CONTENTS

CABLES FOR OFFSHORE INSTALLATIONS –

Halogen-free low smoke and flame-retardant / fire-resistant (HFFR-LS)

FOREWORD

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NEK principally supports the development of International Standards. NEK TS 606 has been developed due to the following circumstances:

- the required support cannot be obtained for an International Standard, despite repeated efforts; and
- there is the future but no immediate possibility of an agreement on an International Standard.

Technical specification NEK TS 606 has been prepared by NEK Technical Committee NK 18A: Electric cables for ships and mobile and fixed offshore units. The NEK/NK 18A is the Norwegian mirror committee of IEC TC 18A.

This ~~fifth~~ 6th edition cancels and replaces the ~~fourth~~ 5th edition published in 201609 and constitutes a technical revision.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This edition includes the following significant technical changes with respect to the previous edition:

a) Standards for cable insulation IEC 60092-351 and cable sheathing materials IEC 60092-359 have been replaced by IEC 60092-360. Normative references for fire resistance according to IEC 60331, Part 1 and 2 have been added.

b) Chapter for oil and mud requirements for outer sheaths has been divided into a mandatory minimum level and three optional levels of higher performance. The levels are: 1) Minimum required oil resistance, 2) Enhanced oil resistance and 3) Mud resistance. New requirements for hydraulic/gear oil resistance are introduced.

c) Oil based test fluid CarboSea is replaced by EDC 95-11

d) Chapter for fire resistant cables has been expanded with new sections describing test methods for fire resistant test including water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.

e) Exxon HC fire curve has been removed. The international recognized HC fire curve is unchanged, but now refers to EN 1363-2.

f) Jet fire (JF) resistant cables according to ISO 22899-1

g) Optional test for cold climate IEC 60092-350 clause 8.10 and Annex E has been added

h) Old section 5.2 listing typical numbers of cores and cross sections has been deleted

i) Cable descriptions has been updated to include class 5 conductors

j) Cable descriptions for S-types has been updated to include XPLE insulation

k) New cable descriptions for RX/TX 1 kV and 250V single wires are included

l) Cable type IFLI is renamed to TFLI

m) P, S and F types are renumbered

n) Silicone is accepted as insulation material for fire resistant SFOU-types. New cable descriptions added.

INTRODUCTION

NEK TS 606 specifies a number of cable types, generally based on the IEC 60092 -350, -360 and -370 series, intended for use on offshore installations. The purpose of this Technical Specification is to give the user a selection of cables, which meets the requirements for installation on mobile and fixed offshore units. The predecessor of the Technical Specification was the publication “Recommended Practice for Specification of Cables”, issued by the Norwegian Oil Industry Association” (OLF). The background for that specification was the need of the industry to limit and standardize the number of cable types being used by the offshore industry in the late 1980s. The responsibility for the standard was taken over by the Norwegian Electrotechnical Committee (NEK), and the first edition was issued by NEK as “Norwegian electrotechnical standard” NEK 606 in 1993.

CABLES FOR OFFSHORE INSTALLATIONS –

Halogen-free low smoke and flame-retardant / fire-resistant (HFFR-LS)

1 Scope

This technical specification covers the basic requirements for halogen-free and/or mud resistant low and high voltage power, control, lighting, instrumentation, and telecommunication, optical fibre cables, Hydro Carbon Fire resistant (HCF) cables and Jet Fire (JF) resistant cables.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60092-350, *Electrical installations in ships – Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications.*

IEC 60092-352, *Electrical installations in ships – Part 352: Choice and installation of electric cables IEC 60092-353 Electrical installations in ships – Part 353: Single and multicore cables with extruded solid insulation for rated voltages 1kV and 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(Um = 7,2kV) up to 30 kV (Um=36 kV).*

IEC 60092-360, *Electrical installation in ships – Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication 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, *Test for electrical cables under fire conditions – Circuit integrity – Part 11: Apparatus – Fire alone at a flame temperature of least 750 °C*~~

~~IEC 60331-21, *Test for electrical cables under fire conditions – Circuit integrity – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0,6/1,0 kV*~~

IEC 60331-25, *Test for electrical cables under fire conditions – Circuit integrity – Part 25: Procedures and requirements – Optical fibre cables*

IEC 60331-1, *Test for electrical 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 overall diameter exceeding 20 mm*

IEC 60331-2, *Test for electrical 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 overall diameter not exceeding 20 mm*

IEC 60331-4, Tests for electric cables under fire conditions – Circuit integrity – Part 4: Test method for fire with shock at a temperature of at least 830 °C for cables of rated voltage higher than 1kV up to and including 30 kV

[*IEC 60331-4* is not yet published. It will be evaluated if this reference can be used before publishing NEK TS 606:202x]

IEC 60332-1-1, *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 - Apparatus.*

IEC 60332-1-2, *Tests 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 60332-2-1, *Tests 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, *Tests 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 for diffusion flame.*

IEC 60332-3-10, *Tests on electric and optical fibre cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables - Apparatus.*

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 60332-3-23, *Tests on electric and optical fibre 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 and optical fibre 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 and optical fibre cables under fire conditions – Part 3-25: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category D.*

IEC 60811, *Common test methods for insulating and sheathing materials of electric cables*

IEC 60079-14:2013, *Explosive atmospheres - Part 14: Electrical installations design, selection and erection*

IEC 60811-404, Electric and optical fibre cables - Test methods for non-metallic materials - Part 404: Miscellaneous tests - Mineral oil immersion tests for sheaths

EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

~~ISO 22899, *Determination of the resistance to jet fires of passive fire protection materials - Part 1: General requirements*~~

ISO 22899-1, *Determination of the resistance to jet fires of passive fire protection materials -- Part 1: General requirements*

BS 8491, *Method for assessment of fire integrity of large diameter power cables for use as components for smoke and heat control systems and certain other active fire safety systems*

EN 50200:2015, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
MUD
Type of drilling liquid present at offshore installations containing additives, which can have a deleterious effect on cable sheathing materials.

