Cable Code Designation

A cable code of 2 letters (1. and 4.) or 4 letters is used to describe the construction.
For example:

1st Letter:
Insulation:
B: Fire resistant tape + insulation (Halogen-free)
R: Ethylene propylene rubber - EPR
T: Cross-linked polyethylene XLPE
I: Thermoplastic compound (Halogen-free)
U: Halogen-free thermosetting compound EMA or EVA
A: Fibre, tight buffered
Q: Fibre in loose tube

2nd letter:
Inner Sheath:
F: Bedding/Inner covering or taping (Halogen-free)
Y: Screen (poss. with PE or PP)
I: Thermoplastic compound (Halogen-free) SHF1

3rd letter:
Armour/Screen:
L: Aluminium (laminated to outer sheath)
X: No armour
O: Copper wire braid (Tinned or bare)
A: Strength member of yarn
C: Galvanized steel wire braid

4rd letter:
Outer Sheath:
I: Thermoplastic compound (Halogen-free), SHF1
U: Halogen-free thermosetting compound, SHF2
U: Halogen-free mud resistant thermosetting compound, SHF Mud
B*: Halogen-free mud resistant thermoplastic compound
*QFCB cables only

Additional Abbreviation for Instrumentation Cables:
(c): Collective screen
(i): Individual pair or triple screen

RFOU(i)

Standards and Tests

NEK 606-2004	Cables for Offshore Installations halogen-free and/or mud resistant
IEC 60092-350	Electrical installations in ships Part 350: Low-voltage shipboard power cables. (General construction and test requirements)
IEC 60092-351	Electrical installations in ships Part 351: Insulating materials for shipboard power cables
IEC 60092-352	Electrical installations in ships Part 352: Choice and installation of electric cables for low voltage power systems
IEC 60092-353	Electrical installations in ships Part 353: Single and multicore cables with extruded solid insulation for rated voltages 0,6/1 and 1,8/3 kV
IEC 60092-354	Electrical installations in ships Part 354: Single and three-core power cables with extruded solid insulation for rated voltages 6 kV up to 30 kV.
IEC 60092-359	Electrical installations in ships Part 359: Sheathing materials for shipboard power and telecommunication cables
IEC 60092-375	Electrical installations in ships Part 375: General instrumentation, control and communication cables
IEC 60092-376	Electrical installations in ships Part 376: 150/250 V cables for Control and instrumentation Circuits
IEC 60228	Conductors of insulated cables
IEC 60331-11/12/21/25/31	Fire resisting characteristics of electrical cables
IEC 60332-1/3	Tests on electric cables under fire condition. Part 1: Tests on a single vertical insulated wire or cable. Part 3: Test on bunched wires or cables.
IEC 60446	Basic and safety principles for man-machine interface, marking and identification. Identification of conductors by colours or alphanumerics
IEC 60754-1/2	Test on gases evolved during combustion of electric cables
IEC 60811	Common test methods for insulating and sheathing materials of electric cables
IEC 61034-1/2	Measurement of smoke density of electric cables burning under defined conditions. Part 1: Test apparatus Part 2: Test procedure and requirements

Cable Characteristics

Mud Resistant

The suitability of sheathing materials for use in areas in which the cables are exposed to drilling fluids is heavily dependent upon the type of fluid present. Each type of fluid contains additives which can have a deleterious effect on the sheathing material.

According to NEK 606, the mud resistant cables shall have a SHF Mud sheath that comply with the requirements in IEC 60092-359 for SHF2 and the below specified. The 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 & Elongation At Break Variation	Volume Swell Variation	Weight Increase Variation
Mineral oil type - IRM 903	100℃	7 d	30%	30%	30%
Calcium Bromide Brine (Waterbased)	70℃	56 d	25%	20%	15%
Carbo Sea (oil based)	70℃	56 d	25%	20%	15%

Oil Resistance

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 SHF2.

Flame Retardance

The cables shall withstand the test specified in IEC 60332-3-10, -22, -23, -24, -25. Single, earth and bonding wires shall withstand the test specified in IEC 60332-1 or IEC 60332-2.

Fire Resistance

Fire resistance cables shall be tested according to IEC 60331-11, -12, -21, -25 and -31.

Hydrocarbon (HCF) Fire Resistant

The purchaser shall specify which of the curves below in Figure 1 or 2 to comply with the HCF test.

The test requires no breakdown for 30 or 60 minutes when connected to operating voltage. Time to breakdown to be considered in agreement with the customer or approval authority.

