

# Cables for telecommunications

## Connecting the world



**The Quality Connection**

**LEONI**

# The LEONI Group



**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.

## Your markets – our strength.

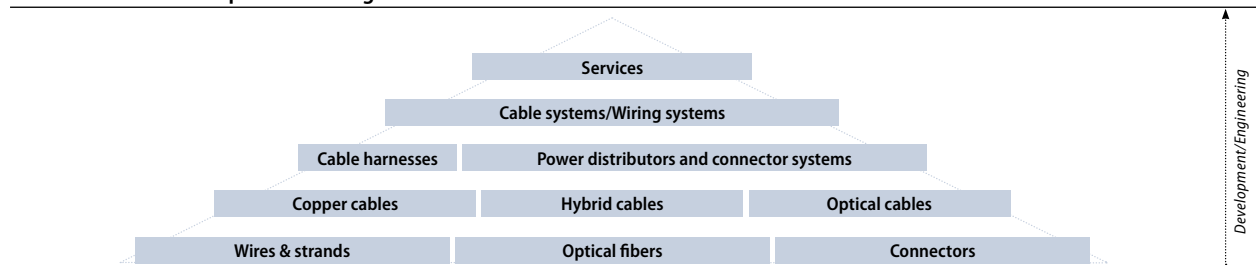
As diverse as our product and service range are the markets and sectors LEONI is supplying. We focus our activities on customers in the fields of Automotive & Commercial Vehicles, Industry & Healthcare, Communication & Infrastructure, Electrical Appliances and Conductors & Copper Solutions.

We are among 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.

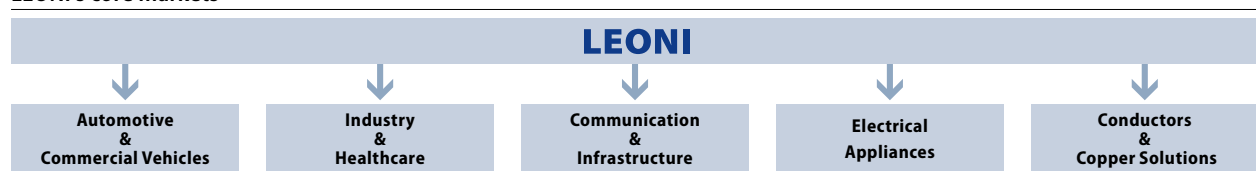
**LEONI – we create the best connection for your future.**

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

## Products and services portfolio at a glance



## LEONI's core markets



# Business Unit Telecommunication Systems



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	4
Type designations for copper cables	6
Products	7
The significance of UL and CSA certifications	24
UL listed cable types	26
Flame tests	28
Quality and environment	34
Competence worldwide	35

# 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



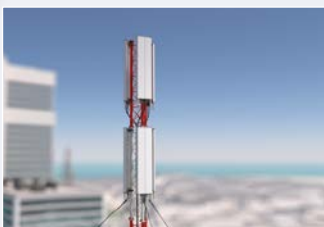
- High speed cables and cable systems
- High frequency cables
- Data cables
- Power cables
- Fiber optic cables
- Patch cables

## 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

Colour code DIN IEC 60757:	
<b>BK</b>	black
<b>BN</b>	brown
<b>RD</b>	red
<b>OG</b>	orange
<b>YE</b>	yellow
<b>GN</b>	green
<b>BU</b>	blue
<b>VT</b>	violet
<b>GY</b>	grey
<b>WH</b>	white
<b>PK</b>	pink
<b>TQ</b>	turquoise
<b>GD</b>	gold
<b>SR</b>	silver

<b>B</b>	armour
<b>(2B...)</b>	two layers of steel tape; thickness of one steel tape in mm
<b>C</b>	screen of copper wire braiding
<b>FE 90</b>	insulation integrity 90 minutes
<b>FLI</b>	flat cable with stranded conductor
<b>FR</b>	improved flame retardant
<b>H</b>	insulation or sheath of halogen-free material
<b>J-</b>	installation cable
<b>-J</b>	grounded wire, green-yellow
<b>... IMF</b>	separate stranding element in metal foil or in metallised paper and sheath wire (e.g. pairs PIMF)
<b>KF ...</b>	cold-proof implementation down to minus ... °C
<b>L</b>	wires with bunched conductor > 0.2 mm <sup>2</sup>
<b>LI</b>	cord with stranded conductor < 0.2 mm <sup>2</sup>
<b>NC</b>	non corrosivity of combustion gases
<b>OE</b>	oil-proof
<b>(ST)</b>	electrostatic shield made of metal foil or plastic laminated metal foil
<b>VZN</b>	tinned conductor
<b>W</b>	corrugated steel sheath
<b>X</b>	insulation, sheath or protective cover of cross-linked Polyvinylchloride (PVC)
<b>2X</b>	insulation, sheath or protective cover of cross-linked Polyethylene (PE)
<b>11X</b>	insulation, sheath or protective cover of cross-linked Thermoplastic Polyurethane (TPU)
<b>Y</b>	insulation, sheath or protective cover of Polyvinylchloride (PVC)
<b>2Y</b>	insulation, sheath or protective cover of Polyethylene (PE)
<b>9Y</b>	insulation, sheath or protective cover of Polypropylene (PP)
<b>11Y</b>	insulation, sheath or protective cover of Thermoplastic Polyurethane (TPU)
<b>12Y</b>	insulation of Polyethylene Terephthalate
<b>99Y</b>	insulation, sheath or protective cover of all other thermoplastics without VDE symbols
<b>02YS</b>	insulation of cellular Polyethylene (PE) with additional skin of solid material (foam skin)
<b>02Y</b>	insulation of cellular Polyethylene (PE)
<b>-Z</b>	wires with printed numbers

## Example hybrid cable (L45467-J216-W15)

**9Y(ST)4x2x0.5/0.98-100**

**LI LI 9Y(ST)CY 3x1x2.5**

<b>9Y</b>	Wire insulation of Polypropylene (PP)
<b>(ST)</b>	Electrostatic shield made of metal foil or plastic laminated metal foil
<b>C</b>	Screen of copper wire braiding
<b>LI</b>	Cord with stranded conductor < 0.2 mm <sup>2</sup>
<b>9Y</b>	Wire insulation of Polypropylene (PP)
<b>(ST)</b>	Electrostatic shield made of metal foil or plastic laminated metal foil
<b>C</b>	Screen of copper wire braiding
<b>Y</b>	Inner jacket of Polyvinylchloride (PVC)



# Products

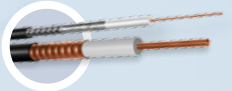
Switchboard cables 8



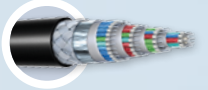
Power cables 10



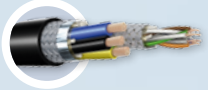
Coaxial cables 12



Multi coaxial cables 16



Hybrid cables 18



Hook-up wires and strands 21

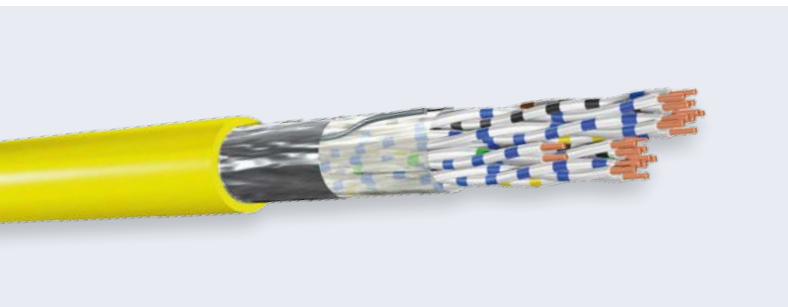


Customised solutions 22



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 you special requirement, so we can provide you the ideal solution.

