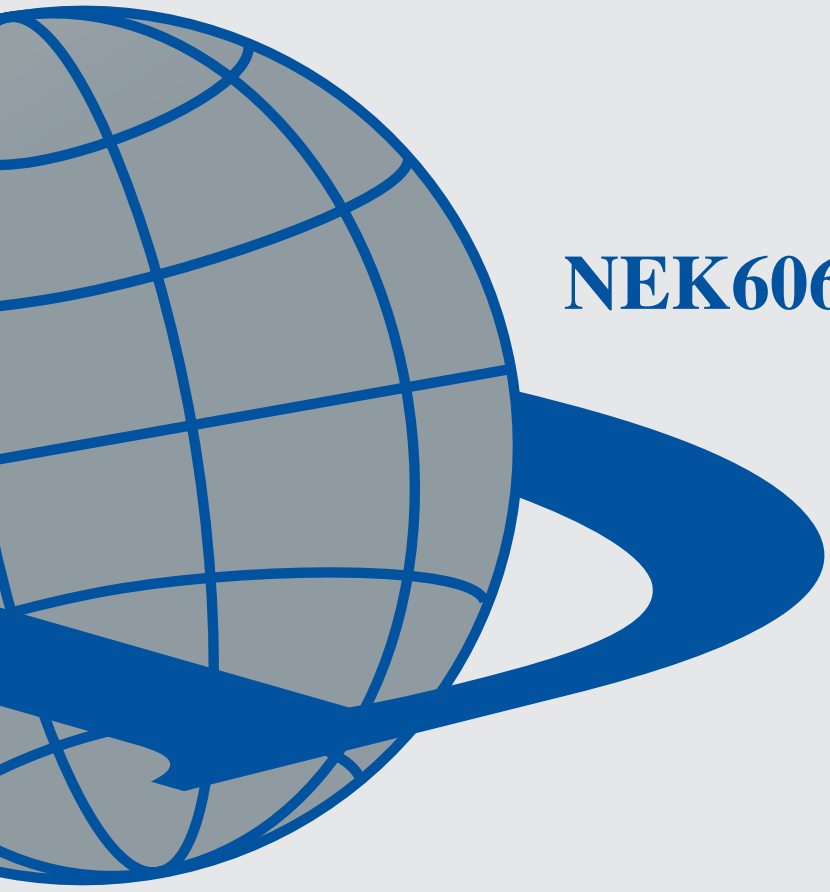
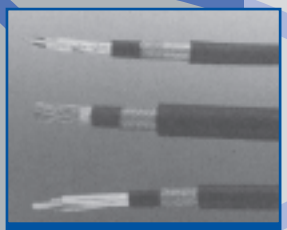
Draka

Draka Cableteq | Marine, Oil & Gas International



NEK606 Technical Data

Draka



Bostrig Type P
MHV and VFD

Offshore

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Colored Conductors Standard
Standard Bostrig Product Meets Crush & Impact Resistant Test
Approvals – ETL, IEEE, UL, ABS, DNV, Lloyds, Transport Canada

Bostrig – Type MHV *High Voltage – Type N (Neoprene Jacket)*

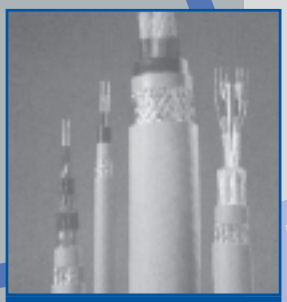
5kV, 8kV, 15kV, 100% OR 133% Insulation Level
Low Smoke Jacket Available

Bostrig – Type VFD

Variable Frequency Drive
3 Conductor, 2kV – Braid Shield, 100ºC Rated

Bostmarine Commercial Shipboard Cable

Type T/N and Type X 600V 90ºC
Type TP Shielded Pairs and T T Triads 600V 90ºC
Lloyd's Approved, UL, IEEE, ABS, USCG

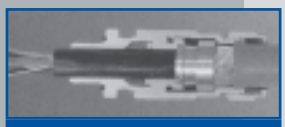


DRAKA IEC
Type 331, 332 and NEK 606

Marine

Draka IEC Cable *Low Smoke, Halogen Free*

Type IEC 60331 Fire Resistant
Type IEC 60332-3 / A Flame-Retardant
Type NEK 606 Mud Resistant



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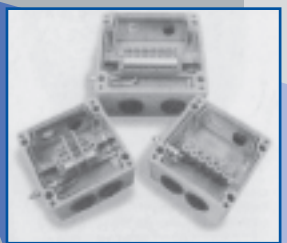

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Offshore Cables
Basic Program
IEC / NEK 606

Index

Approvals

Our cables carry these major approvals:

