



UTEKO

WORLD OF AUTOMATION

sense **connect** control **drive** support



ISO 9001
ISO 14001
BUREAU VERITAS
Certification



About us

- Established in 1972
- Piraeus Port, Greece | Head office & production facility
- Instrumentation & Automation for Marine industry
- Certified Marine type approval by **Lloyd's Register (LR)**
- Quality & Environmentally Certified according to

✓ **ISO 9001:2015**
✓ **ISO 14001:2015**



5 Business Units

USP
Uteco Sensors Production

C&C
Cables & Components

APM
Automation Power & Motion

M&I
Measurement & Instrumentation

Technical Services

USP-Uteco Sensors Production

We Sense



EST 1972

Production of | Temperature Sensors | Level Switches

Marine temperature sensors

- Connection Head type (BM, AM, JG, MS Series)
- Cable type (CB Series)
- Connector type (CON Series)
- Flexible metal sheath type (MIC Series)
- Surface type (SUR Series)
- Customized OEM products



Shipboard applications

- Water & Oil
- Exhaust Gas
- Vapour
- Air
- Bearing
- Surface
- Cylinder Liner
- Cargo
- Incinerators
- Pumps

Level Switches



Accessories



APM- Automation Power & Motion

We drive...



...combining high-tech equipment from renowned brands with a complete Marine Certified Product Portfolio able to meet all marine needs and standards in a variety of applications and operating environments.

- LV AC DRIVES
- MV AC DRIVES
- LV SOFT STARTERS
- MV SOFT STARTERS
- PLC
- HMI
- SCADA
- CONDITION MONITORING
- LV SWITCHGEAR
- LV AC MOTORS
- MV AC MOTORS
- DC MOTORS
- SYNCHRONOUS ALTERNATORS
- POWER TRANSFORMERS
- COLD IRONING POWER SUPPLIES



M&I- Measurement & Instrumentation

We Control

Transmitters & Switches for:

- ✓ Pressure
- ✓ Level
- ✓ Temperature (Transmitters & Converters)
- ✓ Humidity
- ✓ Flow
 - Recorders, Controllers,
 - Liquid Analyzers,
 - Proximity switch, Position Sensors
- Power energy & quality analyzers
- Intrinsic safety barriers & signal conditioners
- Electropneumatic equipment, positioners, control valves, I/P & P/I converters
- ATEX Instrumentation & electrical equipment (Exi, Exd)
- Pressure & Temperature Calibrators



- Bilge and Ballast for cargo ships,
- Energy & Power management,
- Emergency shutdown,
- Heating, ventilation and air conditioning,
- Asset management,
- Vibration monitoring, etc.



C & C – Cables & Components

We Connect

High-end Solutions for all Shipboard Applications

Products and Services Offered :

- Marine & Offshore, Instrumentation Cables
- Energy Cables (Low, Medium and High Voltage cables)
- Broadband Cables (Fiber Optic, Telecommunication, Data, CATV coaxial cables)
- Installation Cables (EMC, Lead sheathed data and energy cables)
- Submarine cables (under water cables Medium Voltage combined with Fibre Optics)



Unique Selling Points

- Medium Voltage Marine Cables Class 5 (very flexible)
- Green Passport issued by Det Norske Veritas (DNV)



PRS Certification



made in Holland



ISO 9001
ISO 14001
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Certification



Technical Services

We Support

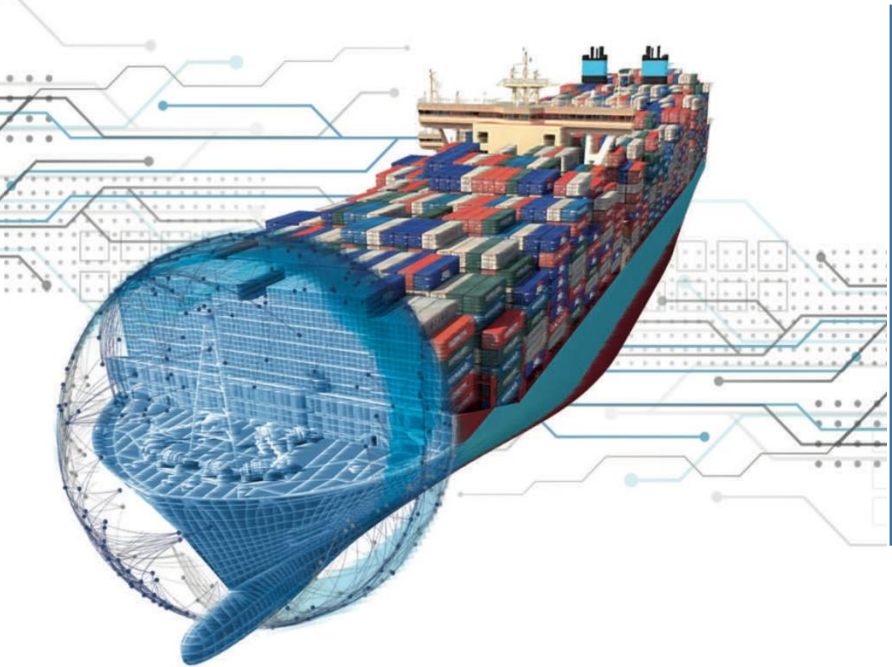
Services Categories

- Telephone Support Service
- Fault Repair Service
- Application registering for a techno-economic solution proposal.
- Technical updates, presentations & customer training.



Represented Firms





MARINE TECHNOLOGY IN 2020:
Smarter and Greener

Marine Cables

The importance of the right selection

Speaker:

Mr. Athanasios M. Athanasopoulos CEO



ΕΛ.Ι.Ν.Τ.
ΕΛΛΗΝΙΚΟ ΙΝΣΤΙΤΟΥΤΟ
ΝΑΥΤΙΚΗΣ ΤΕΧΝΟΛΟΓΙΑΣ

H.I.M.T.
HELLENIC INSTITUTE of MARINE TECHNOLOGY

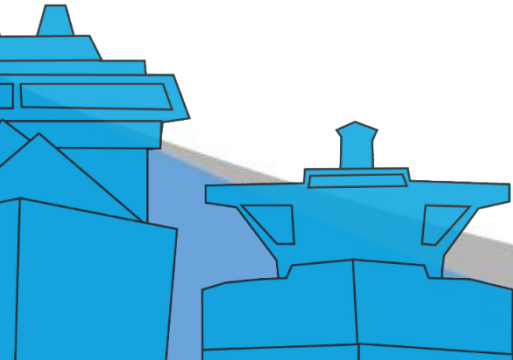


TKF CONNECTIVITY SOLUTIONS



TKF Marine

- Active for more then 45 years in manufacturing marine cables
- Main focus was on clients in the Netherlands
- Now clients worldwide
- Market focus:
 - Specialized High End vessels
 - Work ships (for Offshore)
 - Oil rigs, FPSO
 - Passenger Ships
 - Dredgers
- Yachts....





