<table>
<thead>
<tr>
<th>Impact</th>
<th>Description</th>
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<tbody>
<tr>
<td>Impacts</td>
<td>Cable mechanical resistance to impacts</td>
</tr>
<tr>
<td>UV resistant</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>Permissible ambient temperature</td>
</tr>
<tr>
<td>Flame - Fire</td>
<td>Cable fire performances</td>
</tr>
<tr>
<td>Smoke</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td></td>
</tr>
<tr>
<td>Corrosivity</td>
<td></td>
</tr>
<tr>
<td>Chemical attacks</td>
<td>Resistance to chemicals</td>
</tr>
<tr>
<td>Electro Magnetic Interference</td>
<td></td>
</tr>
<tr>
<td>Halogen free</td>
<td></td>
</tr>
<tr>
<td>Lead free</td>
<td></td>
</tr>
<tr>
<td>Water-tightness</td>
<td></td>
</tr>
<tr>
<td>Bending Radius</td>
<td>$R = n \times \text{cable diameter}$</td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
</tr>
<tr>
<td>Resistance to termite</td>
<td></td>
</tr>
<tr>
<td>Resistance to fungus</td>
<td></td>
</tr>
<tr>
<td>Resistance to rodent</td>
<td></td>
</tr>
</tbody>
</table>
Cable applications guide

Fossil power plant

- Regulation: Page 4
- Fire reaction: Page 7
- Low high voltage cables and accessories: Page 12
- Energy cables: Page 14
- Instrumentation and control cables: Page 16
- Communication cables: Page 18
- Accessories for medium voltage cables: Page 20
- Selection table: Page 21
With a power consumption that should double by 2030, many fossil power plant projects emerge. In this context, our guide provides a quick overview of cable product range present in facility energy and provides some useful benchmarks including standards and different families proposed by Nexans. Plants generally have a capacity of 550 MW and that fossil fuels are coal, oil or gas. The new generation plants take into account environmental aspects in particular on techniques for CO2 capture.

Recall that nearly 1,000 km of cables, all categories are used in the construction of a power plant.

CABLE PRODUCT RANGE

Cables

Construction standards:
There are many cable design standards in the fossil power plant sectors, among these, IEC 60502-1, IEC 60502-2, BS EN 50288-7, IEC 60840:2011, AEIC CS9-06, BS 7912:2001.

IEC 60502-1 and IEC 60502-2 - 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). These international standards are divided in two different parts, defining construction, dimensions and test requirements of power cables having extruded solid insulation. IEC 60502-1 is applicable for cables having voltage rates from 1 kV (Um=1.2 kV) up to 3 kV (Um=3.6 kV), while IEC 60502-2 defines same construction rules for cables having voltage rates from 6 kV (Um=7.2 kV) up to 30 kV (Um=36 kV). These standards include cables which exhibit properties of reduced flame spread, low levels of smoke emission and halogen free gas emission when exposed to fire. On fire behaviour, flame spread tests have to be performed on ST1, ST2, ST8 or SE1 over sheathed cables only when specially required.

BS EN 50288-7 – Multi-element metallic cables used in analogue and digital communication and control-Part 7: Sectional specification for instrumentation and control cables. This sectional specification covers multi-element cables suitable for connecting instruments and control systems for analogue or digital signal transmission. They may or may not be screened and optionally may incorporate armouring and/or moisture or environmental protection layers. The cables shall have a
mechanically robust construction and electrical transmission handling properties. The electrical, mechanical, transmission and environmental performance characteristics of the cables, related to their reference test methods are detailed. This sectional specification is to be read in conjunction with EN 50288-1, which contains the essential provisions for its application. Cables covered by this specification have maximum rated voltages of 90 V, 300 V and 500 V a.c. These cables shall not be connected directly to mains electricity supply or other low impedance sources. Multi-element cables for use in analogue, digital and control circuits are not designed to be used for power supply. These cables should be installed in accordance with the applicable local and national regulations. Cables intended to have limited circuit integrity in a fire are not covered by this specification, but they are however under consideration for future editions. There may be occasions when cables are required to have higher operating temperature ratings than those provided by using materials specified by the EN 50290 series. Suitable alternative materials are under consideration.