3.2
SHF 2 MUD RESISTANT
Designation for cable types with mud resistant outer sheath according to subclause 4.5.

4 Design and test requirements

4.1 Conductor Resistance

The maximum conductor resistance for 250V cables for control and instrumentation circuits shall be in accordance with IEC 60092-376.

The maximum conductor resistance for cables with voltage rating 0,6/1kV and above shall be in accordance with IEC 60228 class 2 or class 5

4.2 Types of insulation compounds

The insulation compounds shall be compliant with EPR (ethylene-propylene rubber) or XLPE (cross-linked polyethylene) requirements as stated in IEC 60092-360. The insulation compound for SFOU types shall be compliant with S95 as stated in IEC 60092-360. Detailed designs are listed in Annex A.

4.3 Types of bedding/ inner covering

The bedding / inner covering, if any, shall be extruded and according to IEC 60092-350:2014. The compound shall be halogen free according to assessment of halogens in IEC 60092-360.

Cables intended for hazardous areas shall be circular and any bedding or sheath shall be extruded.

NOTE IEC 60079-14 specifies requirements to selection of cables in hazardous areas

~~Cables intended for Hazardous areas shall have a bedding/inner covering according to IEC 60079-14:2013 clause 9.3.2 a)~~

4.4 Types of sheathing compounds – Requirements for oil and mud resistance

4.4.1 General

Sheathing compounds shall be compliant with SHF 2 - halogen-free rubber or SHF 1 - halogen-free thermoplastic, as stated in IEC 60092-360, - together with additional requirements and/or performances as defined in Table 1. Oil & MUD resistance shall be tested according to IEC 60811-404, with the requirements given in Table 1.

306

Table 1 – Oil and MUD resistant tests

Category a - Minimum required oil resistance	**Unit**	**Requirement**
Mechanical properties after ageing in IRM 902 ***and IRM 903***:		
- Temperature/tolerance of oil	°C	100±2
- Duration of treatment	h	24
Results to be obtained:		
- Tensile strength, variation max	%	***±30***
- Elongation at break, variation max	%	***±30***
Category b - Enhanced oil resistance: (Sheath Code E)		
Mechanical properties after ageing in IRM 902 ***and IRM 903*****:**		
- Temperature/tolerance of oil	°C	100±2
- Duration of treatment	d	7
Results to be obtained:		
- Tensile strength, variation max	%	***±30***
- Elongation at break, variation max	%	***±30***
- Volume swelling, variation max	%	***±30***
- Weight change, variation max	%	***±30***
Category c - Mud resistance: (shall comply with category b and c) (Sheath code M)		
Mechanical properties after ageing in Calcium Bromide:		
- Temperature/tolerance of oil	°C	70±2
- Duration of treatment	d	56
Results to be obtained:		
- Tensile strength, variation max	%	±25
- Elongation at break, variation max	%	±25
- Volume swelling, variation max	%	±20
- Weight change, variation max	%	±15
Mechanical properties after ageing in ***EDC 95-11 base oil:***		
- Temperature/tolerance of oil	°C	***70±2***
- Duration of treatment	d	***56***
Results to be obtained:		
- Tensile strength, variation max	%	***±30***
- Elongation at break, variation max	%	***±30***
- Volume swelling, variation max	%	***±25***
- Weight change, variation max	%	***±25***
Category d - Hydraulic/gear oil resistance: (shall comply with category b and d. May in addition comply with category c) (Sheath code H or H-M)		
Mechanical properties after ageing in relevant hydraulic/gear oil: *		
- Temperature/tolerance of oil	°C	100±2
- Duration of treatment	d	7
Results to be obtained:		
- Tensile strength, variation max	%	±30
- Elongation at break, variation max	%	±30
- Volume swelling, variation max	%	±30
- Weight change, variation max	%	±30
* Test oil shall be agreed between manufacturer and user.		
NOTE 1 Requirements marked in bold and italic text are more demanding than IEC 60092-360:2014. NOTE 2 EDC 95-11 is a well-defined base oil often used in oil based drilling fluids.		

307

4.4.2 Drilling fluids

Special evaluation or testing should be agreed when muds used deviate from standard mud test fluids specified in Table 1 category c.

NOTE Suitability of sheathing materials for use in areas in where cables are exposed to drilling fluids are heavily dependent on the type of liquid present. These liquids are usually of a propriety type and are unique to the specific project installation or oil field. Each type of liquid contains additives which can have a deleterious effect on the sheathing material.

4.4.3 Hydraulic/gear oils

Types of hydraulic test oil shall be specified by cable manufacturer.

NOTE Suitability of sheathing materials for use in areas in where cables can be exposed to hydraulic/gear oils will be dependent on the type of oil present. These oils are usually of a propriety type and are unique to the specific equipment or project installation.

4.4.4 UV resistance

Cables for use on open deck shall be resistant to sunlight (UV stabilized). The minimum requirements should be specified by the manufacturer with reference to international recognized standards and acceptance criteria

NOTE 1 The degree of UV resistance required will depend on location (UV exposure) and application.