Why Customers Choose TKF

Large Competence Areas

- Medium Voltage
- Fiber Optics
- Low Voltage
- Communication
- NEK 606 standard

Marine Market Specialists

- R&D
- Sales
- Logistics

World Class Products & Service

- High Quality
- Short Delivery Times & Stocks
- Special Products & Innovation
- Customer Specific Solutions
- Logistics (cutting & labeling...)





Technical Details

- **Standards**
- **Materials**
 - Conductors
 - Insulation
 - Sheathing Material
 - Braiding & screening
- **Product Family**
- **Certificates**
- **Developments**

MarineLine

Unbraided, braided or screened power cables
YZp, YOZp, YZafp 0,6/1kV



MarineLine+

Filled, unbraided or braided power cables
YZp, YOZp 0,6/1kV



MarineFlex

Flexible power cables unbraided or braided
YZP, YOZP 0,6/1kV



MarineLine FR

Fire Resistant power cables unbraided or braided
YZp FR, YOZp FR 0,6/1kV



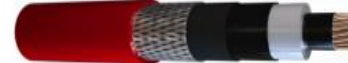
MarineLine+ FR

Fire Resistant power cables unbraided or braided
YZp FR, YOZp FR 0,6/1kV



MarinePower

Medium Voltage cables
YOZmv, YZOZmv 3,6-30kV



MarinePower Multiflex

Flexible Medium Voltage cables for special applications
YQOQmv 6/10kV



MarineCom

Braided or screened twisted pair communication cables
YOZc, YZafc 250V



Marine2Com

Individually screened pair communication cables
YOZ2c, YZaf2c 250V



Marine(2)Com FR

Fire Resistant communication cables
YOZc FR, YOZ2c FR 250V



MarineSignal, MarineSignal+

Signaling cables
YZs, YOZs 250V



Fibre Optic

Multimode or Singlemode Fibre Optic cables, with or without copper braid





TKF CONNECTIVITY SOLUTIONS

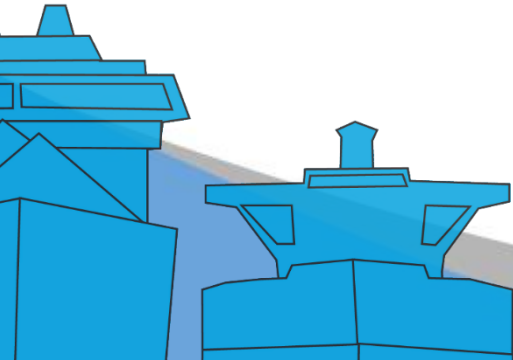
References





TKF CONNECTIVITY SOLUTIONS

References



ΕΛΛΗΝΙΚΕΣ ΚΑΤΑΣΚΕΥΕΣ ΤΕΧΝΙΚΩΝ ΗΛΕΚΤΡΙΚΩΝ ΕΞΟΡΥΣΜΩΝ
HEMEXPO
HELLenic MARINE EQUIPMENT MANUFACTURERS & EXPORTERS



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References



PSV, Brazil, DNV, 64 types, Alianca Shipyard



Transpetro Crude Tanker, Brazil, DNV, 164 KM Maua Shipyard



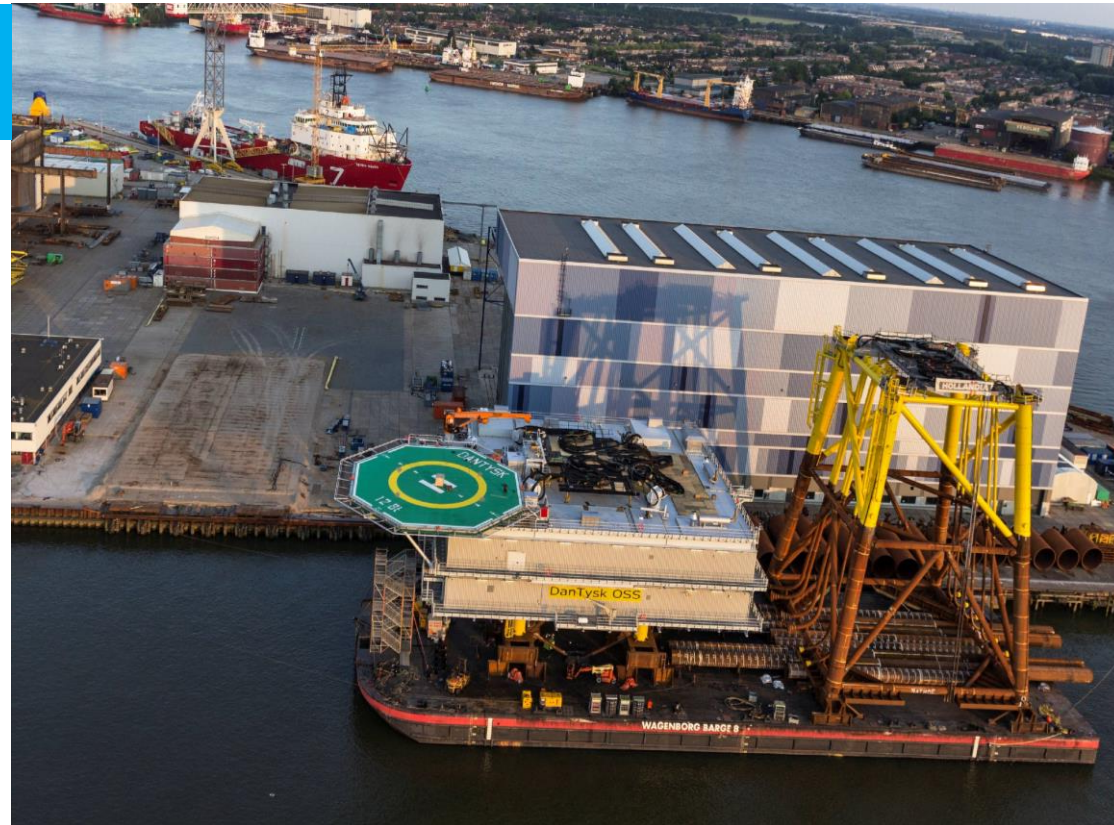
9000 ton ACDC, NL, DNV, 400km



TKF CONNECTIVITY SOLUTIONS

IHC – Seven Seas– Cable + logistic solutions

Strukton/Hollandia – OSS Dan Tysk– Cable + Turn Key delivery of High Voltage connections





