables operating simultaneously at their full rated capacity are laid close together without free air circulating around them. In this case a correction factor of 0.85 should be applied. The tables are for general reference purposes only, and do not describe all installation methods existing in practice. For more detailed information see IEC 60092-352(2005) Annex A & B.

For specific situations not covered by these standards exact current calculations can be made by our engineering office.

Correction Factors for ambient air temperatures for maximum conductor temperature of 90° C						
Air Temperature	35° C	40° C	45° C	50° C	55° C	60° C
Correction Factor	1.10	1.05	1.00	0.94	0.88	0.82
Air Temperature	65° C	70° C	75° C	80° C	85° C	90° C
Correction Factor	0.74	0.67	0.58	0.47	-	-

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Current carrying capacities in continuous service
at maximum rated conductor temperature of 90 °C in A, at
45° C ambient air temperature

Current Rating (A)

Cross Section (mm ²)	Number of cores loaded					
	1		2		3 & 4	
1.5	23		20		16	
2.5	40		26		21	
4	51		34		28	
6	52		44		36	
10	72		61		50	
16	96		82		67	
25	127		108		89	
35	157		133		110	
50	196		167		137	
70	242		206		169	
95	293		249		205	
120	339		288		237	
150	389		331		272	
185	444		377		311	
240	522		444		365	
300	601		511		421	
	d.c.	a.c.	d.c.	a.c.	d.c.	a.c.
400	690	670	587	570	483	469
500	780	720	663	612	546	504
630	890	780	757	663	623	548

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Short Circuit Current

The maximum permissible short circuit current for different cables is based on the formula

$$I_k = 146 \cdot \frac{S}{\sqrt{t}}$$

I_k = the maximum permissible short-circuit current in Ampere
 S = the cross section area of the conductor in mm²
 t = the duration of the short-circuit in seconds

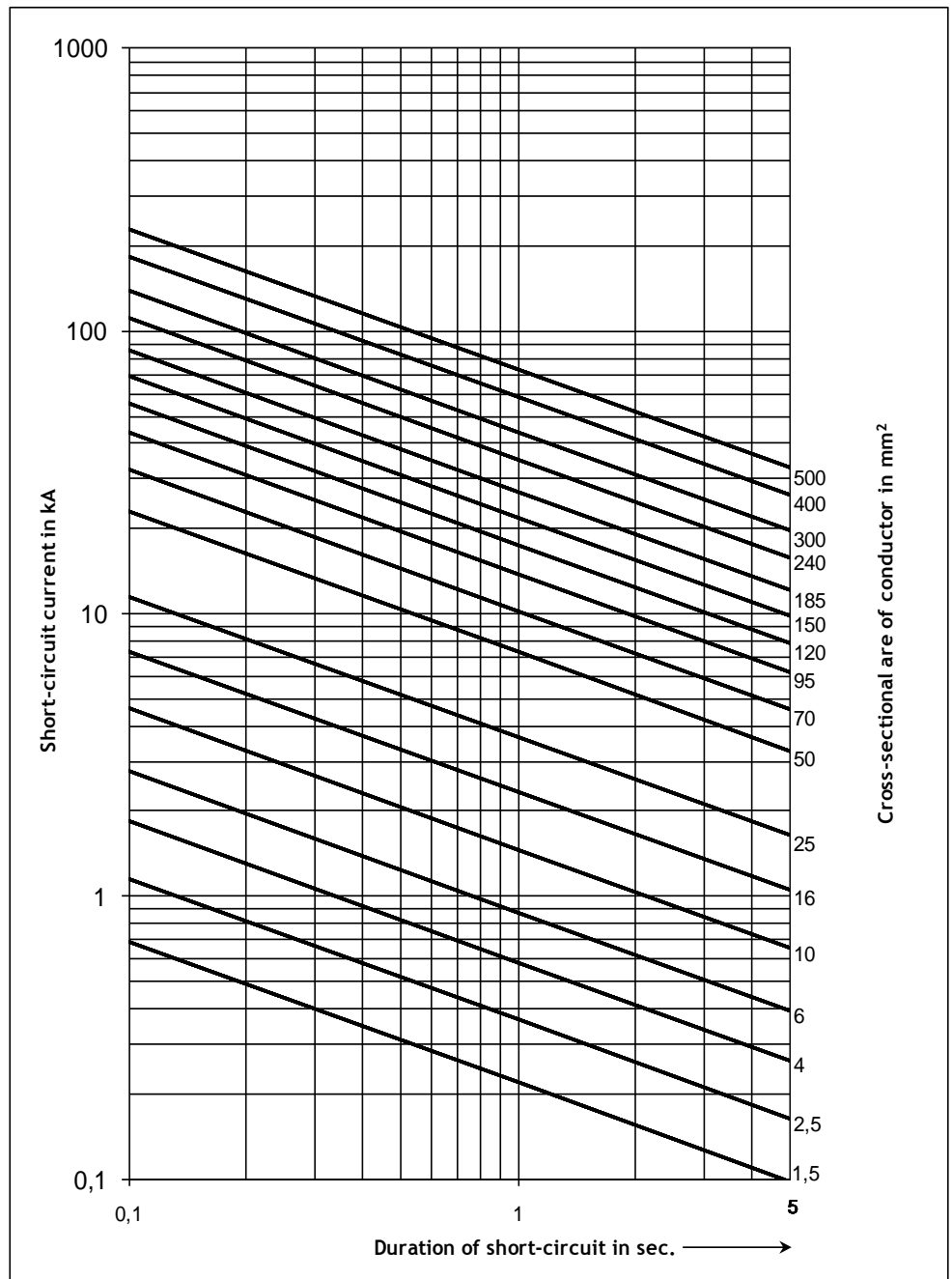
The formula is acceptable for an increase in temperature from 90°C at the start to 250°C at the end (according to IEC 60093-3). In the figure the permissible short-circuit current is given in kA as a function of time (from 0.1 to 5 seconds) and as a function of the cross sectional area of the conductor.