NOTE 2 ISO 4892-2, IEC 60068-2-5, EN 50289-4-17 and EN 50483-6 are considered recognized standards

4.5 Flame retardant cables

The cables shall withstand the test specified in IEC 60332-3-10, Part 22, 23, 24 or 25.

Single, earth and bonding wires shall withstand the test specified in IEC 60332-1-2 or IEC 60332-2-2.

4.6 Fire resistant cables

4.6.1 Fire resistant cables without water spray

Fire resistance cables shall be tested according to:

– IEC 60331-1; or

– IEC 60331-2; or

– IEC 60331-4; or

– IEC 60331-25;

~~IEC 60331, Part 1 and 2; or IEC 60331, Part 11, 21, and 25.~~ Test duration: Minimum 120 minutes~~utes~~ + 15 minutes cooling down time.

Acceptance criteria: No ~~without~~ voltage breakdown and ~~or~~ conductor rupture. A~~.~~ttenuation not more than 1dB for fibre optic cables.

4.6.2 Fire resistant cables with water spray/jet

Fire resistance cables shall be tested according to:

– IEC 60331-1; or

– IEC 60331-2; or

~~– IEC 60331-11 and IEC 60331-21; or~~

– ~~IEC 60331-11 and~~ IEC 60331-25;

Followed by:

either

– after 105 minutes without voltage breakdown or conductor rupture a water spray shall be applied for 15 minutes according to EN 50200:2015 Annex E~~; or~~

~~– a water jet according to BS 8491;~~

– ~~for 105 minutes without voltage breakdown or conductor rupture. During the last 15 minutes, water spray/jet shall be applied.~~ For IEC 60331-1 and IEC 60331-2~~, Part 1 and 2~~ the flame and shock shall continue to be applied during the water spray.

or

~~– a water jet according to BS 8491;~~

– after 115 minutes without voltage breakdown or conductor rupture five bursts of water jet shall be applied during 5 minutes according to BS 8491. For IEC 60331-1 and IEC 60331-2 the flame and shock shall continue to be applied during the water jet.

4.7 Fire test for hydrocarbon (HC) fire resistant cables.

4.7.1 HC Fire curve

The HC fire curve shall be according to EN 1363-2.

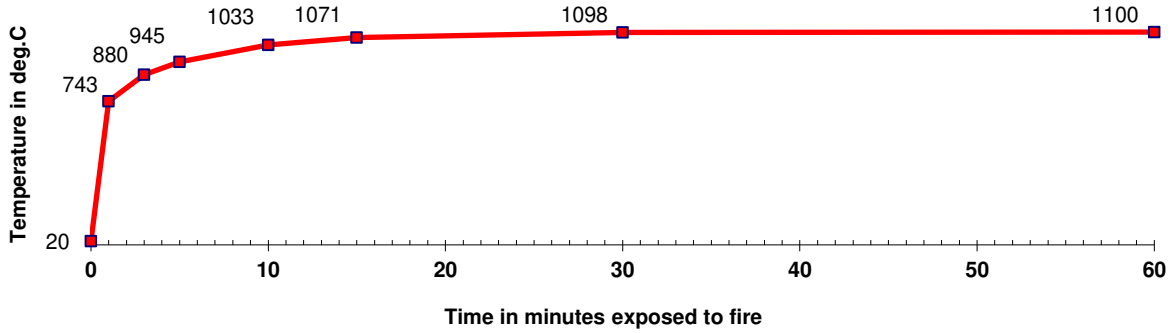

Figure 1 HC fire curve according to EN 1363-2.

Temperature tolerances shall be according to EN 1363-2.

Test-requirements

No insulation breakdown or short circuit for minimum 30 minutes when connected to rated voltage. Alternatively, until measured insulation resistance at operating voltage drops to cause earth fault or short circuit current to exceed 30mA.

4.7.2 Test methods for fire test for hydrocarbon (HC) fire resistant cables.

4.7.2.1 Apparatus

The oven shall consist of a mineral fibre insulated combustion chamber with the dimensions of 450 x 450 x 900 mm. The chamber volume is approximately 180 l.

The oven shall be fired with propane.

Ten burners shall be placed in two rows (five in each row) in the bottom of the combustion chamber.

The total rating of the burners shall be 300 000 BTU (88 kW). The burners shall have programmable controllers to set and measure temperature and time.

NOTE The 88 kW oven can reach temperatures up to 1400 ºC and dissipate a heat flux of min 200kW/m^2.

4.7.2.2 Procedure

o) The cable specimen shall be placed horizontally in the oven and the part of cable that is exposed to the fire shall be approximately 900 mm. The cable specimen shall be positioned in the middle of the combustion chamber and ~~approximately~~ 300 mm ± 50 mm over the burners.

Cables intended for fixed installation can be supported by appropriate means inside the combustion chamber. The support shall not reduce the exposed length of the cable by more than 100 mm in total.

4.8 Fire test for Jet Fire (JF) resistant cables.

4.8.1 General

The purpose of this test is to ensure that cables are able to operate during high temperature fires with high erosion effect. Jet Fire resistant cables shall be tested according to clause 4.~~8~~9.2 and 4.~~8~~9.3

NOTE The test simulates gas fires likely to occur offshore, on board ships, refineries or other locations where hydrocarbons are under pressure

4.8.2 Test method

The test method according to ISO 22899-1 shall be applied

4.8.3 Test requirements

No insulation breakdown or short circuit for minimum 30 minutes when connected to operating voltage.

Alternatively, until measured insulation resistance at operating voltage drops to cause earth fault or short circuit current to exceed 30mA.

