Cables for telecommunications
Connecting the world
LEONI is a leading supplier of cable systems and related services for the automotive industry and various other industrial sectors.

Our group of companies employs more than 74,000 people in 32 countries. Corporate vision, highest quality and innovative power have made us one of the leading cable manufacturers in Europe. LEONI develops and produces technically sophisticated products ranging from wire and optical fibers to cables through to complete cable systems and also offers the related services. Moreover, the product portfolio comprises strands, standardised cables, hybrid cables, glass fiber as well as special cables, cable harnesses, wiring systems components and fully assembled systems for applications in various industrial markets and achieved a group turnover of EUR 4.5 bn in 2015.

LEONI is one of the leading European suppliers in the Industry & Healthcare market to which at LEONI as a cable manufacturer also belong activities in the fields of telecommunication systems, fiber optics, industrial solutions and healthcare.

Our customers benefit worldwide from innovative as well as reliable and long-lasting products of high quality.

LEONI – we create the best connection for your future.

For further information www.leoni.com

LEONI’s core markets

<table>
<thead>
<tr>
<th>Automotive &amp; Commercial Vehicles</th>
<th>Industry &amp; Healthcare</th>
<th>Communication &amp; Infrastructure</th>
<th>Electrical Appliances</th>
<th>Conductors &amp; Copper Solutions</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Cable systems/Wiring systems</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>Cable harnesses</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Power distributors and connector systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Copper cables</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hybrid cables</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Optical cables</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wires &amp; strands</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Optical fibers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Connectors</td>
</tr>
</tbody>
</table>
With an extensive product portfolio and excellent technical expertise, LEONI has over 40 years of experience in meeting the constant demand for more bandwidth and faster speeds in telecommunications. The high-quality cables and connection technologies are the high-performance components for your transmission channels across the globe.

For the traditional field of core networks LEONI provides cables for transmitting either analogue or digital signals in telecommunications equipment up to approximately 20 MHz. The cables are designed for telecommunications as well as for transferring signals and measured data.

For mobile networks, LEONI develops and produces cables to connect the antenna and the base station. The product range also includes tailor-made solutions for network operators and installers.

For applications in microwave technology, LEONI provides the FlexLine® coaxial cables, which are characterised by their outstanding attenuation properties and extremely high flexibility. In addition to the core competencies in the field of data centers, core networks, mobile networks and microwave applications, LEONI can also deliver standard and customised solutions for every conceivable field of application.
Products and applications

1. Core networks
   - High frequency cables
   - Switchboard cables
   - Data cables
   - Power cables
   - Fiber optic cables
   - Patch cables

2. Distributing box
   - High frequency cables
   - Switchboard cables
   - Data cables
   - Power cables
   - Fiber optic cables

3. Local exchange
   - High speed cables and cable systems
   - High frequency cables
   - Data cables
   - Power cables
   - Fiber optic cables
   - Patch cables

4. Microwave applications
   - Coaxial cables
   - Power cables
   - Hybrid cables
   - Fiber optic cables
   - Jumper cables
   - Accessories*

5. Mobile networks
   - Coaxial cables
   - Multi coaxial cables
   - Power cables
   - Hybrid cables
   - Fiber optic cables
   - Jumper cables
   - Accessories*

6. MSC (Mobile switching centre)
   - High speed cables and cable systems
   - Data cables
   - Power cables
   - Fiber optic cables
   - Patch cables

* We also offer accessories such as connectors, cable clamps, grounding kits and power splitters for applications in the mobile and microwave technology.
Type designations for copper cables

<table>
<thead>
<tr>
<th>Colour code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
</tr>
<tr>
<td>RD</td>
<td>red</td>
</tr>
<tr>
<td>OG</td>
<td>orange</td>
</tr>
<tr>
<td>YE</td>
<td>yellow</td>
</tr>
<tr>
<td>GN</td>
<td>green</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
</tr>
<tr>
<td>VT</td>
<td>violet</td>
</tr>
<tr>
<td>GY</td>
<td>grey</td>
</tr>
<tr>
<td>WH</td>
<td>white</td>
</tr>
<tr>
<td>PK</td>
<td>pink</td>
</tr>
<tr>
<td>TQ</td>
<td>turquoise</td>
</tr>
<tr>
<td>GD</td>
<td>gold</td>
</tr>
<tr>
<td>SR</td>
<td>silver</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
<th>armour</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2B...)</td>
<td>two layers of steel tape; thickness of one steel tape in mm</td>
</tr>
<tr>
<td>C</td>
<td>screen of copper wire braiding</td>
</tr>
<tr>
<td>FE 90</td>
<td>insulation integrity 90 minutes</td>
</tr>
<tr>
<td>FLI</td>
<td>flat cable with stranded conductor</td>
</tr>
<tr>
<td>FR</td>
<td>improved flame retardant</td>
</tr>
<tr>
<td>H</td>
<td>insulation or sheath of halogen-free material</td>
</tr>
<tr>
<td>J-</td>
<td>installation cable</td>
</tr>
<tr>
<td>-J</td>
<td>grounded wire, green-yellow</td>
</tr>
<tr>
<td>... IMF</td>
<td>separate stranding element in metal foil or in metallised paper and sheath wire (e.g. pairs PIMF)</td>
</tr>
</tbody>
</table>

| X  | cold-proof implementation down to minus ... °C |
| L  | wires with bunched conductor > 0.2 mm² |
| LI | cord with stranded conductor < 0.2 mm² |
| NC | non corrosivity of combustion gases |
| OE | oil-proof |
| (ST) | electrostatic shield made of metal foil or plastic laminated metal foil |

| VZN | tinned conductor |
| W  | corrugated steel sheath |
| X  | insulation, sheath or protective cover of cross-linked Polyvinylchloride (PVC) |
| 2X | insulation, sheath or protective cover of cross-linked Polyethylene (PE) |
| 11X | insulation, sheath or protective cover of cross-linked Thermoplastic Polyurethane (TPU) |
| Y  | insulation, sheath or protective cover of Polyvinylchloride (PVC) |
| 2Y | insulation, sheath or protective cover of Polyethylene (PE) |
| 9Y | insulation, sheath or protective cover of Polypropylene (PP) |
| 11Y | insulation, sheath or protective cover of Thermoplastic Polyurethane (TPU) |
| 12Y | insulation of Polyethylene Terephthalate |
| 99Y | insulation, sheath or protective cover of all other thermoplastics without VDE symbols |
| 02YS | insulation of cellular Polyethylene (PE) with additional skin of solid material (foam skin) |
| 02Y | insulation of cellular Polyethylene (PE) |
| -Z | wires with printed numbers |

