



Marine Cables

About us

Prysmian Cables & Systems is a world-class multinational company. Founded in 1872 as Ditta Pirelli & C., it has achieved a leading position for more than a century of operations in its two key international markets – “Energy Cables and Systems” and “Telecom Cables & Systems”.

Prysmian Cables and Systems is the world’s largest manufacturer of power and telecommunications cables, with 52 manufacturing facilities in 21 countries in five continents and a market share in excess of 10 %.

Prysmian Energy Cables and Systems is a global solutions provider, offering a wide range of integrated solutions, such as cable systems, system design and engineering, project management, installation and post-sale services.

Prysmian Energy Cables and Systems concentrates on continuous product innovation and on achieving a competitive edge by focusing on research and development. This is done through Prysmian’s own R&D centres and by co-operating with universities, scientific institutions and above all, our customers. Prysmian’s world-wide organisation makes and delivers advanced technological solutions to customers anywhere in the world.

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Marine Cables

Prysmian in Finland

Prysmian Cables and Systems Oy has roots going back to 1912, when The Finnish Braiding Factory, the first cable factory in Finland, was founded in Helsinki.

The company has since had many names, The Finnish Cable Factory, Nokia Cables, NK Cables and Pirelli Cables and Systems Oy. Since October 2005 it is Prysmian Cables and Systems Oy.

Production is situated in Kirkkonummi at the Pikkala cable factory, less than 40 km west of Helsinki along the coast. Production consists of marine cables, heating cables and low, medium and high voltage cables. The main customer groups are ship yards, installers, wholesalers, contractors, industry and power utilities.



PRYSMIAN has built in a multi-step quality assurance programme, covering the production process from cable design and raw material purchase to final inspection and testing documentation. The quality system of PRYSMIAN has been assessed and approved and is audited regularly to the ISO 9001 and the ISO 14001 Quality System Standard by different (depending on the factory) quality assurance entities.

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GENERAL

Marine Cables

Marine Cables

(ship wiring cables, ship board cables)

Marine cables are for installations on board ships. They have been type approved by a classification society and they have a construction that follows standards for marine cables.

Conductor

Marine cable conductors are of stranded annealed copper combining the flexibility and small dimensions to provide excellent installability and economical solutions. To minimise the cable diameter and weight we use sector shaped conductors for bigger cross-section.

Insulation Material

XLPE (cross-linked polyethylene) is used as the main insulation material. It withstands higher temperatures than ordinary thermoplastic polyethylene. It is resistant against deformation and various chemicals. It has excellent mechanical and electrical properties. The maximum conductor temperature stipulated by IEC 60092-351 marine cable standard is 90 °C.

Sheathing Material

The sheath (jacket) is composed of halogen free, flame retardant thermoplastic compound. It fulfils the criterion of SHF1 according to IEC 60092-359. In case of fire the sheathing material offers advantages such as reduced emission of smoke and corrosive toxic gasses.

Quality Control

Each manufactured cable goes through a test procedure according to the IEC 60092-300 series standards.

Fire Testing Methods

Flame retardance of a single cable is tested in accordance with IEC 60332-1. It is performed on a 60 cm cable sample with a gas flame for 1-4 min depending on the cable diameter.

The cable has to be self-extinguishing within certain limits to fulfil the test. Please see figure 1.

Fire retardance is tested on bunched cables in accordance with IEC 60332-3, simulating the fire behaviour of the cables installed in a bunch. The main category that is used is A. This is based on an amount of 7 litres of combustible material per metre.



Bunched cables being tested for fire retardance .

The bunch of cables has to be minimum 3.5 m high when it is in a burning chamber subjected to fire from a burner directed at the cables for forty minutes. The cable bunch may not burn more than 2.5 m above the burner.

Please see figure 2.

Fire resistance test is aimed at verifying the behaviour of a cable that must work even when it is burning. There are two different testing methods, IEC 60331-21 and IEC 60331-31, used for power and control cables. Ship cable standards require the IEC 60331-21 test, where the cable sample is subjected to a flame at 750 °C for 90 minutes followed by a 15 minutes cooling period while the rated voltage is being applied between the conductors. No breakdown or short circuit is permitted during the test. Please see figure 3. The optional testing method for cables with diameter over 20 mm, is the more rigorous IEC 60331-31 test, in which a bent cable, affected by mechanical impacts, is subjected to a 830 °C flame for 120 minutes.

Smoke density is tested according to IEC 61034-1 (apparatus) and IEC 61034-2 (procedure and requirements). It is done by placing cable in a "smoke cube" (3x3x3 m). When the cable is burning, the light transmittance is measured using a photometric system. This test is aimed at simulating visibility when cables are burning on board a ship 60 % (70 % for a single cable) visibility is satisfactory if it is attained throughout the test.

Halogens. To test whether a material is halogen free or not, the tests IEC 60754-1 and 60754-2 are used. The acidity of the gasses from burning materials is measured. Being halogen-free means that the materials used in the cables do not contain any halogens – such as chlorine, bromine, iodine and fluorine. In order to attain the self-extinguishing effects that halogens have in cables, ATH based materials are used instead. This way the negative effects of halogens are avoided (corrosivity, toxicity etc.)

Approvals

All above mentioned test are part of the IEC test procedures for marine cables. As a confirmation of the successfully passed test our products have type approval certificates from the following classification societies:

ABS	American Bureau of Shipping
BV	Bureau Veritas
DNV	Det Norske Veritas
GL	Germanischer Lloyd
LRS	Lloyd's Register of Shipping
RINA	Registro Italiano Navale
RMRS	Russian Marine Register of Shipping

Vertical flame propagation test

IEC 60332-1

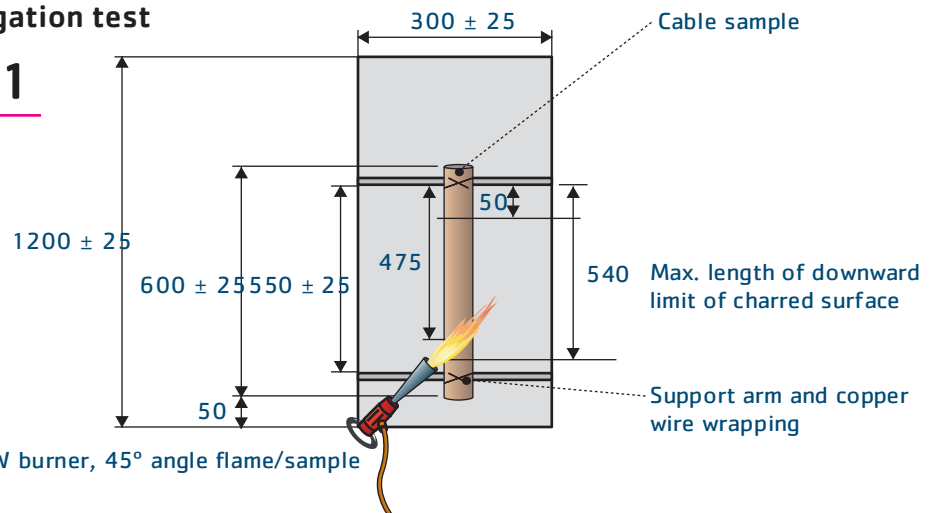


Figure 1.

Vertical flame spread of bunched cables

IEC 60332-3-22 cat.A

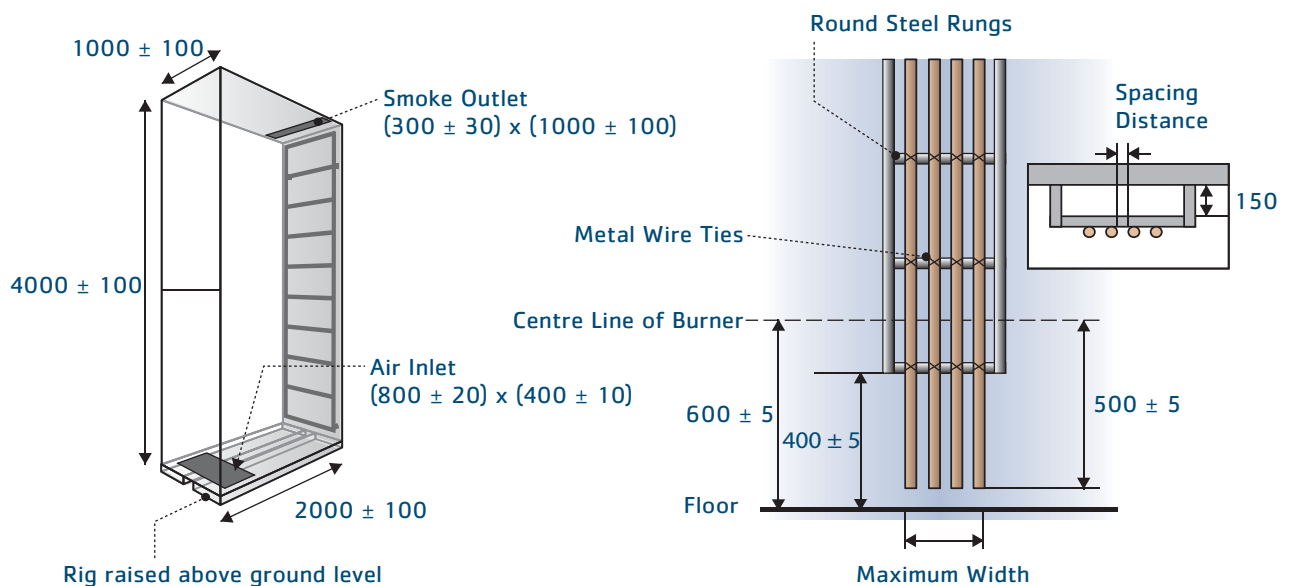


Figure 2.