	DET NORSKE VERITAS	GERMAN ISCHER LLOYD	AMERICAN BUREAU OF SHIPPING	LLOYDS REGISTER OF SHIPPING	ETL	BUREAU VERITAS	USSR REGISTER OF SHIPPING
RFOU 250 V (c) (i)	●	●	●	●	●	●	●
RU 250V (c) (i)	●						
RFOU 0,6/1 kV	●	●	●	●	●	●	●
RFOU 6/10 kV	●				●		
RFOU 12/20 kV	●				●		
RU 0,6/1 kV	●		●	●			
BFOU 250 V (c) (i)	●	●	●	●	●	●	●
BU 250V (i) (c)	●		●	●			
BFOU 0,6/1 kV	●	●	●	●	●	●	●
BU 0,6/1kV	●		●	●			
BFCU 250V (c) (i)	●		●	● *)			
BFCU 0,6/1kV	●		●	● *)			
RFCU 250V (c) (i)	●		●	● *)			
RFCU 0,6/1kV	●		●	● *)			

All cables are designed in accordance with IEC 60092-350, IEC 60092-353, IEC 60092-354 and IEC 60092-376 except those marked with *) . They are designed in accordance with BS 6883

Standards and tests

Standards	Designation Title
IEC 60092-350	Part 350: Shipboard power cables - General construction and test requirements
IEC 60092-351	Part 351: Insulating materials for shipboard and offshore units, power, control, instrumentation, telecommunication and data cables
IEC 60092-352	Part 352: Choice and installation of electrical cables
IEC 60092-353	Part 353: Single and multicore non-radial field power cables with extruded solid insulation for rated voltage 1 kV and 3 kV.
IEC 60092-354	Part 354: Single -and three-core power cables with extruded solid insulation for rated voltages 6 kV (U_m = 7,2kV) up to 30 kV (U_m = 36 kV)
IEC 60092-359	Part 359: Sheathing materials for shipboard power and telecommunication cables.
IEC 60092-376	Part 376: Cables for control and instrumentation circuits 150/250 V (300 V)
IEC 60228	Conductors of insulated cables.
IEC 60331-11	Test for electric cables under fire conditions – Circuit integrity – Part 11 Apparatus – Fire alone at a flame temperature of at least 750°C
IEC 60331-12	Test for electric cables under fire conditions – Circuit integrity – Part 12 Apparatus – Fire with shock at a flame temperature of at least 830°C
IEC 60331-21	Test for electric cables under fire conditions – Circuit integrity – Part 21 Procedures and requirements – Cables of rated voltage up to and including 0,6/1kV
IEC 60331-25	Test for electric cables under fire conditions – Circuit integrity – Part 25 Procedures and requirements – Optical fibre cables
IEC 60331-31	Test for electric cables under fire conditions – Circuit integrity – Part 31 Procedures and requirements for fire with shock – Cables of rated voltage up to and including 0,6/1kV
IEC 60332-1-1	Test on electric and optical fibre cables under fire conditions. Part 1-1 Test for vertical flame propagation for a single insulated wire or cable - Apparatus
IEC 60332-1-2	Test on electric and optical fibre cables under fire conditions. Part 1-2 Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame
IEC 60332-1-3	Test on electric and optical fibre cables under fire conditions. Part 1-3 Test for vertical flame propagation for a single insulated wire or cable – Procedure for determination of flaming droplets/particles
IEC 60332-2-1	Test on electric and optical fibre cables under fire conditions. Part 2-1 Test for vertical flame propagation for a single small insulated wire or cable - Apparatus
IEC 60332-2-2	Test on electric and optical fibre cables under fire conditions. Part 2-2 Test for vertical flame propagation for a single small insulated wire or cable – Procedure

Standards	Designation Title
	for diffusion flame
IEC 60332-3-21	Tests on electric cables under fire conditions . Part 3-21 Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A F/R
IEC 60332-3-22	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 60332-3-23	Tests on electric cables under fire conditions . Part 3-23 Test for vertical flame spread of vertically-mounted bunched wires or cables – Category B
IEC 60332-3-24	Tests on electric cables under fire conditions . Part 3-24 Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C
IEC 60332-3-25	Tests on electric cables under fire conditions . Part 3-25 Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C
IEC 60501-1	Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) - Part 1: Cables for rated voltages of 1 kV (Um = 1,2 kV) and 3 kV (Um = 3,6 kV)
IEC 60754-1	Test on gases evolved during combustion of electrical cables. Part 1: Determination of the amount of halogen acid gas.
IEC 60754-2	Test on gases evolved during combustion of electrical cables. Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity.
IEC 60811	Common test methods for insulating and sheathing materials of electric cables.
IEC 61034-1	Measurement of smoke density of cables burning under defined conditions. Part 1: Test apparatus.
IEC 61034-2	Measurement of smoke density of cables burning under defined conditions. Part 2: Test procedure and requirements.

Definition of terms

Flame retardance

The cables shall withstand the test specified in IEC 60332-3-22.
Single, earth and bonding wires shall withstand the test specified in IEC 60332-1.

Fire resistance

Fire resistant cables shall be tested in accordance with IEC 60331-21 and 31.

Content of halogen

To demonstrate that the cables are halogen-free they shall be tested to IEC 60754-1,2
maximum content of halogen = 5 mg/g.