IEC 60840:2011 – Power cables with extruded insulation and their accessories for rated voltages from 30 kV (Um=36 kV) up to 150 kV (Um=170 kV).

It specifies test methods and requirements for power cable systems, cables alone and accessories alone, for fixed installations and for rated voltages above 30 kV (Um = 36 kV) up to and including 150 kV (Um = 170 kV). The requirements apply to single-core cables and to individually screened three-core cables and to their accessories for usual conditions of installation and operation, but not to special cables and their accessories, such as submarine cables, for which modifications to the standard tests may be necessary or special test conditions may need to be devised. This standard does not cover transition joints between cables with extruded insulation and paper insulated cables.

The significant technical change with respect to the previous edition is as follows:

- introduction of a prequalification test procedure for cables with high electrical stresses and tested as a cable system including accessories.

AEIC CS9-06 - Power cables with extruded insulation and their accessories for rated voltages above 46 kV through 345 kVac.

It describes the requirements for the design of single core extruded power cable systems, including their accessories, for rated a.c. voltages above 46 kV to 345 kV and applies to cable systems with EPR-insulation till 138 kV and to cable systems with XLPE-insulation till 345 kV. It is written as a supplement to Insulated Cable Engineers Association standard "ICEA S-108-720-2004 - Extruded Insulation Power Cables rated above 46 through 345 kV" which is adopted in the public interest to assist the purchaser in selecting of individual major cable components (such as conductors, insulation, semiconducting shields, metallic shields, jackets, etc.) for his particular need. It designates the materials, material characteristics, dimensions and production tests procedures applicable to the particular component materials and to completed cable lengths. Optional qualification tests are described for complete cable systems (cables and accessories) rated above 46 to 150 kV. Prequalification "long term aging" tests are described in order to demonstrate reliable performance of the complete cable system throughout the design life. Accessories are limited to cable joints, terminations and link box connecting systems for bonding and grounding of metallic shield/sheath circuits. The most recent IEC-standards like IEC 60840, IEC 60228, IEC 60229, IEC 60855, etc. form a part of this.
BS 7912:2001 - Power cables with XLPE insulation and metallic sheath, and their accessories, for rated voltages from 66 kV (Um=72.5 kV) to 132 kV (Um=145 kV). Requirements and test methods.

This specifies tests and requirements for power cables with extruded XLPE insulation and metallic sheath and their accessories for rated voltages from 66 kV (72.5 kV) to 132 kV (145 kV) for fixed installations. It is applicable to single core cables and 3-core cables with separate cores and their accessories for usual conditions of installation and operation and implements the nationally applicable parts of Harmonization Document HD 632 published by the European Committee for Electrotechnical Standardization (CENELEC). It describes the routine tests, sample tests, type tests and tests after installation in order to demonstrate the integrity of the production cable lengths and before use. Especially for cable construction with metallic wire and foil sheaths additional tests are specified in BS 7970:2005 for same voltage range but for single core cables only and their accessories. The most recent IEC-standards like IEC 60228, IEC 60229, IEC 60855, etc. form a part of this and the tests out of IEC 60840 are considered herewith with HD 632.

DIN VDE 0276-632 - Power Cables with extruded insulation and their accessories for rated voltages above 36 kV (Um=42 kV) up to 150 kV (Um=170 kV)

This specifies tests and requirements for power cables with extruded insulation and their accessories for rated voltages from 36 kV (Um=42 kV) up to 150 kV (Um=170 kV) for fixed installation in distribution and transmission networks as well as for power plants and substations. The test requirements are applicable to single core cables and 3-core cables with separate cores and to their accessories for usual conditions of installation and operation and implements the nationally applicable parts of Harmonization Document HD 632 published by the European Committee for Electrotechnical Standardization (CENELEC) and describing the routine tests, sample tests, type tests and tests after installation. Due to this routine tests as partial discharge test, a.c. voltage test and electrical test on outer sheath is to carried out on each manufactured length of cable whereas sample tests shall be carried out on one length from each manufacturing series of cable, but shall be limited not more than 10% of the number of lengths. This is same as for IEC 60840.
FIRE BEHAVIOUR OF CABLES

Fire - reminders

Fire is a physical and chemical phenomena for which the following 3 elements must be combined for it to form and spread: a combustible material, oxygen of the air and a heat source. If the conditions are fulfilled, the fire starts.