4.9 Content of Halogen

All cables shall be halogen-free according to IEC 60092-350.

4.10 Smoke Emission

All cables shall be tested for smoke emission according to IEC 60092-350.The measured light transmittance shall be minimum 60%.

4.11 Cold properties

~~4.10.1 Cables designed for cold climate~~

Cables ~~specified for~~ for outdoor use ~~cold climate~~ shall be tested at – 25 °C for cold bend and cold impact according to IEC 60092-350~~:2014, clause 8.10 and Annex E.~~.

NOTE 1 For the 2020 edition of IEC 60092-350 the test procedures are specified in Annex E.

For cables designed for artic climate test shall be according to ~~NOTE~~ IEC 60092-350 as follows:

– ~~:2014, clause 8.10~~for bend test: - 40 ± 2 °C.

– for impact test - 35 ± 2 ~~specifies a cold bend test at -40°C and a cold impact test at -35 °C~~ °C. .

NOTE 2 For the 2020 edition of IEC 60092-350 these requirements are specified in clause 8.10.

~~4.11~~4.12 Additional electrical tests for S-type cables

For fire retardant cables a routine DC voltage test shall be conducted. The test voltage shall be applied for 250 V cables during testing, 3 600 V ~~dc~~ DC for 5 minutes. No break down shall occur.

For fire resistant 250 V BFOU cables a routine DC High Voltage test shall be conducted. Between conductors and screen start with 10 kV ~~dc~~ DC for 10 seconds, the leakage current shall not increase after the 10 seconds. Then apply 3 600 V ~~dc~~ DC for 5 minutes. No break down shall occur.

~~4.12~~4.13 Partial discharge requirements for BFOU medium voltage cables

Medium voltage BFOU cables shall comply with partial discharge requirements in IEC 60092-350.

5 Core identification

5.1 250V cables

For cables rated 250 V the identification of insulated conductors (cores) shall be in accordance with Table 2.

Table 2 – Identification of conductors 250V

Number of cores	Colours of cores		
2	black,	light blue	-
3	black	light blue	brown

Pairs/triples shall be numbered with numbered tape or by numbers printed directly on the insulated conductors.

5.2 0,6/1kV cables

For cables rated 0,6/1 kV the identification of insulated conductors (cores) shall be in accordance with Table 3, Table 4, Table 5 or Table 6:

Table 3 – Cables with a green-and-yellow earth conductor 0,6/1kV

Number of cores	Colours of cores [a]				
	Protective	Live			
3	Green-and-yellow	Blue	Brown		
4	Green-and-yellow	-	Brown	Black	Grey
4 [a]	Green-and-yellow	Blue	Brown	Black	
5	Green-and-yellow	Blue	Brown	Black	Grey

[a] for certain applications only.

[b] 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.

NOTE This table is in accordance with CENELEC HD 308 S2:2001 and IEC 60445

Table 4 – Cables without a green-and-yellow earth conductor 0,6/1kV

Number of cores	Colours of cores [b]				
2	Blue	Brown			
3	-	Brown	Black	Grey	
3 [a]	Blue	Brown	Black		
4	Blue	Brown	Black	Grey	
5	Blue	Brown	Black	Grey	Black

[a] for certain applications only.

[b] 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.

NOTE This table is in accordance with CENELEC HD 308 S2:2001 and IEC 60445

Table 5 – Identification of conductors 0,6/1kV

Number of cores	Colours/marking of cores			
1	off-white (grey)	-	-	-
2	off-white	black	-	-
3	off-white	black	red	-

4	off-white	black	red	blue
>4	black numbers on white base.			
earth	yellow/green	-	-	-

444

445

Table 6 – Identification of conductors 0,6/1kV

Number of cores	Colours of core	Core printed with numbers
1	grey(off-white)	1
2	grey(off-white)	1 and 2
3	grey(off-white)	1, 2 and 3
4	grey(off-white)	1, 2, 3 and 4
>4	grey(off-white)	black numbers
earth	yellow/green	-

5.3 Cables above 3,6/6(7,2) kV

For cables rated 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 the identification of the insulated conductors (cores) shall be in accordance with Table 7.

Table 7 – Identification of cores (above 3,6/6(7,2) kV)

Number of cores	Colour of core		
1	black	-	-
3	off-white/grey tape	black	red tape
earth	yellow/green	-	-

6 Sheath marking and colours

6.1 General

The sheath shall be clearly marked with the following data as a minimum:

– Manufacturer's name
– Cable code designation (clause 6.2)
– Sheath code (clause 6.3)
– Voltage rating
– Number of cores / pairs / triples
– Cross-section of conductors
– For power cables with braid used as protective earth: cross section of braid.
– Year of manufacture

The marking shall be repeated at least every 1,0 m.

EXAMPLE 1 Marking of cable :

- Manufacturer S102 RFOU (c) 250 V 2 PAIR 0,75 mm² 2016
- Manufacturer S102 RFOU (i) 250 V 2 x 2 x 0,75 mm² 2017
- Manufacturer P101 RFOU 0,6/1 kV 4G 95 mm² 2018

EXAMPLE 2 Marking of Enhanced oil resistant cable:

- Manufacturer P101 RFOU E 0,6/1 kV 4G 95 mm² 2018

EXAMPLE 3 Marking of Mud resistant cable:

- Manufacturer S102 RFOU (c) M 250 V 2 PAIR 0,75 mm² 2016
- Manufacturer S102 RFOU (i) M 250 V 2 x 2 x 0,75 mm² 2017
- Manufacturer P101 RFOU M 0,6/1 kV 4G 95 mm² 2018

EXAMPLE 4 Marking of Hydraulic oil and Mud resistant cable:

- Manufacturer P101 RFOU H-M 0,6/1 kV 4G 95 mm² 2018

6.2 Cable code designation

A cable code of two or four letters according to Table 8 shall be used to describe the construction. If two letters are used, columns 1 and 4 shall apply.