Smoke Emission

During a cable fire the smoke emission is recommended to have a minimum value of 60%
when tested in accordance with IEC 61034-2

Oil resistance

For cables with thermoplastic sheath material there are no requirements
for oil resistance properties.

All thermoset sheathed cables shall be suitable for an oil production installation.
The oil resistance properties shall be demonstrated by a test according to
IEC 60092-359 SHF-2 with the cable immersed in IRM oil no. 902 at 100°C for 24 hours.

Mud resistance

In accordance with NEK 606 the mud resistant cables shall have a sheath (SHF Mud) that complies with the requirements in IEC 60092-359 for SHF2 and the below specified.

Mud resistant cables shall be designed with sheathing compounds suitable for installation and operation in contact with MUD unless otherwise specified.

The MUD resistance test requirements for sheathing compounds SHF Mud are as follows:

Test fluid	Temperature	Duration	Tensile strength variation	Elongation at break variation	Volume swell variation	Weight increase variation
Mineral oil type IRM 903	100°C	7 d	30%	30%	30%	30%
Calcium Bromide Brine (Waterbased)	70°C	56 d	25%	25%	20%	15%
Carbo Sea (Oil based)	70°C	56 d	25%	25%	20%	15%

Fire, flame, smoke and corrosion test methods

Cables' integrity during a fire

Fire resistance
During a fire it is vital that emergency circuits should continue to function.
This could be communication circuits, emergency lights, alarms and fire pumps, etc.

On oil rigs and platforms and other confined areas this could be a matter of life and death.

Cables that will function in a fire ensuring circuit integrity

BFOU / BFCU / BU cables

These cable types have Mica tape applied around the conductors which is then insualed with heat-resistant XLPE and have and outer sheathing of a halogen-free thermoplastic material. BXOI cables have between the insualtion and outer sheathing a metal braid armour.

Test method
IEC 60331 750°C 3 hours.
As an option we offer cables to 1000°C for 3 hours with an upgraded IEC 60331 test.

Flame propagation

Flame retardant cables must be self-extinguishing when the source of flames dies out.

Flame retardant cables with built-in self-extinguishing properties

These cables have sheathing and bedding with hydrated flame retardants that provide resistance to ignition and flame spread.

Test methods

IEC 60332 - 1
IEC 60332 - 3, category A, B and C.

IEC 60332 - 3 Category	Amount of combustible material in litres per metre of cable ladder	Burning time Minutes
A	7	40
B	3,5	40
C	1,5	20

Smoke risk to personnel

Smoke evolution is of major significance in situations where escape routes are limited in the event of fire.

Cables having exceptionally low smoke emission
All offshore topside cables, halogen-free shipboard cables and fire resistant cables listed in this catalogue, have sheathing and insulation based on halogen-free materials.
To minimise the risk of smoke and toxic gases, each component from conductor tapes to outer sheath has been taken into consideration.

Test method
3 m Cube Test for the measurement of smoke density.
IEC 61034 - 2

Damage to expensive equipment

Corrosion

Halogen-free cables will not cause corrosion to metals.
When halogen - containing cables burn, the gases generated in combustion of the sheathing and insulation may cause corrosion. The secondary effects after a fire are often many times larger than the damages caused by the fire itself.

Test method
IEC 60754 - 1
IEC 60754 - 2

Installation recommendations

The following installation recommendations are in accordance with IEC regulations and practice.

Different regulations may apply in other countries.

Minimum cable bending radius.

Cables for rated voltages up to 0,6/1 kV, in accordance with IEC 60092-352.

Outer diameter of cable	Minimum bending radius when fixed installed		Minimum bending radius during installation
	Unbraided cables	Braided cables	
D < 25mm	4D	6D	8D
D > 25mm	6D	6D	8D

Medium voltage cables up to and including 12/20(24) kV:

Minimum bending radius during installation:	15D
Minimum bending radius when fixed installed:	9D

Installation temperature.

Minimum recommended installation temperature for cables of rated voltage up to 20 kV, such as:

RFOU – BFOU – RU – BU	-20°C

Pulling tension.

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

p = 50 N × total cross section of conductors in the armoured cable

or

p = 25 N × total cross section of conductors in the unarmoured cable

Additional tension will be supplied from the braid and the insulation and sheathing compound.

Electrical data

Conductor Resistance

Resistance formula:

$$R = p \frac{L}{A}$$

R = resistance in ohm per phase

p = specific resistance $\frac{\text{Ohm} \bullet \text{mm}^2}{\text{m}}$

A = conductor area mm², L = conductor length, m

Resistance as a function of temperature:

$R = R_0 (1 + \alpha (t\text{-}20\ °C))$

R = Resistance at t=20°C, t = conductor temperature °C, α = 0,00393 for copper

Conductor resistance tinned annealed copper 250V, 0,6/1kV, 1,8/3(3,6)kV.