Fire resistance test

IEC 60331-21

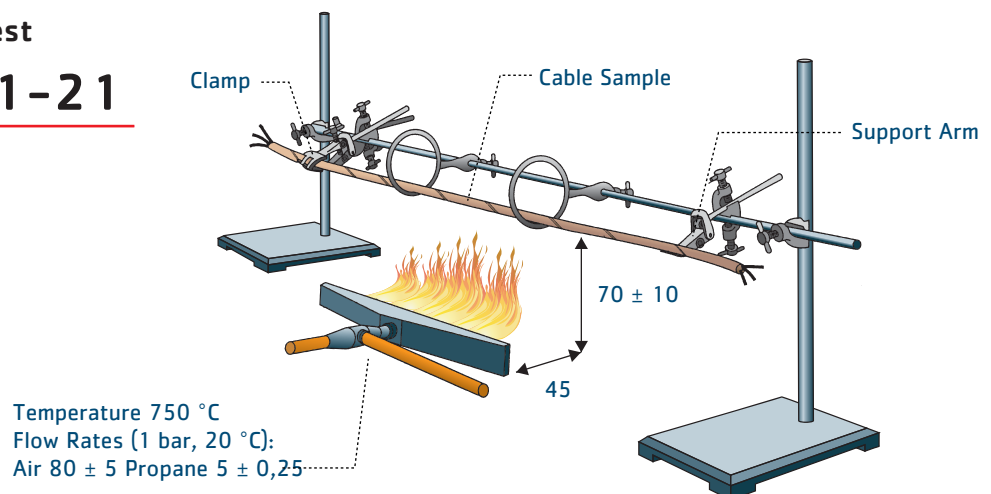


Figure 3.

Power and Control Cables

LM-HF
0,6/1(1,2) kV
(TEMA)



Design

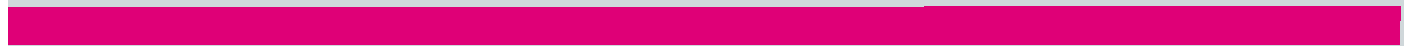
Standards

Marine Cables

Unarmoured Power and Control Cable

- > **Conductor**
 - Annealed stranded plain copper
 - round 1,5 to 16 mm²
 - round compacted 25 to 300 mm²
 - sector shaped in 3-4 cores 25 to 300 mm²
- > **Insulation**
 - Extruded XLPE
 - See page 29 for core identification colours
- > **Sheath**
 - Extruded black halogen free polyolefine, SHF 1
- > **Installation information and electrical data on pages 28-31**

- > **Construction**
 - IEC 60092-353 and IEC 60092-350
- > **Materials**
 - IEC 60228 Class 2 (conductor)
 - IEC 60092-351 (insulation)
 - IEC 60092-359 (sheath)
- > **Flame Retardance**
 - IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
 - IEC 60754-1 and -2
- > **Low Smoke Emission**
 - IEC 61034-1 and -2
- > **Tests**
 - IEC 60092-353
- > **Choice and Installation**
 - IEC 60092-352
- > **Maximum conductor temperature +90 °C**

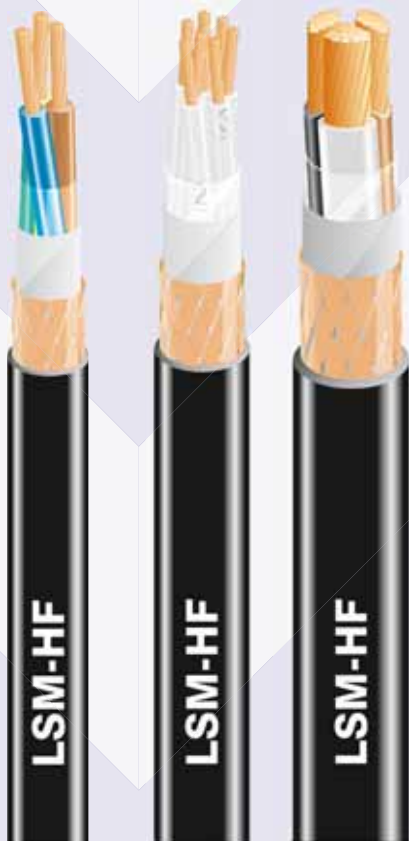


Size *) (n x mm ²)	Conductor		Insulation Thickness nominal (mm)	Cable		Bending Radius min. (mm)
	Diameter/Height approx. (mm)	Width approx. (mm)		Diameter approx. (mm)	Weight approx. (kg/km)	
POWER CABLES						
1x16	5,0	-	0,7	8,8	200	40
1x25	5,8	-	0,9	10,2	290	45
1x35	6,8	-	0,9	11,2	385	45
1x50	7,9	-	1,0	12,7	510	55
1x70	9,6	-	1,1	14,8	720	60
1x95	11,3	-	1,1	16,5	970	70
1x120	12,7	-	1,2	18,3	1210	75
1x150	14,1	-	1,4	20,4	1490	85
1x185	15,7	-	1,6	22,4	1840	90
1x240	18,1	-	1,7	25,2	2390	155
1x300	20,2	-	1,8	28,3	2990	170
2x1,5	1,6	-	0,7	8,4	80	35
2x2,5	2,0	-	0,7	9,5	110	40
2x4	2,6	-	0,7	10,4	150	45
3x1	1,3	-	0,7	8,5	97	35
3x1,5	1,6	-	0,7	8,9	100	40
3x2,5	2,0	-	0,7	10,1	140	45
3x4	2,6	-	0,7	11,1	210	45
3x6	3,1	-	0,7	12,4	280	50
3x10	4,0	-	0,7	14,4	420	60
3x16	5,0	-	0,7	16,8	620	70
3x25	4,8	7,8	0,9	17,8	860	145
3x35	5,6	9,2	0,9	19,9	1150	160
3x50	6,5	10,7	1,0	22,9	1540	185
3x70	7,9	12,8	1,1	26,4	2150	215
3x95	9,3	15,1	1,1	29,8	2910	240
3x120	10,5	17,0	1,2	33,2	3660	270
3x150	11,6	18,9	1,4	36,7	4500	295
4x1,5	1,6	-	0,7	9,9	130	40
4x2,5	2,0	-	0,7	11,0	175	45
4x4	2,6	-	0,7	12,3	265	50
4x6	3,1	-	0,7	13,6	350	55
4x10	4,0	-	0,7	16,0	540	65
4x16	5,0	-	0,7	18,6	800	75
4x25	5,8	-	0,9	21,7	1180	90
4x35	6,2	8,6	0,9	22,6	1510	185
4x50	7,2	9,9	1,0	26,1	2020	210
4x70	8,6	12,0	1,1	30,0	2830	245
4x95	10,2	14,1	1,1	33,9	3860	275
4x120	11,5	15,8	1,2	37,5	4820	305
5x1,5	1,6	-	0,7	10,8	155	45
5x2,5	2,0	-	0,7	12,0	215	50
5x4	2,6	-	0,7	13,4	325	55
5x6	3,1	-	0,7	15,0	435	65
5x10	4,0	-	0,7	17,5	660	75
5x16	5,0	-	0,7	20,5	980	85
5x25	5,8	-	0,9	24,1	1460	100
CONTROL CABLES						
7x1,5	1,6	-	0,7	12,7	215	55
12x1,5	1,6	-	0,7	15,3	325	65
19x1,5	1,6	-	0,7	18,1	480	75
27x1,5	1,6	-	0,7	21,8	670	90
37x1,5	1,6	-	0,7	24,5	890	100
7x2,5	2,0	-	0,7	14,2	305	60
12x2,5	2,0	-	0,7	17,2	460	70
19x2,5	2,0	-	0,7	20,3	690	85
27x2,5	2,0	-	0,7	24,8	980	150
37x2,5	2,0	-	0,7	27,9	1300	170

*) Cables are available also as (nG mm²) versions with green/yellow earth core.