Example hybrid cable (L45467-J216-W15)

9Y(ST)4x2x0.5/0.98-100
LI LI 9Y(ST)CY 3x1x2.5

9Y Wire insulation of Polypropylene (PP)
(ST) Electrostatic shield made of metal foil or plastic laminated metal foil
C Screen of copper wire braiding
LI Cord with stranded conductor < 0.2 mm²
9Y Wire insulation of Polypropylene (PP)
(ST) Electrostatic shield made of metal foil or plastic laminated metal foil
C Screen of copper wire braiding
Y Inner jacket of Polyvinylchloride (PVC)
In addition to the presented products, the Business Unit Telecommunication Systems offers a huge range of further standardised and customised cables for communication systems, as well as individual logistic solutions. Feel free to contact us with your special requirement, so we can provide you the ideal solution.
LEONI provides cables for fixed and mobile applications up to 20 MHz for the transmission of high-frequency signals in telecommunications equipment. The cables are suitable for use with both indoor and outdoor applications and possess outstanding mechanical properties. Due to their small outer diameter and high flexibility, the cables can be installed with low bending radii.

LEONI cables feature excellent electromagnetic shielding and a uniform foaming of the dielectric. One of LEONI’s specialities is skin-foam-skin extrusion (LEONIzell®).

Optional characteristics
- Temperature range from –20 °C up to +70 °C
- VDE, UL and CSA approval
- Highly flexible
- High voltage stability
<table>
<thead>
<tr>
<th>Wire</th>
<th>Wire</th>
<th>Wire</th>
<th>Conductor / wire</th>
</tr>
</thead>
</table>
| Bare copper wire (24 AWG)  
ø 0.5 mm (0.020 in)  
Insulation of foamed Polypropylene (PP)  
with skin ø 1.03 mm (0.041 in) | Bare copper wire (25 AWG)  
ø 0.5 mm (0.020 in)  
Insulation of foamed Polypropylene (PP)  
with skin ø 1.03 mm (0.041 in) | Bare copper wire (25 AWG)  
ø 0.5 mm (0.020 in)  
Insulation of foamed Polypropylene (PP)  
with skin ø 1.03 mm (0.041 in) | |
| Quad | Quad | Quad | |
| 4 wires twisted | 4 wires twisted | 4 wires twisted | |
| Units | Unit | Unit | |
| 4 quads twisted,  
Marking with binder tape | 4 quads twisted  
Marking with binder tape | 4 quads twisted  
Marking with binder tape | |
| Central element | Core | Core | |
| 1 quad 09YS 2x2x0.5/1.03  
1. layer: 3 units 09YS 8x2x0.5/1.03  
Binder tape: RD, BN, WH  
3 quads 09YS 2x2x0.5/1.03  
Identification thread  
Plastic tape, overlapped  
Aluminate foil overlapped,  
applied longitudinally  
Tinned copper drain wire ø 0.5 mm  
Shield braiding of tinned copper wires ø 0.1 mm (38 AWG)  
Coverage about 65 %  
ø 11.6 mm (0.457 in) | 3 units 09YS 8x2x0.5/1.03  
Binder tape: RD, BK, WH  
Identification thread  
Plastic tape, overlapped  
Aluminate foil overlapped,  
applied longitudinally  
Tinned copper drain wire ø 0.5 mm  
Shield braiding of tinned copper wires ø 0.1 mm (38 AWG)  
Coverage about 70 %  
ø 11.1 mm (0.437 in) | 2 units 09YS 8x2x0.5/1.03  
Binder tape: RD, WH  
Identification thread  
Plastic tape, overlapped  
Aluminate foil overlapped,  
applied longitudinally  
Tinned copper drain wire ø 0.5 mm  
Shield braiding of tinned copper wires ø 0.15 mm (35 AWG)  
Coverage about 65 %  
ø 9.8 mm (0.386 in) | |
| Thermoplastic copolymer (FRNC) YE  
Wall thickness about 0.8 mm  
ø (13.4 ±0.4) mm (0.528 ±0.016 in) | Thermoplastic copolymer (FRNC) YE  
Wall thickness about 0.8 mm  
ø (12.9 ±0.4) mm (0.508 ±0.016 in) | Thermoplastic copolymer (FRNC) YE  
Wall thickness about 0.8 mm  
ø (11.4 ±0.5) mm (0.449 ±0.020 in) | |
| Flame retardant acc. to IEC 60332-1  
Telekom Specification TS 0031/96 Part 3  
Halogen free | Flame retardant acc. to IEC 60332-1-2  
Halogen free | Flame retardant acc. to IEC 60332-1-2  
Halogen free | |
| Temperature range | Type designation | Characteristics | |
| –25 °C (~ –13 °F) up to 70 °C (158 °F) | S-09YS(ST)CH 32x2x0.5 STVIII BD | S-09YS(ST)CH 32x2x0.5 STVIII BD | Order number |
| –25 °C (~ –13 °F) up to 70 °C (158 °F) | S-09YS(ST)CH 24x2x0.5 STVIII BD | S-09YS(ST)CH 16x2x0.5 STVIII BD | |
| –25 °C (~ –13 °F) up to 70 °C (158 °F) | | | |
| L45467-YS15-C16 | L45467-YS15-C36 | L45467-YS15-C56 | |
Power cables

LEONI’s high-performance power cables can be used to supply outdoor units with power. They are suitable for RRH applications in mobile phone base stations, microwave systems and for cables in switching cabinets. The structure of the cables (wires/strands) makes them suitable for fixed and mobile installation. The cables are available with different jacket materials and in different colours.