Damen Romania –
PSV's WWS –
Shipboard LV +
Instrumentation +
EMC cables





TKF CONNECTIVITY SOLUTIONS

Tennet/ABB – OSS
Dolwin Alpha + Dolwin
Beta – complete
supply of standard +
customized LV, MV,
Instrument cables



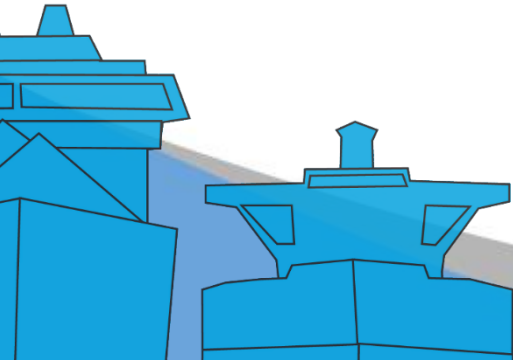


TKF CONNECTIVITY SOLUTIONS

Our Strengths



- **Flexible & Fast**
 - Short production times controlled by state-of-the-art management and production techniques (Theory of Constraints)
 - Very good stock position
 - One roof, one voice – everything is possible
- **Broad portfolio**
- **Logistics solutions for the best customer service**
 - supply chain management, site-logistics, warehousing, cutting and labeling
- **So that the client can focus on building ships, not managing inventory**

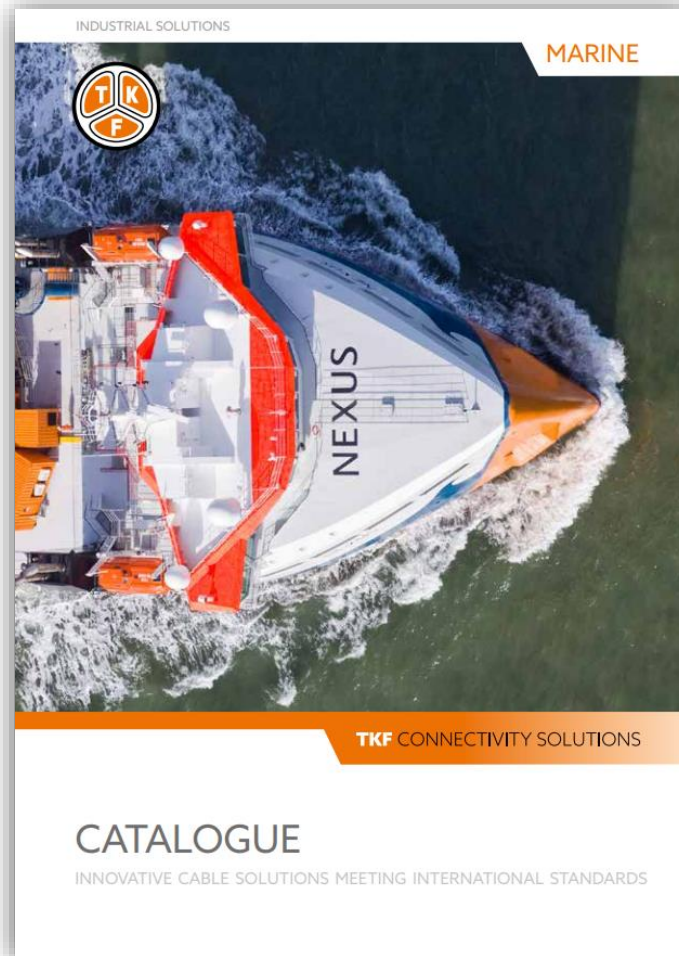




TKF CONNECTIVITY SOLUTIONS

Marine Cables

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sense connect control drivesupport



ΕΛΛΗΝΙΚΕΣ ΚΑΤΑΣΚΕΥΕΣ ΤΕΧΝΗΤΩΝ ΕΞΟΡΥΞΕΩΝ
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Technical standards

Standard	Description
IEC 60092-350	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications
IEC 60092-352	Electrical installation in ships - choice and installation of cable 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 multicore non-radial field power cables with extruded solid insulation for rated voltages 6 kV up to 30 kV
IEC 60092-360	Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables
IEC 60092-376	Cable for control and instrumentation circuits 150/250 Volt
IEC 60228	Conductors of insulated cables

Since july 2015 – PVC is **excluded** in shipbuilding cables, by DNV-GL.





Technical standards

Standard	Description
IEC 60332-1	Tests on electric and optical fibre cables under fire conditions - Part 1-1: Test for vertical flame propagation for a single insulated wire or cable
IEC 60332-3-22	Tests on electric and optical fibre cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A
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 60331-1	Tests for electric cables under fire conditions - Circuit integrity - Part 1: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter exceeding 20 mm
IEC 60331-2	Tests for electric cables under fire conditions - Circuit integrity - Part 2: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage up to and including 0,6/1,0 kV and with an overall diameter not exceeding 20 mm
IEC 60754-1	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content
IEC 60754-2	Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity
IEC 61034	Measurement of smoke density of cables burning under defined conditions
IEC 60811	Common test methods for insulating and sheathing materials of electric cables



Recent norm updates

- IEC 60092-351 & 359; replaced by IEC 60092-360
Excluded PVC insulation and PVC sheath type ST1 (type ST 2 still allowed)
Modified SHF 2 MUD test
- IEC 60092-350, updated in 2014
Reshifting information, modified cold bend & cold shock.
- IEC 60092-353, updated in 2011, expected update in 2016..
Removed PVC insulation and PVC ST 1 sheath.
Added fire integrity to IEC 60331-1/2
- IEC 60092-354, updated in 2014, reshifting information to IEC 60092-350
- IEC 60092-376, update will be expected in 2017.



Marine & Offshore type approvals

- Lloyd's
- Det Norske Veritas
- Bureau Veritas
- Germanischer Lloyd
- American Bureau of Shipping
- Polish Register Statkow
- Other on request.



