

# Data- / Signalcables

## Marine2Com YOZ2c 250 V



The combination of the overall braid, individual and overall pair screening, and tinned copper drain wires of the Marine2Com cables grants optimal protection against electro Magnetic Interference (EMI). The XLPE isolation and variable twist lengths of the pairs provides perfect electrical properties and low capacitance for minimal signal loss.

Characteristics	Properties	Unit
Product group	Communication marine-cables	
Series	Scheepskabel	
Type	Marine2Com YOZ2c 250 V	
Standardization	IEC 60092-350/-351/-376	
Flame retardant	IEC 60332-1 / IEC 60332-3-22 Cat. A	
Conductor category	Class 2 = stranded	
Stranding element	Pair	
Core insulation	XLPE	
Core identification	Numbers	
Construction outer shield	Tinned copper braiding	
Screen over stranding element	Alpet tape	
Screen over stranding	Foil + braiding	
Material outer sheath	Flame Retardant Halogen Free Polyolefin Compound	
Maximum conductor temperature	90	°C
Operating temperature, flexible	-20 / 70	°C
Operating temperature, fixed	-40 / 70	°C
Specification	zie bijlagen	

Partnumber	Construction	Conductor category	Colour outer sheath	Net weight (kg/km)	Bending radius after installation	Outer diameter approx.	Tensile load (N)
17223	2 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	134	82	10,3	30
17280	2 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	158	89	11,1	45
17224	4 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	192	95	11,9	60
17281	4 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	226	103	12,9	90
17225	6 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	273	114	14,2	90
17226	7 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	278	114	14,2	105
17282	7 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	343	127	15,9	158
17227	8 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	308	120	15	120
17228	10 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	376	137	17,1	150
17283	10 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	468	155	19,4	225
17229	12 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	420	142	17,8	180



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Partnumber	Construction	Conductor category	Colour outer sheath	Net weight (kg/km)	Bending radius after installation	Outer diameter approx.	Tensile load (N)
17230	14 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	471	151	18,9	210
17284	14 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	646	174	21,7	315
17231	19 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	657	176	22	285
17285	19 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	833	198	24,7	428
17232	24 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	796	195	24,4	360
17286	24 x 3 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1010	219	27,4	540
17233	27 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	890	206	25,8	405
17234	30 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	958	215	26,9	450
17235	37 x 2 x 0,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1144	236	29,5	555
16290	2 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	159	90	11,3	45
17290	2 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	185	95	11,9	68
16291	4 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	229	103	12,9	90
17291	4 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	284	112	14	135
16292	6 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	329	123	15,4	135
16293	7 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	335	123	15,4	158
17292	7 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	421	137	17,1	236
17237	8 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	378	130	16,3	180
16294	10 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	451	149	18,6	225
17293	10 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	635	170	21,3	338
17238	12 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	509	153	19,1	270
16295	14 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	587	167	20,9	315
17294	14 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	814	188	23,5	473
16296	19 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	826	194	24,2	428
17295	19 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1041	214	26,8	641
16297	24 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1003	215	26,9	540
17296	24 x 3 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1283	238	29,7	810
17239	27 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1092	222	27,8	608
16298	30 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1203	238	29,7	675
16299	37 x 2 x 0,75 mm <sup>2</sup>	Class 2 = stranded	Grey	1427	261	32,6	833
17243	2 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	175	94	11,8	60
17300	2 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	205	101	12,6	90
17244	4 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	237	108	13,5	120
17301	4 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	319	119	14,9	180
17245	6 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	367	130	16,2	180
17246	7 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	377	130	16,2	210
17242	7 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	489	148	18,5	315
17247	8 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	425	139	17,4	240
17248	10 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	522	158	19,8	300
17303	10 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	736	183	22,9	450
17249	12 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	588	166	20,7	360
17250	14 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	728	179	22,4	420
17304	14 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	935	198	24,8	630
17251	19 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	927	204	25,5	570
17305	19 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1210	230	28,7	855

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Partnumber	Construction	Conductor category	Colour outer sheath	Net weight (kg/km)	Bending radius after installation	Outer diameter approx.	Tensile load (N)
17252	24 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1141	228	28,5	720
17256	24 x 3 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1480	257	32,1	1080
17253	27 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1259	239	29,9	810
17254	30 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1363	250	31,3	900
17255	37 x 2 x 1 mm <sup>2</sup>	Class 2 = stranded	Grey	1635	275	34,4	1110
16333	2 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	230	111	13,9	90
17310	2 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	272	118	14,8	135
17311	4 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	427	141	17,6	270
16334	6 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	485	154	19,2	270
16336	7 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	514	155	19,4	315
17312	7 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	728	179	22,4	473
16337	8 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	569	165	20,6	360
16338	10 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	756	192	24	450
17317	10 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	998	218	27,3	675
16339	12 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	863	200	25	540
16340	14 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	975	214	26,8	630
17314	14 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1291	242	30,2	945
16341	19 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1262	246	30,7	855
17315	19 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1661	276	34,5	1283
16342	24 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1580	274	34,2	1080
17316	24 x 3 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2078	310	38,7	1620
16343	27 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1727	288	36	1215
16344	30 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1879	302	37,8	1350
16345	37 x 2 x 1,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2367	336	42	1665
17263	2 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	291	125	15,6	150
17320	2 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	360	134	16,8	225
17276	4 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	452	146	18,2	300
17321	4 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	586	160	20	450
17265	6 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	714	178	22,3	450
17266	7 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	751	178	22,3	525
17322	7 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	987	203	25,4	788
17267	8 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	834	191	23,9	600
17268	10 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1032	218	27,2	750
17323	10 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1363	248	31	1125
17269	12 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1184	230	28,7	900
17270	14 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1342	244	30,5	1050
17324	14 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1786	275	34,4	1575
17271	19 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	1729	279	34,9	1425
17325	19 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2342	317	39,6	2138
17272	24 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2180	314	39,2	1800
17326	24 x 3 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2918	354	44,2	2700
17273	27 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2404	330	41,2	2025
17274	30 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	2608	346	43,2	2250
17275	37 x 2 x 2,5 mm <sup>2</sup>	Class 2 = stranded	Grey	3187	381	47,6	2775