## Switchboard cables



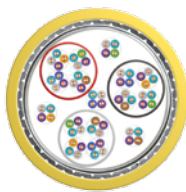
LEONI provides cables for fixed and mobile applications up to 20 MHz for the transmission of high-frequency signals in telecommunications equipment. The cables are suitable for use with both indoor and outdoor applications and possess outstanding mechanical properties. Due to their small outer diameter 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

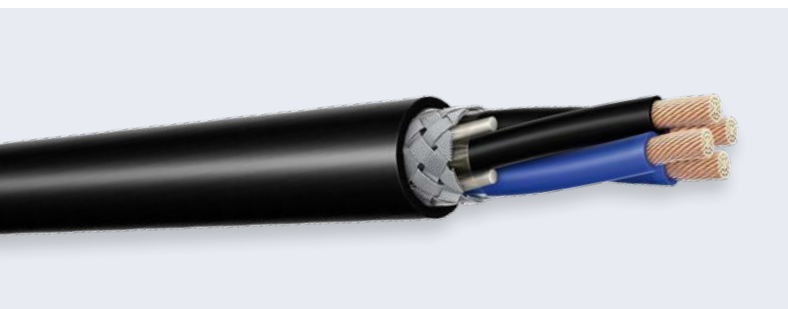
- Temperature range from – 20°C up to + 70°C
- VDE, UL and CSA approval
- Highly flexible
- High voltage stability





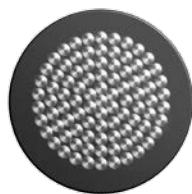
<b>Wire</b> Bare copper wire (24 AWG) ø 0.5 mm (0.020 in) Insulation of foamed Polypropylen (PP) with skin ø 1.03 mm (0.041 in) <b>Quad</b> 4 wires twisted <b>Units</b> 4 quads twisted, Marking with binder tape	<b>Wire</b> Bare copper wire (25 AWG) ø 0.5 mm (0.020 in) Insulation of foamed Polypropylen (PP) with skin ø 1.03 mm (0.041 in) <b>Quad</b> 4 wires twisted <b>Unit</b> 4 quads twisted Marking with binder tape	<b>Wire</b> Bare copper wire (25 AWG) ø 0.5 mm (0.020 in) Insulation of foamed Polypropylen (PP) with skin ø 1.03 mm (0.041 in) <b>Quad</b> 4 wires twisted <b>Unit</b> 4 quads twisted Marking with binder tape	<b>Conductor / wire</b>
<b>Central element</b> 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 Alulamine 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 Alulamine 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 Alulamine 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)	<b>Core</b>
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)	<b>Jacket</b>
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	<b>Characteristics</b>
– 25 °C (– 13 °F) up to 70 °C (158 °F)	– 25 °C (– 13 °F) up to 70 °C (158 °F)	– 25 °C (– 13 °F) up to 70 °C (158 °F)	<b>Temperature range</b>
S-09YS(ST)CH 32x2x0.5 STVIII BD	S-09YS(ST)CH 24x2x0.5 STVIII BD	S-09Y(ST)CH 16x2x0.5 STVIII BD	<b>Type designation</b>
<b>L45467-Y515-C16</b>	<b>L45467-Y515-C36</b>	<b>L45467-Y515-C56</b>	<b>Order number</b>

## 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.

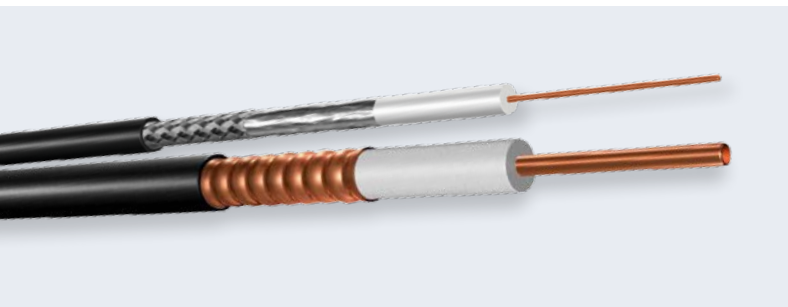
All LEONI power cables consists of flame resistant and halogen free jackets (in accordance with UL 1581 Sec. 1080 (VW-1), UL 1666 (Riser), UL 1685 Vertical tray, IEC 60332-3) and feature a high level of resistance to sunlight as well as high mechanical strength.



Stranded tinned copper wire (2/0 AWG)	Stranded tinned copper wire (10 AWG) ø 3.1 mm (0.122 in) Insulation of Thermoplastic copolymer ø 3.5 mm (0.138 in)	Stranded bare copper wire (8 AWG) (10 mm <sup>2</sup> ) ø 4.2 mm (0.165 in) Insulation of Thermoplastic copolymer (FRNC) ø 5.6 mm (0.220 in)	<b>Conductor / wire</b>
		2 wires, GY and BU twisted to a pair with fillers in gaps, Plastic tape overlapped, Shield braiding of tinned copper wires (4.6 mm <sup>2</sup> )	<b>Core</b>
Thermoplastic copolymer (FRNC) BK ø (14.0 ±0.5) mm (0.551 ±0.020 in)	Thermoplastic copolymer (FRNC) BK ø (8.8 ±0.3) mm (0.346 ±0.012 in)	Thermoplastic copolymer (FRNC) BK ø (13.6 ±0.4) mm (0.535 ±0.016 in)	<b>Jacket</b>
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 61034 Sunlight resistant UL AWM Style 11650 (90°C / 600 V)	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	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	<b>Characteristics</b>
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)	Transport and fixed installation: –40°C (–40°F) up to 85°C (185°F) Installation and flexible use: –40°C (–40°F) up to 85°C (185°F)	Transport and fixed installation: –50°C (–58°F) up to 80°C (176°F) Installation and flexible use: –40°C (–40°F) up to 80°C (176°F)	<b>Temperature range</b>
a) LIH 1X70 VZN SW (BK) b) LIH 1X70 VZN GR (GY) RAL 7032	LI99YDHCCH 6.0/3.5 VZN SW	LIHCH 1X2X10 SW	<b>Type designation</b>
a) L45571-V110-B50 b) L45571-V108-B50	L45572-N12-B6	L45551-J21-B2xx	<b>Order number</b>



# Coaxial cables



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

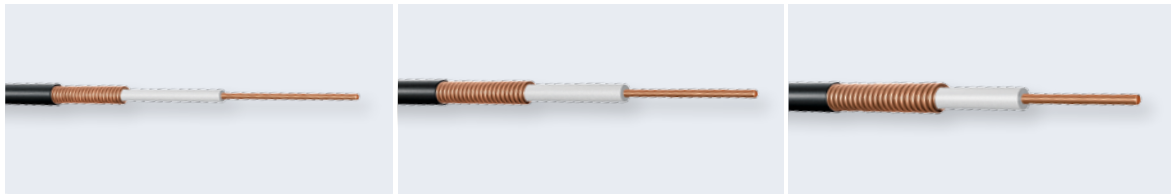
- Low attenuation
- Highly flexible
- Flame resistant and halogen free
- Different RG types available
- For indoor and outdoor use
- VDE, UL and CSA approval
- Small outer diameter

## Coaxial cables 50 Ohm



High strength wire silver-plated (38 AWG) ø 0.1 mm (0.004 in) Insulation of Perfluorethylenpropylen, FEP ø 0.27 mm (0.011 in)	<b>Inner conductor</b> Stranded silver-plated copper wire 7x0.1 (30 AWG) ø 0.3 mm (0.012 in) Insulation of foamed Perfluorethylenpropylen ø 0.8 mm (0.031 in)	<b>Inner conductor</b> Silver-coated copper wire ø 1.4 mm (0.055 in) Insulation of foamed Polyethylene (PE) with skin ø 3.75 mm (0.148 in)	<b>Conductor</b>
Shield braiding of silver-plated copper wires ø 0.05 mm (44 AWG)	<b>1. Shield</b> Silver plated copper wire ø 0.08 mm (40 AWG) Coverage about 95 % <b>2. Shield</b> Silver plated copper wire ø 0.08 mm (40 AWG) ø 1.12 mm (0.044 in) Coverage about 95 %	<b>1. Shield</b> Braiding of tinned copper wires ø 0.1 mm Coverage about 95 % ø 4.2 mm (0.165 in) <b>2. Shield</b> Braiding of tinned copper wires ø 0.1 mm Coverage about 95 % ø 4.6 mm (0.181 in)	<b>Shield</b>
Perfluorethylenpropylen (FEP) ø (0.76 ± 0.05) mm (0.030 ± 0.002 in)	Polyvinylchloride (PVC) YE, ø (1.5 ± 0.1) mm (0.059 ± 0.004 in)	Thermoplastic copolymer (FRNC) BK Wall thickness about 0.5 mm ø (5.7 ± 0.2) mm (2.244 ± 0.008 in)	<b>Jacket</b>
UL AWM Style 1716 (150 °C / 150 V)		Flame retardant acc. to UL 1685 (vertical tray) UL AWM Style 1375 (30 V / 80 °C) UL Communications Cable Type CM 75 °C Sunlight resistant	<b>Characteristics</b>
– 100 °C (– 148 °F) up to 160 °C (320 °F)	– 40 °C (– 40 °F) up to 80 °C (176 °F)	– 40 °C (– 40 °F) up to 85 °C (185 °F)	<b>Temperature range</b>
6YC6Y 0.1/0.27-50 VS	06YDDY 0.3/0.8-50 LI VS GE	02YSCCH 1.4/3.75-50 VS FRNC	<b>Type designation</b>
<b>L45466-B11-G137</b>	<b>L45466-B11-N5</b>	<b>L45466-B14-C126</b>	<b>Order number</b>