PRS

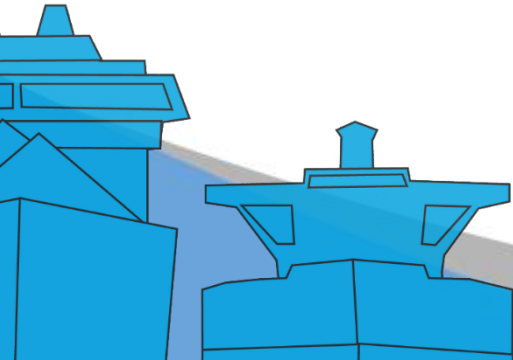




TKF CONNECTIVITY SOLUTIONS

Technical - Conductors

- **In accordance with IEC 60228**
- Class 2 Stranded Copper conductors (standard)
- Class 2 Sector Shaped conductors (type: svs)
 - Smaller cable diameter
- Class 5+ highly flexible conductors (MarineFlex)
 - Easy installation
- TKF Chooses to use a much more flexible construction then specified by the IEC60228 Specification (Class 6)



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Technical – Conductors

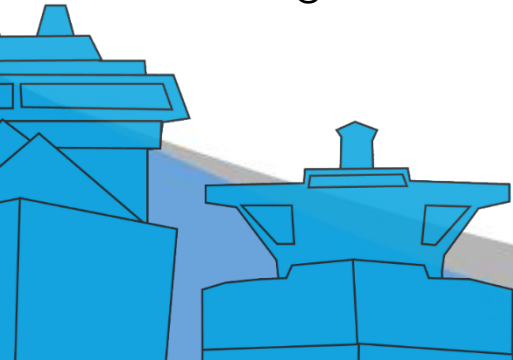
	Class 2 conductors according to IEC 60228		
Conductor size	maximum resistance [Ohm/km]	minimum number of wires	Construction TKF MarineLine
0,5	36,0	7	7x0,25
0,75	24,5	7	7x0,37
1	18,1	7	7x0,43
1,5	12,1	7	7x0,52
2,5	7,41	7	7x0,67
4	4,61	7	7x0,85
6	3,08	7	7x1,04
10	1,83	7	7x1,35
16	1,15	7	7x1,7
25	0,727	7	7x2,13
35	0,524	7	19x1,53
50	0,387	19	19x1,78
70	0,268	19	19x2,13
95	0,193	19	19x2,52
120	0,153	37	37x2,03
150	0,124	37	37x2,25
185	0,0991	37	37x2,52
240	0,0754	37	61x2,25

	Class 5 conductors according to IEC 60228		
Conductor size	maximum resistance [Ohm/km]	Maximum diameter of wires in conductors [mm]	Construction TKF MarineFlex cables
16	1,21	0,41	4x(53x0,3)
25	0,780	0,41	7x(48x0,3)
35	0,554	0,41	19x(23x0,3)
50	0,386	0,41	19x(33x0,3)
70	0,272	0,51	19x(47x0,3)
95	0,206	0,51	19x(62x0,3)
120	0,161	0,51	37x(41x0,3)
150	0,129	0,51	37x(51x0,3)
185	0,1060	0,51	37x(62x0,3)
240	0,0801	0,51	61x(51x0,3)



Technical – Insulation

- High Quality XLPE (cross linked Polyethylene)
- Very high insulation resistance (>20 kV/mm)
- Temperatures:
 - Continuous 90°C
 - Temporary 130°C
 - Short Circuit 250°C
- Brittleness temperature of -50°C
- Low dielectric loss in power cables
- Excellent transmission properties in communication cables
- Halogen free



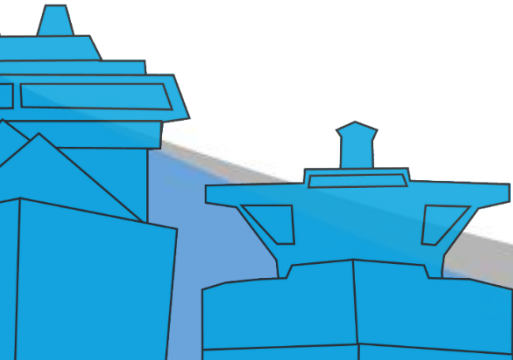


TKF CONNECTIVITY SOLUTIONS

Technical – Insulation

Insulation (in accordance with IEC 60092-360)

- HF90 insulation (crosslinked halogen free flame retardend)
- Used for Marine X-FR cables in combination with mica tape.
 - Continuous 90°C
 - Temporary 130°C
 - Short Circuit 250°C
 - Better circuit integrity performance for IEC 60331-1/2
 - Halogen free





TKF CONNECTIVITY SOLUTIONS

Technical - sheath

Outer Sheath (in accordance with IEC 60092-360)

Polyolefine material (IEC type SHF1)

- Fire Properties
 - Halogen-Free (IEC 60754-1)
 - Flame Retardant (IEC 60332-1, IEC 60332-3-22 Cat. A)
 - Low Smoke (IEC 61034)
 - No Toxic flame-inhibitors
- Chemical Properties
 - Good resistance to oils (ASTM oil 2 – 4 hours 70°C)
 - Aggressive liquids
- Mechanical Properties
 - Excellent abrasion resistance
 - Wide temperature range (installation:-20 +70; use -40 +70)



Special materials like SHF 2 and TPU are available for special applications possible



Technical – armouring

- Tinned copper wire.
 - Mechanical protection
 - Corrosion resistance.
 - 90% coverage density, as according to IEC 60092-350
 - EMI protection while it works as a screen.
- EMC protection
 - Copper tape under braid.
 - 100 % coverage.
 - Also requires proper earthing at both sides of cable.





Technical - Constructions

- Overall:
 - Low Smoke, Zero Halogen, Flame Retardant materials
 - XLPE
- Conductors:
 - Class 2 stranded copper
 - Class 5 stranded copper (Marine Flex)
- Core Identification
 - Power: HD308 S2
 - Com & Signal: Numbered cores
- Braiding
 - Tinned copper wire braid >90% coverage
- Fire Resistant
 - Mica taped conductors
- No hazardous materials
 - Green Passport for all cables (available from DNV website)





TKF CONNECTIVITY SOLUTIONS

Family Overview

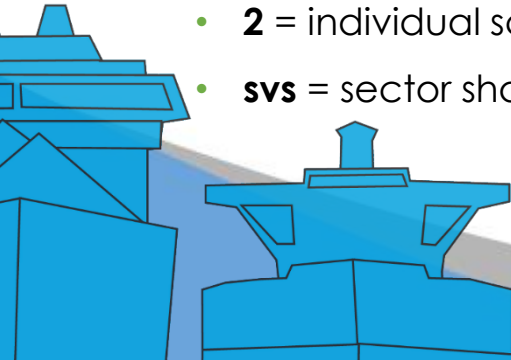
- Low Voltage (0,6/1 & 1,8/3 kV)
MarineLine
MarineLine+
MarineFlex
- Communication Cables (150/250 volt)
MarineCom
Marine2Com
Fiber Optics
- Signal Cables (150/250 volt)
MarineSignal
MarineSignal+
- Medium Voltage 3.6-30kV
MarinePower
- Specials
Extra Flexible Dredger Cables
Fiber Optic for Navy ships
Combined Fiber-optic/signal/power cables
VFD (3 + 3)
EMC