Power and Control Cables

LSM-HF
0,6/1(1,2) kV
(TEMA)



Design

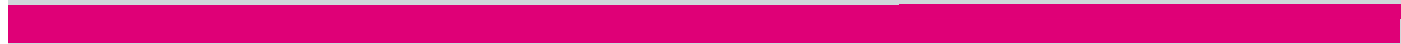
Standards

Marine Cables

Armoured Power and Control Cable

- > **Conductor**
Annealed stranded plain copper
 - round 1,5 to 16 mm²
 - round compacted 25 to 300 mm²
 - sector shaped in 3-4 cores 25 to 300 mm²
- > **Insulation**
Extruded XLPE
 - See page 29 for core identification colours
- > **Armour**
Braid of copper wires designed to act as collective screen
- > **Sheath**
Extruded black halogen free polyolefine, SHF 1
- > **Installation information and electrical data on pages 28-31**

- > **Construction**
IEC 60092-353 and IEC 60092-350
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-353
- > **Choice and Installation**
IEC 60092-352
- > **Maximum conductor temperature +90 °C**



Size *) (n x mm ²)	Conductor		Insulation Thickness nominal (mm)	Diameter over Braid approx. (mm)	Cable Diameter approx. (mm)	Cable Weight approx. (kg/km)	Bending Radius min. (mm)
	Diameter/Height approx. (mm)	Width approx. (mm)					
POWER CABLES							
1x16	5,0	-	0,7	8,1	10,7	270	65
1x25	5,8	-	0,9	9,4	12,2	375	75
1x35	6,8	-	0,9	10,3	13,1	470	80
1x50	7,9	-	1,0	12,0	15,0	640	95
1x70	9,6	-	1,1	14,0	17,2	870	105
1x95	11,3	-	1,1	15,7	18,9	1130	115
1x120	12,7	-	1,2	17,5	21,0	1400	130
1x150	14,1	-	1,4	19,4	23,0	1690	140
1x185	15,7	-	1,6	21,4	25,0	2070	155
1x240	18,1	-	1,7	24,0	27,8	2630	170
1x300	20,2	-	1,8	26,3	30,4	3240	185
2x1,5	1,6	-	0,7	7,7	10,1	135	65
2x2,5	2,0	-	0,7	8,6	10,9	165	70
2x4	2,6	-	0,7	9,7	12,2	225	75
3x1	1,3	-	0,7	7,8	10,0	135	65
3x1,5	1,6	-	0,7	8,1	10,5	160	65
3x2,5	2,0	-	0,7	9,0	11,4	200	70
3x4	2,6	-	0,7	10,3	12,9	275	80
3x6	3,1	-	0,7	11,4	13,9	335	85
3x10	4,0	-	0,7	13,8	16,5	530	100
3x16	5,0	-	0,7	16,1	19,0	740	115
3x25	4,8	7,8	0,9	16,6	20,1	1020	165
3x35	5,6	9,2	0,9	18,5	22,2	1340	180
3x50	6,5	10,7	1,0	21,0	25,1	1760	205
3x70	7,9	12,8	1,1	24,3	28,6	2400	230
3x95	9,3	15,1	1,1	27,8	32,4	3200	260
3x120	10,5	17,0	1,2	31,2	36,1	4080	290
3x150	11,6	18,9	1,4	34,5	39,7	4930	320
4x1,5	1,6	-	0,7	8,8	11,2	190	70
4x2,5	2,0	-	0,7	10,0	12,5	250	80
4x4	2,6	-	0,7	11,3	13,8	325	85
4x6	3,1	-	0,7	13,0	15,7	465	95
4x10	4,0	-	0,7	15,4	18,4	670	115
4x16	5,0	-	0,7	17,9	21,1	940	130
4x25	5,8	-	0,9	20,6	23,9	1330	145
4x35	6,2	8,6	0,9	21,0	24,8	1730	200
4x50	7,2	9,9	1,0	24,1	28,4	2270	230
4x70	8,6	12,0	1,1	28,0	32,5	3120	265
4x95	10,2	14,1	1,1	31,9	36,9	4280	300
4x120	11,5	15,8	1,2	35,3	40,5	5290	325
5x1,5	1,6	-	0,7	9,8	12,3	225	75
5x2,5	2,0	-	0,7	10,9	13,5	290	85
5x4	2,6	-	0,7	12,9	15,7	435	95
5x6	3,1	-	0,7	14,2	17,0	550	105
5x10	4,0	-	0,7	17,0	20,0	800	125
5x16	5,0	-	0,7	19,8	22,9	1140	140
5x25	5,8	-	0,9	23,0	26,5	1630	160
CONTROL CABLES							
7x1,5	1,6	-	0,7	12,0	14,8	330	90
12x1,5	1,6	-	0,7	14,7	17,6	455	110
19x1,5	1,6	-	0,7	17,2	20,3	630	125
27x1,5	1,6	-	0,7	20,8	24,1	850	145
37x1,5	1,6	-	0,7	23,3	26,8	1100	165
7x2,5	2,0	-	0,7	13,5	16,2	435	100
12x2,5	2,0	-	0,7	16,5	19,5	600	120
19x2,5	2,0	-	0,7	19,5	22,6	870	140
27x2,5	2,0	-	0,7	23,5	27,1	1180	165
37x2,5	2,0	-	0,7	26,4	30,2	1540	185

*) Cables are available also as (nG mm²) versions with green/yellow earth core.

Instrumentation Cables

LJST-HF
150/250 (300) V
(TEMA-TA)



Design

Standards

Marine Cables

Armoured Instrumentation and Telecommunication Cable

Conductor

Stranded annealed plain copper conductor 0,75 mm²

> Insulation

Extruded XLPE

- See page 29 for core identification colours

> Armour (common screen)

Combined electrical and mechanical protection

Braid of copper wires

- Drain conductor

> Sheath

Extruded black halogen free polyolefine, SHF 1

> Construction

IEC 60092-376 and IEC 60092-350

> Materials

IEC 60228 Class 2 (conductor)

IEC 60092-351 (insulation)

IEC 60092-359 (sheath)

> Flame Retardance

IEC 60332-3-22 (cat A) and IEC 60332-1

> Halogen Free Properties

IEC 60754-1 and -2

> Low Smoke Emission

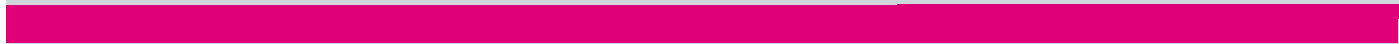
IEC 61034-1 and -2

> Tests

IEC 60092-376

> Maximum conductor temperature +90 °C

> Also available LJST-HF 60 V, n x 2 x 0,5 mm²



Size (n x 2 x 0,75 mm ²)	Conductor Diameter approx. (mm)	Core Diameter approx. (mm)	Screen Diameter approx. (mm)	Diameter approx. (mm)	Cable Weight approx. (kg/km)	Bending Radius min. (mm)
1x2x0,75	1,1	2,2	6,2	8,5	95	50
2x2x0,75 (quad)	1,1	2,2	7,2	9,5	130	55
4x2x0,75	1,1	2,2	11,5	14,0	220	85
7x2x0,75	1,1	2,2	13,0	16,0	320	95
10x2x0,75	1,1	2,2	15,5	19,0	450	115
12x2x0,75	1,1	2,2	17,0	20,5	520	125
14x2x0,75	1,1	2,2	18,0	21,5	590	130
19x2x0,75	1,1	2,2	21,0	24,5	740	150
24x2x0,75	1,1	2,2	23,5	27,5	920	165
37x2x0,75	1,1	2,2	29,0	33,0	1300	200

(quad) construction used in two pair cables:



Electrical data (according to IEC 60092-376)

n x 2 x A mm ²	Conductor resistance at 20 °C max Ω/km	Insulation resistance min MΩ x km
n x 2 x 0,75	26,0	1200