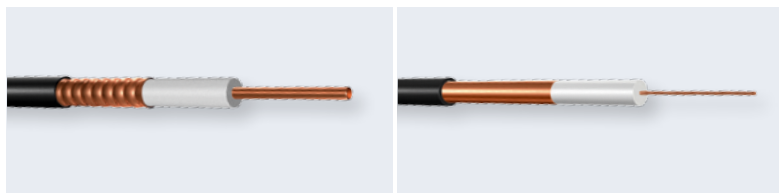
## FlexLine® coaxial cables 50 Ohm



	<b>Super flexible cable 1/4" S (FRNC) UL listed</b>	<b>Super flexible cable 3/8" S (FRNC) CMR/CATVR</b>	<b>Super flexible cables 1/2" S (FRNC) UL listed</b>
<b>Inner conductor</b>	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)	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)	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)
<b>Outer conductor</b>	Copper-tape, longitudinal welded, spiral corrugation ø (6.5 ±0.2) mm (0.256 ±0.008 in)	Copper-tape, longitudinal welded, spiral corrugated ø (9.1 ±0.15) mm (0.358 ±0.006 in)	Copper-tape (thickness 0.20 mm), longitudinal welded, spiral corrugated ø (12.3 ±0.15) mm (0.484 ±0.006 in)
<b>Jacket</b>	Thermoplastic copolymer (FRNC) BK, ø (7.7 ±0.15) mm (0.303 ±0.006 in)	Thermoplastic copolymer (FRNC) BK, ø (10.6 ±0.15) mm (0.417 ±0.006 in)	Thermoplastic copolymer (FRNC) BK, ø (13.5 ±0.2) mm (0.531 ±0.008 in)
<b>Characteristics</b>	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	Flame retardant acc. to IEC 60332-3-24 (Cat. C) UL 1581, Sec. 1080 (VW-1)  Sunlight resistant acc. to UL 1581 Sec.1200  Halogen free acc. IEC 60754-2  Smoke-density acc. to IEC 61034-1/2  Fire performance acc. to EN 50305 9.1.1  Flame retardant acc. to IEC 60332-1-2  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
<b>Temperature range</b>	Installation: – 25 °C (– 13 °F) up to + 85 °C (+ 185 °F)  Operation: – 55 °C (– 67 °F) up to + 85 °C (+ 185 °F)	Installation: – 25 °C (– 13 °F) up to + 60 °C (+ 140 °F)  Operation: – 55 °C (– 67 °F) up to + 85 °C (+ 185 °F)	Installation: – 25 °C (– 13 °F) up to + 60 °C (+ 140 °F)  Operation: – 55 °C (– 67 °F) up to + 85 °C (+ 185 °F)
<b>Type designation</b>	02YSWKH 1.9/4.4-50 ALCU FRNC	02YSWKH 2.6/6.5-50 ALCU FRNC	02YSWKH 3.6/9.1-50 ALCU FRNC
<b>Order number</b>	<b>L45466-B15-C96</b>	<b>V45466-B17-C156</b>	<b>L45466-B19-C166</b>



## CATV cables 75 Ohm



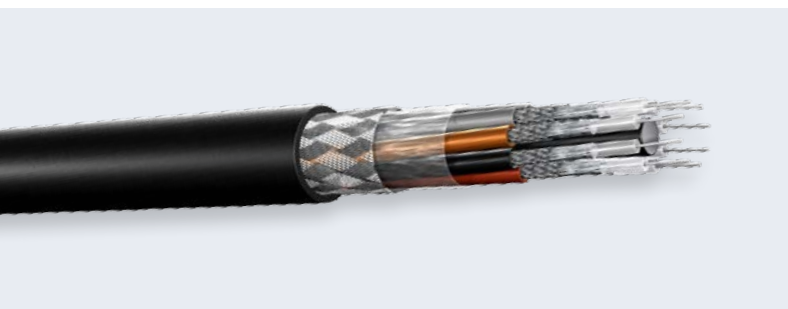
<b>Inner conductor</b> Bare copper wire (10 AWG) $\varnothing$ 2.65 mm (0.104 in) Insulation of foamed Polyethylene (PE) with skin $\varnothing$ 10.6 mm (0.417 in), water blocking tape, <b>Outer conductor</b> Copper-tape (thickness 0.25 mm), longitudinal welded, annular corrugation $\varnothing$ 12.0 mm (0.539 in)	<b>Inner conductor</b> Bare copper wire $\varnothing$ 2.2 mm (0.087 in) Insulation of foamed Polyethylene (PE) with skin $\varnothing$ 8.80 mm (0.346 in) <b>Outer conductor</b> Copper-tape, longitudinal welded	<b>Conductor</b>
Polyethylene (PE) BK $\varnothing$ (14.1 +0.4 –0.2) mm (0.555 +0.016 –0.008 in)	Thermoplastic copolymer (FRNC) BK $\varnothing$ (16.0 $\pm$ 0.4) mm (0.630 $\pm$ 0.016 in)	<b>Jacket</b>
	Sunlight resistant Halogen free	<b>Characteristics</b>
–50 °C (–58 °F) up to 80 °C (176 °F)	–25 °C (–13 °F) up to 80 °C (176 °F)	<b>Temperature range</b>
02YWK2Y 2.65/10.6-75	02YSKH 3.1/12.4-75	<b>Type designation</b>
L45466-D21-C46	L45466-D19-Cxx	<b>Order number</b>

## RG cables



Type of cable	Inner conductor	Dielectric	Ohm
RG 6	0.74 mm	4.8 mm	75
RG 8	2.25 mm	7.25 mm	50
RG 11	11.2 mm	7.25 mm	75
RG 58	0.9 mm	2.95 mm	50
RG 59	0.6 mm	3.7 mm	75
RG 174	0.48 mm	1.5 mm	50
RG 178	0.3 mm	0.88 mm	50
RG 179	0.32 mm	1.6 mm	75
RG 213	2.25 mm	7.25 mm	50
RG 214	2.25 mm	7.25 mm	50
RG 223	0.89 mm	2.95 mm	50
RG 316	0.54 mm	1.5 mm	50

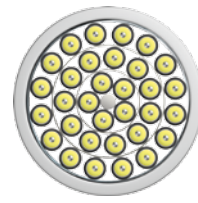
## Multi coaxial cables



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:**

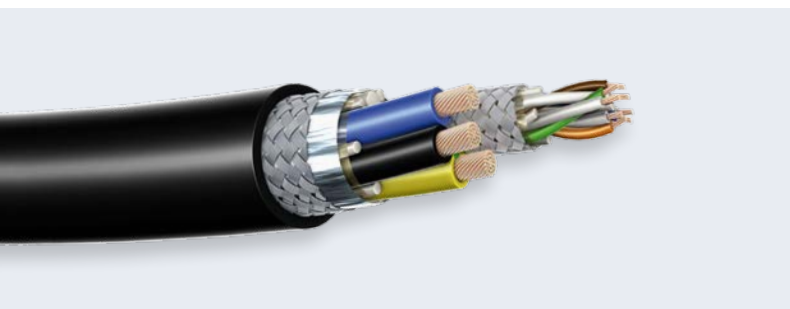
- Outstanding signal integrity
- Special insulation systems
- Low insertion loss
- Excellent impedance tolerance
- Minimal bending radii
- Excellent return loss
- VDE, UL and CSA approval