All LEONI power cables consists of flame resistant and halogen free jackets (in accordance with UL 1581 Sec. 1080 (VW-1), UL 1666 (Riser), UL 1685 Vertical tray, IEC 60332-3) and feature a high level of resistance to sunlight as well as high mechanical strength.
<table>
<thead>
<tr>
<th>Conductor/wire</th>
<th>Core</th>
<th>Characteristics</th>
<th>Temperature range</th>
<th>Type designation</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stranded tinned copper wire (2/0 AWG)</td>
<td>2 wires, GY and BU twisted to a pair with fillers in gaps, Plastic tape overlapped, Shield braiding of tinned copper wires (4.6 mm²)</td>
<td>Flame retardant acc. to UL 2556, Sec. 9.4 (VW-1) Low smoke Fire retardant Halogen free Corrosivity of fumes acc. to IEC 60754-2 Smoke-density acc. to IEC 60134 Sunlight resistant UL AWM Style 11650 (90 °C / 600 V)</td>
<td>-40 °C (–40 °F) up to 90 °C (194 °F) Installation and flexible use: –20 °C (–4 °F) up to 90 °C (194 °F)</td>
<td>a) L1H 1X70 VZN SW (BK) b) L1H 1X70 VZN GR (GY) RAL 7032</td>
<td>a) L45571-V110-B50 b) L45571-V108-B50</td>
</tr>
<tr>
<td>Stranded tinned copper wire (10 AWG)</td>
<td>Ø 3.1 mm (0.122 in) Insulation of Thermoplastic copolymer Ø 3.5 mm (0.138 in)</td>
<td>Flame retardant acc. to IEC 60332-1-2 Flame retardant acc. to UL 2556, Sec. 9.4 (VW-1) Halogen-free acc. to IEC 60754-2</td>
<td>-40 °C (–40 °F) up to 95 °C (193 °F) Installation and flexible use: –30 °C (–22 °F) up to 95 °C (193 °F)</td>
<td>L99YDHCCCH 6.0/3.5 VZN SW</td>
<td>L45572-N12-B6</td>
</tr>
<tr>
<td>Stranded bare copper wire (8 AWG) (10 mm²)</td>
<td>Ø 4.2 mm (0.165 in) Insulation of Thermoplastic copolymer (FRNC) Ø 5.6 mm (0.220 in)</td>
<td>Low smoke Fire retardant, zero halogen Corrosivity of fumes acc. to IEC 60754-2 Smoke-density acc. to IEC 61034 Flame retardant acc. to IEC 60332-3-24 (Cat. C) Sunlight resistant acc. to UL 444 Sec. 7.12</td>
<td>-50 °C (–58 °F) up to 80 °C (176 °F) Installation and flexible use: –40 °C (–40 °F) up to 80 °C (176 °F)</td>
<td>LIHCH 1X2X10 SW</td>
<td>L45551-J21-B2xx</td>
</tr>
</tbody>
</table>
LEONI develops and manufactures coaxial and multi coaxial cables for a wide range of applications in telecommunications (e.g. microwave technology, CATV, GSM, UMTS, LTE). Data and signals can be transmitted without interference in a variety of frequency ranges. LEONI coaxial cables feature excellent electromagnetic shielding and a uniform foaming of the dielectric. One of LEONI’s specialities is the skin-foam-skin extrusion (LEONIzell®).

The LEONI product portfolio contains:
- Coaxial cables 50 Ohm
- FlexLine® coaxial cables 50 Ohm
- CATV cables 75 Ohm
- RG cables

Optional characteristics
- Low attenuation
- Highly flexible
- Flame resistant and halogen free
- Different RG types available
- For indoor and outdoor use
- VDE, UL and CSA approval
- Small outer diameter

RoHS 2
2011/65/EU
## Coaxial cables 50 Ohm

<table>
<thead>
<tr>
<th>High strength wire silver-plated (38 AWG)</th>
<th>Inner conductor</th>
<th>Inner conductor</th>
<th>Conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø 0.1 mm (0.004 in)</td>
<td>Stranded silver-plated copper wire 7xØ 0.1 (30 AWG) ø 0.3 mm (0.012 in)</td>
<td>Silver-coated copper wire ø 1.4 mm (0.055 in)</td>
<td>ø (0.76 ± 0.05) mm (0.030 ± 0.002 in)</td>
</tr>
<tr>
<td>Insulation of Perfluorethylenpropylen, FEP ø 0.27 mm (0.011 in)</td>
<td>Insulation of foamed Perfluorethylenpropylen ø 0.8 mm (0.031 in)</td>
<td>Insulation of foamed Polyethylene (PE) with skin ø 3.75 mm (0.148 in)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shield braiding of silver-plated copper wires ø 0.05 mm (44 AWG)</th>
<th>1. Shield</th>
<th>1. Shield</th>
<th>Shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver plated copper wire ø 0.08 mm (40 AWG)</td>
<td>Silver plated copper wire ø 0.08 mm (40 AWG)</td>
<td>Braiding of tinned copper wires ø 0.1 mm</td>
<td>ø 0.08 mm (40 AWG)</td>
</tr>
<tr>
<td>Coverage about 95 %</td>
<td>Coverage about 95 %</td>
<td>Coverage about 95 %</td>
<td>ø 1.32 mm (0.044 in)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Shield</th>
<th>2. Shield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver plated copper wire ø 0.08 mm (40 AWG)</td>
<td>Braiding of tinned copper wires ø 0.1 mm</td>
</tr>
<tr>
<td>ø 1.32 mm (0.044 in)</td>
<td>ø 0.08 mm (40 AWG)</td>
</tr>
<tr>
<td>Coverage about 95 %</td>
<td>Coverage about 95 %</td>
</tr>
<tr>
<td>ø 4.2 mm (0.165 in)</td>
<td>ø 0.1 mm</td>
</tr>
</tbody>
</table>

| Polyvinylchloride (PVC) YE, ø (1.5 ± 0.1) mm (0.059 ± 0.004 in) | Thermoplastic copolymer (FRNC) BK, ø (5.7 ± 0.2) mm (2.244 ± 0.008 in) | |

<table>
<thead>
<tr>
<th>Perfluorethylenpropylen (FEP) ø (0.76 ± 0.05) mm (0.030 ± 0.002 in)</th>
<th>Jacket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyvinylchloride (PVC) YE, ø (1.5 ± 0.1) mm (0.059 ± 0.004 in)</td>
<td>Thermoplastic copolymer (FRNC) BK, ø (5.7 ± 0.2) mm (2.244 ± 0.008 in)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UL AWM Style 1716 (150 °C / 150 V)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame retardant acc. to UL 1685 (vertical tray)</td>
<td>Temperature range</td>
</tr>
<tr>
<td>UL AWM Style 1375 (30 V / 80 °C)</td>
<td>– 100 °C (–148 °F) up to 160 °C (320 °F)</td>
</tr>
<tr>
<td>UL Communications Cable Type CM 75 °C</td>
<td>– 40 °C (–40 °F) up to 80 °C (176 °F)</td>
</tr>
<tr>
<td>Sunlight resistant</td>
<td>– 40 °C (–40 °F) up to 85 °C (185 °F)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>6YCY6Y 0.1/0.27-50 VS</td>
<td>L45466-B11-G137</td>
</tr>
<tr>
<td>06YDDY 0.3/0.8-50 LI VS GE</td>
<td>L45466-B11-N5</td>
</tr>
<tr>
<td>02YSCCH 1.4/3.75-50 VS FRNC</td>
<td>L45466-B14-C126</td>
</tr>
</tbody>
</table>
## FlexLine® coaxial cables 50 Ohm