Family Overview abbreviation list

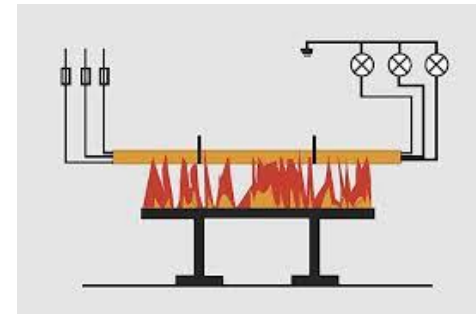
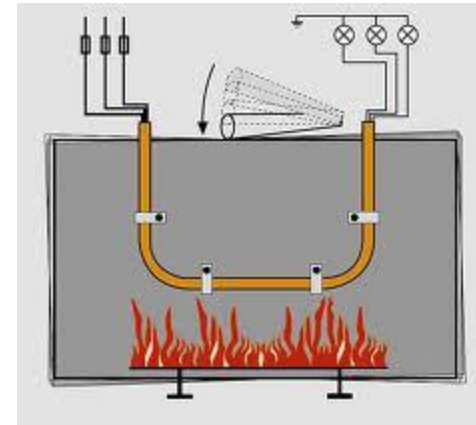
- **Y** = crosslinked insulation
- **O** = armouring
- **Z** = halogen free sheath
- **af** = aluminium foil screen
- **p** = power cable
- **c** = communication cable
- **s** = signal cable
- **mv** = medium voltage cable
- **+** = cable with HFFR filler
- **2** = individual screened
- **svs** = sector shaped conductor





Fire, circuit integrity, abbreviation.

- **X-FR**
 - Fire resistance according to IEC 60331-1/2
 - Cable is bend.
 - Hammer stricke
 - Flame temperature 830°C
- **FR**
 - Fire resistance according IEC 60331-21
 - Flame temperature 750°C
 - Cable is straight





TKF CONNECTIVITY SOLUTIONS

MarineLine Power Cables



**MarineLine
YZp
3 x 2,5 mm²**



**MarineLine
YOZp
3 x 2,5 mm²**



**MarineLine Yzp
X-FR
3 x 2,5 mm²**



**MarineLine
YOZp X-FR
3 x 2,5 mm²**



Marine Line Power Cables

Characteristics:

No filler but tape

- Sector shaped multi cores > 35mm²

Portfolio: Unarmoured, Armoured

- Fire Resistant

Cores	Conductor mm ²
1 - 5	1-300
5-27	1 - 1,5 - 2,5

Advantages:

- Up to 25% Smaller Diameter
- Up to 16% Weight Reduction

Usage:

- Fast ships, Yachts
- Limited installation space

YZp		Competition	TKF	difference
3x1,5	diameter	9	8,5	-6%
	weight	100	92	-8%
3x120	diameter	42,5	34,7	-18%
	weight	3970	3817	-4%



TKF CONNECTIVITY SOLUTIONS

Marine Line & Power Cables



MarineLine+ YZp
3 x 2,5 mm²



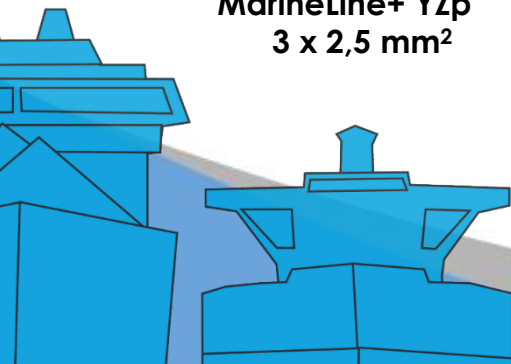
MarineLine+ YOZp
3 x 2,5 mm²



MarineLine+ YZp X-FR
3 x 2,5 mm²



MarineLine+ YOZp X-FR
3x2,5mm²





Marine Line+ Power Cables

- Characteristics:

- FRNC Filler
- Class 2 Cores

- Portfolio:

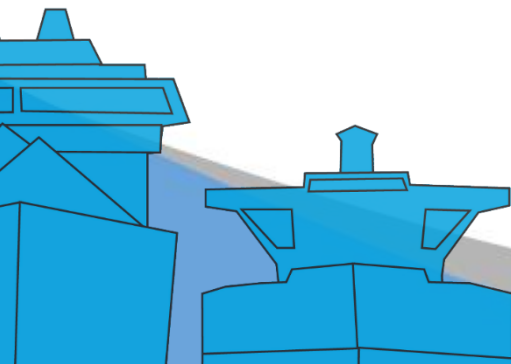
Cores	Conductor mm ²
1-5	1-300

- Advantages:

- Better Impact Resistant
- More Round

- Usage:

- Harsh Environment – Dredgers, Pipe Layers

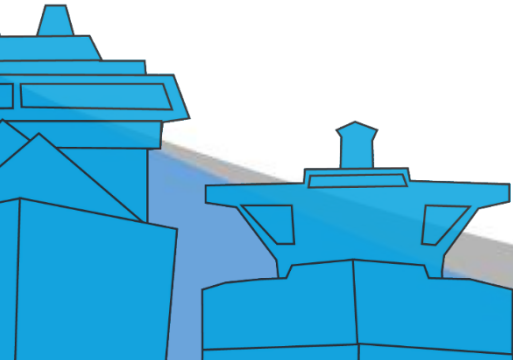




Marine Flex Power Cables

- The Marine Line+ Cables with conductors over 16mm² are Marine Flex class 5 flexible

Marine Flex Yzp	Marine Flex YOZp
3 x 50 mm ²	3 x 50 mm ²





MarineFlex Power Cables

- Characteristics:

- FRNC Filler
- Class 5 Cores

- Portfolio:

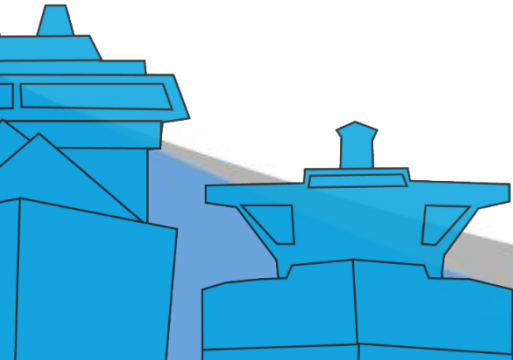
Cores	Conductor mm ²
1 – 5	16 – 300

- Advantages:

- Flexibility, easy to install
- Attractive prices for bigger multi cores
- Save money and time

- Usage:

- Where ease of installation is most important





TKF CONNECTIVITY SOLUTIONS

Marine Signal Cables

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ΕΛΛΗΝΙΚΕΣ ΚΑΤΑΣΚΕΥΕΣ ΤΕΧΝΙΚΩΝ ΗΛΕΚΤΡΙΚΩΝ ΕΞΟΡΥΣΜΩΝ
HEMEXPO
HELLenic MARINE EQUIPMENT MANUFACTURERS & EXPORTERS