<p><b>Wire LIY 0.38/1.5 VZN</b></p> <p><b>Wire LIY 0.09/0.8 VZN</b></p> <p><b>Wire</b></p> <p>Stranded silver-plated copper-clad steel wire (30 AWG) <math>\varnothing</math> 0.3 mm (0.012 in)</p> <p>Insulation of foamed Polyethylene (PE) with skin <math>\varnothing</math> 0.75 mm (0.030 in)</p> <p><b>Parallel pair</b></p> <p>Tinned copper drain wire <math>\varnothing</math> 0.25 mm (30 AWG), alulamine foil overlapped, bonded plastic tape, overlapped</p> <p><b>Coaxial element</b></p> <p>06YC6Y 0.4/1.0-50 LI VS BK</p> <p>Inner conductor: Stranded silver-plated copper wire (28 AWG) <math>\varnothing</math> 0.4 mm (0.016 in)</p> <p>Insulation of foamed Perfluorethylenpropylen <math>\varnothing</math> 1.0 mm (0.039 in)</p> <p>Shield braiding of silver-plated copper wires</p> <p>Coverage about 95 % <math>\varnothing</math> 1.3 mm (0.051 in)</p> <p><b>Jacket</b></p> <p>Perfluorethylenpropylen, FEP BK <math>\varnothing</math> (1.52 <math>\pm</math> 0.07) mm (0.060 <math>\pm</math> 0.003 in)</p>	<p><b>Coaxial element</b></p> <p>Inner conductor: Silver plated copper wire <math>\varnothing</math> 0.32 mm (0.013 in)</p> <p>Insulation of Perfluorethylenpropylen, FEP <math>\varnothing</math> 0.62 mm (0.024 in)</p> <p>Insulation of LEONIZell® Skin-Foam-Skin <math>\varnothing</math> 1.60 mm (0.063 in)</p> <p>Alulamine foil overlapped <math>\varnothing</math> 1.70 mm (0.067 in)</p> <p>Tinned copper drain wire <math>\varnothing</math> 0.32 mm (0.013 in)</p> <p><b>Jacket</b></p> <p>TPE-E BK <math>\varnothing</math> 2.01 mm (0.079 in)</p> <p>Wall thickness about 0.15 mm (bulge with drain wire) <math>\varnothing</math> 2.33 mm (0.092 in)</p>	<p><b>Coaxial element</b></p> <p>Inner conductor: Bare copper wire (28 AWG) <math>\varnothing</math> 0.31 mm (0.012 in)</p> <p>Insulation of foamed Polyethylene (PE) with skin <math>\varnothing</math> 1.4 mm (0.055 in)</p> <p>Alulamine foil overlapped, applied longitudinally</p> <p>Shield braiding of tinned copper wires</p> <p>Coverage about 95 % <math>\varnothing</math> 1.95 mm (0.077 in)</p> <p><b>Jacket</b></p> <p>Thermoplastic copolymer (FRNC) BK - numbered <math>\varnothing</math> (2.7 <math>\pm</math> 0.1) mm (0.106 <math>\pm</math> 0.004 in)</p>	<b>Conductor / wire</b>
<p>1. layer: 1 coaxial element BK 2 wires LIY 0.38/1.5 VZN RD-BU + fillers, plastic tape overlapped</p> <p>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</p> <p>Plastic tape overlapped <math>\varnothing</math> 5.1 mm (0.201 in)</p>	<p>Central element:</p> <p>1 Coaxial element,</p> <p>1. layer: 6 coaxial elements, Alulamine foil overlapped</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.1 mm (0.004 in)</p> <p>Coverage about 85 % <math>\varnothing</math> 6.6 mm (0.260 in)</p>	<p>Filler as central element</p> <p>1. layer: 5 coaxial elements</p> <p>2. layer: 11 coaxial elements</p> <p>3. layer: 16 coaxial elements</p> <p>Plastic tape, overlapped <math>\varnothing</math> 18.5 mm (0.728 in)</p>	<b>Core</b>
<p>Polyvinylchloride (PVC) WH <math>\varnothing</math> (6.8 <math>\pm</math> 0.2) mm (0.268 <math>\pm</math> 0.008 in)</p>	<p>Polyvinylchloride (PVC) BK <math>\varnothing</math> (7.5 + 0.12 – 0.2) mm (0.295 + 0.005 – 0.008 in)</p>	<p>Thermoplastic copolymer (FRNC) grey <math>\varnothing</math> (20.2 <math>\pm</math> 0.6) mm (0.795 <math>\pm</math> 0.024 in)</p>	<b>Jacket</b>
<p>UL Style 2502 (80 °C / 30 V)</p>		<p>Halogen free</p>	<b>Characteristics</b>
<p>– 30 °C (– 22 °F) up to 80 °C (176 °F)</p>	<p>– 10 °C (14 °F) up to 70 °C (158 °F)</p>	<p>– 25 °C (– 13 °F) up to 80 °C (176 °F)</p>	<b>Temperature range</b>
<p>06YC6Y 0.4/1.0-50 LI VS LI02YS 2x2x0.06/0.75-100 PPIMF LIY 2x0.38 VZN LIY Y 8x0.09 VZN WS</p>	<p>6Y02Y(ST)12Y (ST)CY 7x0.32/1.6-75 VS</p>	<p>02YS(ST)CH H 32x0.31/1.4-75 GR</p>	<b>Type designation</b>
<p><b>L45466-B1312-N5</b></p>	<p><b>L45466-D712-Y5</b></p>	<p><b>L45466-D3212-C16</b></p>	<b>Order number</b>



# 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.

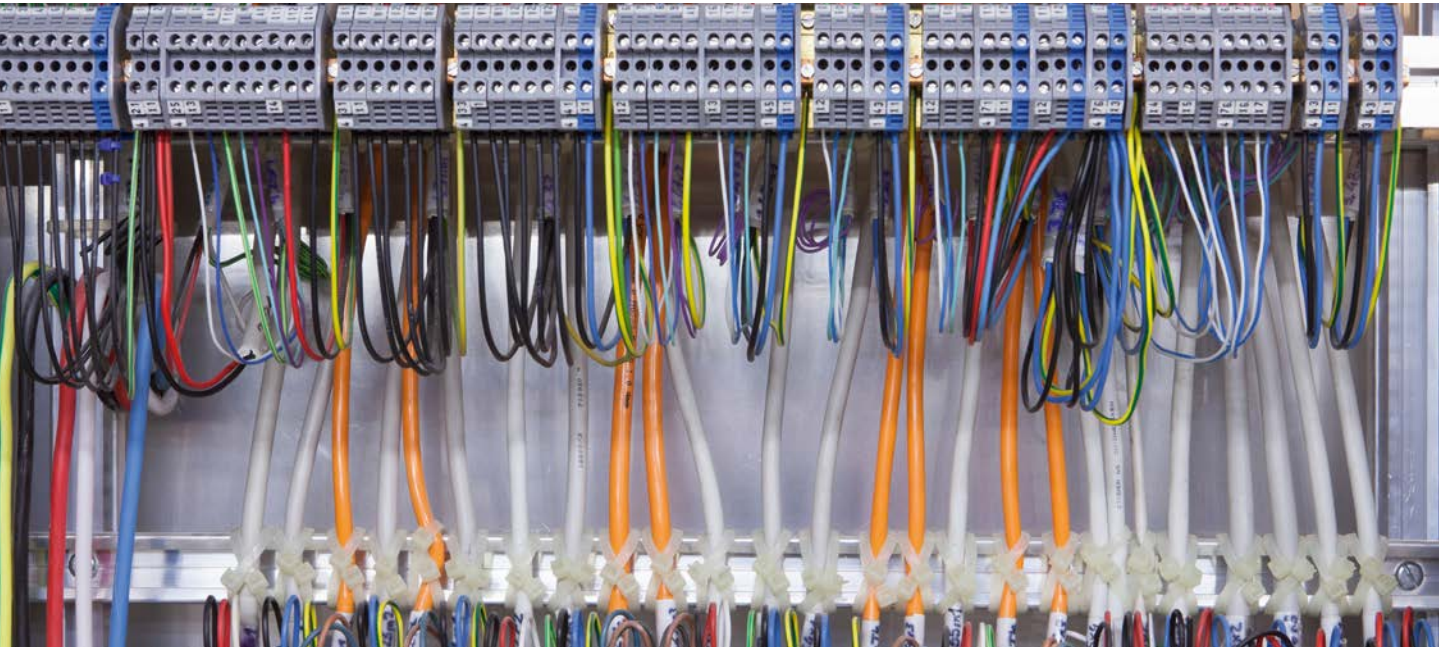
## Optional characteristics

- Halogen free
- Flame-retardant
- Sunlight resistant
- Cold-resistant and weatherproof for outdoor applications
- High mechanical strength
- VDE, UL and CSA approval