After a flame starts, there are two main phases in the progress of a fire which appear successively depending on time and temperature:

- Spreading phase (period when the fire spreads slowly and where it can be kept under control).

- Fire fully developed when the fire cannot be kept under control (this period occurs almost instantaneously: this is the “flash over” phase) (Fig. 1).

Standards and tests

Fire reaction

The burning behaviour of cables is characterized by tests defined by IEC 60332-1, EN 50265 in terms of flame retardant properties and IEC 60332-3 (cat. A,B,C and D), EN 50266-2 for fire retardant performances. Cables are qualified during these tests according to their vertical flame spread resistance.

Fire resistance

The fire resistance of cables is characterized by tests defined by the IEC 60331, EN 50200, BS 6387 (cat. CWZ).

Fire behaviour of cables

The cables are classified according to:

- The fire reaction ①, i.e. their role as passive elements during a fire characterized by the flammability, fire spread, heat release, smoke emission and toxicity.

- The fire resistance ②, i.e. their role as active elements characterized by electrical continuity under fire conditions.

Cables are qualified during these tests according to their resistance to fire and other combined parameters (mechanical shocks, water spraying, etc...). These tests are carried out under power supply.
Fire rating of cables

IEC 60332-1 - Tests for vertical flame propagation for a single insulated wire or cable

Standard defines the procedure for testing the resistance to vertical flame propagation for a single vertical electrical insulated conductor or cable, or optical fibre cable, under fire conditions. Flame shall be applied continuously for a period of time corresponding to the diameter of the tested piece of cable, having an initial length of 600 ± 25 mm.

Recommended performance requirements: Cable shall pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50 mm.

IEC 60332-3 (cat. A, B, C and D) - Tests for vertical flame spread on vertically mounted bunched wires or cables

Different categories are defined in IEC 60332-3-10. This standard gives details of a test where a number of cables are bunched together to form various test sample installations. For easier use and differentiation of various test categories, the parts are designated as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Flame application time</th>
<th>Volume of non-metallic material</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40min.</td>
<td>7.0 l/m</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>3.5 l/m</td>
</tr>
<tr>
<td>C</td>
<td>20min.</td>
<td>1.5 l/m</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>0.5 l/m</td>
</tr>
</tbody>
</table>

- Standard IEC 60332-3-22 defines the category A and relates to cables installed on the test ladder to achieve a nominal total volume of non-metallic material of 7.0 l/m of test sample. The flame application time is 40 minutes.

- Standard IEC 60332-3-24 defines the category B and relates to cables installed on the test ladder to achieve a nominal total volume of non-metallic material of 3.5 l/m of test sample. The flame application time is 20 minutes.

- Standard IEC 60332-3-25 defines the category D and relates to small cables of overall diameter 12 mm or smaller and cross-section of 35 mm² or smaller installed on the test ladder to achieve a nominal total volume of non-metallic material of 0.5 l/m of test sample. The flame application time is 20 minutes.

Fire resistance performances - IEC 60331 and BS 6387 categories C, W, Z

- Standard IEC 60331 gives the test procedure and performance requirement which includes a recommended flame application time, for cables which need to maintain circuit integrity when subjected to fire under specified conditions. It describes the means of continuity checking arrangements, electrical testing procedure, method of burning and gives requirements for evaluating test results. Standard covers low voltage power cables and control cables with rated voltage. Cable has to show electrical continuity, so its ability to continue to operate in the designated manner whilst subjected to a specified flame source for a specified period of time (90 minutes flame application is recommended).

