

# Low voltage power cables

## MarineLine YZp X-FR 0,6/1 kV



Fire resistant low voltage power cables according to the new demanding IEC -60331 1/2 specifications for power and lighting applications in all ship areas, with reduced diameter and weight. High abrasion resistant sheath and easily strippable with ripcord. Halogen-free and low-smoke, flame-retardant in fire conditions.

Characteristics	Properties	Unit
Product group	Ship low voltage power cables	
Series	Scheepskabel	
Type	MarineLine YZp X-FR 0,6/1 kV	
Standardization	IEC 60092-350/-351/-353	
Insulation integrity in accordance with IEC 60331	Yes	
Conductor material	Cu	
Shape of conductor	Article dependant, see detail sheet	
Conductor category	Class 2 = stranded	
Core insulation	Mica + XLHFFR	
Core identification	HD 308 S2	
Material outer sheath	Flame Retardant Halogen Free Polyolefin Compound	
Colour outer sheath	Orange	
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)
27080	3 G 1,5 mm <sup>2</sup>	Round	130	42	10,5	68
27081	4 G 1,5 mm <sup>2</sup>	Round	162	47	11,7	90
27082	5 G 1,5 mm <sup>2</sup>	Round	200	51	12,8	113
27083	7 G 1,5 mm <sup>2</sup>	Round	262	56	14,1	158
27000	1 x 1,5 mm <sup>2</sup>	Round	48	23	5,8	23
27001	2 x 1,5 mm <sup>2</sup>	Round	99	40	9,9	45
27002	3 x 1,5 mm <sup>2</sup>	Round	128	42	10,5	68



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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)
27003	4 x 1,5 mm <sup>2</sup>	Round	162	46	11,5	90
27004	5 x 1,5 mm <sup>2</sup>	Round	202	51	12,8	113
27005	6 x 1,5 mm <sup>2</sup>	Round	240	56	13,9	135
27006	7 x 1,5 mm <sup>2</sup>	Round	256	56	13,9	158
27007	8 x 1,5 mm <sup>2</sup>	Round	292	52	13	180
27008	10 x 1,5 mm <sup>2</sup>	Round	375	63	15,7	225
27009	12 x 1,5 mm <sup>2</sup>	Round	430	59	14,8	270
27010	16 x 1,5 mm <sup>2</sup>	Round	565	68	16,9	360
27011	19 x 1,5 mm <sup>2</sup>	Round	664	73	18,2	428
27012	24 x 1,5 mm <sup>2</sup>	Round	847	103	25,8	540
27013	27 x 1,5 mm <sup>2</sup>	Round	899	110	27,4	608
27014	30 x 1,5 mm <sup>2</sup>	Round	988	113	28,3	675
27015	37 x 1,5 mm <sup>2</sup>	Round	1205	125	31,2	833
27084	3 G 2,5 mm <sup>2</sup>	Round	174	38	9,5	113
27085	4 G 2,5 mm <sup>2</sup>	Round	219	51	12,8	150
27086	5 G 2,5 mm <sup>2</sup>	Round	271	46	11,6	188
27087	7 G 2,5 mm <sup>2</sup>	Round	339	61	15,3	263
27016	1 x 2,5 mm <sup>2</sup>	Round	61	25	6,3	38
27017	2 x 2,5 mm <sup>2</sup>	Round	125	44	10,9	75
27018	3 x 2,5 mm <sup>2</sup>	Round	168	46	11,5	113
27019	4 x 2,5 mm <sup>2</sup>	Round	216	51	12,8	150
27020	5 x 2,5 mm <sup>2</sup>	Round	264	56	14,1	188
27021	6 x 2,5 mm <sup>2</sup>	Round	312	61	15,3	225
27022	7 x 2,5 mm <sup>2</sup>	Round	338	61	15,3	263
27088	3 G 4 mm <sup>2</sup>	Round	229	51	12,8	180
27089	4 G 4 mm <sup>2</sup>	Round	291	56	14	240
27023	1 x 4 mm <sup>2</sup>	Round	81	27	6,8	60
27024	2 x 4 mm <sup>2</sup>	Round	165	48	11,9	120
27025	3 x 4 mm <sup>2</sup>	Round	228	51	12,8	180
27026	4 x 4 mm <sup>2</sup>	Round	292	56	14	240
27090	3 G 6 mm <sup>2</sup>	Round	298	57	14,2	270
27091	4 G 6 mm <sup>2</sup>	Round	393	62	15,6	360
27027	1 x 6 mm <sup>2</sup>	Round	104	30	7,4	90
27028	2 x 6 mm <sup>2</sup>	Round	219	53	13,2	180
27029	3 x 6 mm <sup>2</sup>	Round	298	56	14	270
27030	4 x 6 mm <sup>2</sup>	Round	391	62	15,6	360
27092	3 G 10 mm <sup>2</sup>	Round	436	63	15,8	450
27093	4 G 10 mm <sup>2</sup>	Round	566	70	17,4	600
27031	1 x 10 mm <sup>2</sup>	Round	148	32	8,1	150
27032	2 x 10 mm <sup>2</sup>	Round	308	59	14,7	300
27033	3 x 10 mm <sup>2</sup>	Round	436	63	15,8	450
27034	4 x 10 mm <sup>2</sup>	Round	566	70	17,4	600
27094	3 G 16 mm <sup>2</sup>	Round	632	74	18,4	720
27095	4 G 16 mm <sup>2</sup>	Round	816	80	20,1	960