<p><b>Wire LIH 0.75/1.9</b></p> <p>Stranded tinned copper wire 96x0.1 (19AWG) <math>\varnothing</math> 1.15 mm (0.045 in)</p> <p>Insulation of Thermoplastic copolymer (FRNC) <math>\varnothing</math> 1.9 mm (0.075 in)</p> <p>Wall thickness about 0.38 mm</p> <p><b>Coaxial element</b></p> <p>Inner conductor: Stranded tinned copper wire 7x0.15 (27 AWG)</p> <p>Insulation of Polyethylen (PE) alulamine foil overlapped, applied longitudinally</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.1 mm (38 AWG)</p> <p>Coverage about 85 % <math>\varnothing</math> 3.3 mm (0.130 in)</p> <p><b>Jacket</b></p> <p>Thermoplastic copolymer (FRNC) YE</p> <p>Wall thickness about 0.35 mm <math>\varnothing</math> (4.0 <math>\pm</math> 0.15) mm (0,157 <math>\pm</math> 0.006 in)</p>	<p><b>Wire LIY 1x2.5/4.3</b></p> <p>Stranded bare copper wire 50x0.25 (14 AWG) <math>\varnothing</math> 2.1 mm (0,083 in)</p> <p>Insulation of Polyvinylchloride (PVC) <math>\varnothing</math> 4.3 mm (0.169 in)</p> <p>Wall thickness about 1.1 mm</p>	<p><b>Wire LI9Y 1X2.5/3.1</b></p> <p>Stranded bare copper wire 50x0.25 (14 AWG) <math>\varnothing</math> 2.1 mm (0.083 in)</p> <p>Insulation of Polypropylene (PP) <math>\varnothing</math> 3.1 mm (0.122 in)</p> <p>Wall thickness about 0.5 mm 9Y(ST)C 4x2x0.5/0.98-100 LI (Cat5)</p> <p><b>Wire</b></p> <p>Stranded bare copper wire 7x0.17 (26 AWG) <math>\varnothing</math> 0.5 mm (0.020 in)</p> <p>Insulation of Polypropylene (PP) <math>\varnothing</math> (0.98 <math>\pm</math> 0.02) mm (0.039 <math>\pm</math> 0.001 in)</p> <p>2 wires twisted to a pair 4 pairs twisted + fillers</p> <p>Sequence of colors: WHBU/BU-WHOG/OG-WHGN/GN-WHBN/BN</p> <p>Plastic tape overlapped, alulamine foil overlapped, applied longitudinally</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.1 mm (38 AWG)</p> <p>Coverage about 80 % <math>\varnothing</math> 5.1 mm (0.201 in)</p>	<b>Conductor / wire</b>
<p>1 Coaxial element</p> <p>2 wires LIH 0.75/1.9 RD, BK + fillers plastic tape, overlapped</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.13 mm</p> <p>Coverage about 85 % <math>\varnothing</math> 6.5 mm ( 0.256 in)</p>	<p>3 wires LIY 1X2.5/4.3 BK-BU-GNYE</p> <p>2 optical fibers number 1 and 2 + filler</p> <p>Sequence of colors: BU – optical fiber/1 – BK- optical fiber/2 – GNYE - filler</p> <p>Plastic tape, overlapped</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.2 mm (32 AWG)</p> <p>Coverage about 85 % <math>\varnothing</math> 10.2 mm (0.402 in)</p>	<p>9Y(ST)C 4X2X0.5/0.98-100 LI (Cat5)</p> <p>3 wires LI9Y 2.5/3.1 BK-BU-GNYE + fillers</p> <p>Plastic tape overlapped, alulamine foil overlapped, applied longitudinally</p> <p>Shield braiding of tinned copper wires <math>\varnothing</math> 0.2 mm (32 AWG)</p> <p>Coverage about 85 % <math>\varnothing</math> 9.9 mm (0.390 in)</p>	<b>Core</b>
<p>Thermoplastic copolymer (FRNC) BK <math>\varnothing</math> (8.0 <math>\pm</math> 0.2) mm (0.315 <math>\pm</math> 0.008 in)</p>	<p>Polyvinylchloride (PVC) BK <math>\varnothing</math> (12.2 <math>\pm</math> 0.3) mm (0.480 <math>\pm</math> 0.012 in)</p>	<p>Polyvinylchloride (PVC) BK</p> <p>Wall thickness about 1.0 mm <math>\varnothing</math> (11.9 <math>\pm</math> 0.4) mm (0.469 <math>\pm</math> 0.016 in)</p>	<b>Jacket</b>
<p>Flame test acc. to IEC 60332-3-24 (Cat. C),</p> <p>Flame retardant acc. to ECE-R 118</p> <p>Fire retardant</p> <p>Corrosivity of fire gases acc. to IEC 60754-2</p> <p>Smoke-density acc. to IEC 61034</p>			<b>Characteristics</b>
– 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	<b>Temperature range</b>
2Y(ST)CH 0.45/2.8-75 LI VZN LIH CH 2x0.75/1.9 VZN FRNC	I-V(ZN)H 2x1G62.5/125 L-Y CY 3x1x2.5	9Y(ST)C 4x2x0.5/0.98-100 LI LI9Y (ST)CY 3x1x2.5	<b>Type designation</b>
<b>L45466-D313-Wxx</b>	<b>L46910-L2-H46</b>	<b>L45467-J216-W15</b>	<b>Order number</b>

## Hook-up wires and strands



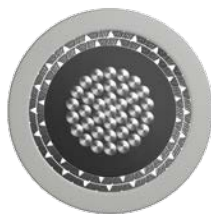
LEONI offers a wide range of hook-up wires and strands for signal transmission in communications technology. The copper wire or copper alloy wires are available in different versions depending on the particular specification. The insulated covering can be manufactured from a variety of materials such 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



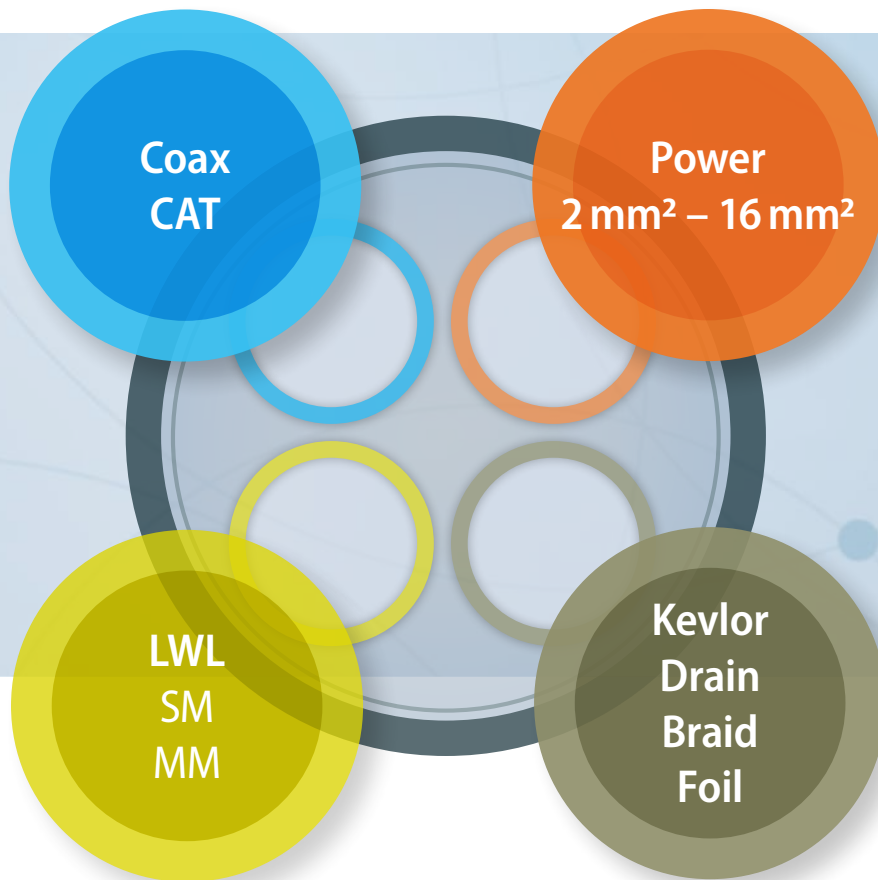


<p>Stranded tinned copper wire (10 AWG) ø 3.1 mm (0.122 in)</p> <p>Insulation of Thermoplastic copolymer (FRNC) ø 4.6 mm (0.181 in)</p> <p>1. Shield braiding of tinned copper wires</p> <p>2. Shield braiding of tinned copper wires (cross section for both 10 AWG) ø 5.8 mm (0.228 in)</p>	<p>Stranded tinned copper wire 7x0.2 (24 AWG) ø 0.6 mm (0.024 in)</p>	<p>Stranded bare copper wire (6 AWG) ø 5.3 mm (0.209 in)</p>	<b>Conductor / wire</b>
<p>Thermoplastic copolymer (FRNC) GY ø (7.4 ± 0.3) mm (0.291 ± 0.012 in)</p>	<p>Ethylentetrafluoretylen, ETFE ø (1.00 ± 0.05) mm (0.039 ± 0.002 in) Wall thickness about 0.2 mm</p>	<p>Thermoplastic copolymer (FRNC) ø (7.7 ± 0.6) mm (0.303 ± 0.024 in)</p>	<b>Jacket</b>
<p>– 40 °C (– 40 °F) up to 90 °C (194 °F)</p>	<p>– 65 °C (– 85 °F) up to 150 °C (302 °F)</p>	<p>Transport and fixed installation: – 40 °C (– 40 °F) up to 90 °C (194 °F)</p> <p>Installation and flexible use: – 20 °C (– 4 °F) up to 90 °C (194 °F)</p>	<b>Temperature range</b>
YVO(ST)Y 2X0.5/0.9	LI7Y 0.22/1.0 VZN	LIH 16/7.7 SW	<b>Type designation</b>
<b>L45572-N110-B6</b>	<b>L45571-B1xx-H60</b>	<b>L45571-S110-B20</b>	<b>Order number</b>