In accordance with IEC 60228, class 2. Tinned stranded annealed copper conductors for single core and multi-core cables 250V, 0,6/1kV and 1,8/3kV

Nominal conductor area	No. of wires and diameter of wires	Approx. diam.	Max. resistance pr km	
			20°C	90°C
mm²	mm	mmØ	ohm	ohm
0,5	7x 0,30	0,9	36,7	46,8
0,75	7x 0,37	1,1	24,8	31,6
1	7x 0,43	1,3	18,2	23,2
1,5	7x 0,53	1,6	12,2	15,6
2,5	7x 0,67	2,0	7,56	9,64
4	7x 0,85	2,6	4,70	5,99
6	7x 1,05	3,2	3,11	3,97
10	7x 1,35	4,1	1,84	2,35
16	7x 1,71	5,2	1,16	1,48
25	7 x 2,13	6,6	0,734	0,936
35	19x 1,53	7,7	0,529	0,675
50	19x 1,80	9,1	0,391	0,499
70	19x 2,17	10,9	0,270	0,344
95	37x 1,80	12,6	0,195	0,249
120	37x 2,03	14,2	9,154	0,196
150	37x 2,27	15,9	0,126	0,161
185	37x 2,52	17,7	0,100	0,128
240	61x 2,24	20,2	0,0762	0,0972
300	61x 2,52	22,6	0,0607	0,0774
400	91x 2,36	26,0	0,04475	0,0596
500	91x 2,64	29,0	0,0369	0,0463
630	127x 2,52	32,8	0,0286	0,0359

Conductor resistance, tinned annealed copper conductor 3,6/6(7,2)kV, 6/10(12)kV, 8,7/15(17,5)kV, 12/20(24)kV and 18/30(36)kV.

In accordance with IEC 60228, class 2. Compressed tinned stranded annealed copper conductors for single core and multicore cables 3,6/6kV, 6/10kV, 8,7/15kV, 12/20(24)kV and 18/30(36)kV.

Nominal conductor area	No. of wires and diameter of wires *)	Approx. diam.	Max. resistance pr km	
			20°C	90°C
mm²	mm	mmØ	ohm	ohm
16	7x 1,71	5,2	1,16	1,48
25	7 x 2,14	6,5	0,734	0,936
35	19x 1,53	7,4	0,529	0,675
50	19x 1,80	8,8	0,391	0,499
70	19x 2,17	10,3	0,270	0,344
95	37x 1,80	12,1	0,195	0,249
120	37x 2,03	13,6	9,154	0,196
150	37x 2,27	15,1	0,126	0,161
185	37x 2,52	16,8	0,100	0,128
240	61x 2,24	19,1	0,0762	0,0972
300	61x 2,52	21,5	0,0607	0,0774

*) Diameter of wires before compressing

Wire gauge conversion table

US Standard cross-section to square millimetres

U.S. Standard	Equivalent cross-section mm²	Nearest available cross-section mm²
20 AWG	0.519	0.5 – 0.75
18	0.823	1.0
16	1.31	1.5
14	2.08	2.5
12	3.31	4
10	5.26	6
8	8.37	10
6	13.30	16
4	21.15	25
2	33.62	35
1	42.41	50
1/0	53.49	50 - 70
2/0	67.23	70
3/0	85.01	95
4/0	107.2	120
250 MCM	126.7	120 - 150
300	152.0	150
350	177.3	185
400	202.7	185
450	228.0	185-240
500	253.4	240
550	278.7	240 – 300
600	304.0	300
650	329.4	300
700	354.7	300 – 400
750	380.0	400
800	405.4	400
850	430.7	400
900	456.0	400
950	481.4	400
1000	506.7	400 – 630
1250	633.4	630
1500	760.0	800
1750	886.7	800 – 1000
2000	1013.4	1000

Current ratings for 250V and 0,6/1kV cables in fixed installations.

Current carrying capacities in continuous service at maximum rated temperature of 90°C.
In accordance with IEC 60092-352 (2005) Annex B, Table B.4. Ambient temperature 45°C

Conductor area mm²	1-core Amp	2-core Amp	3-4 core Amp
1	18	15	13
1,5	23	20	16
2,5	30	26	21
4	40	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	273
185	444	377	311
240	522	444	366
300	601	511	420
400	719	611	503
500	827	703	579
630	955	812	669

For cables with more than 4 cores, the current ratings are given by the following formula:

$$I = \frac{I_1}{\sqrt[3]{N}}$$

I_1 = current rating for single core
N = number of cores

No. of cores	1,5 mm² Amp	2,5 mm² Amp
5	13	18
7	12	16
12	10	13
19	9	11
24	8	10
37	7	9

Current rating for 1,8/3(3,6)kV, 3,6/6(7,2)kV, 6/10(12)kV, 8,7/15(17,5)kV, 12/20(24)kV and 18/30(36)kV cables in fixed installations.

Current carrying capacities in continuous service at maximum rated temperature of 90°C.
In accordance with IEC 60092-352 (2005) Annex B, Table B.4.

Conductor area mm²	1-core Amp	2-core Amp	3-4 core Amp
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	273
185	444	377	311
240	522	444	366
300	601	511	420
400	719	-	-
500	827	-	-
630	955	-	-

The tabled current ratings must be adjusted for ambient air temperatures other than 45°C.

