

# Low voltage power cables

## MarineLine YOZp 0,6/1 kV



Armoured, lightweight, reduced diameter low voltage cables for power and lighting applications in all ship areas where extra mechanical and EMC protection is needed. The tinned copper braid is highly corrosion resistant which ensures a long cable lifetime. Halogen-free and low-smoke, flame-retardant in fire conditions.

Characteristics	Properties	Unit
Product group	Ship low voltage power cables	
Series	Scheepskabel	
Type	MarineLine YOZp 0,6/1 kV	
Standardization	IEC 60092-350/-351/-353	
Conductor material	Cu	
Shape of conductor	Article dependant, see detail sheet	
Conductor category	Class 2 = stranded	
Core insulation	XLPE	
Core identification	HD 308 S2	
Construction outer shield	Tinned copper braiding	
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 U <sub>0</sub>	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	Shape of conductor	Net weight (kg/km)	Bending radius after installation (mm)	Outer diameter approx. (mm)	Tensile load (N)
15984	3 G 1,5 mm <sup>2</sup>	Round	130	38	9,4	68
15985	4 G 1,5 mm <sup>2</sup>	Round	158	41	10,2	90
15986	5 G 1,5 mm <sup>2</sup>	Round	192	45	11,2	113
16110	1 x 1,5 mm <sup>2</sup>	Round	60	23	5,8	23
16111	2 x 1,5 mm <sup>2</sup>	Round	110	36	9	45
16112	3 x 1,5 mm <sup>2</sup>	Round	131	38	9,4	68
16113	4 x 1,5 mm <sup>2</sup>	Round	158	41	10,2	90
16114	5 x 1,5 mm <sup>2</sup>	Round	192	45	11,2	113



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Partnumber	Construction	Shape of conductor	Net weight (kg/km)	Bending radius after installation (mm)	Outer diameter approx. (mm)	Tensile load (N)
16115	6 x 1,5 mm <sup>2</sup>	Round	222	48	12,1	135
16116	7 x 1,5 mm <sup>2</sup>	Round	232	49	12,2	158
16117	8 x 1,5 mm <sup>2</sup>	Round	313	56	13,9	180
16118	10 x 1,5 mm <sup>2</sup>	Round	386	63	15,7	225
16119	12 x 1,5 mm <sup>2</sup>	Round	398	64	16,1	270
16120	16 x 1,5 mm <sup>2</sup>	Round	505	73	18,2	360
16121	19 x 1,5 mm <sup>2</sup>	Round	582	76	19	428
16430	20 x 1,5 mm <sup>2</sup>	Round	605	80	20	450
16122	24 x 1,5 mm <sup>2</sup>	Round	722	86	21,5	540
16159	27 x 1,5 mm <sup>2</sup>	Round	784	91	22,7	608
16185	37 x 1,5 mm <sup>2</sup>	Round	1005	104	26,1	833
15987	3 G 2,5 mm <sup>2</sup>	Round	171	42	10,4	113
15988	4 G 2,5 mm <sup>2</sup>	Round	211	46	11,5	150
15989	5 G 2,5 mm <sup>2</sup>	Round	249	50	12,4	188
16123	1 x 2,5 mm <sup>2</sup>	Round	71	25	6,2	38
16124	2 x 2,5 mm <sup>2</sup>	Round	137	40	9,9	75
16125	3 x 2,5 mm <sup>2</sup>	Round	169	42	10,4	113
16126	4 x 2,5 mm <sup>2</sup>	Round	209	46	11,4	150
16127	5 x 2,5 mm <sup>2</sup>	Round	249	50	12,4	188
16128	7 x 2,5 mm <sup>2</sup>	Round	354	56	14,1	263
16567	10 x 2,5 mm <sup>2</sup>	Round	490	71	17,8	375
16429	19 x 2,5 mm <sup>2</sup>	Round	807	87	21,7	713
15992	4 G 4 mm <sup>2</sup>	Round	286	51	12,8	240
16129	1 x 4 mm <sup>2</sup>	Round	92	27	6,8	60
16130	2 x 4 mm <sup>2</sup>	Round	184	44	11,1	120
16131	3 x 4 mm <sup>2</sup>	Round	233	47	11,7	180
16132	4 x 4 mm <sup>2</sup>	Round	286	51	12,7	240
16109	7 G 6 mm <sup>2</sup>	Round	627	71	17,6	630
16133	1 x 6 mm <sup>2</sup>	Round	117	29	7,3	90
16134	2 x 6 mm <sup>2</sup>	Round	234	49	12,3	180
16135	3 x 6 mm <sup>2</sup>	Round	301	52	12,9	270
16136	4 x 6 mm <sup>2</sup>	Round	419	59	14,8	360
16566	5 x 6 mm <sup>2</sup>	Round	505	64	16,1	450
16089	7 x 6 mm <sup>2</sup>	Round	626	70	17,5	630
15993	4 G 10 mm <sup>2</sup>	Round	612	67	16,8	600
16108	5 G 10 mm <sup>2</sup>	Round	735	67	18,3	600
16137	1 x 10 mm <sup>2</sup>	Round	162	32	8,1	150
16138	2 x 10 mm <sup>2</sup>	Round	368	57	14,3	300
16139	3 x 10 mm <sup>2</sup>	Round	472	60	15,1	450
16140	4 x 10 mm <sup>2</sup>	Round	610	67	16,7	600
15994	4 G 16 mm <sup>2</sup>	Round	874	77	19,4	960
16141	1 x 16 mm <sup>2</sup>	Round	229	37	9,3	240
16142	2 x 16 mm <sup>2</sup>	Round	508	66	16,5	480
16143	3 x 16 mm <sup>2</sup>	Round	678	70	17,5	720