<p>Wire YV 1x0.5/0.9 tinned copper wire ø 0.5 mm</p> <p>Insulation of Polyvinylchloride (PVC) ø 0.9 mm</p> <p>Wall thickness about 0.2 mm</p>	<p>Tinned copper wire ø 0.4 mm (0.016 in)</p> <p>Insulation of foamed Polyethylene (PE) with skin ø 1.0 mm (0.039 in)</p>	<b>Conductor / wire</b>
<p>2 wires, WH and BN twisted to a pair copper drain wire, tinned plated ø 0.5 mm VDE thread alulamine foil overlapped, alu inside ø 1.9 mm</p>	<p>2 wires, WH and BN twisted to a pair Plastic laminate, overlapped tinned copper drain wire ø 0.4 mm</p> <p>Identification thread alulamine foil overlapped ø 2.3 mm (0.091 in)</p>	<b>Core</b>
<p>Polyvinylchloride (PVC) GY Wall thickness about 0.3 mm ø (2.6 + 0.1 – 0.3) mm</p>	<p>Polyvinylchloride (PVC) GY Wall thickness about 0.25 mm ø (2.8 ± 0.1) mm (0.11 ± 0.004 in)</p>	<b>Jacket</b>
<p>– 15 °C (5 °F) up to 70 °C (158 °F)</p>	<p>– 40 °C (– 40 °F) up to 70 °C (158 °F)</p>	<b>Temperature range</b>
YVO(ST)Y 2x0.5/0.9	LI7Y 0.22/1.0 VZN	<b>Type designation</b>
<b>H50402-B509-D43</b>	<b>V45467-F14-C25</b>	<b>Order number</b>

## Customised hybrid cables



### The sky is the limit

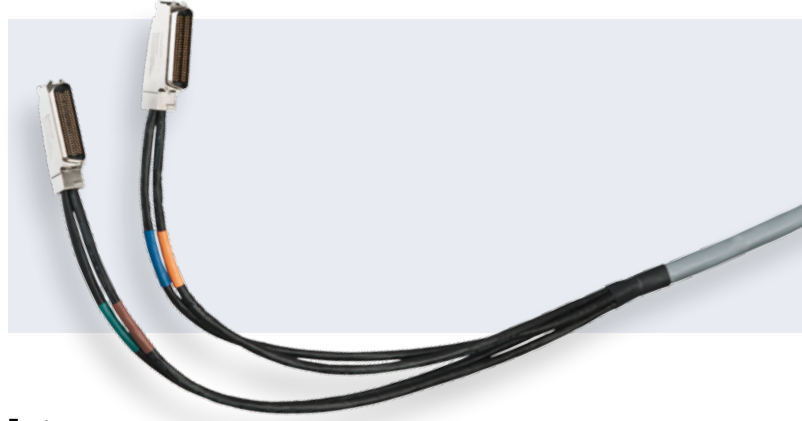
LEONI can supply individual hybrid cables for your specific application which can contain different elements such as copper wires, fiber optic cables, tubes, shielded pairs, etc., With correspondingly optimised cable construction the required installation space can be significantly reduced and fitting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

## Customised cable systems



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

	Certification only for Canada	Certification only for USA	Certification for Canada and USA
The organisations UL, Intertek ETL and CSA International, are recognised in Canada and in the USA. They issue various certification mark according to validity.	  	  	  
The certification mark (UR) identifies products which are integrated as components in electrical equipment (recognised mark).	  		

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.

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.

### Certification for the USA:

Certifications have to be issued by a Nationally Recognized Testing Laboratory (NRTL). NRTL status is awarded by the Occupational Safety and Health Administration (OSHA).

e.g. ■ 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)

e.g. ■ 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.

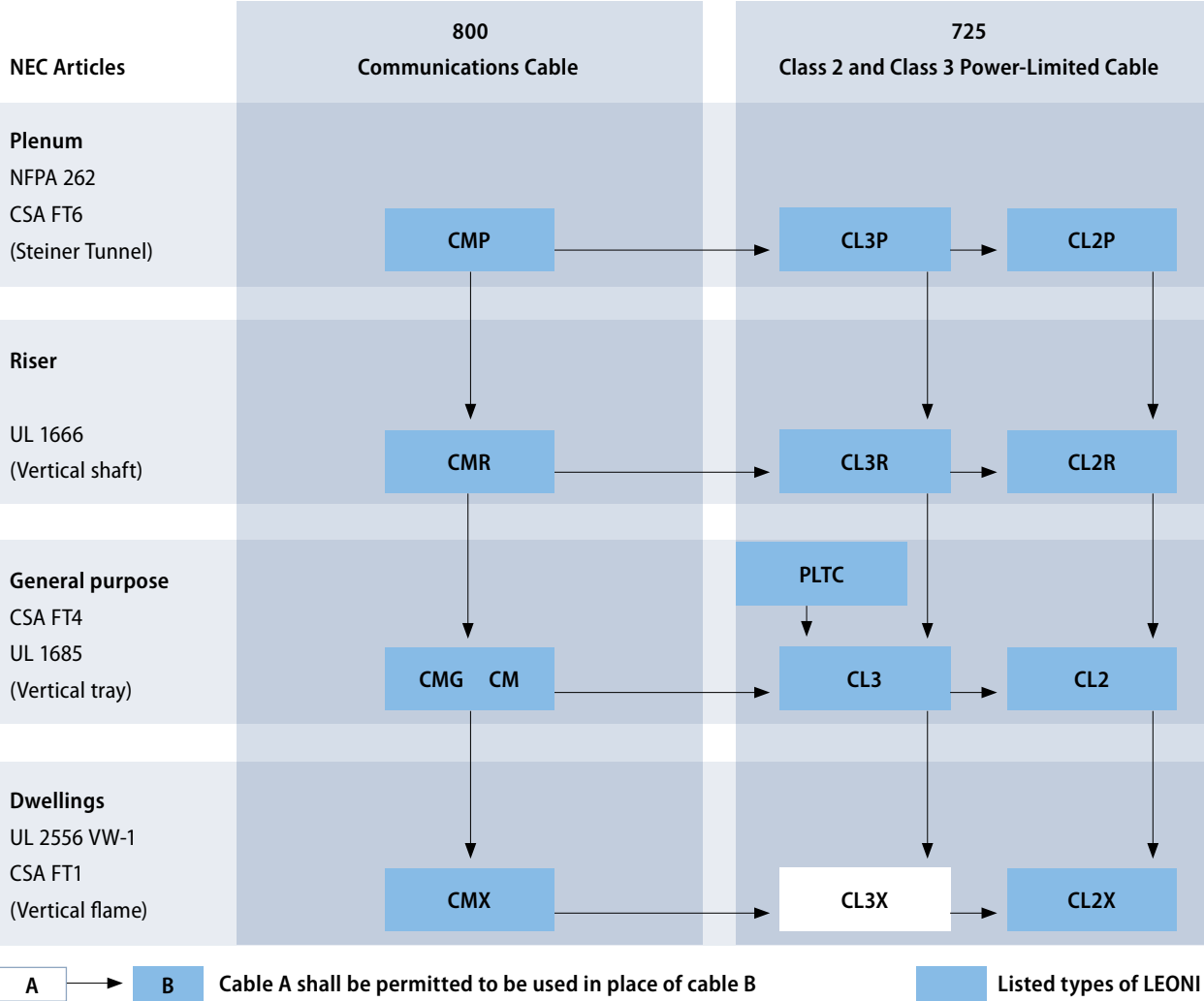
### UL / CSA Single cable flame tests

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

# UL listed cables types

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

NEC cable substitution hierarchy



Cable types	Use	NEC article	UL standard
CMP, CMR, CMG, CM, CMX	Communications cables	800	444
CL3P, CL2P, CL3R, CL2R, CL3, CL2, CL3X, CL2X	Class 2, Class 3 Remote-Control, signaling and power limited cables	725	13
PLTC	Power limited tray cables	725	13

### **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](http://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.