Appropriate rating factors are:

Ambient air temp. °C	35	40	45	50	55	60	65	70	75	80
Rating factors	1,10	1,05	1,00	0,94	0,88	0,82	0,74	0,67	0,58	0,47

Short circuit ratings

The following short circuit currents are for cables normally operating at a maximum conductor temperature of 85°C.

The theoretical temperature that arises in the conductor during a short circuit, which is used as a basis of the calculation, is 250°C. EPR and XLPE insulation are capable of withstanding short term temperatures up to 250°C.The short circuit currents for copper conductors given in the table are values for one second, for other durations the current may be calculated from the following formula:

$$I_t = \frac{I}{\sqrt{t}}$$

I_t = short ciricut current for t sec. (Amp),
I = short circuit current for one sec. (Amp),
t = short circuit duration (sec.)

The duration of the short circuit based on these assumptions should be between 0,2 sec. and 5 sec.

Conductor area mm²	Current 1 second amperes	Conductor area mm²	Current 1 second amperes
1,0	140	70	9800
1,5	210	95	13300
2,5	350	120	16800
4	560	150	21000
6	840	185	25900
10	1400	240	33600
16	2240	300	42000
25	3500	400	56000
35	4900	500	70000
50	7000	630	88200

Reactance

The reactance of a cable operating in an AC system depends on many factors, including, in particular, the axial spacing between conductors and the proximity and magnetic properties of adjacent steelwork. The former is known for multicore cable, but may vary for single core cables depending upon the spacing between them and their disposition when installed. Reactance of cables in certain disposition when installed. Reactance of cables in certain dispositions remote from steelwork are calculable and are shown. The tabulated values are for cables with circular conductors. The value for a sector-shaped conductor should be taken as 90% of the calculated value.

Induction for 2-, 3- and 4- conductor cables is given by the formula:

$$L = 0{,}2 * \left(\ln \left(\frac{2a}{d} \right) + 0{,}25 \right) * 10^{-6}$$

L = Induction in H/m and phase, a = Axial space between conductors in mm.
d = conductor diameter in mm.
Reactance for 2-, 3- and 4-conductor cables is given by the formula:

$X = 2 * \pi * f * L * I$

X = Reactance in ohm pr. Phase, f = frequency in Hz, L = Induction in H/m and phase
I = Conductor length in meter.

Reactance Values for Cables

Power and control cables. RFOU 0,6/1 kV

Cross-section mm²	2-, 3- and 4 cores ohm/km 60 Hz	50 Hz	1- core* ohm/km 60 Hz	50 Hz
1,5	0,132	0,110		
2,5	0,123	0,103		
4	0,115	0,096		
6	0,108	0,090		
10	0,101	0,084		
16	0,096	0,080	0,139	0,116
25	0,095	0,079	0,134	0,112
35	0,092	0,076	0,127	0,106
50	0,092	0,076	0,123	0,103
70	0,091	0,075	0,120	0,100
95	0,088	0,073	0,116	0,097
120	0,086	0,072	0,113	0,094
150	0,087	0,072	0,110	0,092
185	0,086	0,072	0,109	0,091
240	0,086	0,072	0,109	0,090
300	0,086	0,071	0,107	0,089

*) Reactance for 1-conductor cables given at Three- foil formation

Power and control cables, BFOU 0,6/1 kV.

Cross- section mm²	2-, 3- and 4 core ohm/km 60 Hz	50 Hz	1- core* ohm/km 60 Hz	50 Hz
1,5	0,138	0,115		
2,5	0,129	0,107		
4	0,120	0,100		
6	0,112	0,094		
10	0,105	0,088		
16	0,099	0,082	0,144	0,120
25	0,098	0,081	0,135	0,113
35	0,094	0,078	0,129	0,107
50	0,093	0,078	0,125	0,104
70	0,092	0,077	0,121	0,101
95	0,090	0,075	0,117	0,098
120	0,088	0,073	0,112	0,094
150	0,088	0,073	0,112	0,094
185	0,088	0,073	0,109	0,091
240	0,087	0,072	0,109	0,091
300	0,086	0,072	0,108	0,090

*) Reactance for 1-conductor cables given at Three- foil formation

Medium Voltage Power cables. RFOU 6/10 kV

Cross-section mm²	3 core ohm/km 50 Hz	3 core ohm/km 60 Hz	1- core* ohm/km 50 Hz	1- core* ohm/km 60 Hz
16	0.119	0.143	0.154	0.185
25	0.119	0.143	0.144	0.173
35	0.114	0.137	0.138	0.166
50	0.108	0.130	0.132	0.158
70	0.103	0.124	0.125	0.150
95	0.098	0.118	0.119	0.142
120	0.095	0.114	0.116	0.139
150	0.092	0.111	0.111	0.133
185	0.092	0.111	0.108	0.130
240	0.087	0.104	0.104	0.125
300	0.084	0.101	0.104	0.124
400	-	-	0.090	0.118
500	-	-	0.097	0.117
630	-	-	0.092	0.110

*) Reactance for 1-conductor cables given at Three- foil formation

Medium Voltage Power cables. RFOU 12/20(24)kV.