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Partnumber	Construction	Shape of conductor	Net weight (kg/km)	Bending radius after installation (mm)	Outer diameter approx. (mm)	Tensile load (N)
16144	4 x 16 mm <sup>2</sup>	Round	870	77	19,3	960
16145	1 x 25 mm <sup>2</sup>	Round	344	45	11,2	375
16146	2 x 25 mm <sup>2</sup>	Round	735	80	20,1	750
16147	3 x 25 mm <sup>2</sup>	Round	991	85	21,3	1125
16148	4 x 25 mm <sup>2</sup>	Round	1306	94	23,6	1500
16436	5 G 35 mm <sup>2</sup>	Round	2123	121	30,2	2625
16158	1 x 35 mm <sup>2</sup>	Round	476	53	13,2	525
16157	2 x 35 mm <sup>2</sup>	Round	965	94	23,4	1050
16149	3 x 35 mm <sup>2</sup>	Sector-shaped	1370	86	21,6	1575
16426	4 x 35 mm <sup>2</sup>	Sector-shaped	1691	95	23,8	2100
16401	1 x 50 mm <sup>2</sup>	Round	621	59	14,7	750
16150	3 x 50 mm <sup>2</sup>	Sector-shaped	1775	96	23,9	2250
16427	4 x 50 mm <sup>2</sup>	Sector-shaped	2304	107	26,8	3000
16402	1 x 70 mm <sup>2</sup>	Round	854	66	16,6	1050
16151	3 x 70 mm <sup>2</sup>	Sector-shaped	2416	112	28	3150
16403	1 x 95 mm <sup>2</sup>	Round	1129	75	18,7	1425
16152	3 x 95 mm <sup>2</sup>	Sector-shaped	3284	128	32,1	4275
16404	1 x 120 mm <sup>2</sup>	Round	1397	82	20,5	1800
16153	3 x 120 mm <sup>2</sup>	Sector-shaped	4141	142	35,5	5400
16405	1 x 150 mm <sup>2</sup>	Round	1684	90	22,6	2250
17191	1 x 150 mm <sup>2</sup>	Round	1689	90	22,6	2250
16154	3 x 150 mm <sup>2</sup>	Sector-shaped	5126	159	39,7	6750
16183	4 x 150 mm <sup>2</sup>	Sector-shaped	6628	181	45,3	9000
16406	1 x 185 mm <sup>2</sup>	Round	2087	101	25,3	2775
16155	3 x 185 mm <sup>2</sup>	Sector-shaped	6264	171	42,8	8325
16407	1 x 240 mm <sup>2</sup>	Round	2657	112	27,9	3600
16156	3 x 240 mm <sup>2</sup>	Sector-shaped	8169	198	49,5	10800
16433	1 x 300 mm <sup>2</sup>	Round	3175	126	31,6	4500
16434	3 x 300 mm <sup>2</sup>	Sector-shaped	9984	206	51,4	13500