Table 8 – Cable code designation

Materials	1. letter: Insulation	2. letter: Bedding/ inner covering Inner sheath	3. letter: Armour/ Screen	4. letter: Outer Sheath
Fire resistant tape + insulation	B			
Ethylene propylene rubber - EPR	R			
Cross-linked polyethylene XLPE	T			
Thermoplastic compound	I			
Fibre, tight buffered	A			
Fibre in loose tube	Q			
Fire resistant silicone	S			
Bedding/Inner covering or taping		F		
Aluminium (laminated to outer jacket)			L	
No armour			X	
Tinned copper wire braid			O	
Strength member of yarn			A	
Galvanized steel wire braid			C	
Thermoplastic compound SHF 1		I		I
Thermoset compound, SHF 2				U
Mud resistant thermoset compound, SHF 2 MUD				U
Mud resistant thermoplastic compound			~~B~~	B~~a~~
~~a QFCB cables only~~				

Additional abbreviation for instrumentation cables (S-types):

– Collective screen = (c)

– Individual pair or triple screen = (i)

EXAMPLE “Manufacturer” S101 RFOU (i) E-M 250 V 2 PAIR 0,75 mm^2 “year”

6.3 Sheath code

The cable shall be marked with a sheath code according to Table 9, which describes the cable type and Oil/mud performance.

Table 9 – Sheath Code

Marking letters	Combinations of sheath codes describing the Oil/mud performance according to Table 1:
"no marking"	Minimum requirements
E	Enhanced Oil resistant – category b
M	Enhanced Oil resistant – category b Mud resistant – category c
H	Enhanced Oil resistant – category b Hydraulic/gear Oil resistant – category d
H-M	Enhanced Oil resistant – category b Mud resistant – category c Hydraulic/gear Oil resistant – category d
NOTE For requirements to hydraulic test oil, see clause 4.5.3	

6.4 Sheath Colours

6.4.1 250V cables

Cables up to and including 250 V shall have a GREY sheath, unless otherwise specified by the user. RED shall not be used.

6.4.2 0,6/1 kV cables

Cables for 0,6/1 kV shall have a BLACK sheath.

6.4.3 Cables for higher voltages

Cables for voltage above 0,6/1 kV shall have a RED sheath.

7 Required information and data

7.1 General

All information and data shall be in English language and in SI units. The supplier shall list all information as specified in clause 7.2, 7.3 and 7.4 together with the quotation.

7.2 Electrical data for cables for control, lighting and power.

– maximum continuous current rating at ambient temperature of 45 °C in accordance with IEC 60092-352.
– derating factors in accordance with IEC 60092-352.
– reactance at 50 Hz and 60 Hz in Ω/km
– impedance at 50 Hz and 60 Hz in Ω/km
– short time rating and end temperature

7.3 Electrical data for cables for instrumentation and telecommunication.

– Inductance between conductors with screen grounded in mH/km
– Mutual capacitance in nF/km

7.4 Mechanical and Physical Data

– weight in kg/km
– cable diameter under braid in mm (with tolerances)
– diameter of braid in mm
– cable diameter overall in mm (with tolerances)
– minimum installation temperature in °C

516 – minimum bending radius in mm at minimum installation temperature
517 – maximum pulling tension that can be safely applied
518 – cable length, weight and dimension of each drum
519 – minimum ordering lengths
520 – drawing of each cable type showing conductor, insulation, braiding, armouring and
521 sheathing arrangement, including filler cores, if used.

522 # 8 Inspection and testing

523 ## 8.1 Routine tests

524 All cables shall be routine tested in accordance with relevant IEC Publications. All cables shall
525 be delivered with a routine test certificate with reference to the different tests.

526 ## 8.2 Type tests

527 The cable manufacturer shall list all applicable type tests in the quotation.

528 # 9 Preparation for delivery

529 ## 9.1 General

530 All drum lengths shall be continuous. Cables or conductors shall not be jointed in any form.

531 Cable ends shall be fitted with end caps to prevent entry of moisture into the cable.

532 ## 9.2 Cable Drum identification

533 Cable drums shall be indelibly marked as follows:

534 – Company
535 – Drum No.
536 – Cable type and dimension
537 – Length of cable on the drum (m)
538 – Total weight of cable and drum (in kg)
539

Annex A
(normative)
Cable descriptions

NOTE Design numbers in Annex A starts with “P101” to avoid confusion with numbering structures from previous editions of NEK TS 606

Table A.1 – Cable type P101 RFOU/TFOU 0,6/1 kV

	Cables for control, lighting and power. **Flame retardant, low smoke and halogen free.** **Design and construction in accordance with IEC 60092-353**
Basic type:	RFOU / TFOU
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.2 – Cable type P102 RFOU/TFOU 3.6/6 kV

	High voltage power cables. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354**
Basic type:	RFOU / TFOU
Rated voltage:	3,6/6(7,2) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi-conducting material
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.3 – Cable type P103 RFOU/TFOU 6/10(12) kV

	High voltage power cables. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354**
Basic type:	RFOU / TFOU
Rated voltage:	6/10(12) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.4 – Cable type P104 RFOU/TFOU 8,7/15(17,5) kV

	High voltage power cables. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354**
Basic type:	RFOU / TFOU
Rated voltage:	8,7/15(17,5) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.5 – Cable type P105 BFOU 0,6/1 kV

	Cables for control, lighting and power. **Fire resistant, flame retardant, low smoke and halogen-free. Design and construction in accordance with IEC 60092-353.**
Basic type:	BFOU
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen free thermoset compound type SHF 2 according to Table 1.