### Super flexible cable
- **1/4" S** (FRNC) UL listed
  - **Inner conductor**: Copper-clad aluminium wire Ø 1.88 mm (0.074 in)
  - **Insulation**: of foamed Polyethylene (PE) with skin Ø 4.4 mm (0.173 in)

- **3/8" S** (FRNC) CMR/CATVR
  - **Inner conductor**: Copper-clad aluminium wire Ø 2.6 mm (0.102 in)
  - **Insulation**: of foamed Polyethylene (PE) with skin Ø 6.5 mm (0.256 in)

- **1/2" S** (FRNC) UL listed
  - **Inner conductor**: Copper-clad aluminium wire Ø 3.6 mm (0.142 in)
  - **Insulation**: of foamed Polyethylene (PE) with skin Ø 9.1 mm (0.358 in)

### Outer conductor
- **Copper-tape, longitudinal welded, spiral corrugation**
  - Ø (6.5 ±0.2) mm (0.256 ±0.008 in)
  - Ø (9.1 ±0.15) mm (0.358 ±0.006 in)
  - Ø (12.3 ±0.15) mm (0.484 ±0.006 in)

### Jacket
- **Thermoplastic copolymer (FRNC) BK**
  - Ø (7.7 ±0.15) mm (0.303 ±0.006 in)
  - Ø (10.6 ±0.15) mm (0.417 ±0.006 in)
  - Ø (13.5 ±0.2) mm (0.531 ±0.008 in)

### Characteristics
- **Flame retardant**: acc. to IEC 60332-3-24 (Cat. C) and IEC 60332-1-2
- **Corrosivity of fire gases**: acc. to IEC 60754-2
- **Halogen free**: acc. to IEC 60754-1
- **Railway approval**: acc. to EN45545 Tab. 7 R15 HL2
- **Smoke-density**: acc. to IEC 61034-1/2
  - UL-File E119100 Vol.1 Sec.15 CM
- **Flame retardant**: acc. to UL 1666 (Riser), and IEC 60332-3-24 (Cat. C)
- **Corrosivity of fire gases**: acc. to IEC 60754-2
- **Sunlight resistant**: acc. to UL 2556 Sec. 4.2.8.5
  - UL-File E119100 Vol.1 Sec.15 CMR
  - UL-File E214464 Vol.1 Sec.2 CATVR
- **Fire performance**: acc. to EN 50305 9.1.1
  - Toxicity EN 50305 TS 45545-2 table 5 R15/HL2, DIN EN 45545-2 R15/HL2
  - UL File E121168 Vol.1 Sec.3 Page 1

### Temperature range
- **Installation**: – 25 °C (~-13 °F) up to + 85 °C (+ 185 °F)
- **Operation**: – 55 °C (~-67 °F) up to + 85 °C (+ 185 °F)

### Type designation
- 02YSWKH 1.9/4.4-50 ALCU FRNC
- 02YSWKH 2.6/6.5-50 ALCU FRNC
- 02YSWKH 3.6/9.1-50 ALCU FRNC

### Order number
- L45466-B15-C96
- V45466-B17-C156
- L45466-B19-C166
CATV cables 75 Ohm

Inner conductor
Bare copper wire (10 AWG)
ø 2.65 mm (0.104 in)
Insulation of foamed Polyethylene (PE) with skin ø 10.6 mm (0.417 in),
water blocking tape,
Outer conductor
Copper-tape (thickness 0.25 mm), longitudinal welded,
annular corrugation ø 12.0 mm (0.476 in)

Inner conductor
Bare copper wire
ø 2.2 mm (0.087 in)
Insulation of foamed Polyethylene (PE) with skin ø 8.80 mm (0.346 in)
Outer conductor
Copper-tape, longitudinal welded

Polyethylene (PE) BK
ø (14.1 ±0.4 –0.2) mm
(0.555 +0.016 –0.008 in)

Thermoplastic copolymer (FRNC) BK
ø (16.0 ±0.4) mm (0.630 ±0.016 in)

Characteristics
– 50 °C (– 58 °F) up to 80 °C (176 °F)
– 25 °C (– 13 °F) up to 80 °C (176 °F)

Sunlight resistant
Halogen free

Temperature range

Type designation
02YW2Y 2.65/10.6-75
02YSKH 3.1/12.4-75
L45466-D21-C46
L45466-D19-Cxx

Order number

RG cables

<table>
<thead>
<tr>
<th>Type of cable</th>
<th>Inner conductor</th>
<th>Dielectric</th>
<th>Ohm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG 6</td>
<td>0.74 mm</td>
<td>4.8 mm</td>
<td>75</td>
</tr>
<tr>
<td>RG 8</td>
<td>2.25 mm</td>
<td>7.25 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 11</td>
<td>11.2 mm</td>
<td>7.25 mm</td>
<td>75</td>
</tr>
<tr>
<td>RG 58</td>
<td>0.9 mm</td>
<td>2.95 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 59</td>
<td>0.6 mm</td>
<td>3.7 mm</td>
<td>75</td>
</tr>
<tr>
<td>RG 174</td>
<td>0.48 mm</td>
<td>1.5 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 178</td>
<td>0.3 mm</td>
<td>0.88 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 179</td>
<td>0.32 mm</td>
<td>1.6 mm</td>
<td>75</td>
</tr>
<tr>
<td>RG 213</td>
<td>2.25 mm</td>
<td>7.25 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 214</td>
<td>2.25 mm</td>
<td>7.25 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 223</td>
<td>0.89 mm</td>
<td>2.95 mm</td>
<td>50</td>
</tr>
<tr>
<td>RG 316</td>
<td>0.54 mm</td>
<td>1.5 mm</td>
<td>50</td>
</tr>
</tbody>
</table>
Multi coaxial cables

LEONI manufactures multi coaxial cables according to specific customer requirements for a wide range of different applications, for example, for signal transmission in switchboards, mobile phone base stations or video conference solutions.