### 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

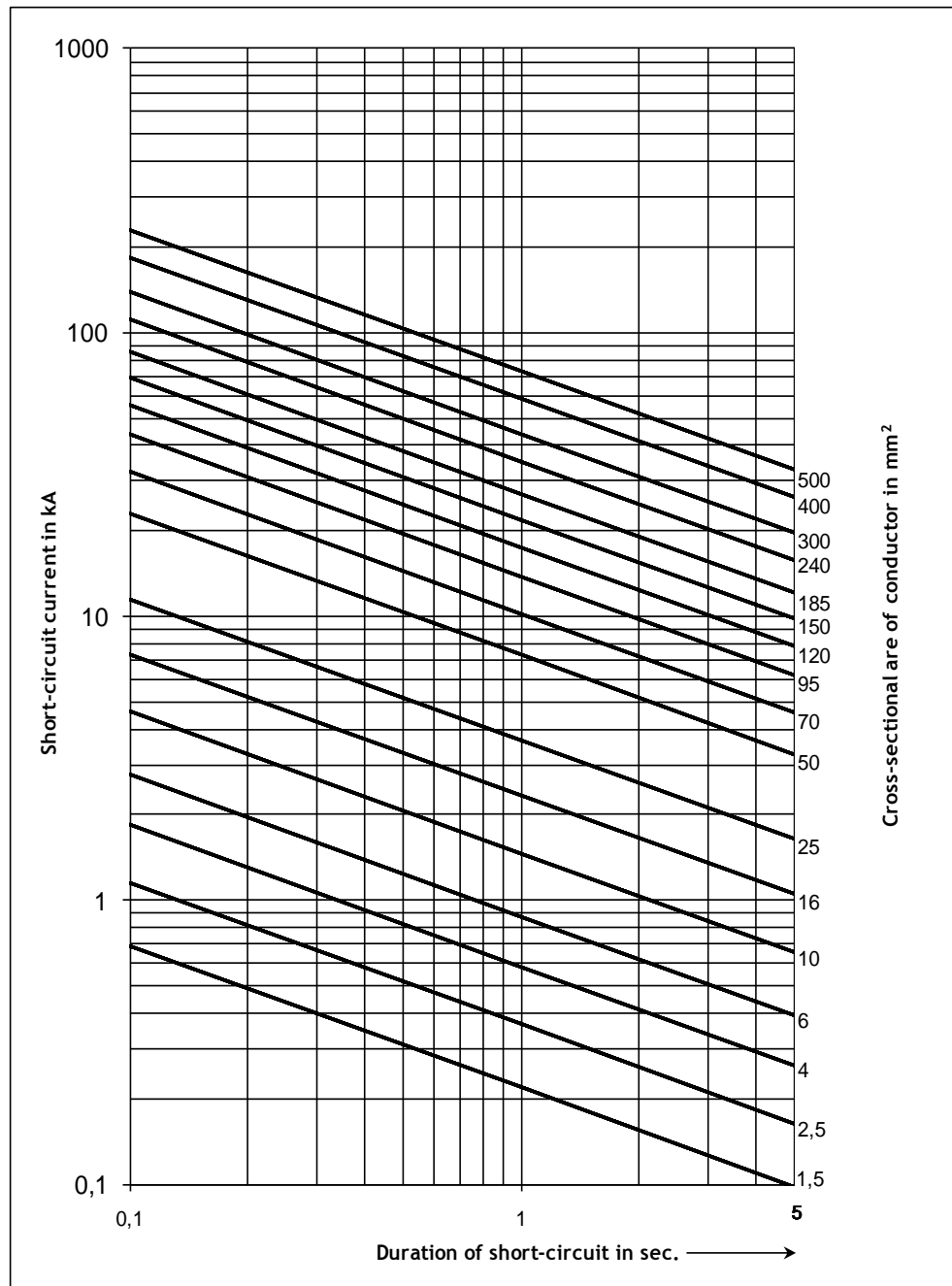
The formula is acceptable for an increase in temperature from  $90^\circ\text{C}$  at the start to  $250^\circ\text{C}$  at the end (according to IEC 60093-3). In the figure the permissible short-circuit current is given in kA as a function of time (from 0.1 to 5 seconds) and as a function of the cross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

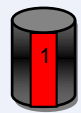
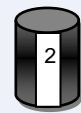

#### Communication Cables 250 V

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