- Standard BS 6387 specifies performance requirements and gives test methods for fire tests applicable to cables rated at voltages not over 450/750 V. Coverage includes definitions, bending characteristics, voltage designation and fire resistance characteristics. The cables are intended to be used for wiring and interconnection where it is required to maintain circuit integrity under fire conditions for longer periods than can be achieved with cables of conventional construction.

Cables shall be categorized by a letter symbol or series of symbols according to the requirements for fire resistance characteristics they have to comply with, the test temperatures...
selected and the duration of the test for resistance to fire alone. First letter symbol shall be as follows:

- Resistance to fire alone: Symbol
  - 650°C for 3 hours: A
  - 750°C for 3 hours: B
  - 950°C for 3 hours: C
  - 950°C for 20 min (short duration): S

- Resistance to fire with water:
  - W

- Resistance to fire with mechanical shocks:
  - 650°C: X
  - 750°C: Y
  - 950°C: Z

Materials which do not contain halogen products are used in the manufacture of HFFR (Halogen Free Fire Retardant) cables used to limit smoke emission and toxicity. HFFR materials can be used both for insulation and sheathing.

IEC 61034 - Measurement of smoke density of cables burning under defined conditions

Standard IEC 61034 provides details of the test procedure to be employed for the measurement of the density of smoke emitted from cables burning under defined conditions. It describes the means of preparing and assembling cables for test, the method of burning the cables, and gives recommended requirements for evaluating test results.

IEC 60754-1 - Test on gases evolved during combustion of electric cables - Determination of the amount of halogen acid gas

Standard IEC 60754-1 specifies a method for the determination of the amount of halogenic acid gas, other than hydrofluoric acid, evolved during the combustion of compounds based on halogenated polymers and compounds containing halogenated additives taken from cable constructions. This method is not recommended for use where the amount of halogen acid evolved is less than 5 mg/g of the sample taken.

IEC 60754-2 - Determination of degree of acidity of gases evolved during combustion of electric cables by measuring pH and conductivity

Standard IEC 60754-2 specifies a method for the determination of the degree of acidity of gases evolved during the combustion of compounds taken from cable components. Coverage includes procedure and conditioning of the samples.

Problems with smoke emission

Human impact

During a fire, the smoke due to the combustion of various materials make rescue and evacuation of premises difficult and often represents a lethal trap for those caught in the incident.

Smoke forms a complex, heterogeneous, opaque and toxic environment.

Cables are involved because they are present in all the premises, go through the walls and can contain combustible materials. During the fire, they may play an aggravating role specifically with respect to the emission of opaque, corrosive and toxic smoke.
Euroclasses construction directive for cables

CPD means « Construction Products Directive » and was initiated in 1989 through EU Directive 89/106/EEC document. It concerns “any product which is incorporated in construction works, including both buildings and civil engineering works”. CPD is aiming at removing barriers to trade within EU for the very broad range of products used in construction of buildings and civil works. As a Directive the CPD had to be “transposed” in national legislations, which led to varying interpretations. CPD has now developed into a Regulation directly applicable as law in all EU countries, thus avoiding varying interpretations.

CPD/CPR does not in itself impose requirements on the level of performance of products. It provides a “common language” to be used by Member States in their national construction regulations and procedures.

CPR means “Construction Products Regulation” and was initiated in 2011 through document EU 305/2011. This regulation will be fully applicable in July 2013 with an identical implementation of regulations throughout EU: same conditions throughout EU, no national deviations. There are no changes in requirements for cables (compared to CPD), but CE-marking mandatory.