Table A.6 – Cable type P106 BFOU 3,6/6(7,2) kV

	High voltage power cables. **Fire resistant, flame retardant, low smoke and halogen free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	BFOU
Rated voltage:	3,6/6(7,2) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5
Conductor screening:	None
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.7 – Cable type P107 BFOU 6/10(12) kV

	High voltage power cables. **Fire resistant, flame retardant, low smoke and halogen free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	BFOU
Rated voltage:	6/10(12) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	None
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.8 – Cable type P108 UX 0,6/1 kV

	Earthing wire . **Flame retardant, low smoke and halogen free**
Basic type:	UX
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Sheath:	Halogen-free thermoset compound in accordance with type SHF 2 according to Table 1
Colour:	Yellow /green.

Table A.9 – Cable type P109 TFLI 250 V

	Cables for living quarter and office areas. **Flame retardant, low smoke and halogen-free.**
Basic type:	TFLI
Rated voltage:	250V
Max. operating temperature:	90 °C
Conductor:	Circular stranded copper in accordance with IEC 60228, class 2. 1,5mm^2 and 2,5 mm^2
Number of cores:	2 and 3 core cables
Insulation:	Cross linked Polyethylene (XLPE). Thickness - IEC 60092-353, Table 1.
Bedding/inner covering:	Halogen-free thermoplastic compound
Metal screen:	Longitudinal aluminium tape, thickness 0,2 mm in contact with a stranded copper earth conductor.
Outer sheath:	Halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.10 – Cable type P110 BU 0,6/1 kV

	Unarmoured cables for control, lighting and power. **Fire resistant, flame retardant, low smoke and halogen-free. Design and construction in accordance with IEC 60092-353.**
Basic type:	BU
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.11 – Cable type P111 RU/TU 0,6/1 kV

	Unarmoured cables for control, lighting and power. **Flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-353.**
Basic type:	RU
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.12 – Cable type P112 RFOU/TFOU 12/20(24) kV

	High voltage power cables. **Flame retardant, halogen-free, low smoke and mud resistant.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	12/20(24) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5
Conductor screening:	Semi conducting material
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free mud resistant thermoset compound type SHF 2 according to Table 1.

Table A.13 – Cable type P113 RFOU/TFOU 18/30(36) kV

	High voltage power cables. **Flame retardant, halogen-free, low smoke and mud resistant.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	18/30(36) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free mud resistant thermoset compound type SHF 2 according to Table 1.

Table A.14 – Cable type P114 RFOU-HCF / TFOU-HCF 6/10(12) kV

	High voltage power cables for continuously operation during a 1100 °C hydrocarbon fire. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU - HCF / TFOU - HCF
Rated voltage:	6/10(12) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Overall sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.15 – Cable type P115 RFOU-HCF / TFOU-HCF 8,7/15(17,5) kV

	High voltage power cables for continuously operation during a 1100 °C hydrocarbon fire. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU - HCF / TFOU – HCF
Rated voltage:	8,7/15(17,5) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Overall sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.16 – Cable type P116 RFOU-HCF / TFOU-HCF 12/20(24) kV

	High voltage power cables for continuously operation during a 1100 °C hydrocarbon fire. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU - HCF / TFOU - HCF
Rated voltage:	12/20(24) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Overall sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to table 1.

Table A.17 – Cable type P117 RFOU-HCF / TFOU-HCF 18/30(36) kV

	High voltage power cables for continuously operation during a 1100 °C hydrocarbon fire. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU - HCF / TFOU – HCF
Rated voltage:	18/30(36) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Overall sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.18 – Cable type P118 BFOU-HCF 0,6/1 kV

	Cables for use in emergency control, lighting and power systems that need to be operational during a 1100 °C hydrocarbon fire. **Fire resistant, flame retardant, low smoke and halogen-free. Design and construction in accordance with IEC 60092-353.**
Basic type:	BFOU-HCF
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Overall sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.19 – Cable Type P119 RX/TX 0,6/1 kV

	Cables for use as single wire. Flame retardant, low smoke and Halogen free.
Rated voltage:	0,6/1kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE). Thickness in accordance with IEC 60092-353
Colour:	Blue, Brown, Black or Grey

Table A.20 – Cable type P120 RFOU/TFOU-FIRE RESISTANT 3,6/6(7,2) kV

	High voltage power cables for continuous operation during an IEC 60331-~~21~~ 4 fire test. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	3,6/6 (7,2) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi-conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound. and optional halogen free tapes or layers for fire and/or water integrity
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
Optional Fire protection:	Extruded thermoplastic fire protection compound
Optional Taping:	Suitable fire resistant tape(s)
Optional Sheath:	Flame retardant halogen-free thermoplastic compound, type SHF 1 or SHF 2 according to Table 1
Test conditions:	Flame application time 90 or 120 minutes.
	Nominal voltage applied on cable during test
	Optional: Water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.
Acceptance criteria:	No earth fault or short circuit