Cross-section mm²	3 core ohm/km 50 Hz	3 core ohm/km 60 Hz	1-core* ohm/km 50 Hz	1-core* ohm/km 60 Hz
35	0.128	0.153	0.149	0.178
50	0.121	0.145	0.140	0.169
70	0.115	0.135	0.133	0.160
95	0.109	0.131	0.127	0.152
120	0.105	0.126	0.124	0.149
150	0.102	0.122	0.119	0.142
185	0.099	0.118	0.116	0.139
240	0.095	0.114	0.112	0.134
300	-	-	0.108	0.130

*) Reactance for 1-conductor cables given at Three- foil formation

Impedance

Induction for 2-, 3- and 4- conductor cables is given by the formula:

$Z = \sqrt{(R^2 + X^2)}$

Z = Impedansce in ohm pr. phase, R = Resistance at operating temprature in ohm pr. phase.

X = Reactance in ohm pr. phase.

Electrical characteristics for instrumentation and telecommunication cables such as 250 V cables: RFOU and BFOU *according to IEC 60092-376*

Cables with collective screen

Type	Capacitance, approx. (nF/km)	Inductance, approx, (mH/km)	Resistance at 20°C, max. (Ohm/km)	L/R ratio, (microH/Ohm)
Unshielded pair 0,75 mm²	100	0,67	24,8	14,3
Unshielded triple 0,75 mm²	100	0,67	24,8	14,3
Unshielded pair 1,5 mm²	110	0,63	12,2	26,6
Unshielded triple 1,5 mm²	110	0,63	12,2	26,6
Unshielded pair 2,5 mm²	125	0,59	7,56	39,0
Unshielded triple 2,5 mm²	125	0,59	7,56	39,0

Cables with individually screened pair/triples

Type	Capacitance, approx. (nF/km)	Inductance, approx, (mH/km)	Resistance at 20°C, max. (Ohm/km)	L/R ratio, (microH/Ohm)
Shielded pair 0,75 mm²	110	0,67	24,8	14,3
Shielded triple 0,75 mm²	110	0,67	24,8	14,3
Shielded pair 1,5 mm²	125	0,63	12,2	26,6
Shielded triple 1,5 mm²	125	0,63	12,2	26,6
Shielded pair 2,5 mm²	145	0,59	7,56	39,0
Shielded triple 2,5 mm²	145	0,59	7,56	39,0

Material properties

Polymeric materials used in cables for ships and offshore topside installations

For 25 years Draka Norsk Kabel has been facing the same challenge :

The increasing severe performance criteria demands from our ship and offshore customers.

Elastomers are the major part of our cable construction.
The insulation, bedding and sheathing have been developed through intensive research and development to meet the offshore and ship industry's specific and stringent requirements.

This information is not intended to give you details of the elastomers in use.
For correct selection and application of materials our technical representatives will be pleased to provide you with more complete information.

EP - rubber (EPDM)
EPDM is a hydrocarbon rubber that combines electrical performance suitable for fire resistant offshore cables with mechanical toughness and resistance to ozone, UV light and heat.
It's wet electrical properties are unique.

Applications : Wire insulation
Bedding compounds

Flame retardant halogen-free termoset compound (EVA)
EVA, ethylene vinyl acetate, is a multi-functional elastomer,
which resists the combined deteriorating influences of heat, oil and weather.
(In accordance with IEC 60092-359 type SHF2). For offshore applications, EVA can be compounded to produce high quality cable sheathing with low smoke and flame propagation, and with no emission of halogenous acids.

Applications : Cable sheathing on offshore oil platforms,
ships, hotels and in rooms with expensive equipment, which must not be subjected to corrosion damage.

Low smoke , Flame retardant , Halogen-free and Thermoplastic compounds , HFFR.

When PVC is not acceptable due to the problems chlorine (halogen) containing materials present in the event of a fire HFFR must be used.
(In accordance with IEC 60092-359 type SHF1).

Our HFFR materials will not propagate a fire along a cable run, drip or give off black smoke.
No acid gases will be released during a fire that can corrode and damage expensive equipment.

Applications: Cable sheating for
Rooms with IT equipment
high - rise buldings (hotels)
hospitals
Telephone exchanges
subway systems, airports and many others.

Core colours for cables according to NEK 606

Instrumentation and communications cable for fixed installation (conductor size from 0,75 mm² and above) such as RFOU, BFOU, RU and BU 250V.

Pair: Black -- Light blue
Triple: Black -- Light blue - Brown

Pairs and triples are identified by numbered tape with printed black numbers or by numbers printed directly on the insulated conductors.

Power and control cables for fixed installation, such as RFOU, BFOU, RU and BU 0,6/1kV

1-core : Off-white
2-cores: Off-white - Black
3-cores: Off-white - Black - Red
4-cores: Off-white - Black - Red - Blue
5-cores: Off-white - Black - Red - Blue - Black

Above 5-cores : Black numbers on white base.
Separate earth conductor (if any): Yellow/green.