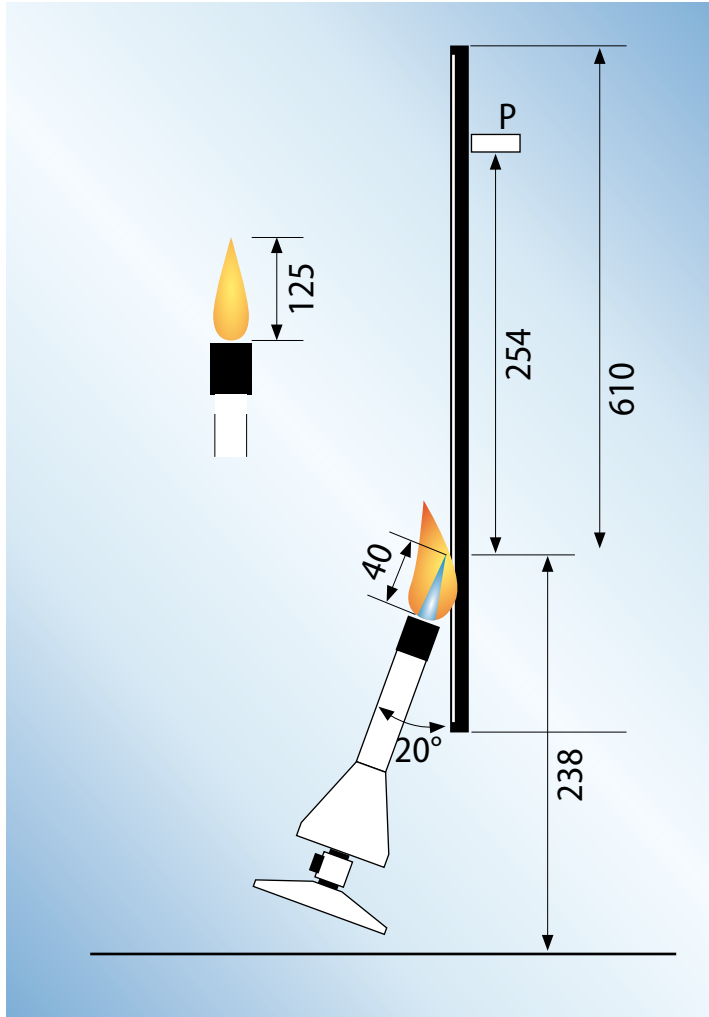
#### **Type PLTC**

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.

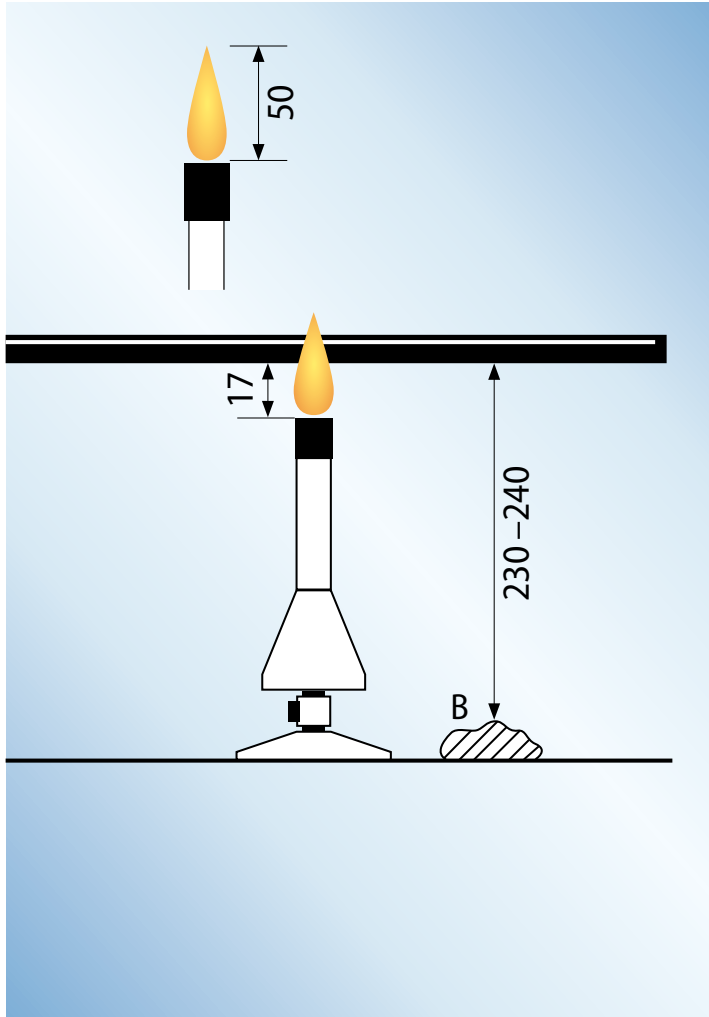
Sec. 1061: 3 cycles of flame applied for 60 s with a break of 30 s.

### 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).



UL1581 Sec.1090 H / UL2556 Sec.9.1 FT2



**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:**

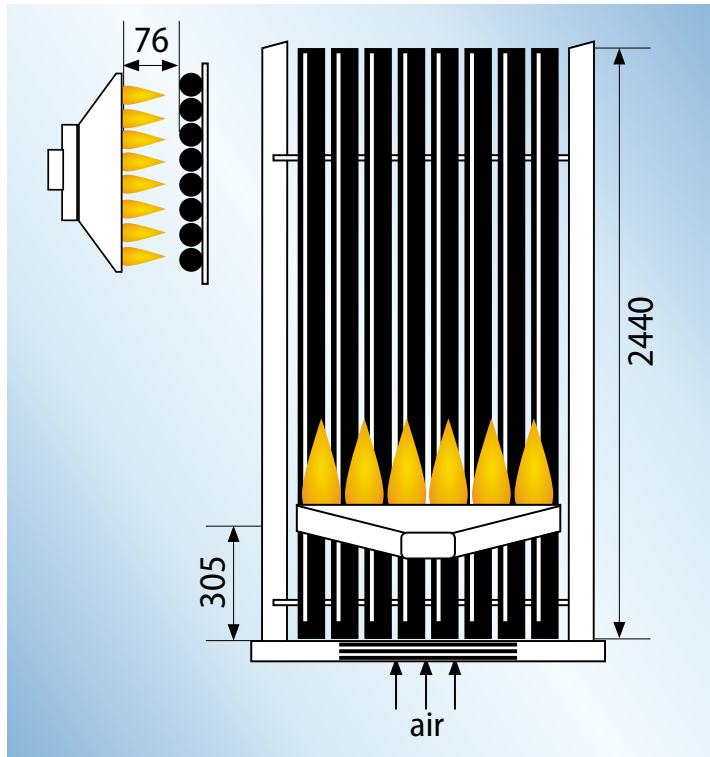
Any glowing or flaming material dripping off must not ignite the cotton wool (B).

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).

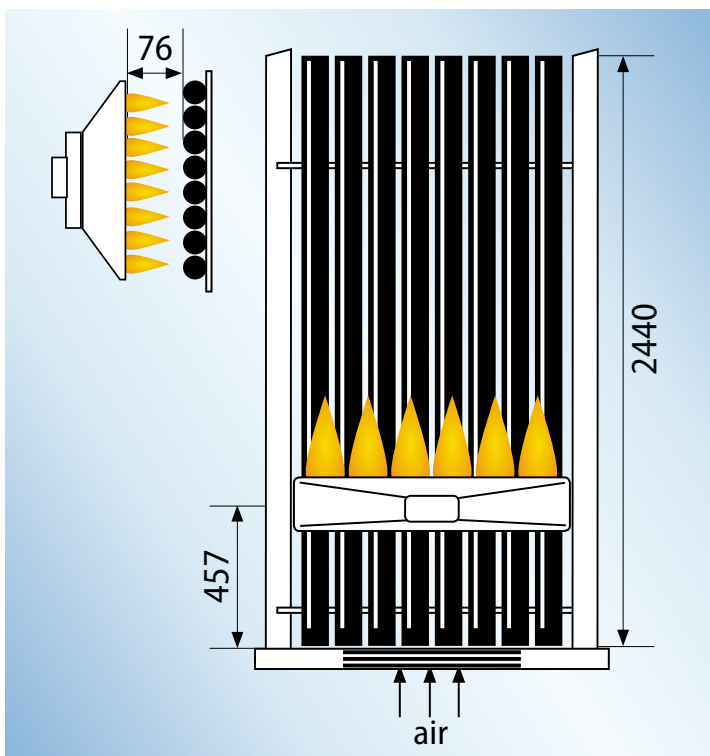
#### Test duration:

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:

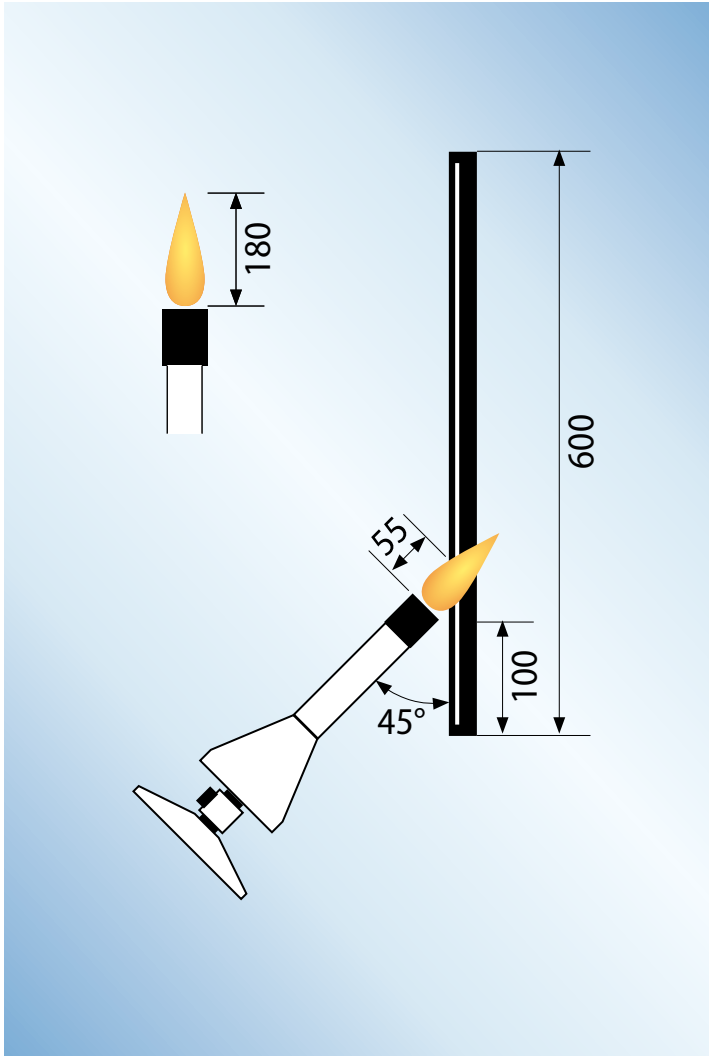
20 minutes (2 test runs)

#### 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:

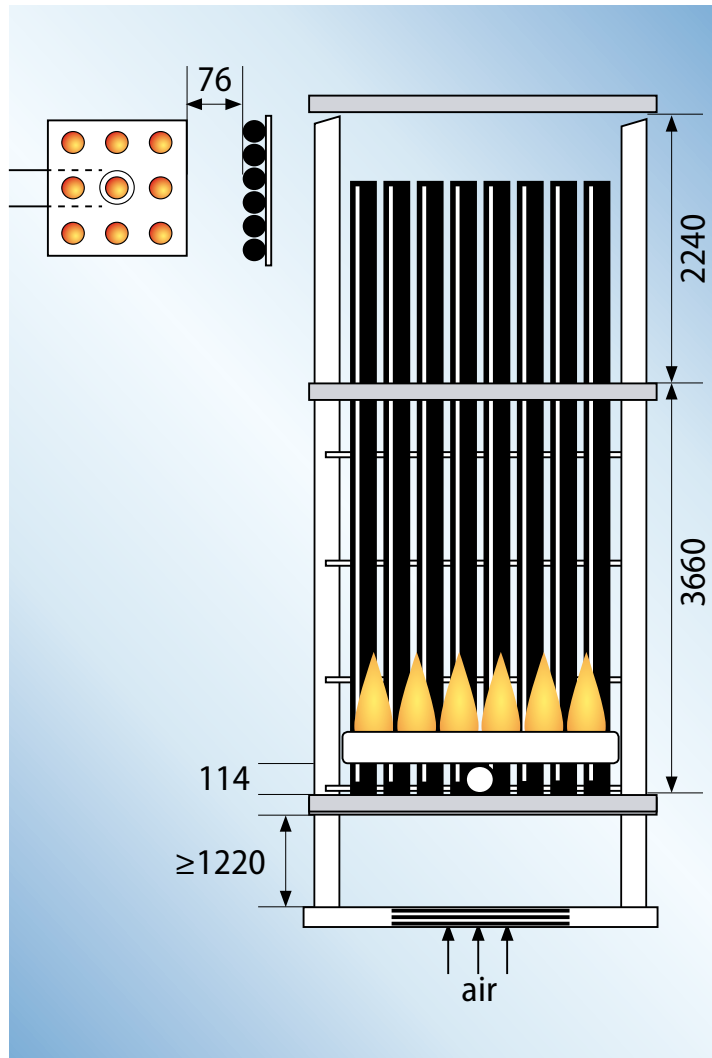
Cable with a diameter of  $\leq 25$  mm: 60 sec

Cable with a diameter of  $25 < D \leq 50$  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.

## UL 1666 Riser



### 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)

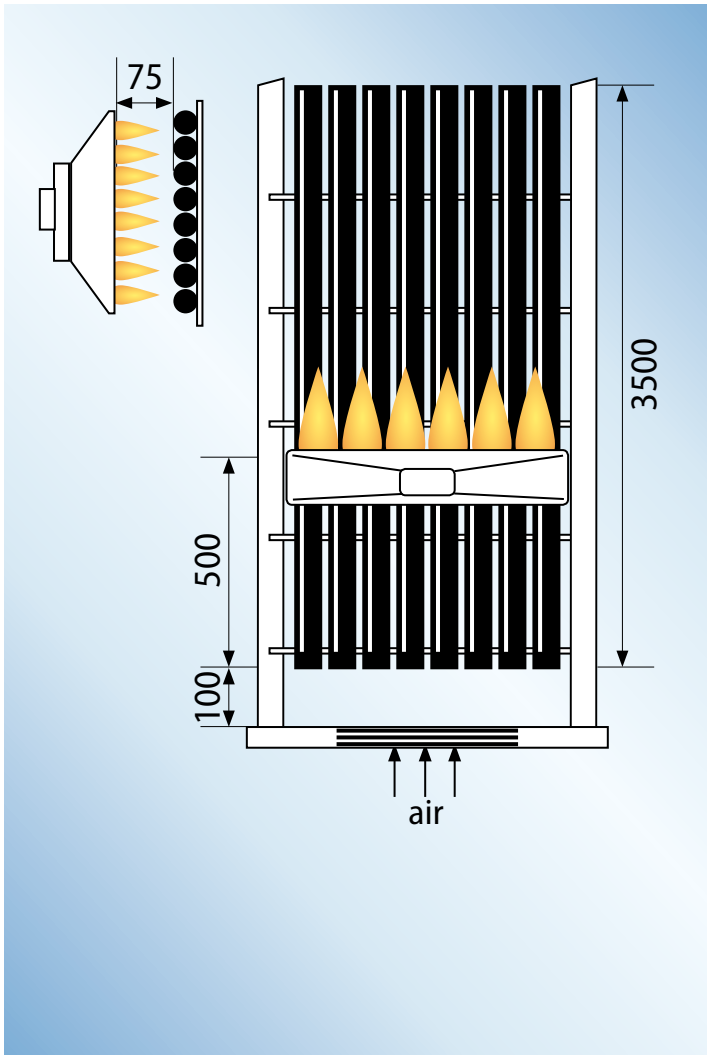
### Compliance criterion:

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.



IEC 60332-3/EN 50266-2

**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.

# Quality, environment and energy



## Quality

The outstanding quality and reliability of products and solutions make the name a brand. With these attributes LEONI is setting standards across the global market.



The quality management system is DIN ISO 9001 certified and parts of it have even been DIN EN 9100 certified. They are being constantly monitored. For the manufacture and sale of products for the North American market LEONI is able to apply over 650 different UL-styles.



## Environment

Business success and environmental responsibility are not a contradiction in terms for us. Environmental protection is consequently a mandatory element of the LEONI business activity. The environmental management system is DIN ISO 14001 certified, which guarantees that the environmental policy is being implemented effectively.

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Sustainable action will secure the future of the company. In line of economic, environmental and social requirements, LEONI takes social responsibility. LEONI is committed to the continual improvement of energy efficiency and sustainable resource utilisation (DIN ISO 50001).

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### **LEONI Special Cables GmbH**

Eschstrasse 1  
26169 Friesoythe  
Germany

Phone +49 4491 291-5060

Fax +49 4491 291-5061

E-mail [telecom@leoni.com](mailto:telecom@leoni.com)