Table A.21 – Cable type P121 RFOU/TFOU-FIRE RESISTANT 6/10(12) kV

	High voltage power cables for continuous operation during an IEC 60331-~~21~~ 4 fire test. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	6/10 (12) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound. and optional halogen free tapes or layers for fire and/or water integrity
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
Optional Fire protection:	Extruded thermoplastic fire protection compound
Optional Taping:	Suitable fire resistant tape(s)
Optional Sheath:	Flame retardant halogen-free thermoplastic compound, type SHF 1 or SHF 2 according to Table 1
Test conditions:	Flame application time 90 or 120 minutes.
	Nominal voltage applied on cable during test

	Optional: Water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.
Acceptance criteria:	No earth fault or short circuit

Table A.22 – Cable type P122 RFOU/TFOU-FIRE RESISTANT 8,7/15(17,5) kV

	High voltage power cables for continuous operation during an IEC 60331-21 4 fire test. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	8,7/15 (17,5) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound. and optional halogen free tapes or layers for fire and/or water integrity
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
Optional Fire protection:	Extruded thermoplastic fire protection compound
Optional Taping:	Suitable fire resistant tape(s)
Optional Sheath:	Flame retardant halogen-free thermoplastic compound, type SHF 1 or SHF 2 according to Table 1
Test conditions:	Flame application time 90 or 120 minutes.
	Nominal voltage applied on cable during test
	Optional: Water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.
Acceptance criteria:	No earth fault or short circuit

Table A.23 – Cable type P123 RFOU/TFOU-FIRE RESISTANT 12/20(24)kV

	High voltage power cables for continuous operation during an IEC 60331-21 4 fire test. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	12/20 (24) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound. and optional halogen free tapes or layers for fire and/or water integrity
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
Optional Fire protection:	Extruded thermoplastic fire protection compound
Optional Taping:	Suitable fire resistant tape(s)

Optional Sheath:	Flame retardant halogen-free thermoplastic compound, type SHF 1 or SHF 2 according to Table 1
Test conditions:	Flame application time 90 or 120 minutes.
	Nominal voltage applied on cable during test
	Optional: Water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.
Acceptance criteria:	No earth fault or short circuit

Table A.24 – Cable type P124 RFOU/TFOU-FIRE RESISTANT 18/30(36)kV

	High voltage power cables for continuous operation during an IEC 60331-~~21~~ 4 fire test. **Flame retardant, low smoke, halogen-free.** **Design and construction in accordance with IEC 60092-354.**
Basic type:	RFOU / TFOU
Rated voltage:	18/30 (36) kV
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Conductor screening:	Semi conducting material.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE).
Insulation screening:	Semi conducting material and tinned copper wire braid.
Bedding/inner covering:	Extruded halogen-free compound. and optional halogen free tapes or layers for fire and/or water integrity
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
Optional Fire protection:	Extruded thermoplastic fire protection compound
Optional Taping:	Suitable fire resistant tape(s)
Optional Sheath:	Flame retardant halogen-free thermoplastic compound, type SHF 1 or SHF 2 according to Table 1
Test conditions:	Flame application time 90 or 120 minutes.
	Nominal voltage applied on cable during test
	Optional: Water spray according to EN 50200:2015 Annex E or water jet according to BS 8491.
Acceptance criteria:	No earth fault or short circuit

Table A.25 – Cable type P125 SFOU 0,6/1 kV

	Cables for control, lighting and power. **Fire resistant, flame retardant, low smoke and halogen-free. Design and construction in accordance with IEC 60092-353.**
Basic type:	SFOU
Rated voltage:	0,6/1 kV
Max. operating temperature:	90 °C
Conductor:	Tinned stranded copper in accordance with IEC 60228, class 2 or class 5
Insulation:	Fire resistant silicon compound
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid in accordance with IEC 60092-350.
Outer sheath:	Halogen free thermoset compound in accordance with type SHF 2.

Table A.26 – Cable type S101 RFOU(i)/TFOU(i) 250 V

	Cables for control, instrumentation and telecommunication. **Individually screened pairs/triples.** **Flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	RFOU(i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE)
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.27 – Cable type S102 RFOU(c)/TFOU(c) 250 V

	Cables for control, instrumentation and telecommunication. **Collectively screened pairs/triples.** **Flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	RFOU(c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm2 or 2,5 mm2 in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Pairs/triples are laid up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.28 – Cable type S103 BFOU(i) 250 V

	Cables for control, instrumentation and telecommunication. **Individually screened pairs/triples.** **Fire resistant flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-359 for the sheath material.**
Basic type:	BFOU(i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.29 – Cable type S104 BFOU(c) 250 V

	Cables for control, instrumentation and telecommunication. **Collectively screened pairs/triples.** **Fire resistant, flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	BFOU(c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Pairs/triples are laid up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.30 – Cable type S105 RU (i)/TU (i) 250 V

	Unarmoured cables for control, instrumentation and telecommunication. **Individually screened pairs/triples.** **Flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	RU (i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.31 – Cable type S106 RU (c)/TU (c) 250 V

	Unarmoured cables for control, instrumentation and telecommunication. **Collectively screened pairs/triples.** **Flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	RU (c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm2 or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Pairs/triples are layed up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.32 – Cable type S107 BU (i) 250 V

	Unarmoured cables for control, instrumentation and telecommunication. **Individually screened pairs/triples. Fire resistant, flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	BU (i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.33 – Cable type S108 BU (c) 250 V

	Unarmoured cables for control, instrumentation and telecommunication. **Collectively screened pairs/triples.** **Fire resistant, flame retardant, low smoke and halogen-free. Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	BU (c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Pairs/triples are layed up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.34 – Cable type S109 BFOU-HCF (i) 250 V

