

# Low voltage power cables

## MarineFlex YZp 0,6/1 kV



These extra flexible low voltage cables for fixed installation ensure easy installation, also in tight spaces and for bigger conductor sizes. The sheath material has excellent abrasion resistance properties and can be stripped easily with the ripcord. Halogen-free and low-smoke, flame-retardant in fire conditions. Different sheath colours available on request.


Characteristics	Properties	Unit
Product group	Ship low voltage power cables	
Series	Scheepskabel	
Type	MarineFlex YZp 0,6/1 kV	
Standardization	IEC 60092-350/-351/-353	
Conductor material	Cu	
Shape of conductor	Round	
Conductor category	Article dependant, see detail sheet	
Core insulation	XLPE	
Core identification	HD 308 S2	
Material outer sheath	Flame Retardant Halogen Free Polyolefin Compound	
Colour outer sheath	Black	
Flame retardant	IEC 60332-1 / IEC 60332-3-22 Cat. A	
Halogen free	IEC 60754-1/2	
Nominal voltage U0	0.6	kV
Nominal voltage U	1	kV
Maximum conductor temperature	90	°C
Operating temperature, flexible	-20 / 70	°C
Operating temperature, fixed	-40 / 70	°C
Specification	zie bijlagen	

Partnumber	Construction G=Y/G	Shape of conductor	Net weight (kg/km)	Bending radius after installation (mm)	Outer diameter approx. (mm)	Tensile load (N)
16090	1 x 35 mm <sup>2</sup>	Round	373	48	11,9	525
16091	2 x 35 mm <sup>2</sup>	Round	1138	93	23,3	1050
16092	3 x 35 mm <sup>2</sup>	Round	1473	103	25,8	1575
16438	4 x 35 mm <sup>2</sup>	Round	1891	116	28,9	2100
16093	1 x 50 mm <sup>2</sup>	Round	499	54	13,4	750
16094	3 x 50 mm <sup>2</sup>	Round	1968	118	29,4	2250
16439	4 x 50 mm <sup>2</sup>	Round	2542	132	33,1	3000
16095	1 x 70 mm <sup>2</sup>	Round	684	62	15,6	1050
16096	3 x 70 mm <sup>2</sup>	Round	2686	137	34,3	3150



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Partnumber	Construction G=Y/G	Shape of conductor	Net weight (kg/ km)	Bending radius after installation (mm)	Outer diameter approx. (mm)	Tensile load (N)
16440	4 x 70 mm <sup>2</sup>	Round	3447	152	37,9	4200
16097	1 x 95 mm <sup>2</sup>	Round	910	70	17,4	1425
16098	3 x 95 mm <sup>2</sup>	Round	3517	153	38,2	4275
16441	4 x 95 mm <sup>2</sup>	Round	4463	168	42,1	5700
16099	1 x 120 mm <sup>2</sup>	Round	1151	78	19,4	1800
16100	3 x 120 mm <sup>2</sup>	Round	4471	170	42,6	5400
16442	4 x 120 mm <sup>2</sup>	Round	5715	170	42,6	5400
16101	1 x 150 mm <sup>2</sup>	Round	1422	86	21,4	2250
16102	3 x 150 mm <sup>2</sup>	Round	5541	190	47,4	6750
16103	1 x 185 mm <sup>2</sup>	Round	1732	94	23,6	2775
16104	3 x 185 mm <sup>2</sup>	Round	6650	208	52,1	8325
16105	1 x 240 mm <sup>2</sup>	Round	2316	107	26,8	3600
16106	3 x 240 mm <sup>2</sup>	Round	8875	236	59	10800
16107	1 x 300 mm <sup>2</sup>	Round	2603	123	30,8	4500

### 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.

### 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 (Um = 7.2 kV) up to 30 kV (Um = 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

### 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 x D	YZp, YZs
	Unarmoured	>25 mm	R = 6 x D	YZp, YZs
	Armoured/Screened	any	R = 6 x D	YOZp, YOZs, YOZc
	Foil screened	any	R = 8 x D	YOZ2c, YZafp, YZafc
≥3.6/6 kV	Single Core	any	R = 12 x D	YOZmv
	Triple Core	any	R = 9 x 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	-	-

#### 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 <sup>2</sup> )	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

### 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  $\text{mm}^2$   
 $t$  = the duration of the short-circuit in seconds