Hereafter a table summarizing different euroclasses for cables:

<table>
<thead>
<tr>
<th>Euroclass</th>
<th>Criteria</th>
<th>Additional options</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Non combustible</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Very low propagation - special for plenum</td>
<td>s, a, d</td>
</tr>
<tr>
<td>B2</td>
<td><strong>Very low</strong> fire propagation&lt;br&gt;Very low heat release&lt;br&gt;+ Low flame propagation</td>
<td>Smoke&lt;br&gt;Acidity&lt;br&gt;Droplets</td>
</tr>
<tr>
<td>C</td>
<td><strong>Low</strong> fire propagation&lt;br&gt;Low heat release&lt;br&gt;+ Low flame propagation</td>
<td>Smoke&lt;br&gt;Acidity&lt;br&gt;Droplets</td>
</tr>
<tr>
<td>D</td>
<td><strong>High</strong> fire propagation&lt;br&gt;Moderate heat release&lt;br&gt;+ Low flame propagation</td>
<td>Smoke&lt;br&gt;Acidity&lt;br&gt;Droplets</td>
</tr>
<tr>
<td>E</td>
<td>Low flame propagation (only)</td>
<td>Smoke&lt;br&gt;Acidity&lt;br&gt;Droplets</td>
</tr>
<tr>
<td>F</td>
<td>No performance determined</td>
<td></td>
</tr>
</tbody>
</table>
Environmental impact

HFFR cables contribute to sustainable development due to their reduced environmental impact both with respect to their end of life recycling and to their low emission of polluting smoke in case of fire.

Sustainable development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Definition was established during the World commission on Environment and Development (WCED).

Environment:
- Reuse
- Consumption of resources
- Waste from energy
- Consumption of energy
- Ecological materials

Social:
- Housing policy
- Stable employment
- Good and meaningful work
- Good wages and conditions of job
- Good health and safety
- Learning

Economic:
- Consumption of materials
- Wasted time
- Delays - Errors
- Satisfaction of customers
- Expenses - Quality
- etc…
Accessories for High Voltage XLPE-cables

Inside the power plant the safe electrical distribution of HV-cables is achieved by a wide range of cable accessories developed and produced by Nexans in line with international standards or to stricter internal guide lines which satisfy the highest demands and guarantee fault-free operation even under the most severe laying conditions. Their service life period is expected the same as for the cables.

The accessories for XLPE-insulated HV-cables are used to connect the cables by means of premolded joints at route section lengths of approx. more than 800 - 900 m or to joint a cable to the network with terminations for outdoor/indoor use as well as for their insertion into transformers and GIS-switchgears.
In thermal power plants the stored energy inside fossil fuels such as coal, gas and oil are converted in a final step by the generator from mechanical into electrical energy.

The power plants typically produce 50 Hz alternating current electricity with 3-phase voltages up to 33 kV which is stepped up by unit transformers at power plant site to high voltage level for distribution network and transmission to far distances.

LHV networks 72.5 - 170 kV

Application examples:
- Generator GIS

Cable families:
XLPE

Generally all high voltage cable constructions are not fully covered by a national or international standard but the cables are designed, manufactured and tested according to generally accepted standards such as IEC 60840, AEIC CS9-06, BS 7912, DIN VDE 0276-632 and on the basis of client particular technical specifications and testing requirements and also standards that apply locally as well.

For their fail-safe operation in thermal power plants the HV-cable systems in the range of ≤ 170 kV with high electrical voltage stresses have to prove their highest reliability.

The cables manufactured by Nexans are usually tested in accordance with the international standard IEC 60840 "Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um=36 kV) up to 150 kV (Um=170 kV) - Test methods and requirements".

Cable characteristics
See selection table p.21
Nexans produces medium voltage and low voltage power cables as well as accessories for these applications such as joints and terminations, plug-in connectors and bushings for networks and industrial applications.

Earth cables
Cables are used to guarantee the integrity of the electrical systems and human safety.
Medium voltage networks

Application examples:
- Medium voltage substation power supply
- Generating unit power supply...

Cable families:
IEC 60502-2, IEC 60502-4

Low voltage circuits

Application examples:
- Low voltage networks
- Lighting system power supply
- Engine power supply
- Solenoid valve power supply

Cable families:
IEC 60502-1

Low voltage safety circuits

Application examples:
- Living area and control room
- Smoke extractor
- Emergency circuit power supply

Cable families:
IEC 60502-1, complying with IEC 60331 and/or BS 6387 (Cat. CWZ)

Cable characteristics
See selection table p.21
Instrumentation circuits

Application examples:
- Instrumentation connection control board process
- Transmission signals/sensor [pressure, chemical concentration...]