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TKF CONNECTIVITY SOLUTIONS

MarineSignal & MarineSignal+



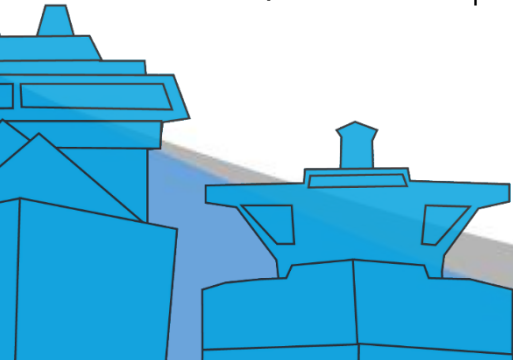
- 250 (300) V Signal Cables
- Numbered Cores
- YZs = Unarmoured
- YOZs = Armoured
- MarineSignal + = Filler
- MarineSignal = no filler
- Max. # conductors = 37



TKF CONNECTIVITY SOLUTIONS

MarineCom YOZc

- 150/250 (300) V Twisted Pair Telecommunication Cable
- Numbered Cores
- Tinned Copper Screen
- Excellent cross-talk properties due to different lay-lengths of pairs in different layers
- From 1-37 pairs
- Conductor 0,5; 0,75; 1,0; 1,5 and 2,5mm²
- 2 pair cable really is 2x2x0,75
- Quads and triples on request





TKF CONNECTIVITY SOLUTIONS

Marine Com YOZc

UTECO
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sense connect control drives support



ΕΛΛΗΝΙΚΕΣ ΚΑΤΑΣΚΕΥΕΣ ΤΕΧΝΙΚΩΝ ΗΛΕΚΤΡΙΚΩΝ ΕΞΟΡΥΣΜΩΝ
HEMEXPO
HELLenic MARINE EQUIPMENT MANUFACTURERS & EXPORTERS



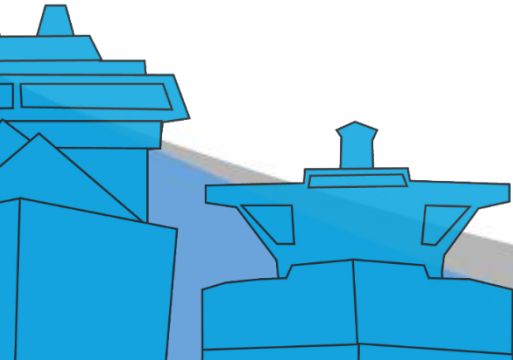
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Marine2Com YOZ2c

- 150/250 (300) V Twisted Pair Telecommunication Cable with individually screened cores
- Aluminium –PET tape for pair screening with drain wire
- Overall ALU-PET tape + Copper Wire braid for overall screening
- From 2-37 pairs
- Conductor 0,50; 0,75; 1,0; 1,5 and 2,5mm²





Comparison Cu and Alu Screening

YOZp= tinned CU wire braid					% Reduction		Yzafp= Alu-foil screen with drain wire				
#	Type	cores	Diam. (mm)	gewicht (kg/km)	% diameter	% Kg	gewicht (kg/km)	Diam. (mm)	#	Type	
16111	MarineLine YOZp 0,6/1 kV	2 x 1,5 mm ²	9	109,589	-10%	-31%	76	8,1	16601	MarineLine YZafp 0,6/1 kV	2 x 1,5 mm ²
16112	MarineLine YOZp 0,6/1 kV	3 x 1,5 mm ²	9,4	130,149	-6%	-23%	100	8,8	16602	MarineLine YZafp 0,6/1 kV	3 x 1,5 mm ²
16113	MarineLine YOZp 0,6/1 kV	4 x 1,5 mm ²	10,2	158,469	-7%	-24%	121	9,5	16603	MarineLine YZafp 0,6/1 kV	4 x 1,5 mm ²
16114	MarineLine YOZp 0,6/1 kV	5 x 1,5 mm ²	11,2	191,068	-8%	-23%	147	10,3	16604	MarineLine YZafp 0,6/1 kV	5 x 1,5 mm ²
16115	MarineLine YOZp 0,6/1 kV	6 x 1,5 mm ²	12,1	220,3	-6%	-19%	178	11,4	16605	MarineLine YZafp 0,6/1 kV	6 x 1,5 mm ²
16116	MarineLine YOZp 0,6/1 kV	7 x 1,5 mm ²	12,2	232,504	-7%	-19%	188	11,4	16606	MarineLine YZafp 0,6/1 kV	7 x 1,5 mm ²
16117	MarineLine YOZp 0,6/1 kV	8 x 1,5 mm ²	13,9	313,796	-5%	-26%	233	13,2	16607	MarineLine YZafp 0,6/1 kV	8 x 1,5 mm ²
16118	MarineLine YOZp 0,6/1 kV	10 x 1,5 mm ²	15,7	401,869	1%	-22%	313	15,8	16609	MarineLine YZafp 0,6/1 kV	10 x 1,5 mm ²
16119	MarineLine YOZp 0,6/1 kV	12 x 1,5 mm ²	16,1	396,749	-7%	-24%	303	15	16611	MarineLine YZafp 0,6/1 kV	12 x 1,5 mm ²
16120	MarineLine YOZp 0,6/1 kV	16 x 1,5 mm ²	18,2	504,479	-7%	-22%	396	17	16615	MarineLine YZafp 0,6/1 kV	16 x 1,5 mm ²
16121	MarineLine YOZp 0,6/1 kV	19 x 1,5 mm ²	19	572,174	-4%	-21%	454	18,3	16618	MarineLine YZafp 0,6/1 kV	19 x 1,5 mm ²
16122	MarineLine YOZp 0,6/1 kV	24 x 1,5 mm ²	21,5	742,236	-5%	-20%	595	20,4	16623	MarineLine YZafp 0,6/1 kV	24 x 1,5 mm ²
16159	MarineLine YOZp 0,6/1 kV	27 x 1,5 mm ²	22,7	785,03	-6%	-21%	621	21,4	16626	MarineLine YZafp 0,6/1 kV	27 x 1,5 mm ²
16124	MarineLine YOZp 0,6/1 kV	2 x 2,5 mm ²	9,9	136,413	-7%	-24%	103	9,2	16631	MarineLine YZafp 0,6/1 kV	2 x 2,5 mm ²
16125	MarineLine YOZp 0,6/1 kV	3 x 2,5 mm ²	10,4	169,907	-7%	-23%	130	9,7	16632	MarineLine YZafp 0,6/1 kV	3 x 2,5 mm ²
16126	MarineLine YOZp 0,6/1 kV	4 x 2,5 mm ²	11,4	207,931	-7%	-21%	164	10,6	16633	MarineLine YZafp 0,6/1 kV	4 x 2,5 mm ²
16127	MarineLine YOZp 0,6/1 kV	5 x 2,5 mm ²	12,4	293,581	-6%	-31%	204	11,7	16634	MarineLine YZafp 0,6/1 kV	5 x 2,5 mm ²
16128	MarineLine YOZp 0,6/1 kV	7 x 2,5 mm ²	14,1	352,844	-10%	-26%	260	12,7	16636	MarineLine YZafp 0,6/1 kV	7 x 2,5 mm ²