Reactance Calculations

The reactance of cables can be calculated with the following formula:

$$2 \cdot \pi \cdot f \cdot L$$

f = frequency in Hz
 L = inductance in H



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Sheath Colours & Core Identification

Overview types, standards, core identification and sheath colour

Application	Type	Standard	Core Identification	Sheath Colour
Low voltage	Marineline (+) Y(O)Z(af)p 0,6/1 kV	IEC 60092-350/-351/-353	HD308 S2-2001	black
	MarineFlex Y(O)Zp & YOQp 0,6/1 kV	IEC 60092-350/-351/-353	HD308 S2-2001	black
	MarineFlex YOZp 1,8/3 kV	IEC 60092-350/-351/-353	HD308 S2-2001	black
	Marineline (+) Y(O)Zp FR 0,6/1 kV	IEC 60331-11/21	HD308 S2-2001	orange
Medium voltage	MarinePower Y(Z)OZmv 3,6-30 kV	IEC 60092-350/-351/-354	Coloured tape + numbers	red
	MarinePower Multiflex YQOQmv 6/10kV	IEC 60092-350/-351/-354	Coloured tape + numbers	red
Communication	Marine(2)Com Y(O)Z(af)(2)c 250V	IEC 60092-350/-351/-376	Blue/White cores + numbers	grey
	Marine(2)Com Y(O)Z(af)(2)c FR 250V	IEC 60331-11/21	Blue/White cores + numbers	orange
Signal	MarineSignal (+) Y(O)Zs 250V	IEC 60092-350/-351/-376	Black cores + numbers	grey

Different sheath colours on request

Core Identification

Low voltage power cables 0,6/1 kV -1,8/3kV – According to HD308 S2-2001

Cond .	Without Yellow/Green Conductor					With Yellow/Green Conductor (G)				
	N	L1/L2	L/L2	L3	L3	PE	N	L1/L2	L/L2	L3
1			Black							
2	Blue	Orange								
3		Orange	Black	Grey		Green/Yellow	Blue	Orange		
4	Blue	Orange	Black	Grey		Green/Yellow		Orange	Black	Grey
5	Blue	Orange	Black	Grey	Black	Green/Yellow	Blue	Orange		
>5			Nr.			Green/Yellow			Nr.	

- Notes:
- 1) PE = protective conductor - beschermingsleiding - Schutzleiter - conducteur de protection
N = neutral conductor - nulleiding - Neutralleiter - conducteur neutre
L, L1, L2, L3 = phase conductors - faseleidingen - Phasenleiter - conducteurs de phase
 - 2) Nr. = black numbered - zwart genummerd - schwarz nummeriert - noir numéroté

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

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Communication Cables 250 V

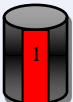
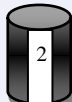
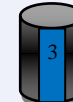
Pairs (n x 2 x y mm ²)	
	
1	2
3..etc	4..etc

Triples (n x 3 x y mm ²)		
		
1	2	3
4..etc	5..etc	6..etc

Signal Cables 250 V

Multicores

1
2..etc

Medium Voltage cables 3,6 - 30 kV

Triple Cores (YZOZmv, YQOQmv)		
		
Spiral wound red tape with number	Spiral wound white tape with number	Spiral wound blue tape with number

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