Cable families:
Multi IP/IT 05/09 EI PF..., BS EN 50288-7

Control circuits

Application examples:
Connection to various industrial equipments from control room. Some of them are requesting anti-inductive screen (EMI).

Cable families:
IEC 60502-1

Instrumentation circuits

Application examples:
- Control centre panel cabling
- Connection process/sensors (pressure, electronic measurement...)

Cable families:
Multi IP/IT 05/09 EI PF..., BS EN 50288-7

Compensation circuits

Application examples:
- Connection control board/process for temperature measurement
- Thermocouple transmission signal

Cable families:
JC/TC/SC/KC/KCB ..., IEC 60584-3, ANSI/MC 96-1, BS EN 50288-7

Cable characteristics
See selection table p. 22
Specificities of data cables

Definitions of the classes of a symmetrical pair cable wiring system in an industrial and tertiary environment (EN 50173-1)
- Class D specified up to 100 MHz,
- Class E specified up to 250 MHz,
- Class F specified up to 600 MHz.

NB: Classes EA (500 MHz) and FA (1000 MHz) are standardized.

LAN cables
- Foiled twisted pair cables (F/UTP and SF/UTP):
  Cable protected against external electromagnetic influences by a screen consisting, for instance, of a tape combined or not with a braid.
- Foiled twisted pair cables (x/FTP):
  Each pair is individually foiled (U/FTP). If cables have also a global screen it may consist of a tape (F/FTP) or a braid (S/FTP).
- Unfoiled twisted pair cables (U/UTP):
  Cable without any protection.

Duct routing conditions
"Power and communication ducts shall make their way through at a minimum distance of 1 m from lift machinery, disruptive medical or industrial equipment or at a minimum distance of 0.5m from fluorescent lighting."
"If this is impossible, the circuits shall be installed in raceways or metal conduits connected to the equipotential network." (IEC guide IEC 60364-5-52).
Protection of communication circuits against electromagnetic interferences. Raceways and cable tray systems must be earthed according to the recommendations of IEC guide 60364-4-44 to reduce the effects of electromagnetic interferences.

1. **Data networks**
   - Application examples:
     - Data networks
     - Data board cabling
     - iP video networks
   - Cable families:
     - U/UTP - F/UTP - SF/UTP - x/FTP

2. **Data and video networks**
   - Application examples:
     - Process zone data connection
     - Video signal transmission
   - Cable families: (optical fibre)
     - FOH/HFFR,
     - KX6, KX8 (coaxial)

3. **FIELDBUS’s networks**
   - Application examples:
     - Process zone phone cabling
     - Safety communication networks
   - Cable families:
     - Foundation Fieldbus, Profibus, Profinet, Industrial Ethernet ...

Cable characteristics: See selection table p.23
Accessories

A specific range of terminations, joints, and lugs for the Fossil Power Plant industry.
**LOW HIGH VOLTAGE** cables

<table>
<thead>
<tr>
<th>Function</th>
<th>Fire performances</th>
<th>Cables</th>
<th>Voltage rate</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low high voltage circuits</td>
<td>IEC 60332-1-2</td>
<td>According to IEC 603840 AEIC CS9:06</td>
<td>36/63 (72.5) kV</td>
<td>Copper or aluminium</td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-22(A)</td>
<td>IEC 60502-2</td>
<td>64/110 (123) kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-23(B)</td>
<td>ICEA S-108-720-2004 BS 7912</td>
<td>76/132 (145) kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-24(C)</td>
<td>DIN VDE 0276-632</td>
<td>87/150 (170) kV</td>
<td></td>
</tr>
</tbody>
</table>