Characteristic properties (approximate values)

Variable	Value	
Working capacitance	single pair	60 nF/km
	multi pair	50 nF/km
Loop inductance	0,7 mH/km	

Instrumentation Cables

LJT-HF
60 V
(TEMA-TO)



Design

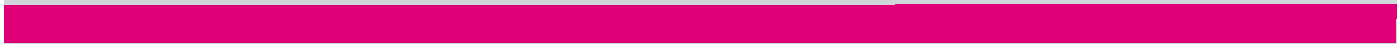
Standards

Marine Cables

Screened Instrumentation and Telecommunication Cable

- > **Conductor**
Stranded annealed plain copper conductor 0,5 mm²
- > **Insulation**
Extruded XLPE
- See page 29 for core identification colours
- > **Common screen**
Plastic coated aluminium tape
- Tinned copper drain wire
- Coverage 100 %
- > **Sheath**
Extruded black halogen free polyolefine, SHF 1

- > **Construction**
IEC 60092-375, -376 and IEC 60092-3
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-375
- > **Maximum conductor temperature +90 °C**



Size (n x 2 x 0,5 mm ²)	Conductor Diameter approx. (mm)	Core Diameter approx. (mm)	Screen Diameter approx. (mm)	Cable Diameter approx. (mm)	Weight approx. (kg/km)	Bending Radius min. (mm)
1x2x0,5	0,9	2,1	4,6	6,6	50	55
2x2x0,5 (quad)	0,9	2,1	5,5	7,5	70	60
4x2x0,5	0,9	2,1	9,0	11,5	125	90
7x2x0,5	0,9	2,1	10,5	13,5	180	110
10x2x0,5	0,9	2,1	13,0	16,0	250	130
12x2x0,5	0,9	2,1	14,0	17,0	300	135
14x2x0,5	0,9	2,1	15,0	18,5	340	150
19x2x0,5	0,9	2,1	17,0	21,0	430	170
24x2x0,5	0,9	2,1	19,5	23,0	530	185
37x2x0,5	0,9	2,1	24,0	27,0	770	215

(quad) construction used in two pair cables:



Electrical data (according to IEC 60092-375)

n x 2 x A mm ²	Conductor resistance at 20 °C max Ω/km	Insulation resistance min MΩ x km
n x 2 x 0,5	40,4	1200

Characteristic properties (approximate values)

Variable	Value	
Working capacitance	single pair	60 nF/km
	multi pair	50 nF/km
Loop inductance	0,7 mH/km	

Instrumentation Cables

HFX-ISOSA/Cu 60 and 250 V (TEMA-TIOA)



Design

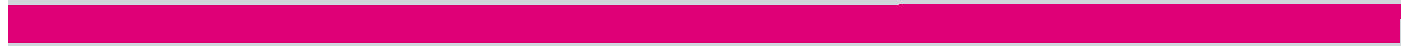
Marine Cables

Individually Screened Instrumentation and Telecommunication Cable

- > **Conductor**
Stranded annealed plain copper conductor
- > **Insulation**
Extruded XLPE
- Number identification of black and blue cores
- > **Screen**
Individual and collective screen of plastic laminated aluminium tape
- tinned copper drain wires
- > **A armour**
Braid of plain copper wires
- > **Sheath**
Extruded orange halogen free polyolefine, SHF 1

Standards

- > **Construction**
IEC 60092-375, -376 and 92-3
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-375, -376
- > **Maximum conductor temperature +90 °C**



Size (n x 2 x n mm)	Conductor		Insulation Thickness nominal (mm)	Core Diameter approx. (mm)	Cable		Bending Radius min. (mm)
	Resistance max. (Ω/km)	Diameter approx. (mm)			Diameter max. (mm)	Weight approx. (kg/km)	
60 V							
2 x 2 x 0,5	40,4	0,9	0,4	1,9	12,2	165	98
4 x 2 x 0,5	40,4	0,9	0,4	1,9	14,4	220	115
7 x 2 x 0,5	40,4	0,9	0,4	1,9	17,2	355	138
10 x 2 x 0,5	40,4	0,9	0,4	1,9	21,1	475	169
14 x 2 x 0,5	40,4	0,9	0,4	1,9	22,9	600	183
19 x 2 x 0,5	40,4	0,9	0,4	1,9	25,4	760	203
24 x 2 x 0,5	40,4	0,9	0,4	1,9	28,7	930	230
30 x 2 x 0,5	40,4	0,9	0,4	1,9	30,5	1100	244
250 V							
2 x 2 x 0,75	26,0	1,1	0,5	2,2	13,6	170	109
4 x 2 x 0,75	26,0	1,1	0,5	2,2	17,0	300	136
7 x 2 x 0,75	26,0	1,1	0,5	2,2	20,1	420	161
10 x 2 x 0,75	26,0	1,1	0,5	2,2	24,9	630	199
14 x 2 x 0,75	26,0	1,1	0,5	2,2	27,1	760	217
19 x 2 x 0,75	26,0	1,1	0,5	2,2	30,1	1000	241
24 x 2 x 0,75	26,0	1,1	0,5	2,2	34,1	1190	273
30 x 2 x 0,75	26,0	1,1	0,5	2,2	36,2	1460	290

Instrumentation Cables

PROFIBUS M-02Y(ST)CHX 100V (TEMA-PROFIBUS)



Design

Marine Cables

Bus-Cable

- > **Conductor**
Bare copper, round stranded R-Cu 58 according to DIN 40500 Part 4, 0,35 mm
- > **Insulation**
Polyethylene foam (cellular HDPE)
- > **Multilayered shield**
Laminated aluminium foil, overlapped
Braided screen of tinned copper wires
- > **Inner Sheath**
Halogen-free polymer HM4 acc. to DIN VDE 0207 Part 24
- > **Outer Sheath**
SHF1 compound according to IEC 60092-359
- > **Identification**
Number of cores:
 - a core red
 - b core green
 - 2 dummy cores

Standards

- > **Ozone**
DIN VDE 0472 Part 805, Test B
- > **Fire retardance**
DIN VDE 0472 Part 805, Test C (based on IEC 60332-3)
- > **Corrosivity of combustion gasses**
DIN VDE 0472 Part 813 (corresponds to IEC 60754-2)
- > **Smoke density**
DIN VDE 0472 Part 816 (corresponds to IEC 61034)
- > **Resistance to chemicals:**
 - diesel fuel to din 51601
 - ASTM oil number 2 to DIN 53521
 - Nato code oils 0-278, BW-TL 9150-0031/2 to VG 95214 Part 4
 - Hydraulic fluids, NATO code H-515, BW-TL 9150-0031/2 to VG 95214 Part 4
 - Solvent cleaning agents, Bw-TL 6850-0017 to 95214 Part4
 - DE-ionozed water to VG 95214 Part4
 - DE-ionized water with 3,5 % NaCl
- > **Test to VG 95218 Part 2**
- > **Maximum conductor temperature +80 °C**

Transmission characteristics

- > **Voltage**
100 V
- > **Conductor resistance 1 km loop at 20 °C**
max. 110 Ω/km
- > **Characteristic impedance**

at 3 to 20 MHz	150 ± 15 Ω
at 38,4 kHz	185 ± 18,5 Ω
at 9,6 kHz	250 ± 25 Ω
- > **Wave attenuation**

at 16 MHz	max. 45 dB/km
at 4 MHz	max. 22 dB/km
at 38,4 kHz	max. 5 dB/km
at 9,6 kHz	max. 3 dB/km
- > **Mutual capacitance at 800 Hz**
max. 30 nF/km
- > **Insulation resistance at 20 °C**
min. 1600 MΩkm
- > **Outer sheath surface resistance min 10⁹ Ω**

Other properties

- > **Ambient temperatures**

During operations as bus cable fixed intallation	-40 to 80 °C
During installation	-10 to 50 °C
Conductor temperature in operation	max. 80 °C
- > **Tensile load during installation**
max. 100 N
- > **Bending radius** **(D = overall diameter)**

Single bending	min 10 x D
Flexing	min 20 x D
- > **Weight**
appr. 109 kg/1000 m

Fire Resistant Cables

LM-FRHF
0.6/1 (1,2) kV
(TEMA-FR)



Design

Standards

Marine Cables

Unarmoured Fire Resistant Power and Control Cable

- > **Conductor**
Annealed stranded plain copper
 - round 1,5 to 16 mm²
 - round compacted 25 to 300 mm²
 - sector shaped in 3-4 cores 25 to 300 mm²
- > **Insulation**
Mica tape with overlap as fire resistant layer
Extruded XLPE
 - see page 29 for core identification colours
- > **Sheath**
Extruded orange halogen free polyolefine, SHF 1
- > **Installation information and electrical data on pages 28-31**