From Q3 2007 the core colours on RFOU, BFOU, RU and BU 0,6/1kV will be changed to follow Cenelec HD 308S2 colours:

One core:	*Black*
Two cores:	*Blue – Brown*
Two cores + earth	*Blue – Brown – Yellow/green*
Three cores:	*Brown - Black – Grey*
Three cores + earth	*Brown - Black – Grey – Yellow/green*
Four cores:	*Blue - Brown - Black– Grey*
Four cores + earth	*Blue - Brown - Black– Grey – Yellow/green*
Five cores	*Blue - Brown - Black– Grey - Black*

Above 5-cores : Black numbers on white base.

Medium Voltage cables for fixed installation, RFOU

1-core : Off-white insulation + black semi-conductive layer.

3-cores : Off-white insulation + black semi-conductive layer identified by White-Black-Red threads under and over the metallic screen on each individual core.

Separate earth conductor (if any): Yellow/green

SHF1 versus SHF2

The table below addresses only some main characteristics differences. For complete information see IEC60092-359

	SHF1	SHF2
Type of material	Halogen-free Thermoplastic	Halogen-free Elastomeric or thermosetting material
Some main characteristics		
Mechanical characteristics after immersion in hot oil (IEC 60811-2-1, clause 10)* * If oil resistance is required for a halogen-free compound, SHF 2 compound is recommended.	No requirements	100 °C for 24 hours: • ±40% maximum variation in tensile strength: • ±40% maximum variation in elongation at break
Hot set test (IEC 60811-2-1, clause 9)	No requirements	200 °C, 15 min time under load with 20 (N/mm²) mechanical stress: • 175% Maximum elongation under load • 25% Maximum permanent elongation after cooling
Pressure test at high temperature IEC 60811-3-1, subclause 8.2)	80 °C, 4-6 min under load depending on cable diameter: • 50% Maximum permissible deformation	No requirements
Heat shock test (IEC 60811-3-1, subclause 9.2)	150 °C) 1h duration:	No requirements
Ozone resistance test IEC 60811-2-1, clause 8 (Alternative test method may be used in some countries for legal reasons)	No requirements	25 ± 2°C for 24 h: • Max 0,025 to 0,030 % ozone concentration (in volume)

Core colours for cables according to NEK 606

Please look at the actual page for each cable type.

Instrumentation and communications cable for fixed installation (conductor size from 0,75 mm² and above) such as RFOU, BFOU, RU and BU 250V.

Pair: Black -- Light blue
Triple: Black -- Light blue - Brown

Pairs and triples are identified by numbered tape with printed black numbers or by numbers printed directly on the insulated conductors.

Power and control cables for fixed installation, such as RFOU, BFOU, RU and BU 0,6/1kV

1-core : Off-white
2-cores: Off-white - Black
3-cores: Off-white - Black - Red
4-cores: Off-white - Black - Red - Blue
5-cores: Off-white - Black - Red - Blue - Black

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Two cores:	***Blue – Brown***
Two cores + earth	***Blue – Brown – Yellow/green***
Three cores:	***Brown - Black – Grey***
Three cores + earth	***Brown - Black – Grey – Yellow/green***
Four cores:	***Blue - Brown - Black– Grey***
Four cores + earth	***Blue - Brown - Black– Grey – Yellow/green***
Five cores	***Blue - Brown - Black– Grey - Black***

Above 5-cores : Black numbers on white base.

Medium Voltage cables for fixed installation, RFOU

1-core : Off-white insulation + black semi-conductive layer.

3-cores : Off-white insulation + black semi-conductive layer identified by White-Black-Red threads under and over the metallic screen on each individual core.

Separate earth conductor (if any): Yellow/green

Drum capacity in meters

Free space mm.	30	30	30	30	30	30	30	40	50	60	60	60	60	70	70	80	90	100	Free space mm
Drum No:	R5	R6	R6T	R8	R9	R10	R10A	R11	R12	R14	R14A	R16	R16A	R18	R20	R22	R24	R26	Drum No:
Overall cable diam.mm																			Overall cable diam.mm
10	360	720	850	1470															10
12	250	500	565	1020	1440														12
14	185	370	425	770	1105	1520													14
16		280		550	825	1160		1335											16
18				450	620	920	570	1010	1510										18
20				375	510	745	460	850	1100	1565	1065								20
22					420	615	380	700	885	1925	880	1645							22
24					340	515	320	580	830	1075	740	1380	870						24
26						440	270	470	685	905	630	1175	740	1485					26
28						380	235	440	555	745	540	985	635	1255	1685				28
30						330	205	345	525	705	470	930	555	1045	1375				30
32							180	330	410	560	415	755	490	980	1300	1565			32
34							160		395	545	370	735	430	825	1105	1350			34
36							140		370	420	330	580	385	765	1035	1265			36
38							130		285	405	295	560	345	630	860	1070	1570		38
40							115			390	265	445	310	605	830	1035	1355	2060	40
42										300	240	430	285	485	640	820	1255	1870	42
44										285	220	410	260	460	620	790	1065	1700	44
46											200	390	235	440	595	760	1025	1560	46
48											185	315	215	445	595	635	895	1430	48
50											170	300	200	340	460	605	855	1320	50
52											160	285	185	320	440	580	820	1220	52
54											145	285	170	320	420	550	665	1130	54
56											135		160	300	420	445	670	1050	56
58											125		150	300	420	425	635	980	58
60											120		140	215	400	425	640	915	60
62													130	215	310	400	500	860	62
64													120		290	405	500	805	64
66													115		290	380	475	755	66
68													110		275	295	475	715	68
70													100		275	275	445	675	70
72															255	275	360	635	72
74															260	275	360	600	74
76																255	335	570	76
78																255	335	540	78