TKF CONNECTIVITY SOLUTIONS

UTECO
WORLD OF AUTOMATION
sense connect control drives support

Marine Power Medium Voltage



SAHINES KATASKEVASETES HAYTIAIKOY EZDRAISMOY
HEMEXPO
HELLenic MARINE EQUIPMENT MANUFACTURERS & EXPORTERS



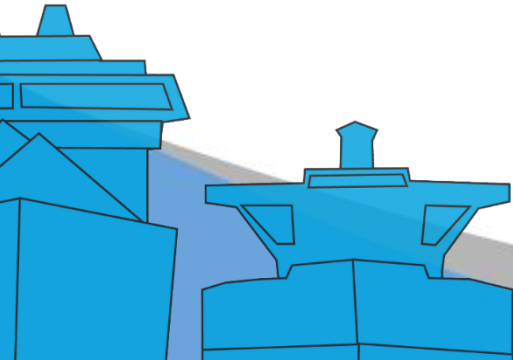
ISO 9001
ISO 14001
BUREAU VERITAS
Certification





Marine Power Medium Voltage

- Medium Voltage Marine Power Cables
- Ranges: 3,6/6 – 18/30 kV
- Class 2 & Class 5 conductors
- XLPE insulation
- Copper Tape conductor screen for multi cores
- Tinned Copper Wire Braid for excellent EMC protection and earthing requirements according to ABB specification





TKF CONNECTIVITY SOLUTIONS

Specials



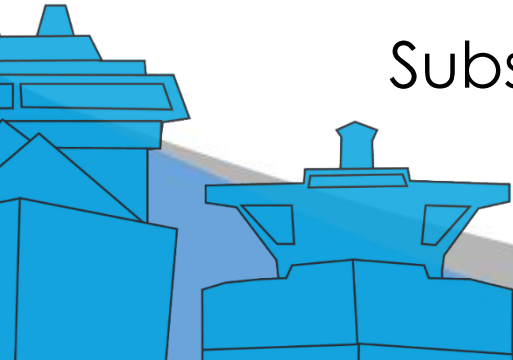
Subsea



Multiflex



Break out

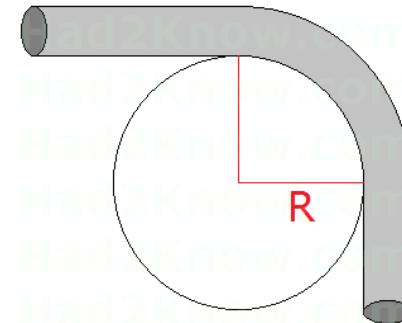




Bending Radii according to IEC 60092-352

Voltage Rating	Cable Construction	Outer Diameter	Bending Radius	TKF Marine Cable Types
<u>Up to 1.8/ 3 kV</u>	Unarmoured	<25 mm	$R = 4 \times D^*$	YZp, YZs
	Unarmoured	>25 mm	$R = 6 \times D$	YZp, YZs
	Armoured/Screened	Any	$R = 6 \times D$	YOZp, YOZs, YOZc
	Foil screened	Any	$R = 8 \times D$	YOZ2c, YZafp, YZafc
<u>>3,6/6kV</u>	Single Core	Any	$R = 12 \times D$	YOZmv
	Triple Core	Any	$R = 9 \times D$	YZOZmv

* For FR types $6 \times D$





Cable handling

Pulling Force

The cable pulling force during installation can be estimated by means of the following formula:

Max. Pulling Force (N) = $15 \times \text{total cross section}$

Pulling instructions

It is recommended to use a sleeve on the cable head when pulling cable into cable trays, to evenly distribute the pulling stress over the whole conductor area of the cable.

When using lubricants to lower the friction in cable pulling a lubricant suitable for Halogen Free cable should be used.

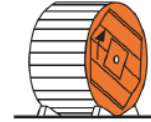
When installing cables in below zero temperatures, installing the cable is greatly eased

when the cable has been stored in a location with a temperature of +15 degrees for at least 24 hours.

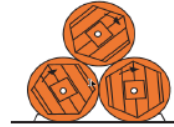
When pulling cable in winter conditions and the reels have been stored outside, please

check the reels for ice buildup and layers of cable frozen together, which could cause damage to the cable when unwinding the reels.

Storage



Keep the drums standing upright, using wedges in the heels of the flanges.



Only drums with protection lagging may be piled flange on flange. Lower layer to be secured over full drum width.



Never lay drums flat.

Transportation



Roll the drum in the direction used during cable reeling.



Drums may be lifted either by crane or fork-lift truck.



De-reeling

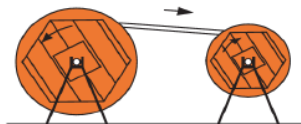


De-reel in this way.



Never de-reel in this way.

Re-winding



Recommended.



Not recommended.



Correction factor for general installations

- Correction factor according: IEC 60092-352

Correction Factors for ambient air temperatures for maximum conductor temperature of 90°C

Air Temperature [°C]	35	40	45	50	55	60	65	70	75	80	85	90
Correction Factors	1.10	1.05	1.00	0.94	0.88	0.82	0.74	0.67	0.58	0.47	-	-



Current rating for general installations

- Current carrying capacities in continuous service at maximum rated conductor temperature of 90 °C in A, at 45° C ambient air temperature, Based on IEC 60092-352 Annex A Table B-4

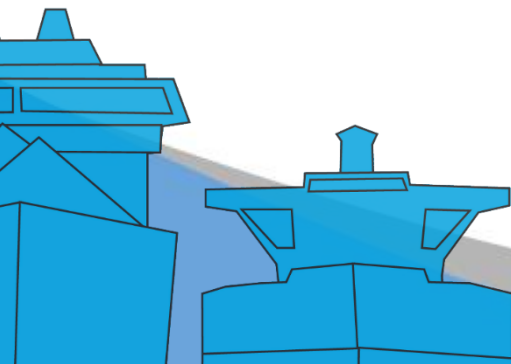
Current Rating [A]			
Cross section [mm ²]	Number of cores loaded		
	1	2	3 & 4
1,5	23	20	16
2,5	40	26	21
4	51	34	28
6	52	44	36
10	72	61	50
16	96	82	67
25	127	108	89
35	157	133	110
50	196	167	137
70	242	206	169
95	293	249	205
120	339	288	237
150	389	331	272
185	444	377	311
240	522	444	365



Voltage (U_0 / U / U_m)

- **U_0**
 - Rated power voltage between conductor and earth or metallic screen for which the cable is designed.
- **U**
 - is the rated power frequency voltage between conductors for which the cable is designed
- **U_m**
 - Is the maximum value of the highest system voltage, which may be sustained
 - under normal operating conditions at anytime and at any point in the system.
 - It excludes transient voltage conditions and rapid disconnection of loads.