- > **Construction**
IEC 60092-353 and IEC 60092-350
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Fire Resistance**
IEC 60331-21
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-353
- > **Choice and Installation**
IEC 60092-352
- > **Maximum conductor temperature +90 °C**



Size *) (n x mm ²)	Conductor		Insulation Thickness nominal (mm)	Cable		Bending Radius min. (mm)
	Diameter/Height approx. (mm)	Width approx. (mm)		Diameter approx. (mm)	Weight approx. (kg/km)	
POWER CABLES						
1x16	5,0	-	0,7	10,3	215	45
1x25	5,8	-	0,9	11,8	310	50
1x35	6,8	-	0,9	12,8	410	55
1x50	7,9	-	1,0	13,9	530	60
1x70	9,6	-	1,1	16,0	740	65
1x95	11,3	-	1,1	17,7	990	75
1x120	12,7	-	1,2	19,6	1240	80
1x150	14,1	-	1,4	21,6	1520	90
1x185	15,7	-	1,6	23,8	1890	100
1x240	18,1	-	1,7	26,6	2450	160
1x300	20,2	-	1,8	28,9	3020	175
2x1,5	1,6	-	0,7	10,0	95	45
2x2,5	2,0	-	0,7	11,0	125	45
3x1,5	1,6	-	0,7	10,4	120	45
3x2,5	2,0	-	0,7	11,5	160	50
3x4	2,6	-	0,7	12,6	235	55
3x6	3,1	-	0,7	13,8	300	60
3x10	4,0	-	0,7	15,9	450	65
3x16	5,0	-	0,7	18,1	650	75
3x25	5,8	-	0,9	21,0	980	170
3x35	5,6	9,2	0,9	21,7	1230	175
3x50	6,5	10,7	1,0	24,3	1600	195
3x70	7,9	12,8	1,1	27,8	2230	225
3x95	9,3	15,1	1,1	31,4	3010	255
3x120	10,5	17,0	1,2	34,5	3750	280
3x150	11,6	18,9	1,4	38,3	4620	310
4x1,5	1,6	-	0,7	11,4	145	50
4x2,5	2,0	-	0,7	12,4	195	50
4x4	2,6	-	0,7	13,8	290	60
4x6	3,1	-	0,7	15,0	375	65
4x10	4,0	-	0,7	17,4	570	70
4x16	5,0	-	0,7	20,1	800	85
4x25	5,8	-	0,9	27,2	1640	95
4x35	6,2	8,6	0,9	24,7	1620	200
4x50	7,2	9,9	1,0	27,7	2100	225
4x70	8,6	12,0	1,1	31,9	2940	260
4x95	10,2	14,1	1,1	35,7	3970	290
4x120	11,5	15,8	1,2	39,5	4960	320
CONTROL CABLES						
5x1,5	1,6	-	0,7	12,0	175	50
7x1,5	1,6	-	0,7	14,5	250	60
12x1,5	1,6	-	0,7	17,7	370	75
19x1,5	1,6	-	0,7	20,8	550	85
27x1,5	1,6	-	0,7	25,1	770	155
37x1,5	1,6	-	0,7	28,1	1010	170
5x2,5	2,0	-	0,7	13,5	245	55
7x2,5	2,0	-	0,7	16,1	340	65
12x2,5	2,0	-	0,7	19,8	520	80
19x2,5	2,0	-	0,7	23,2	770	95
27x2,5	2,0	-	0,7	28,0	1090	170
37x2,5	2,0	-	0,7	31,5	1440	190

*) Cables are available also as (nG mm²) versions with green/yellow earth core.

Fire Resistant Cables

LSM-FRHF
0.6/1 (1,2) kV
(TEMA-AFR)



Design

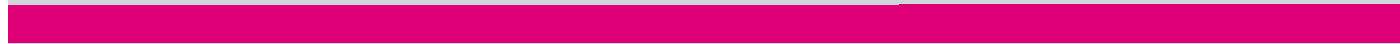
Standards

Marine Cables

Armoured Fire Resistant Power and Control Cable

- > **Conductor**
Annealed stranded plain copper
 - round 1,5 to 16 mm²
 - round compacted 25 to 300 mm²
 - sector shaped in 3-4 cores 25 to 300 mm²
- > **Insulation**
Mica tape with overlap as fire resistant layer
Extruded XLPE
 - See page 29 for core identification colours
- > **Armour**
Braid of copper wires designed to act as collective screen
- > **Sheath**
Extruded orange halogen free polyolefine, SHF1
- > **Installation information and electrical data on pages 28-31**

- > **Construction**
IEC 60092-353 and IEC 60092-350
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Fire Resistance**
IEC 60331-21
- > **Flame Retardance**
IEC 60332-3-22= (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-353
- > **Choice and Installation**
IEC 60092-352
- > **Maximum conductor temperature +90 °C**



Size *) (n x mm ²)	Diameter/Height approx. (mm)	Conductor Width approx. (mm)	Insulation Thickness nominal (mm)	Diameter over Braid approx. (mm)	Diameter approx. (mm)	Cable Weight approx. (kg/km)	Bending Radius min. (mm)
POWER CABLES							
1x16	5,0	–	0,7	8,9	11,4	270	70
1x25	5,8	–	0,9	10,3	13,0	380	80
1x35	6,8	–	0,9	11,2	13,9	475	85
1x50	7,9	–	1,0	12,7	15,6	640	95
1x70	9,6	–	1,1	14,6	17,7	870	110
1x95	11,3	–	1,1	16,3	19,4	1140	120
1x120	12,7	–	1,2	17,9	21,2	1400	130
1x150	14,1	–	1,4	19,8	23,3	1700	140
1x185	15,7	–	1,6	21,8	25,3	2070	155
1x240	18,1	–	1,7	24,4	28,1	2650	170
1x300	20,2	–	1,8	26,7	30,6	3250	185
2x1,5	1,6	–	0,7	8,4	10,8	140	65
2x2,5	2,0	–	0,7	9,5	12,0	180	75
2x4	2,6	–	0,7	10,4	13,0	240	80
3x1,5	1,6	–	0,7	8,9	11,2	170	70
3x2,5	2,0	–	0,7	9,9	12,5	220	80
3x4	2,6	–	0,7	11,1	13,6	280	85
3x6	3,1	–	0,7	12,9	15,6	380	95
3x10	4,0	–	0,7	14,9	17,8	560	110
3x16	5,0	–	0,7	17,1	20,0	770	125
3x25	5,8	–	0,9	19,5	23,0	1200	190
3x35	5,6	9,2	0,9	19,8	23,7	1420	190
3x50	6,5	10,7	1,0	22,2	26,3	1810	215
3x70	7,9	12,8	1,1	25,4	29,8	2450	240
3x95	9,3	15,1	1,1	29,2	33,9	3360	275
3x120	10,5	17,0	1,2	32,0	37,0	4120	300
3x150	11,6	18,9	1,4	35,4	40,8	5030	330
4x1,5	1,6	–	0,7	9,8	12,4	210	75
4x2,5	2,0	–	0,7	10,9	13,4	265	85
4x4	2,6	–	0,7	12,9	15,7	380	95
4x6	3,1	–	0,7	14,1	16,9	465	105
4x10	4,0	–	0,7	16,4	19,3	690	120
4x16	5,0	–	0,7	18,9	22,0	960	135
4x25	5,8	–	0,9	21,9	25,3	1380	155
4x35	6,2	8,6	0,9	22,6	26,7	1830	215
4x50	7,2	9,9	1,0	25,4	29,8	2340	240
4x70	8,6	12,0	1,1	29,1	33,9	3210	275
4x95	10,2	14,1	1,1	33,2	38,2	4360	310
4x120	11,5	15,8	1,2	36,6	42,0	5390	340
CONTROL CABLES							
5x1,5	1,6	–	0,7	11,3	13,8	255	85
7x1,5	1,6	–	0,7	14,0	16,7	385	105
12x1,5	1,6	–	0,7	16,4	19,4	500	120
19x1,5	1,6	–	0,7	19,3	22,5	710	140
27x1,5	1,6	–	0,7	23,3	26,8	960	165
37x1,5	1,6	–	0,7	26,2	29,9	1230	180
5x2,5	2,0	–	0,7	13,0	15,8	375	95
7x2,5	2,0	–	0,7	15,3	18,3	490	110
12x2,5	2,0	–	0,7	18,3	21,5	670	130
19x2,5	2,0	–	0,7	21,6	24,9	950	150
27x2,5	2,0	–	0,7	26,1	29,8	1300	180
37x2,5	2,0	–	0,7	29,3	33,3	1680	200

*) Cables are available also as (nG mm²) versions with green/yellow earth core.