	Cables for use in emergency instrumentation and telecommunication systems that need to be operational during a 1100 °C hydrocarbon fire. **Individually screened pairs/triples. Fire resistant, flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	BFOU-HCF (i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.35 – Cable type S110 BFOU-HCF(c) 250 V

	Cables for use in emergency instrumentation and telecommunication systems that need to be operational during a 1100 °C hydrocarbon fire. **Collectively screened pairs/triples. Fire resistant, flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	BFOU-HCF (c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant tape helically wrapped around the conductor; and Ethylene propylene rubber (EPR); or Cross linked Polyethylene (XLPE).
Twinning:	Colour coded cores twisted together. Pairs/triples are laid up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping:	Lapped fire resistant tape
Sheath:	Flame retardant halogen-free thermoplastic compound type SHF 1 according to Table 1

Table A.36 – Cable Type S 111 RX/TX 250 V

	Cables for use as single wire. Flame retardant, low smoke and Halogen free.
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper in accordance with IEC 60228, class 2 or class 5.
Insulation:	Ethylene propylene rubber (EPR); or Cross-linked Polyethylene (XLPE). Thickness in accordance with IEC 60092-376
Colour:	Blue, Brown, Black or Grey

Table A.37 – Cable type S112 SFOU(i) 250 V

	Cables for control, instrumentation and telecommunication. **Individually screened pairs/triples.** **Fire resistant flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-359 for the sheath material.**
Basic type:	SFOU(i)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant silicon compound
Twinning:	Colour coded cores twisted together. Each pairs/triples are screened by copper backed polyester tape in contact with a stranded tinned copper drain wire and wrapped with polyester tape. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.38 – Cable type S113 SFOU(c) 250 V

	Cables for control, instrumentation and telecommunication. **Collectively screened pairs/triples.** **Fire resistant, flame retardant, low smoke and halogen-free.** **Design and construction in accordance with IEC 60092-376 and IEC 60092-360 for the sheath material.**
Basic type:	SFOU(c)
Rated voltage:	250 V
Max. operating temperature:	90 °C
Conductor:	Circular tinned stranded copper 0,75 mm², 1,5 mm² or 2,5 mm² in accordance with IEC 60228, class 2 or class 5. Conductor resistance according to IEC 60092-376.
Insulation:	Fire resistant silicon compound.
Twinning:	Colour coded cores twisted together. Pairs/triples are laid up and collectively screened by copper backed polyester tape in contact with a stranded tinned copper drain wire. Pairs/triples are identified by numbered tapes or by printed numbers.
Bedding/inner covering:	Extruded halogen-free compound.
Braid armour:	Tinned copper wire braid.
Outer sheath:	Halogen-free thermoset compound type SHF 2 according to Table 1

Table A.39 – Cable type F101 QFCI

	Fire resistant steel armoured optical fibre cable **Outdoor cables for use in communication and emergency systems that need to be operational during fire. Fire resistant, flame retardant, low smoke and halogen-free**
Basic type:	QFCI
Fibre element:	Loose tube core design
Central strength element:	Steel wire or fibre reinforced plastic (FRP)
Inner sheath/bedding:	Halogen-free and flame retardant thermoplastic compound.
Armour:	Galvanized steel wire braiding
Outer sheath:	Halogen-free and flame retardant, UV-stabilized, thermoplastic compound SHF 1 according to Table 1.

Table A.40 – Cable type F102 QFCI-HCF

	High temperature, Fire resistant steel armoured optical fibre cable. **Outdoor cables for use in communication and emergency systems that need to be operational during fire.** **Fire resistant, flame retardant, low smoke and halogen-free.**
Basic type:	QFCI-HCF
Fibre element:	Loose tube core design
Central strength element:	Steel wire or fibre reinforced plastic (FRP)
Inner sheath/bedding:	Halogen-free and flame retardant thermoplastic compound.
Armour:	Galvanized steel wire braiding
Outer sheath:	Halogen-free and flame retardant, UV-stabilized, thermoplastic compound SHF 1
HC - fire protection:	Extruded thermoplastic fire protection compound
Taping;	Lapped fire resistant tape
Sheath:	Flame retardant halogen-free thermoplastic compound SHF 1 according to Table 1.

Table A.41 – Cable type F103 QFCB

	Fire and mud resistant steel armoured optical fibre cable **Outdoor cables for use in communication and emergency systems that need to be operational during fire.** **Fire resistant, mud resistant and halogen-free.**
Basic type:	QFCB
Fibre element:	Loose tube core design
Central strength element:	Steel wire or fibre reinforced plastic (FRP)
Inner sheath/bedding:	Halogen-free and flame retardant thermoplastic compound.
Armour:	Galvanized steel wire braiding
Outer sheath:	Halogen-free and flame retardant, UV-stabilized, thermoplastic compound SHF 1
Sheath:	Mud resistant and halogen-free thermoplastic compound SHF 1 according to Table 1.

Table A.42 – Cable type F104 AICI

	Flame retardant steel armoured optical fibre cable **Outdoor cables for instrumentation, data and telecommunication.** **Flame retardant, low smoke and halogen-free.**
Basic type:	AICI
Fibre element:	Tight buffered fibres
Strength element:	Fibre reinforced plastic (FRP) and/or aramid yarns
Inner sheath/bedding:	Halogen-free and flame retardant thermoplastic compound.
Armour:	Galvanized steel wire braiding
Outer sheath:	Halogen-free and flame retardant, UV-stabilized, thermoplastic compound SHF 1 according to Table 1

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