These cables provide:
- Outstanding signal integrity
- Special insulation systems
- Low insertion loss
- Excellent impedance tolerance
- Minimal bending radii
- Excellent return loss
- VDE, UL and CSA approval

RoHS 2
2011/65/EU
<table>
<thead>
<tr>
<th>Wire LIY 0.38/1.5 VZN</th>
<th>Coaxial element</th>
<th>Conductor/wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire LIY 0.09/0.8 VZN</td>
<td>Inner conductor: Silver plated copper wire ø 0.32 mm (0.013 in)</td>
<td>Inner conductor: Bare copper wire (28 AWG) ø 0.31 mm (0.012 in)</td>
</tr>
<tr>
<td>Wire</td>
<td>Insulation of foamed Perfluorethylene-propylen, FEP ø 0.62 mm (0.024 in)</td>
<td>Insulation of foamed Polyethylene (PE) with skin ø 1.4 mm (0.055 in)</td>
</tr>
<tr>
<td></td>
<td>with skin ø 1.60 mm (0.063 in)</td>
<td>Alulaminate foil overlapped, applied longitudinally</td>
</tr>
<tr>
<td></td>
<td>Alulaminate foil overlapped ø 1.70 mm (0.067 in)</td>
<td>Shield braiding of tinned copper wires</td>
</tr>
<tr>
<td></td>
<td>Tinned copper drain wire ø 0.32 mm (0.013 in)</td>
<td>Coverage about 95% ø 1.95 mm (0.077 in)</td>
</tr>
<tr>
<td></td>
<td>TPE-E BK ø 2.01 mm (0.079 in)</td>
<td>Jacket</td>
</tr>
<tr>
<td></td>
<td>Wall thickness about 0.15 mm (bulge with drain wire) ø 2.33 mm (0.092 in)</td>
<td>Thermoplastic copolymer (FRNC) BK - numbered ø (2.7 ±0.1) mm (0.106 ±0.004 in)</td>
</tr>
<tr>
<td></td>
<td>ø (1.52 ±0.07) mm (0.060 ±0.003 in)</td>
<td></td>
</tr>
</tbody>
</table>

**Jacket**

Polyvinylchloride (PVC) WH ø (6.8 ±0.2) mm (0.268 ±0.008 in)
Polyvinylchloride (PVC) BK ø (7.5 ±0.12 – 0.2) mm (0.295 + 0.005 – 0.008 in)
Thermoplastic copolymer (FRNC) grey ø (20.2 ±0.6) mm (0.795 ±0.024 in)

**Core**

1. layer: 1 coaxial element BK
2 wires LIY 0.38/1.5 VZN RD-BU + fillers, plastic tape overlapped

2. layer: 2 parallel pairs BU/BN - GN/OG 8 wires LIY 1x0.09/0.80 VZN VT-WH-BN-GN-YE-GY-OG-BK + fillers
Plastic tape overlapped ø 5.1 mm (0.201 in)

**Central element:**

1 Coaxial element, 1 layer: 6 coaxial elements, Alulaminate foil overlapped
Shield braiding of tinned copper wires ø 0.31 mm (0.004 in)
Coverage about 85% ø 6.6 mm (0.260 in)

**Filler as central element**

1. layer: 5 coaxial elements
2. layer: 11 coaxial elements
3. layer: 16 coaxial elements
Plastic tape, overlapped ø 18.5 mm (0.728 in)

**Jacket**

UL Style 2502 (80 °C / 30 V)
Halogen free

**Temperature range**

-30 °C (–22 °F) up to 80 °C (176 °F)
-10 °C (14 °F) up to 70 °C (158 °F)
-25 °C (–13 °F) up to 80 °C (176 °F)

**Type designation**

06YCY6Y 0.4/1.0-50 LI VS LIQ2YS 2x2x0.06(0.75-100 PPIMF LIY 2x0.38 VZNN LIY Y 8x0.09 VZN WS
6Y02Y(ST)12Y (ST)CY 7x0.32/1.6-75 VS 02YS(ST)CH H 32x0.31/1.4-75 GR

**Order number**

L45466-B1312-N5 L45466-D712-Y5 L45466-D3212-C16

www.leoni-telecom.com
Hybrid cables

LEONI hybrid cables combine different cable elements such as copper wires, fiber optic cables, tubes, shielded pairs, ensuring that the supply of data, media, signals and power is supplied via one single cable.

The hybrid cables on page 19 were specially developed for Remote Radio Head (RRH) applications. These are weatherproof installations of mobile radio station transceiver units at the top of mobile phone masts. Communication with the base station is achieved by using fiber optic cables or twisted-pair copper cables in line with the IEEE 802.16 WiMax standard. The fiber optic cable solution enables data to be transmitted without interference over an installation length over 50 m.