Fire Resistant Cables

LJST-FRHF
150/250 (300) V
(TEMA-TAFR)



Design

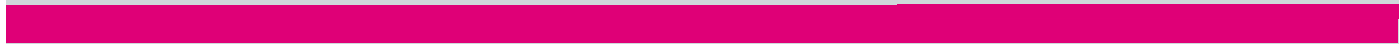
Marine Cables

Armoured Fire Resistant Instrumentation and Telecommunication Cable

- > **Conductor**
Stranded annealed plain copper conductor 0,75 mm²
- > **Insulation**
Mica tape with overlap as fire resistant layer
Extruded EPR, nominal thickness 0,6 mm
- See page 29 for core identification colours
- > **Armour (common screen)**
Braid of copper wires
- drain conductor
- > **Sheath**
Extruded orange halogen free polyolefine, SHF 1

Standards

- > **Construction**
IEC 60092 -376
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Fire Resistance**
IEC 60331-21
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-376
- > **Maximum conductor temperature +90 °C**



Size (n x 2 x 0,5 mm)	Conductor Diameter approx. (mm)	Core Diameter approx. (mm)	Screen Diameter approx. (mm)	Cable Diameter approx. (mm)	Weight approx. (kg/km)	Bending Radius min. (mm)
1x2x0,75	1,1	2,9	6,9	9,2	115	55
2x2x0,75 (quad)	1,1	2,9	8,0	10,4	165	60
4x2x0,75	1,1	2,9	13,4	16,3	335	100
7x2x0,75	1,1	2,9	15,4	18,5	465	110
12x2x0,75	1,1	2,9	19,7	23,2	710	140
19x2x0,75	1,1	2,9	24,0	27,7	1010	165
24x2x0,75	1,1	2,9	26,9	31,1	1240	185
37x2x0,75	1,1	2,9	33,8	37,3	1780	225

(quad) construction used in two pair cables:



Electrical data (according to IEC 60092-375)

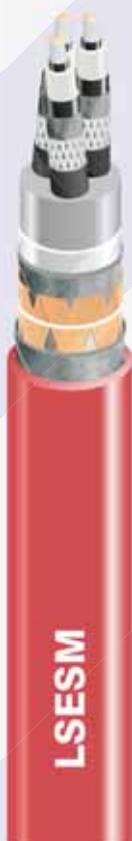
n x 2 x A mm ²	Conductor resistance at 20 °C max Ω/km	Insulation resistance min MΩ x km
n x 2 x 0,75	26,0	1200

Characteristic properties (approximate values)

Variable	Value	
Working capacitance	single pair	60 nF/km
	multi pair	50 nF/km
Loop inductance	0,7 mH/km	

Medium Voltage Cables

LSESM
6/10 (12) kV
(TEMA-A)



Design

Marine Cables

Armoured Medium Voltage Power Cable

- > **Conductor**
Annealed stranded and compressed copper conductor
- > **Insulation**
Extruded off-white EPR-rubber, nominal thickness 3,4 mm
- > **Metallic Screen**
Braid of copper wires
- > **Inner Covering**
Extruded halogen free EPDM compound
- > **Armour**
Braid of copper wires
- > **Sheath**
Extruded red halogen free compound, SHF1

Standards

- > **Construction**
IEC 60092-354 and IEC 60092-350
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-354
- > **Choice and Installation**
IEC 60092-352
- > **Maximum conductor temperature +90 °C**

Size (n x mm ²)	Conductor Diameter approx. (mm)	Core Diameter approx. (mm)	Inner Cover Thickness approx. (mm)	Braid Diameter approx. (mm)	Diameter approx. (mm)	Cable Weight approx. (kg/km)
1x35	7,3	18,5	1,2	22,5	26,4	1290
1x50	8,8	19,9	1,2	23,9	27,8	1480
1x70	10,3	21,1	1,2	25,0	29,2	1740
1x95	12,1	23,1	1,2	27,0	31,2	2080
1x120	13,6	24,6	1,2	28,6	33,0	2410
1x150	15,0	26,9	1,4	31,3	35,9	2850
1x185	16,8	28,2	1,4	32,6	37,2	3250
1x240	19,1	31,1	1,4	35,8	40,6	4110
1x300	21,4	33,8	1,4	38,6	43,6	4750
3x35	7,3	18,4	1,6	44,9	50,6	4370
3x50	8,8	19,8	1,6	48,0	54,0	5040
3x70	10,3	21,0	1,6	50,5	56,8	5950
3x95	12,1	23,0	1,8	55,1	61,6	7190
3x120	13,6	24,5	1,8	58,5	65,4	8390

Size (n x mm ²)	Cross Section (mm ²)	Current rating at +45 °C ambient 1) (A)	Conductor Resistance R _{DC} (Ω/km)			Inductance L (mH/km)	Capacitance C (μF/km)
			at +20 °C	at +45 °C	at +85 °C		
1x35	35	141	0,529	0,581	0,664	0,457	0,280
1x50	50	186	0,391	0,429	0,491	0,438	0,320
1x70	70	229	0,270	0,297	0,339	0,411	0,360
1x95	95	278	0,195	0,214	0,245	0,392	0,400
1x120	120	322	0,154	0,169	0,193	0,379	0,440
1x150	150	369	0,126	0,138	0,158	0,375	0,480
1x185	185	421	0,100	0,110	0,126	0,360	0,530
1x240	240	495	0,0762	0,084	0,096	0,350	0,580
1x300	300	570	0,0607	0,067	0,076	0,343	0,630
3x35	35	104	0,529	0,581	0,664	0,385	0,280
3x50	50	130	0,391	0,429	0,491	0,370	0,320
3x70	70	160	0,270	0,297	0,339	0,345	0,360
3x95	95	194	0,195	0,214	0,245	0,331	0,400
3x120	120	225	0,154	0,169	0,193	0,320	0,440

1) IEC 60092-352 Table B.4 x 0,95 (see also Tables A.1 - A.8)

Size (n x mm ²)	Reactance (Ω/km)		DC	Voltage Drop at +85 °C cos φ = 0,8 (mV/Am)			
	at 50 Hz X ₅₀	at 60 Hz X ₆₀		at 50 Hz		at 60 Hz	
				1-phase	3-phase	1-phase	3-phase
1x35	0,144	0,172	1,328	1,235	1,070	1,270	1,099
1x50	0,138	0,165	0,982	0,951	0,823	0,984	0,852
1x70	0,129	0,155	0,678	0,697	0,604	0,728	0,631
1x95	0,123	0,148	0,490	0,539	0,467	0,569	0,493
1x120	0,119	0,143	0,387	0,452	0,392	0,481	0,417
1x150	0,118	0,142	0,316	0,395	0,342	0,423	0,366
1x185	0,113	0,136	0,251	0,337	0,292	0,364	0,315
1x240	0,110	0,132	0,191	0,285	0,247	0,311	0,270
1x300	0,114	0,137	0,152	0,259	0,224	0,286	0,248
3x35	0,121	0,145	1,328	1,208	1,046	1,237	1,071
3x50	0,116	0,140	0,982	0,925	0,801	0,953	0,825
3x70	0,108	0,130	0,678	0,672	0,582	0,699	0,605
3x95	0,104	0,125	0,490	0,516	0,447	0,541	0,469
3x120	0,101	0,121	0,387	0,430	0,372	0,454	0,393

Medium Voltage Cables

LSESM
12/20 (24) kV
(TEMA-A)



Design

Marine Cables

Armoured Medium Voltage Power Cable

- > **Conductor**
Annealed stranded and compressed copper conductor
- > **Insulation**
Extruded off-white EPR-rubber, nominal thickness 5,5 mm
- > **Metallic Screen**
Braid of copper wires
- > **Inner Covering**
Extruded halogen free EPDM compound
- > **Armour**
Braid of copper wires
- > **Sheath**
Extruded red halogen free compound, SHF1