Code designation for cables

A cable code of 2 - 4 letters is used to describe the construction.
Additional abbrevation for instrumentation cables: Collective screen = (c) Individual pair or triple screen = (i)
The interpretation (per letter) can be read from the table below:

1st. letter: Insulation		2nd. letter Bedding / inner sheath		3rd. letter Armouring / screen		4th. letter Outer sheath	
A	Fibre, tight cladded	**A**	Aluminium (optional with corrosion protection)	**A**	Strength member yarn	**A**	Yarn + bitumen
B	Fire resistant tape + insulation (Halogen-free)	**B**	Corrogated aluminium (o.w.c.p.)	**B**	Steel tapes, 2 off	**B**	Hydrocarbon resistant sehath
C	Polychloroprene (Neoprene) PCP, or chlorinated polyethylene - CPE	**C**	Polychloroprene (Neoprene) PCP, or chlorinated polyethylene - CPE	**C**	Galvanized steel wire braid	**C**	Polychloroprene (Neoprene) PCP, or chlorinated polyethylene - CPE
D	Impregnated paper Drip free	**D**	Aluminium + Plastics	**D**	Oil filled cable reinforcement (Longitudinal / Transverse)	**D**	
E	Polyethylene - PE Polypropylene - PP	**E**	Polyethylene - PE Polypropylene - PP	**E**	Oil filled cable reinforcement (Transverse only)	**E**	Polyethylene - PE Polypropylene - PP
F	PE or PP + filling compound	**F**	Bedding or taping (Halogen-free)	**F**	Flat steel wire armour	**F**	Semi-conducting PE
G	Polyamid - PA	**G**		**G**		**G**	PE + PA
H	Chlorosulphonated polyethylene - CSP	**H**	Chlorosulphonated polyethylene - CSP	**H**	Steel tape + steel wires	**H**	Chlorosulphonated polyethylene - CSP
I	Thermoplastic compound (Halogen-free)	**I**	Thermoplastic compound (Halogen-free)	**I**	Steel tapes, 4 off	**I**	Thermoplastic compound (Halogen-free)
K	Paper	**K**	Lead	**K**	Steel wire, plastics or rubber coated	**K**	Lead
L	Air + plastics (Coaxial cable)	**L**	Aluminium laminate + plastics sheath	**L**	Aluminium (laminated to outer jacket)	**L**	
M	Expanded PE or PP + filling compound	**M**	Polyester	**M**		**M**	Polyester
N	Impregnated paper	**N**	Polyurethane	**N**	Steel (laminated to outer jacket)	**N**	Polyurethane
O	Impregnated paper, oilfilled cable	**O**	Lead + Plastics	**O**	Copper wire braid (Tinned or bare)	**O**	
P	Polyvinylchloride - PVC	**P**	Polyvinylchloride - PVC	**P**	Phosphorbronze wire braid	**P**	Polyvinylchloride - PVC
Q	Fibre in loose tube	**Q**		**Q**	Steel wires + counter steel tape (optional)	**Q**	
R	Ethylenepropylene rubber - EPR	**R**	Ethylenepropylene rubber - EPR	**R**	Steel wires (round) + filling compound	**R**	Ethylenepropylene rubber - EPR
S	Silicone rubber	**S**	Bedding or taping + concentric conductor	**S**	Concentric conductor (Screen)	**S**	Silicone rubber
T	Cross-linked polyethylene XLPE	**T**	PE + aluminium wire + steel tape	**T**		**T**	Cross-linked polyethylene XLPE
U	Halogen-free thermoset compound EMA or EVA	**U**	Halogen-free thermoset compound EMA or EVA	**U**		**U**	Halogen-free thermoset compound EMA or EVA
V	Fibre, slotted core	**V**	Aluminium screen	**V**	Double wire armour (two layers)	**V**	Other halogen-free thermoset materials

1st. letter: Insulation		2nd. letter Bedding / inner sheath		3rd. letter Armouring / screen		4th. letter Outer sheath	
W	Other materials	**W**	Other materials	**W**	Catenary wire	**W**	Other materials
X	No insulation	**X**	No bedding or equivalent	**X**	No armour	**X**	No sheath
Y		**Y**	Screen	**Y**		**Y**	
Z	Flour plastics PTFE / FEP	**Z**	Flour plastics	**Z**		**Z**	Flour plastics

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