Optional characteristics
- Halogen free
- Flame-retardant
- Sunlight resistant
- Cold-resistant and weatherproof for outdoor applications
- High mechanical strength
- VDE, UL and CSA approval
<table>
<thead>
<tr>
<th>Wire</th>
<th>Coaxial element</th>
<th>Jacket</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| **Wire LIH 0.75/1.9**  
Stranded tinned copper wire  
96x0.1 (19AWG) ø 1.15 mm (0.045 in)  
Insulation of Thermoplastic copolymer (FRNC) ø 1.9 mm (0.075 in)  
Wall thickness about 0.38 mm  
| Inner conductor:  
Stranded tinned copper wire  
7x0.15 (27 AWG)  
Insulation of Polyethylen (PE)  
aluminate foil overlapped, applied longitudinally  
Shield braiding of tinned copper wires ø 0.1 mm (38 AWG)  
Coverage about 85 % ø 3.3 mm (0.130 in)  
| Thermoplastic copolymer (FRNC) YE  
Wall thickness about 0.35 mm  
ø (4.0 ±0.15) mm (0.157 ±0.006 in)  
| |  
| **Wire LIY 1x2.5/4.3**  
Stranded bare copper wire  
50x0.25 (14 AWG) ø 2.1 mm (0.083 in)  
Insulation of Polyvinylchloride (PVC) ø 4.3 mm (0.169 in)  
Wall thickness about 1.1 mm  
|  
| **Wire LI9Y 1X2.5/3.1**  
Stranded bare copper wire  
50x0.25 (14 AWG) ø 2.1 mm (0.083 in)  
Insulation of Polypropylene (PP) ø 3.1 mm (0.122 in)  
Wall thickness about 0.5 mm  
|  
| **Coaxial element**  
Inner conductor:  
Stranded tinned copper wire  
7x0.15 (27 AWG)  
Insulation of Polyethylen (PE)  
aluminate foil overlapped, applied longitudinally  
Shield braiding of tinned copper wires ø 0.1 mm (38 AWG)  
Coverage about 85 % ø 3.3 mm (0.130 in)  
|  
| **Jacket**  
Thermoplastic copolymer (FRNC) YE  
Wall thickness about 0.35 mm  
ø (4.0 ±0.15) mm (0.157 ±0.006 in)  
| |  
| **Conductor / wire**  
|  
| **1 Coaxial element**  
2 wires LIH 0.75/1.9 RD, BK + fillers  
plastic tape, overlapped  
Shield braiding of tinned copper wires ø 0.13 mm  
Coverage about 85 % ø 6.5 mm (0.256 in)  
|  
| **3 wires LIY 1x2.5/4.3 BK-BU-GNYE**  
2 optical fibers number 1 and 2 + filler  
Sequence of colors:  
BU – optical fiber/1 – BK- optical fiber/2 – GNYE - filler  
Plastic tape, overlapped  
Shield braiding of tinned copper wires ø 0.2 mm (32 AWG)  
Coverage about 85 % ø 10.2 mm (0.402 in)  
|  
| **9Y(ST)C 4x2x0.5/0.98-100 LI (Cat5)**  
3 wires LI9Y 2.5/3.1 BK-BU-GNYE + fillers  
Plastic tape overlapped, aluminate foil overlapped, applied longitudinally  
Shield braiding of tinned copper wires ø 0.2 mm (32 AWG)  
Coverage about 85 % ø 9.9 mm (0.390 in)  
| |  
| **Thermoplastic copolymer (FRNC) BK**  
ø (8.0 ±0.2) mm (0.315 ±0.008 in)  
| **Polyvinylchloride (PVC) BK**  
ø (12.2 ±0.3) mm (0.480 ±0.012 in)  
| **Polyvinylchloride (PVC) BK**  
ø (11.9 ±0.4) mm (0.469 ±0.016 in)  
| |  
| Flame test acc. to IEC 60332-3-24  
(Cat. C),  
Flame retardant acc. to ECE-R 118  
Fire retardant  
Corrosivity of fire gases acc. to IEC 60754-2  
Smoke-density acc. to IEC 61034  
| |  
| –25 °C (~ -13 °F) up to 70 °C (158 °F)  
| –40 °C up to 90 °C (~ -40 °F up to 194 °F)  
| –30 °C up to 80 °C ~ -22 °F up to 176 °F  
| |  
| 2Y(ST)CH 0.45/2.8-75 LI VZN  
LIH CH 2x0.75/1.9 VZN FRNC  
| I-VZN/CH 2xIG62.5/125 L-Y CY 3x1x2.5  
| 9Y(ST)C 4x2x0.5/0.98-100 LI LI9Y (ST)CY 3x1x2.5  
|  
| L45466-D313-Wxx  
| L46910-L2-H46  
| L45467-J216-W15  
| |  
| www.leoni-telecom.com |
Hook-up wires and strands

LEONI offers a wide range of hook-up wires and strands for signal transmission in communications technology. The copper wire or copper alloy wires are available in different versions depending on the particular specification. The insulated covering can be manufactured from a variety of materials such as PVC or LSZH as well as ETFE, MFA and many more. Different types of construction in compliance with DIN VDE, MIL, BS, EN, IEC, UL and CSA are possible.

All wires can be delivered stranded and/or with an outer jacket.

Optional properties
- Lightweight and space-saving
- Oil and chemical resistant
- Halogen free
- Highly flexible
<table>
<thead>
<tr>
<th>Conductor / Wire</th>
<th>Jacket</th>
<th>Temperature Range</th>
<th>Type Designation</th>
<th>Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stranded tinned copper wire (10 AWG) ø 3.1 mm (0.122 in)</td>
<td>Thermoplastic copolymer (FRNC) GY ø (7.4 ± 0.3) mm (0.291 ± 0.012 in)</td>
<td>– 40 °C (– 40 °F) up to 90 °C (194 °F)</td>
<td>YVO(ST)Y 2x0.5/0.9</td>
<td>L45572-N110-B6</td>
</tr>
<tr>
<td>Stranded tinned copper wire 7x0.2 (24 AWG) ø 0.6 mm (0.024 in)</td>
<td>Ethylentetrafluoretylen, ETFE ø (1.00 ±0.05) mm (0.039 ±0.002 in)</td>
<td>– 65 °C (– 85 °F) up to 150 °C (302 °F)</td>
<td>LJ7Y 0.22/1.0 VZN</td>
<td>L45571-B1xx-H60</td>
</tr>
<tr>
<td>Stranded bare copper wire (6 AWG) ø 5.3 mm (0.209 in)</td>
<td>Thermoplastic copolymer (FRNC) ø (7.7 ±0.6) mm (0.303 ±0.024 in)</td>
<td>Transport and fixed installation: – 40 °C (– 40 °F) up to 90 °C (194 °F) Installation and flexible use: – 20 °C (– 4 °F) up to 90 °C (194 °F)</td>
<td>LIH 16/7.7 SW</td>
<td>L45571-S110-B20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conductor / Wire</th>
<th>Jacket</th>
<th>Temperature Range</th>
<th>Type Designation</th>
<th>Order Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire YV 1x0.5/0.9 tinned copper wire ø 0.5 mm</td>
<td>Polyvinylchloride (PVC) GY ø (2.6 ± 0.1 – 0.3) mm</td>
<td>– 15 °C (5 °F) up to 70 °C (158 °F)</td>
<td>YVO(ST)Y 2x0.5/0.9</td>
<td>H50402-B509-D43</td>
</tr>
<tr>
<td>Insulation of Polyvinylchloride (PVC) ø 0.9 mm</td>
<td>Polyvinylchloride (PVC) GY ø (2.8 ± 0.1) mm (0.11 ± 0.004 in)</td>
<td>– 40 °C (– 40 °F) up to 70 °C (158 °F)</td>
<td>LJ7Y 0.22/1.0 VZN</td>
<td>V45467-F14-C25</td>
</tr>
<tr>
<td>Wall thickness about 0.2 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Customised hybrid cables

The sky is the limit
LEONI can supply individual hybrid cables for your specific application which can contain different elements such as copper wires, fiber optic cables, tubes, shielded pairs, etc., With correspondingly optimised cable construction the required installation space can be significantly reduced and fitting simplified.

Advantages
- Lightweight solution and compact design decreases tower loads.
- Hybrid cable solution allows standard and fast installation process.
- Coax design for power conductors reduces the amount of lightning energy to reach equipment with more than half compared to conventional cables.

The LEONI engineers design also your hybrid cable solution for every application. Please contact us.
Individual solutions for applications in telecommunications and data centers are an integral part of the LEONI product range.

LEONI offers a complete cable system with line card power connectors (100 pol.) and a 5 m cable with 96 wires. The interconnect solution transfers power from the supply to the line card.