Standards

- > **Construction**
IEC 60092-354 and IEC 60092-350
- > **Materials**
IEC 60228 Class 2 (conductor)
IEC 60092-351 (insulation)
IEC 60092-359 (sheath)
- > **Flame Retardance**
IEC 60332-3-22 (cat A) and IEC 60332-1
- > **Halogen Free Properties**
IEC 60754-1 and -2
- > **Low Smoke Emission**
IEC 61034-1 and -2
- > **Tests**
IEC 60092-354
- > **Choice and Installation**
IEC 60092-352
- > **Maximum conductor temperature +90 °C**

Size (n x mm ²)	Conductor Diameter approx. (mm)	Core Diameter approx. (mm)	Inner Cover Thickness approx. (mm)	Braid Diameter approx. (mm)	Diameter approx. (mm)	Cable Weight approx. (kg/km)
1x35	7,3	23,1	1,2	27,1	31,3	1640
1x50	8,8	24,5	1,2	28,5	32,9	1860
1x70	10,3	25,9	1,2	29,9	34,3	2160
1x95	12,1	27,9	1,2	32,2	36,8	2560
1x120	13,6	29,4	1,2	34,2	39,0	3010
1x150	15,0	31,5	1,2	36,3	41,1	3430
1x185	16,8	32,8	1,2	37,6	42,6	3860
1x240	19,1	35,5	1,2	40,2	45,5	4630
3x35	7,3	23,0	1,4	55,3	61,8	5850
3x50	8,8	24,4	1,6	58,3	65,0	6690
3x70	10,3	25,8	1,6	61,3	68,4	7740
3x95	12,1	27,8	1,6	65,5	72,9	9080

Size (n x mm ²)	Cross Section (mm ²)	Current rating at +45 °C ambient 1) (A)	Conductor Resistance R _{DC} (Ω/km)			Inductance L (mH/km)	Capacitance C (μF/km)
			at +20 °C	at +45 °C	at +85 °C		
1x35	35	141	0,529	0,581	0,664	0,492	0,200
1x50	50	186	0,391	0,429	0,491	0,472	0,220
1x70	70	229	0,270	0,297	0,339	0,443	0,250
1x95	95	278	0,195	0,214	0,245	0,425	0,280
1x120	120	322	0,154	0,169	0,193	0,413	0,300
1x150	150	369	0,126	0,138	0,158	0,402	0,320
1x185	185	421	0,100	0,110	0,126	0,387	0,350
1x240	240	495	0,0762	0,084	0,096	0,373	0,390
3x35	35	104	0,529	0,581	0,664	0,430	0,200
3x50	50	130	0,391	0,429	0,491	0,412	0,220
3x70	70	160	0,270	0,297	0,339	0,386	0,250
3x95	95	194	0,195	0,214	0,245	0,368	0,280

1) IEC 60092-352 Table B.4 x 0,95 (see also Tables A.1 - A.8)

Size (n x mm ²)	Reactance (Ω/km)		DC	Voltage Drop at +85 °C cos φ = 0,8 (mV/Am)			
	at 50 Hz X ₅₀	at 60 Hz X ₆₀		at 50 Hz		at 60 Hz	
				1-phase	3-phase	1-phase	3-phase
1x35	0,154	0,185	1,328	1,248	1,081	1,285	1,113
1x50	0,148	0,178	0,982	0,963	0,834	0,999	0,865
1x70	0,139	0,167	0,678	0,709	0,614	0,743	0,643
1x95	0,133	0,160	0,490	0,552	0,478	0,584	0,506
1x120	0,130	0,156	0,387	0,465	0,403	0,496	0,430
1x150	0,126	0,152	0,316	0,405	0,351	0,435	0,377
1x185	0,122	0,146	0,251	0,347	0,300	0,376	0,326
1x240	0,117	0,141	0,191	0,294	0,254	0,322	0,279
3x35	0,135	0,162	1,328	1,225	1,061	1,257	1,089
3x50	0,129	0,155	0,982	0,941	0,815	0,972	0,842
3x70	0,121	0,146	0,678	0,688	0,596	0,717	0,621
3x95	0,116	0,139	0,490	0,531	0,460	0,558	0,484

Technical Information

General

The rated voltage of a cable must not be lower than the nominal voltage of the circuit in which it is used. The ambient temperature during operation should be at least 10 °C lower than the maximum conductor temperature allowed to the insulation material.

Rated Voltage

The rated voltages of cables are expressed as $U_0/U(U_m)$ where

- U_0 the rated voltage between the conductor and earth, or between the conductor and the metal screen for which the cable is designed.
- U the rated voltage between the conductors for which the cable is designed.
- U_m the highest system voltage for which the cables may be used

Installation Temperature

The minimum installation temperature for thermoplastic sheathed cables is -15 °C. If, however, the cables are warmed up prior to installation, they can be installed at lower temperatures. Lowest operation temperature -40 °C

Earthing of Braids

Earthing of braids is to be carried out in accordance with the regulations of the classification society.

Bending Radius

The minimum bending radii according to IEC 60092-352 in the final fixed assembly:

Insulation	Outer covering	Overall diameter of cable (D)	Minimum internal radius of bend
Thermoplastic or thermosetting with circular copper conductors	Unarmoured or unbraided	≤25 mm	4D
		≥25 mm	6D
	Metal braid screened or armoured	Any	6D
	Metal wire armoured Metal tape armoured or metal sheathed	Any	6D
Thermoplastic or thermosetting with shaped copper conductors	Composite polyester/metal laminate screened units or collective tape screening	Any	8D
	Any	Any	8D
Medium voltage cable	Any	single core	12D
		3-core	9D

During installation the recommended radius is 1,5 times the value given in the table. Maximum pulling tension $P = 50 \text{ N/mm}^2 \times \text{total conductor cross section mm}^2$ value of the cable.

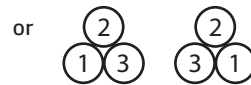
Marine Cables

Special precautions for single core cables for a.c. wiring

Whenever possible, a.c. wiring should be carried out with multicore cables. When it is necessary to use single core cables, they should either be unarmoured or armoured with a non-magnetic material.

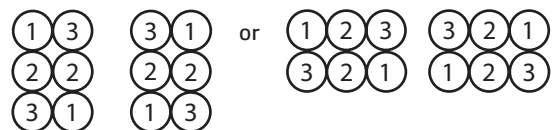
When several multi or single core cables are connected in parallel per phase, they should be of the same type and equal length.

All cables pertaining to the same phase should be alternated with those of the other phases to avoid unequal division of the current. In the case of two cables per phase, for example, the correct dispositions to conform with IEC 60092-352 (phases 1, 2 and 3) are:

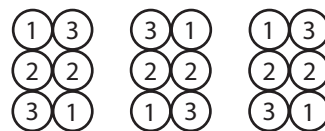


Some other installation examples of single core cables (phases 1, 2 and 3)

Four cables per phase



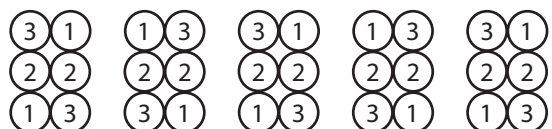
Six cables per phase



or



Ten cables per phase on the same cable tray



Current Rating

Conductor cross section

Current rating for continuous service.
 Conductor temperature max. +90°C, ambient max +45°C.
 According to IEC 60092-352, Table B.4 for 0,6/1 kV cables.
 Up to 6 cables bunched together.

Cores	1	2	3	4	5	7	12	19	27	37
Reduction (mm²)	1,00	0,85	0,70	0,70	0,58	0,52	0,44	0,37	0,33	0,30
	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1,5	23	20	16	16	13	12	10	9	8	7
2,5	30	26	21	21	18	16	13	11	10	9
4	41	35	29	29	24					
6	52	44	36	36	30					
10	72	61	50	50	42					
16	96	82	67	67	56					
25	127	108	89	89	74					
35	157	133	110	110	92					
50	196	167	137	137						
70	242	206	169	169						
95	293	249	205	205						
120	339	288	237	237						
150	389	331	272	272						
185	444	377	311	311						
240	522	444	365	365						
300	601	511	421	421						

Ambient temperature correction factors according to IEC 60092-352

Temperature (°C)	35	40	45	50	55	60	65	70	75
Correction factor	1,10	1,05	1,00	0,94	0,88	0,82	0,74	0,67	0,58

Short time duty and intermittent service load correction factors (according to IEC 60092-352)