U_0	U	U_m
0.6	1	1.2
1.8	3	3.6
3.6	6	7.2
6	10	12
12	20	24
18	30	36





Cable and core identification

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(Z)OZmv 3,6-30 kV	IEC 60092-350/-351/-354	Coloured tape + numbers	red
	MarinePower Multiflex YQOQmv 6/10kV	IEC 60092-350/-351/-354	Coloured tape + numbers	red
Communication	Marine(2)Com Y(O)Z(af)(2)c 250V	IEC 60092-350/-351/-376	Blue/White cores + numbers	grey
	Marine(2)Com Y(O)Z(af)(2)c FR 250V	IEC 60331-11/21	Blue/White cores + numbers	orange
Signal	MarineSignal (+) Y(O)Zs 250V	IEC 60092-350/-351/-376	Black cores + numbers	grey

Different sheath colours on request

Core Identification

Low voltage power cables 0,6/1 kV -1,8/3kV - According to HD308 S2-2001

Cond .	Without Yellow/Green Conductor					With Yellow/Green Conductor (G)				
	N	L1/L2	L/L2	L3	L3	PE	N	L1/L2	L/L2	L3
1										
2										
3										
4										
5										
>5										
			Nr.						Nr.	

- Notes:
- 1) PE = protective conductor - beschermingsleiding - Schutzleiter - conducteur de protection
N = neutral conductor - nulleiding - Neutraleiter - conducteur neutre
L, L1, L2, L3 = phase conductors - faseleidingen - Phasenleiter - conducteurs de phase
 - 2) **Nr.** = black numbered - zwart genummerd - schwarz nummeriert - noir numéroté



Cable and core identification

Communication Cables 250 V

Pairs (n x 2 x y mm ²)	
1	2
3..etc	4..etc

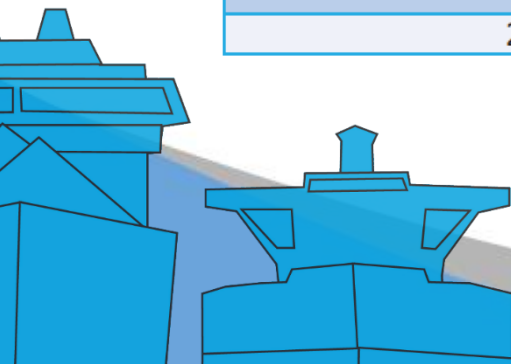
Triples (n x 3 x y mm ²)		
1	2	3
4..etc	5..etc	6..etc

Signal Cables 250 V

Multicores
1
2..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





Quality Assurance

- Semi automated quality monitoring and measurements at every production step
- Every full reel: 100% tested
- Automated logging of all measurement and production data
- ISO 9001 certified and reviewed (KEMA)





Green Passport

MATERIAL DECLARATION

Type 1: SELF DECLARATION

<Date of declaration>
Date: 23-6-2009

<MD ID Number> (DNV will assign a unique number to each MD)

MD-ID-No.

<Other information (e.g. shipbuilder, hull NO if applicable)>

Remark 1

Remark 2

Remark 3

<Supplier (Respondent) information>

Company name TKF, BV Twentsche Kabelfabriek

Division name

Address Spinnerstraat 15, Haaksbergen

Contact person Hans de Boer

Telephone no 00 31 53 57 32 207

Fax no 00 31 53 57 32 288

E-mail address h.deboer@tkf.nl

Is product already Type approved by DNV? Yes No
☒ ☐

<Product information>

Product Name	Product Number	Product Total Mass	Product Information
Shipboard Cable		Mass Unit	Shipboard Power, Signalling & Communication cables

This material information shows the amount of hazardous materials contained in

Unit

<Material information>

Table	Material Name	Threshold level	Intentionally added?	IF YES	IF YES
			State Yes or No	Material Mass	Information on where it is used
				Mass Unit	
Table A	Asbestos	No threshold level	No		
	Polychlorinated Biphenyls (PCBs)	No threshold level	No		
	Chlorofluorocarbons (CFC's)		No		
	Halons		No		
	Other fully halogenated CFC's		No		
	Carbon Tetrachloride		No		
	1,1,1-Trichloroethane	No threshold level	No		
	Hydrochlorofluorocarbons		No		
	Hydrobromofluorocarbons		No		
	Methyl Bromide		No		
	Bromochloromethane		No		
	Organotin compounds				
	Tributyl tin	No threshold level	No		
	Triphenyl tin		No		
	Tributyl tin oxide (TBTO)		No		

Table	Material Name	Threshold level	Intentionally added above the level?	IF YES	IF YES
			State Yes or No	Material Mass	Information on where it is used
				Mass Unit	
Table B	Cadmium & Cadmium Compounds	100 mg/kg	No		
	Hexavalent Chromium and Hexavalent Chromium Compounds	1,000 mg/kg	No		
	Lead and Lead Compounds	1,000 mg/kg	No		
	Mercury and Mercury Compounds	1,000 mg/kg	No		
	Polychlorinated Biphenyls (PCBs)	1,000 mg/kg	No		
	Polychlorinated Biphenyl Ethers (PBCE's)	1,000 mg/kg	No		
	Polychlorinated Biphenyls (PCBs)	No the level	No		
	Radioactive substances	No the level	No		
	Certain Shortchain Chlorinated Paraffins	1%	No		

The object of declaration described above is in conformity with the Guidelines for the development of Inventory of Hazardous Materials IMO MEPC 59/3 dated 9. April 2009.

13.10.2009
(Date, Signature and Company Stamp)

BY TWENTSCHE KABELFABRIEK
P.O. BOX 8
NL - 7480 AA HAAKSBERGEN
TEL: +31 (0)53 573 22 55
FAX: +31 (0)53 573 21 85

IMPORTANT NOTICE: Any significant change in material content may render this declaration invalid. Validity date relates to the DNV Internet publication of declaration.



TKF CONNECTIVITY SOLUTIONS

www.tkf.nl



We sense

We control

We drive

We connect

Onboard...



5-7, M. Mavrogenous Str.
18542 Piraeus, Greece

Tel: +30 211 1206 900
Fax: +30 211 1206 999

E-mail: uteco@uteco.gr