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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)
27035	1 x 16 mm <sup>2</sup>	Round	214	38	9,4	240
27036	2 x 16 mm <sup>2</sup>	Round	445	69	17,2	480
27037	3 x 16 mm <sup>2</sup>	Round	632	74	18,4	720
27038	4 x 16 mm <sup>2</sup>	Round	823	81	20,3	960
27039	1 x 25 mm <sup>2</sup>	Round	323	45	11,2	375
27040	2 x 25 mm <sup>2</sup>	Round	678	84	20,9	750
27041	3 x 25 mm <sup>2</sup>	Round	972	90	22,4	1125
27042	4 x 25 mm <sup>2</sup>	Round	1281	100	24,9	1500
27043	1 x 35 mm <sup>2</sup>	Round	446	49	12,3	525
27044	2 x 35 mm <sup>2</sup>	Round	930	92	22,9	1050
27045	3 x 35 mm <sup>2</sup>	Sector-shaped	1310	87	21,7	1575
27046	4 x 35 mm <sup>2</sup>	Sector-shaped	1735	101	25,3	2100
27047	1 x 50 mm <sup>2</sup>	Round	551	56	14,1	750
27048	2 x 50 mm <sup>2</sup>	Round	1174	109	27,3	1500
27049	3 x 50 mm <sup>2</sup>	Sector-shaped	1729	98	24,4	2250
27050	4 x 50 mm <sup>2</sup>	Sector-shaped	2299	113	28,2	3000
27051	1 x 70 mm <sup>2</sup>	Round	764	64	16	1050
27053	3 x 70 mm <sup>2</sup>	Sector-shaped	2391	113	28,2	3150
27054	4 x 70 mm <sup>2</sup>	Sector-shaped	3133	131	32,7	4200
27055	1 x 95 mm <sup>2</sup>	Round	1031	73	18,3	1425
27057	3 x 95 mm <sup>2</sup>	Sector-shaped	3202	126	31,5	4275
27058	4 x 95 mm <sup>2</sup>	Sector-shaped	4256	147	36,8	5700
27059	1 x 120 mm <sup>2</sup>	Round	1292	80	19,9	1800
27061	3 x 120 mm <sup>2</sup>	Sector-shaped	3923	140	34,9	5400
27062	4 x 120 mm <sup>2</sup>	Sector-shaped	5366	164	40,9	7200
27063	1 x 150 mm <sup>2</sup>	Round	1566	88	22	2250
27065	3 x 150 mm <sup>2</sup>	Sector-shaped	4934	153	38,2	6750
27066	4 x 150 mm <sup>2</sup>	Sector-shaped	6478	182	45,4	9000
27067	1 x 185 mm <sup>2</sup>	Round	1942	99	24,7	2775
27069	3 x 185 mm <sup>2</sup>	Sector-shaped	6078	171	42,7	8325
27070	4 x 185 mm <sup>2</sup>	Sector-shaped	8178	196	49	11100
27071	1 x 240 mm <sup>2</sup>	Round	2500	109	27,3	3600
27075	1 x 300 mm <sup>2</sup>	Round	3020	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