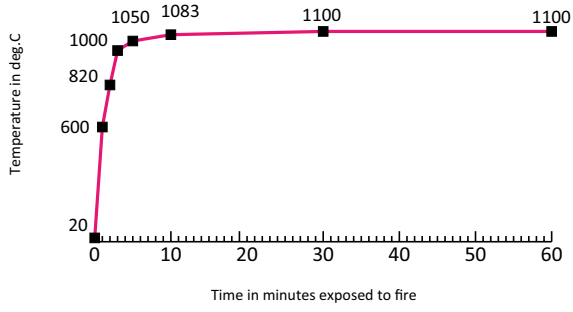

Fig.1 HC fire curve based on Exxon calculations, which required functional security for 15 minutes

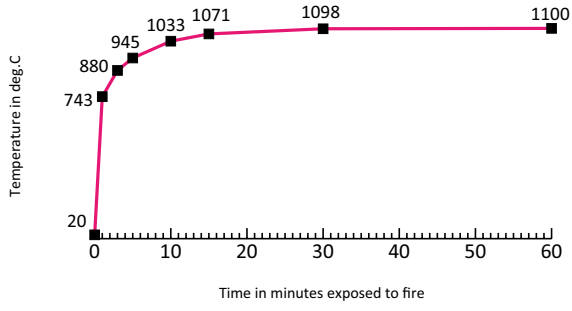

Fig.2 International recognized HC fire curve.

Content of Halogen

All cables shall be halogen-free according to IEC 60754-1/2.

Smoke Emission

During a cable fire smoke emission shall be kept to a minimum value of 60% according to IEC 61034-1/2.

Electrical Data

Conductor Resistance

Resistance formula:

$$R = \rho \frac{L}{A} \qquad [\Omega]$$

p = specific resistance, Ω.mm²/m
A = conductor area, mm²
L = conductor length, m

Resistance as a function of temperature:

$$R = R_0[1 + \alpha(t - 20)]$$

R_0= Resistance at t=20°C
t = conductor temperature °C
α= 0.00393 for copper

Short circuit ratings

The following short circuit currents are for cables normally operating at a maximum conductor temperature of 90°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:

$$I = I/\sqrt{t}$$

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	Conductor area mm²	Current 1 second amperes	Conductor area mm²	Current 1 second amperes
1.0	140	10	1400	70	9800	240	33600
1.5	210	16	2240	95	13300	300	42000
2.5	350	25	3500	120	16800	400	56000
4	560	35	4900	150	21000	500	70000
6	840	50	7000	185	25900	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 dispositions remote from steelwork is calculable and is shown. The 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:

$$L = 0.2 \times \left[\ln \left(2a/d \right) + 0.25 \right] \times 10^{-6} \quad [H/m]$$

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:

$$X = 2\pi fLl \quad [\Omega]$$

f = frequency in Hz
L = Induction in H/m
l = Conductor length in m

Impedance

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

$$Z = \sqrt[3]{(R^2 + X^2)} \quad [\Omega]$$

R = Resistance at operating temprature in Ω
X = Reactance in Ω

Core Identification

The identification of insulated conductors (cores) for the 250 V cables

Cable element	Colour of cores		
Pair	Black	Light blue	
Triple	Black	Light blue	Brown
Pairs/triples are numbered with numbered tape or by numbers printed directly on the insulated conductors			

The identification of insulated conductors (cores) for the 0.6/1 kV cables according to NEK standard

No. of cores	Colour of cores			
Single core	Off-white(grey)			
Two cores	Off-white(grey)	Black		
Three cores	Off-white(grey)	Black	Red	
Four cores	Off-white(grey)	Black	Red	Blue
above 4 cores	black numbers on white base			
earthing core	yellow/green			

The identification of insulated conductors (cores) for the 0.6/1 kV cables according to standard HD 308 S2

Cables with a green/yellow core					
No. of cores	Colour of cores*				
Three cores	Green/yellow	Blue	Brown		
Four cores**	Green/yellow	-	Brown	Black	Grey
Four cores	Green/yellow	Blue	Brown	Black	
Five cores	Green/yellow	Blue	Brown	Black	Grey

** For certain applications only.
* In this table an uninsulated concentric conductor, such as a metallic sheath, armour or screen wires, is not regarded as a core. A concentric conductor is identified by its position and, therefore, need not be identified by colour.

Cables without a green/yellow core					
No. of cores	Colour of cores*				
Two cores	Blue	Brown			
Three cores**	-	Brown	Black	Grey	
Three cores	Blue	Brown	Black		
Four cores	Blue	Brown	Black	Grey	
Five cores	Blue	Brown	Black	Grey	Black

** For certain applications only.
* In this table an uninsulated concentric conductor, such as a metallic sheath, armour or screen wires, is not regarded as a core. A concentric conductor is identified by its position and, therefore, need not be identified by colour.

The identification of insulated conductors (cores) for the 3.6/6kV, 6/10kV, 8.7/15kV,12/20kV and 18/30kV cables

No. of cores	Colour of cores
Single core	off-white insulation + black semi conducting layers
Three cores	off-white insulation + black semi conducting layers identified by White-Black-Red threads under and over the metallic screen on each individual core.
earthing core	yellow/green

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