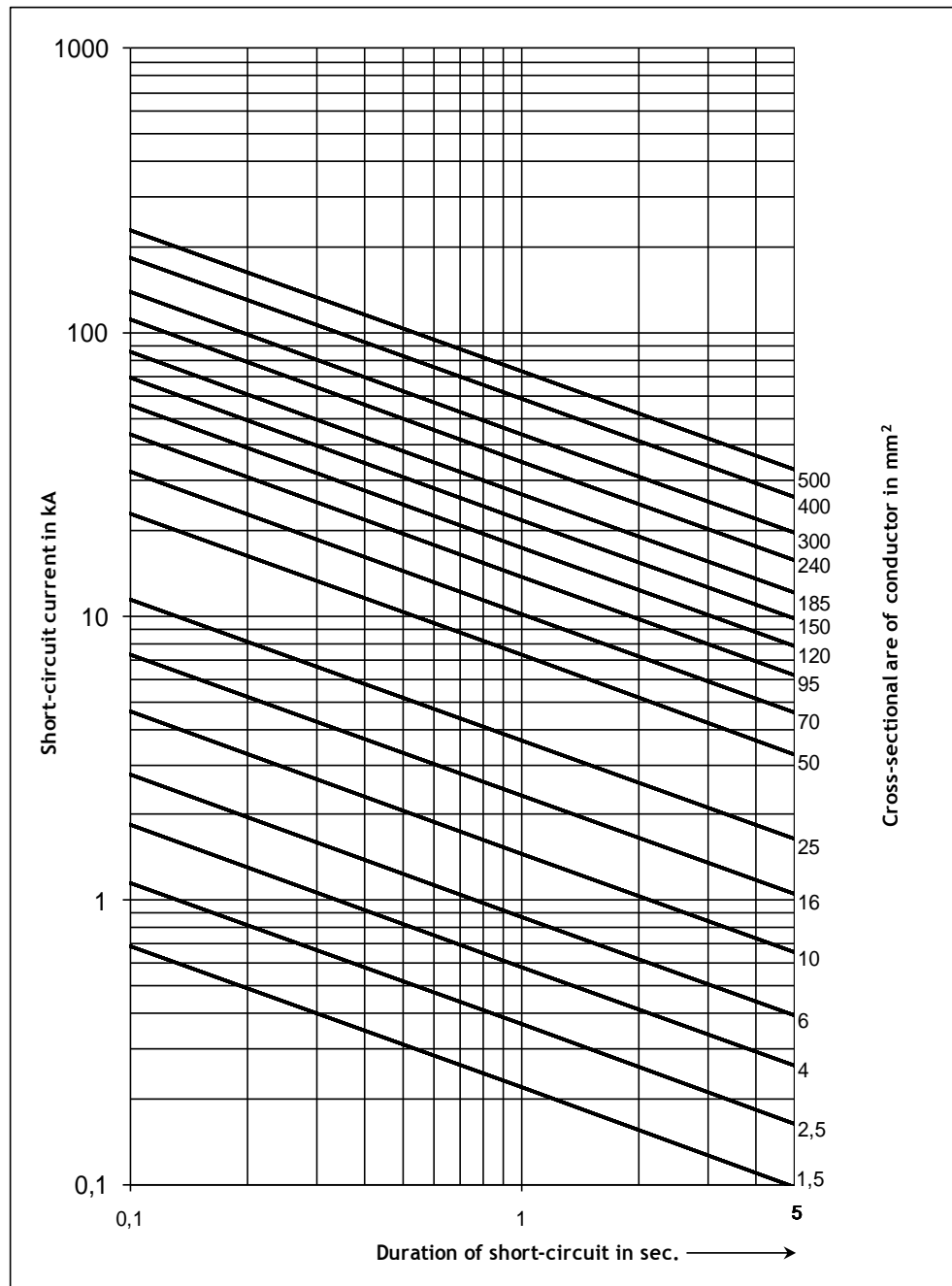
The formula is acceptable for an increase in temperature from  $90^\circ\text{C}$  at the start to  $250^\circ\text{C}$  at the end (according to IEC 60093-3). In the figure the permissible short-circuit current is given in kA as a function of time (from 0.1 to 5 seconds) and as a function of the cross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



# Technical Product information

## Marine Cables

### 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(O)Z(mv) 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			■							
2	■	■								
3		■	■	■	■	■	■	■	■	■
4	■	■	■	■	■	■	■	■	■	■
5	■	■	■	■	■	■	■	■	■	■
>5			Nr.						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

#### Communication Cables 250 V

Pairs (n x 2 x y mm <sup>2</sup> )	
1	2
3..etc	4..etc

Triples (n x 3 x y mm <sup>2</sup> )		
1	2	3
4..etc	5..etc	6..etc

#### Medium Voltage cables 3,6-30kV

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

#### Signal Cables 250 V

Multicores
1
2..etc