Cable diameter D (mm)	Time constant T (min)	Critical duration (rest time between service periods) 3xT (min)	Service time correction factor		Intermittent service correction factor 4 min load + 6 min rest
			30 min	60 min	
5	2,2	6,5	1,058	1,058	1,083
6	2,8	8,3	1,058	1,058	1,127
7	3,4	10	1,058	1,058	1,170
8	4,1	12	1,059	1,058	1,208
9	4,8	14	1,059	1,058	1,242
10	5,5	16	1,061	1,058	1,273
15	9,5	28	1,081	1,059	1,376
20	14	42	1,126	1,066	1,433
25	19	57	1,186	1,081	1,468
30	24	73	1,255	1,105	1,490
35	30	89	1,328	1,137	1,506
40	36	107	1,403	1,173	1,518
45	42	125	1,479	1,212	1,527
50	48	145	1,554	1,254	1,534
60	62	185	1,705	1,341	1,544
70	76	228	1,852	1,432	1,551
80	91	273	1,996	1,522	1,556
90	107	320	2,136	1,613	1,559
100	123	368	2,273	1,702	1,562

Identification Colours

POWER AND CONTROL CABLE CORES

Cable without earth core

Type	N	Line		
2X	Blue	Brown		
3X		Brown	Black	Grey
4X	Blue	Brown	Black	Grey
5...37X	White insulation with black numbers			

Cable with earth core

Type	PE	N	Line		
3G	G Y	Blue	Brown		
4G	G Y		Brown	Black	Grey
5G	G Y	Blue	Brown	Black	Grey
7...37G	White insulation with black numbers + last core green and yellow				

INSTRUMENTATION AND TELECOMMUNICATION CABLE CORES

Pair	Core a White insulation + black number	Core b Blue insulation + black number
1	1	2
2	3	4
N	2 * N - 1	2 * N

Electrical Data

Marine Cables

Cable Type LM-HF, LSM-HF, LM-FRHF, LSM-FRHF (n x mm ²)	Cross Section (mm ²)	Conductor Resistance (IEC 60228) R (Ω/km)			Inductance L (mH/km)
		at +20 °C	at +45 °C	at +85 °C	
1 x 35	35	0,524	0,575	0,658	0,316
1 x 50	50	0,387	0,425	0,486	0,315
1 x 70	70	0,268	0,294	0,336	0,303
1 x 95	95	0,193	0,212	0,242	0,292
1 x 120	120	0,153	0,168	0,192	0,284
1 x 150	150	0,124	0,136	0,156	0,286
1 x 185	185	0,0991	0,109	0,124	0,281
1 x 240	240	0,0754	0,083	0,095	0,276
1 x 300	300	0,0601	0,066	0,075	0,288
2 x 1,5	1,5	12,1	13,289	15,191	0,336
2 x 2,5	2,5	7,41	8,138	9,303	0,313
3 x 1,5	1,5	12,1	13,289	15,191	0,336
3 x 2,5	2,5	7,41	8,138	9,303	0,313
3 x 4	4	4,61	5,063	5,788	0,293
3 x 6	6	3,08	3,383	3,867	0,281
3 x 10	10	1,83	2,010	2,297	0,266
3 x 16	16	1,15	1,263	1,444	0,254
3 x 25	25	0,727	0,798	0,913	0,211
3 x 35	35	0,524	0,575	0,658	0,202
3 x 50	50	0,387	0,425	0,486	0,200
3 x 70	70	0,268	0,294	0,336	0,197
3 x 95	95	0,193	0,212	0,242	0,190
3 x 120	120	0,153	0,168	0,192	0,189
3 x 150	150	0,124	0,136	0,156	0,191
3 x 185	185	0,0991	0,109	0,124	0,193
3 x 240	240	0,0754	0,083	0,095	0,190
3 x 300	300	0,0601	0,066	0,075	0,188
4 x 1,5	1,5	12,1	13,289	15,191	0,359
4 x 2,5	2,5	7,410	8,138	9,303	0,336
4 x 4	4	4,61	5,063	5,788	0,317
4 x 6	6	3,08	3,383	3,867	0,304
4 x 10	10	1,83	2,010	2,297	0,289
4 x 16	16	1,15	1,263	1,444	0,278
4 x 25	25	0,727	0,798	0,913	0,267
4 x 35	35	0,524	0,575	0,658	0,258
4 x 50	50	0,387	0,425	0,486	0,217
4 x 70	70	0,268	0,294	0,336	0,213
4 x 95	95	0,193	0,212	0,242	0,206
4 x 120	120	0,153	0,168	0,192	0,205
4 x 150	150	0,124	0,136	0,156	0,209
4 x 185	185	0,0991	0,109	0,124	0,209
4 x 240	240	0,0754	0,083	0,095	0,206
4 x 300	300	0,0601	0,066	0,075	0,204

Electrical Data

Cable Type LM-HF, LSM-HF, LM-FRHF, LSM-FRHF (n x mm ²)	Reactance (Ω /km)		DC	Voltage Drop at +85 °C os φ =0,8			
	at 50 Hz X50	at 60 Hz X60		at 50 Hz (mV/Am)		at 60 Hz	
				1-phase	3-phase	1-phase	3-phase
1 x 35	0,099	0,119	1,316	1,172	1,015	1,195	1,035
1 x 50	0,099	0,119	0,972	0,896	0,776	0,920	0,796
1 x 70	0,095	0,114	0,673	0,653	0,565	0,675	0,585
1 x 95	0,092	0,110	0,485	0,498	0,431	0,520	0,450
1 x 120	0,089	0,107	0,384	0,415	0,359	0,436	0,378
1 x 150	0,090	0,108	0,311	0,357	0,309	0,379	0,328
1 x 185	0,088	0,106	0,249	0,305	0,264	0,326	0,282
1 x 240	0,087	0,104	0,189	0,255	0,221	0,276	0,239
1 x 300	0,090	0,108	0,151	0,229	0,198	0,251	0,217
2 x 1,5	0,106	0,127	30,382	24,432	21,159	24,458	21,181
2 x 2,5	0,098	0,118	18,606	15,003	12,993	15,026	13,013
3 x 1,5	0,106	0,127	30,382	24,432	21,159	24,458	21,181
3 x 2,5	0,098	0,118	18,606	15,003	12,993	15,026	13,013
3 x 4	0,092	0,111	11,575	9,371	8,115	9,393	8,135
3 x 6	0,088	0,106	7,734	6,293	5,450	6,314	5,468
3 x 10	0,083	0,100	4,595	3,776	3,270	3,796	3,288
3 x 16	0,080	0,096	2,888	2,406	2,084	2,425	2,100
3 x 25	0,066	0,080	1,825	1,540	1,334	1,556	1,347
3 x 35	0,064	0,076	1,316	1,129	0,978	1,144	0,991
3 x 50	0,063	0,075	0,972	0,853	0,738	0,868	0,751
3 x 70	0,062	0,074	0,673	0,612	0,530	0,627	0,543
3 x 95	0,060	0,072	0,485	0,459	0,398	0,474	0,410
3 x 120	0,059	0,071	0,384	0,379	0,328	0,393	0,340
3 x 150	0,060	0,072	0,311	0,321	0,278	0,335	0,291
3 x 185	0,061	0,073	0,249	0,272	0,235	0,286	0,248
3 x 240	0,060	0,072	0,189	0,223	0,193	0,237	0,206
3 x 300	0,059	0,071	0,151	0,192	0,166	0,206	0,178
4 x 1,5	0,113	0,136	30,382	24,441	21,167	24,468	21,190
4 x 2,5	0,106	0,127	18,606	15,011	13,000	15,037	13,022
4 x 4	0,099	0,119	11,575	9,380	8,123	9,403	8,144
4 x 6	0,096	0,115	7,734	6,302	5,457	6,324	5,477
4 x 10	0,091	0,109	4,595	3,785	3,278	3,807	3,297
4 x 16	0,087	0,105	2,888	2,415	2,091	2,436	2,109
4 x 25	0,084	0,101	1,825	1,561	1,352	1,581	1,369
4 x 35	0,081	0,097	1,316	1,150	0,996	1,169	1,013
4 x 50	0,068	0,082	0,972	0,859	0,744	0,875	0,758
4 x 70	0,067	0,080	0,673	0,619	0,536	0,635	0,550
4 x 95	0,065	0,078	0,485	0,465	0,403	0,481	0,417
4 x 120	0,064	0,077	0,384	0,385	0,333	0,400	0,346
4 x 150	0,066	0,079	0,311	0,328	0,284	0,343	0,297
4 x 185	0,066	0,079	0,249	0,278	0,241	0,294	0,254
4 x 240	0,065	0,078	0,189	0,229	0,198	0,245	0,212
4 x 300	0,064	0,077	0,151	0,198	0,171	0,213	0,184

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