Features:
- Power from Bus Bar to BP, DC or Mezz card
- Customised for a compact design
- Cable system is available for different solutions

From prototypes to series production: LEONI is your competent partner for advice, support and help in implementing specific product solutions.

LEONI can also provide you with a special circuit board and housing design as well as HF analyses in their High Speed Laboratory. In addition, LEONI will support long-term product testing for various product approvals.
The significance of UL and CSA certifications

<table>
<thead>
<tr>
<th>Certification only for Canada</th>
<th>Certification only for USA</th>
<th>Certification for Canada and USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The organisations UL, Intertek ETL and CSA International, are recognised in Canada and in the USA. They issue various certification mark according to validity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The certification mark (UR) identifies products which are integrated as components in electrical equipment (recognised mark).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before electrical products are allowed onto the North American market they have to be tested and certified as to their hazard potential in respect of combustibility, electric shock and – for certain equipment – electromagnetic compatibility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To comply with product liability laws a manufacturer has to ensure by the testing and certification of his components that they fully satisfy national statutory requirements.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Certification for the USA:**
Certificates have to be issued by a Nationally Recognized Testing Laboratory (NRTL). NRTL status is awarded by the Occupational Safety and Health Administration (OSHA).

- UL (Underwriters Laboratories)
- CSA International (Canadian Standards Association)
- ITSNA (Intertek Testing Service NA, Inc.)
- TUV Rheinland of North America

**Certification for Canada:**
Certifications have to be issued by a qualification office recognised by the Standards Council of Canada (SCC)

- CSA International
- UL
- ITSNA
Appliance Wiring Material (AWM)

Appliance wiring material (AWM) is a recognised component. That means that it is used in UL Listed or Classified end products. AWM wires are intended as factory-installed or factory-provided components of complete equipment. The final acceptance of the component depends on its installation and use in or with complete equipment submitted to UL.

Many different constructions of wires and cables make up the AWM category, including single- and multi-conductor types of a wide range of conductor sizes, insulation and jacket materials and uses. Each construction of wire is given a style number with a corresponding style page, used to describe the construction. The style page includes temperature and voltage ratings, conductor size and material, insulation and jacket materials and thicknesses, shields or coverings and as well as the UL reference Standard used to evaluate the wire.

The basic standard used to evaluate AWM is UL 758, the standard for Safety of Appliance Wiring Material. The Canadian standard for appliance wiring material is CSA C22.2 No. 210-11, Appliance Wiring Material Products. The UL Recognised Component Mark may be used on components certified by UL to both Canadian and U.S. requirements. LEONI has more than 700 Styles in its procedure of authorised AWM styles.

Flame tests for AWM applications are described in UL 1581, UL 2556 and CSA C22.2 No. 03. Characteristic for these tests is the periodic exposure of the test specimen to flames and the disallowance of the ignition of cotton wool by dripping off glowing particles. The most severe flame test for single cables is the VW-1 test. Any style can be rated and marked VW-1 as long as it meets the requirements in the standard.

### UL / CSA Single cable flame tests

<table>
<thead>
<tr>
<th>Name / Class</th>
<th>Standard</th>
<th>Area of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>VW-1</td>
<td>UL 2556 Sec. 9.4</td>
<td>Special applications and „limited use“ acc. to NEC</td>
</tr>
<tr>
<td>Vertical-Specimen Flame Test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT1</td>
<td>UL 2556 Sec. 9.3</td>
<td>AWM Class I / Class II</td>
</tr>
<tr>
<td>Vertical Flame Test</td>
<td>CSA C22.2 No. 03</td>
<td>(internal/external wiring)</td>
</tr>
<tr>
<td>CFT</td>
<td>UL 1581 Sec. 1061</td>
<td>AWM Use II (external wiring)</td>
</tr>
<tr>
<td>Cable Flame Test</td>
<td></td>
<td>(formerly known as Page 95)</td>
</tr>
<tr>
<td>H</td>
<td>UL 1581 Sec. 1090</td>
<td>AWM Use I (internal wiring)</td>
</tr>
<tr>
<td>Horizontal Flame Test</td>
<td></td>
<td>(formerly known as Page 31)</td>
</tr>
<tr>
<td>FT2</td>
<td>UL 2556 Sec. 9.1</td>
<td>AWM Class I / Class II</td>
</tr>
<tr>
<td>Horizontal Flame Test</td>
<td>CSA C22.2 No. 03</td>
<td>(internal/external wiring)</td>
</tr>
</tbody>
</table>
UL listed cables types

for fixed wiring in buildings, factory wired equipment and for field wiring

NEC cable substitution hierarchy

<table>
<thead>
<tr>
<th>NEC Articles</th>
<th>800 Communications Cable</th>
<th>725 Class 2 and Class 3 Power-Limited Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plenum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NFPA 262</td>
<td>CMP</td>
<td>CL3P</td>
</tr>
<tr>
<td>CSA FT6</td>
<td></td>
<td>CL2P</td>
</tr>
<tr>
<td>(Steiner Tunnel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riser</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UL 1666</td>
<td>CMR</td>
<td>CL3R</td>
</tr>
<tr>
<td>(Vertical shaft)</td>
<td></td>
<td>CL2R</td>
</tr>
<tr>
<td>General purpose</td>
<td></td>
<td></td>
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<tr>
<td>CSA FT4</td>
<td>CMG</td>
<td>PLTC</td>
</tr>
<tr>
<td>UL 1685</td>
<td>CM</td>
<td></td>
</tr>
<tr>
<td>(Vertical tray)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dwellings</td>
<td>CMX</td>
<td>CL3X</td>
</tr>
<tr>
<td>UL 2556 VW-1</td>
<td>CL2X</td>
<td></td>
</tr>
<tr>
<td>CSA FT1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Vertical flame)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cable types</th>
<th>Use</th>
<th>NEC article</th>
<th>UL standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMP, CMR, CMG, CM, CMX</td>
<td>Communications cables</td>
<td>800</td>
<td>444</td>
</tr>
<tr>
<td>PLTC</td>
<td>Power limited tray cables</td>
<td>725</td>
<td>13</td>
</tr>
</tbody>
</table>

Cable A shall be permitted to be used in place of cable B

Listed types of LEONI
National Electrical Code (NEC)

The NEC is published by the National Fire Protection Association (NFPA) to provide practical protection for persons and property from the risks of using electricity (see also www.nfpa.org). Instructions on how to use cables and wires in various areas (e.g. inside and outside buildings, factories and other premises) are set out in nine chapters. NEC type IDs are abbreviations consisting of a prefix and a suffix. The prefix describes the type of cable (e.g. CM = Communications metallic, CL3 = Class 3 Power Limited Circuit, OF = Optical Fibre). The suffix indicates the type of mandatory flame test and the area of use (e.g. P = Plenum, R = Riser, X = Limited Use).