### 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

## Marine Cables

### 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

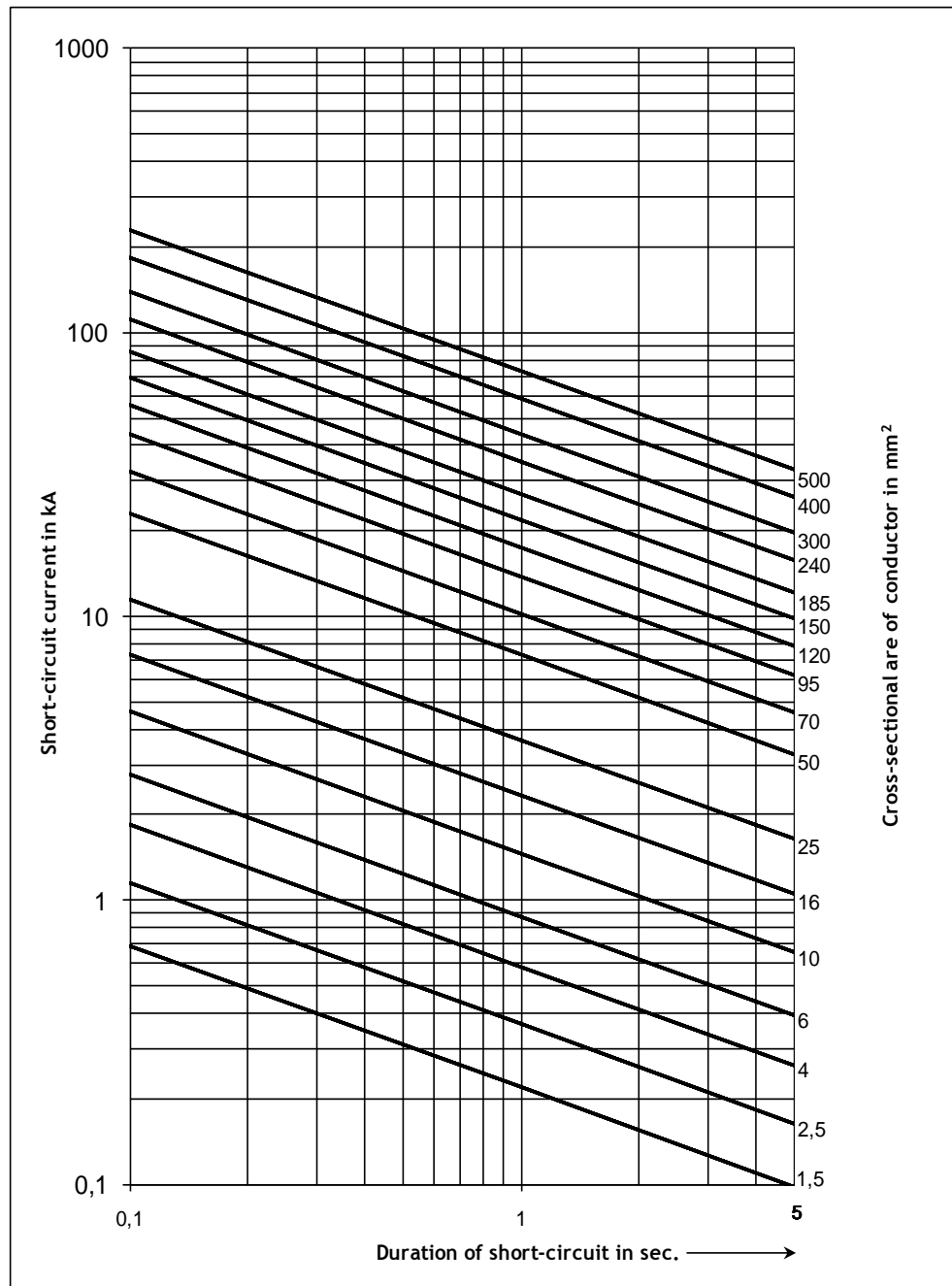
The formula is acceptable for an increase in temperature from  $90^\circ\text{C}$  at the start to  $250^\circ\text{C}$  at the end (according to IEC 60093-3). In the figure the permissible short-circuit current is given in kA as a function of time (from 0.1 to 5 seconds) and as a function of the cross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

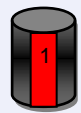
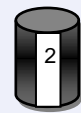

#### Communication Cables 250 V

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)		
		
1	2	3
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