**MEDIUM VOLTAGE** cables

<table>
<thead>
<tr>
<th>Function</th>
<th>Fire performances</th>
<th>Cables</th>
<th>Voltage rate</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium voltage circuit</td>
<td>IEC 60332-1-2</td>
<td>According to IEC 60322-3-22(A)</td>
<td>3.6/6kV</td>
<td>Copper or aluminium</td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-23(B)</td>
<td>IEC 60322-3-24(C)</td>
<td>6/6kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non armoured</td>
<td>8.7/15kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screened by copper tape or copper wires</td>
<td>6/10kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>12/20kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18/30kV</td>
<td></td>
</tr>
</tbody>
</table>

**LOW VOLTAGE** cables

<table>
<thead>
<tr>
<th>Function</th>
<th>Fire performances</th>
<th>Cables</th>
<th>Voltage rate</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy circuit</td>
<td>IEC 60332-1-2</td>
<td>According to IEC 60322-3-22(A)</td>
<td>0.6/1kV</td>
<td>Copper or aluminium</td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-23(B)</td>
<td>IEC 60322-3-24(C)</td>
<td>1.8/3kV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60322-3-24(C)</td>
<td>IEC 60322-3-25(D)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IEC 60331 BS 6387 (cat. CWZ)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### INSTRUMENTATION and CONTROL cables

<table>
<thead>
<tr>
<th>Function</th>
<th>Fire performances</th>
<th>Cables</th>
<th>Voltage rate</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal transmission</td>
<td>IEC 60332-1-2&lt;br&gt;IEC 60322-3-22(A)&lt;br&gt;IEC 60322-3-23(B)&lt;br&gt;IEC 60322-3-24(C)&lt;br&gt;IEC 60322-3-25(D)&lt;br&gt;IEC 60331&lt;br&gt;BS 6387 (cat. CWZ)</td>
<td>BS EN 50288-7&lt;br&gt;Collective screen or&lt;br&gt;Collective and individual screen&lt;br&gt;Non armoured</td>
<td>300 or 500V</td>
<td>Copper</td>
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<tr>
<td>Control circuit</td>
<td>IEC 60332-1-2&lt;br&gt;IEC 60322-3-22(A)&lt;br&gt;IEC 60322-3-23(B)&lt;br&gt;IEC 60322-3-24(C)&lt;br&gt;IEC 60322-3-25(D)&lt;br&gt;IEC 60331&lt;br&gt;BS 6387 (cat. CWZ)</td>
<td>According to IEC 60502-1&lt;br&gt;Non armoured&lt;br&gt;screened</td>
<td>0.6/1 kV&lt;br&gt;1.8/3 kV</td>
<td>Copper</td>
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### COMPENSATION cables

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<tr>
<th>Function</th>
<th>Fire performances</th>
<th>Cables</th>
<th>Voltage rate</th>
<th>Conductor</th>
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<tbody>
<tr>
<td>Temperature measurement</td>
<td>IEC 60332-1-2</td>
<td>BS EN 50288-7&lt;br&gt;Collective screen or&lt;br&gt;Collective and individual screen&lt;br&gt;Non armoured</td>
<td>-</td>
<td>Thermocouple</td>
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## Communication Cables

For any further information: [www.nexans.com](http://www.nexans.com)

### Selection Table

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<th>Voltage rate</th>
<th>Conductor</th>
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<tr>
<td>Phone networks</td>
<td>IEC 60332-1-2</td>
<td>SYT1 (THTE) SYT2 (THTA)</td>
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<td>IEC 60322-3-22(A)</td>
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<td>IEC 60322-3-25(D)</td>
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<td>Video circuits and access control</td>
<td>IEC 60332-1-2</td>
<td>KX8 RH KX6 RH</td>
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<td>Copper</td>
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<td>Local Area Network</td>
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<td>U/UTP F/UTP SF/UTP X/UTP Fibre optic cables (monomode, multimode)</td>
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<td>Fieldbus systems</td>
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<td>Foundation Fieldbus IEC 61158-2</td>
<td>300V</td>
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## Earth Cables

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<tr>
<td>Earthing</td>
<td>IEC 60332-1-2</td>
<td>HO7-VR</td>
<td>450/750V</td>
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<td>IEC 60332-3-22(A)</td>
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