Plenum
Cables which are allowed to be used without additional protection in ducts and horizontal spaces above suspended ceilings plenums are called Plenum Cable or Horizontal Cable. The requirements imposed on these cables for “low smoke” and “low flame spread” are very severe. To comply with the NEC, a plenum cable has to pass the Steiner Tunnel flame test in accordance with NFPA 262 FT6. The type ID ends with a P.

Riser
Cables which are installed in risers (vertical shafts) or other cavities linking at least two storeys are called riser cables or backbone cables. Requirements imposed on fire safety are less severe than for plenum cables. A riser cable has to pass the riser flame test in accordance with UL 1666. Its type ID ends with an R.

General purpose
Cables used in areas of buildings which are neither plenums or risers are called general purpose cables. As a minimum requirement they have to pass the vertical tray flame test in accordance with UL 1685 Sec. 4 – UL-version (no ID letter issued). Cables which pass the vertical tray FT 4 test in accordance to UL 1685, Sec. 12 - CSA-version have a G at the end of their ID code.

Dwelling
These types of cable are for limited use inside dwellings. They are identified by the letter X and are required to pass at least the vertical wire flame test VW-1 according to UL 2556. UL listed cables are marked with the NEC type ID which corresponds to the respective UL standard.

Type PLTC
For cable that is for Class 3 and Class 2 circuits in general and in trays and complies with the requirements in UL 13, including the vertical tray flame test and the sunlight resistance. PLTC cables are acceptable for outdoor use.
Flame tests

UL single cable flame tests
UL 2556 Sec.9.3 FT1 / Sec.9.4 VW-1 / UL 1581 Sec.1061 Cable Flame

Test set-up:
The cable is fixed vertically and fitted with a paper indicator flag (P, 10 x 20 mm).
A Tirrill burner (modified Bunsen burner), fixed at an angle of 20° to the vertical, is used to apply the flame.

Flame temperature:
Determined by the specific setting of the Tirrill burner flame. The power amounts to 500 W.

Test duration:
Sec. 9.3: 5 cycles of flame applied for 15 s with a break of 15 s.
Sec. 9.4: 5 cycles of flame applied for 15 s with a break of 15 s and a maximum break of 60 s.
Sec. 1061: 3 cycles of flame applied for 60 s with a break of 30 s.

Compliance criteria:
The sample may continue to burn for a maximum of 60 s after the flame is removed and the paper indicator flag (P) can be carbonised at a maximum of 25%. Any glowing or flaming material dripping off must not ignite the cotton wool (B) (does not apply to the FT1 test).
Test set-up:
The cable is fixed horizontally with a Tirrill burner flame applied vertically (for the FT2 test the burner is angled 20° from the vertical). The cotton wool (B) is laid out next to the burner.

Flame temperature:
Determined by the specific setting of the Tirrill burner flame.

Test duration:
30 sec

Compliance criteria:
Any glowing or flaming material dripping off must not ignite the cotton wool (B).

Sec. 1090: The flame propagation speed must not exceed 25 mm/min.

Sec. 9.1: The length of the carbonised part may not exceed 100 mm.
UL large scale flame tests
UL 1685 FT4 Test / IEEE 1202 – CSA method

Test set-up:
The cables are fixed in several layers to a ladder (quantity depends on the cable diameter). The length of each specimen is 2.44 m (8 ft). Cables with a diameter < 13 mm may be fixed to the ladder in bunches. The burner is angled 20° from the horizontal.

Flame temperature:
Determined by the specific volumes of propane and air. The power amounts to 20.5 kW (70,000 Btu/hr).

Test duration:
20 minutes (2 test runs)

Compliance criteria:
The cable damage height shall be less than 1.50 m (4 ft 11 in) when measured from the lower edge of the burner surface.

UL 1685 Vertical Tray Test – UL method

Test set-up:
One layer of cables is fixed to a ladder (quantity depends on the cable diameter). The length of each specimen is 2.44 m (8 ft).

Flame temperature:
Determined by the specific volumes of propane and air. The power amounts to 20.5 kW (70,000 Btu/hr).

Test duration:
20 minutes (2 test runs)

Compliance criteria:
The cable damage height shall be less than 2.44 m (8 ft) when measured from the bottom of the cable tray.
IEC single and large scale flame tests
IEC 60332-1-2 / EN 60332-1-2 / VG 95218-2 Method 1 / BS 4066 Part 1

Test set-up:
The single cable to be tested is fixed vertically and exposed to a Bunsen burner flame at a 45° angle to the vertical. Test apparatus according to IEC/EN 60332-1-1.

Flame temperature:
Determined by the specified setting of the Bunsen burner flame.

Test duration:
Cable with a diameter of ≤ 25 mm: 60 sec
Cable with a diameter of 25 < D ≤ 50 mm: 120 sec

Compliance criteria:
The fire damage must end at least 50 mm below the upper fixing clamp. The cable must be self-extinguishing.
Test set-up:
The cables are secured to a ladder in a single layer (quantity depends on the diameter of the cable). The length of each sample is 5.33 m. The flame is applied using a burner diffuser plate.

Flame temperature:
Determined by the stipulated quantity of propane gas and air. The power equals 154.5 kW (527,500 Btu/hr).

Test duration:
30 minutes (2 tests to be performed)

Compliance criterion:
The area of fire damage to the cables must be less than 3.66 m (measured from the bottom of the ladder) and the temperature of any of the thermocouples (at a height of 3.66 m) must not exceed 454.4 °C. A third test must be carried out if the difference in propagation height for the two tests is greater than 1.52 m.
Test set-up:
The cables are fixed to a ladder, close together or at a distance depending on the type of fire. The cables may be fixed in several layers.

Flame temperature:
Determined by the specified volume of propane and air.

Test duration:
Part 21: Category A F/R only for special applications
Part 22: Category A
(7 l flammable material/m): 40 min
Part 23: Category B
(3.5 l flammable material/m): 40 min
Part 24: Category C
(1.5 l flammable material/m): 20 min
Part 25: Category D
(0.5 l flammable material/m): 20 min

Compliance criteria:
Fire damage to the cable may be visible for a maximum of 2.5 m from the bottom of the burner to the top.
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