## 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

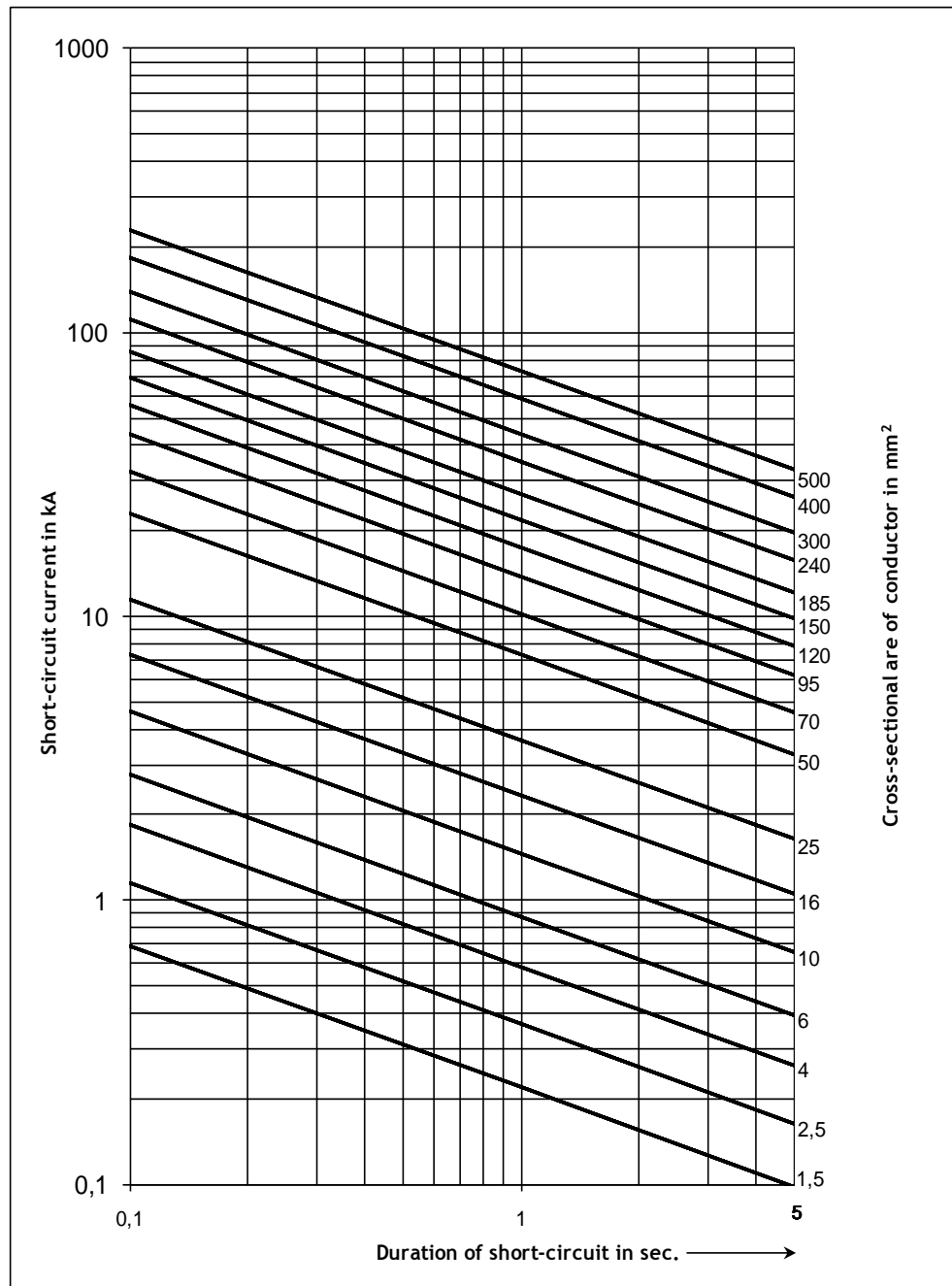
The formula is acceptable for an increase in temperature from  $90^\circ\text{C}$  at the start to  $250^\circ\text{C}$  at the end (according to IEC 60093-3). In the figure the permissible short-circuit current is given in kA as a function of time (from 0.1 to 5 seconds) and as a function of the cross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

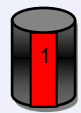
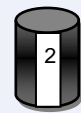

#### Communication Cables 250 V

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)		
		
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