



Special PVC Compounds

Business Unit Industrial Projects



The Quality Connection

LEONI

The LEONI Group

Concentrated competence in cables



Business Unit Industrial Projects

Competence in cables and compounds



LEONI is a leading supplier of cable systems and related services for the automotive industry and many other industrial sectors.

Our group of companies employs over 77,000 people in 32 countries. Entrepreneurial insight, first-class quality and the power to innovate have secured us our position as one of Europe's leading cable manufacturers. LEONI not only develops and manufactures a portfolio of technically sophisticated products that extends from wire and optical fiber to cables, cable systems and services, but also offers its customers a range of bespoke services.

Our full range of products and services also includes strands, standardised cables, hybrid/optical fiber and special cables, cable harnesses and wiring system components, as well as turnkey, assembled systems for applications in various industrial markets.

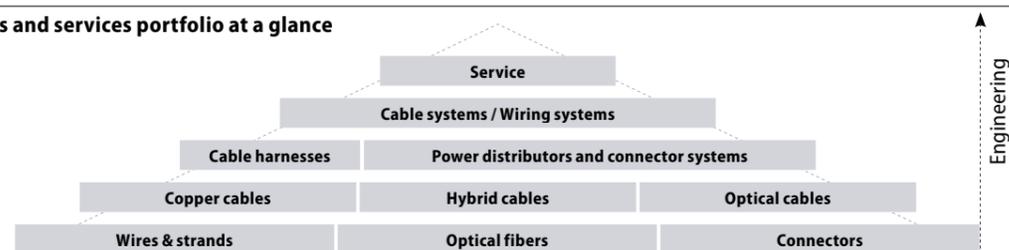
Your markets – our strength.

The breadth of LEONI's spectrum of products and services is matched by the markets and segments we supply. We focus our activities on customers in the sectors Automotive & Commercial Vehicles, Industrial Solutions, Electrical Appliances and Conductors & Copper Solutions.

In the Industrial Solutions market, we are one of Europe's leading providers. Acting as both a cable manufacturer and a dedicated solution provider, we work in fields as diverse as telecommunications systems, fiber optic cable, data communications, manufacturing projects, solar and wind power, energy and infrastructure, building services, bespoke product and robotics solutions, healthcare, traffic systems and automation technologies. Customers worldwide benefit from our innovative, high-quality products that are both reliable and long-lasting. LEONI – we create the best connection for your future.

For further information, please visit www.leoni.com

Products and services portfolio at a glance



LEONI's core markets



Relied on worldwide

We are your specialist manufacturer of choice for standardised, preassembled cable systems used in instrumentation and control technology. We are one of the leading companies in this market, with over 40 years of experience. Customers rely on our solutions the world over – from Chile to Japan and from South Africa to Scandinavia. Support is provided by a network that spans 49 countries throughout the world – to guarantee maximum availability.

Our maxim: first the customer, then the cable

Bespoke solutions are standard at LEONI and therefore always cost-optimised. Of the cables that leave our factories, 70% are individually designed, manufactured and assembled. To date, we have manufactured over 40,000 cable designs, carefully tailored both to our company-internal guidelines and applicable international standards. Our strength is tailor-made customer service.

Every cable is a promise

The durability – even under adverse conditions – the reliability and the quality of our products form the cornerstones of our success as a company. As a customer, you naturally expect to see a return on your valuable investment. Which is why we make every effort to offer you guaranteed quality every step of the way. For systems in use all day, every day.

What makes us what we are?

From its premises in Stolberg, our company can look back on almost a century in business as a cable producer, and can draw on over 50 years of experience as a compounder.

Perfection – but only with the right compounds

Compounds are the final touch that makes an ideal cable even possible. The combination of our expertise as a compounder and our technical know-how in cable manufacturing creates synergy effects that directly benefit our customers. We don't simply develop and produce tailor-made insulation and jacket materials but are also seasoned experts in their industrial deployment. Draw on our comprehensive wealth of experience to optimise your own cable production.

Our compounds are designed and tested in our internal chemicals lab in accordance with the latest standards. We manufacture around 150 separate compounds at present. Our ultra-modern production facilities enable us to respond quickly and flexibly to customer requirements.

From small quantities to silo deliveries – we make it all possible.

Comprehensive quality management ensures a consistently high level of quality. Our company is of course certified according to ISO 9001, ISO 14001 and OHSAS 18001.

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The compounding partner you can rely on – worldwide

Our markets



We are member of the following committees:

- ZVEI German Cable Makers' Association, Chair of the Materials working group
- CENELEC TC46X, Chair of the Materials working group
- Europacable, German representative in the Materials working group

Everything under one roof – consultancy, development, inspection, production, supply

Our service package: From individual development of your formulations through to punctual delivery, we support you by drawing on our 50-plus years of experience.

Consultancy:

We work with our customers to determine their specific requirements for PVC compounds, so as to develop individual, purpose-built solutions.

Formulation development:

Our experts work closely with your team to design and develop a suitable formulation.

Production using customer formulation:

We can of course use your own individual formulation as the basis for production.

Quality control:

Qualified specialists inspect all compounds using the very latest instruments and in strict accordance with ISO 9001.

Service:

Our team of consultants is always at hand to provide you with technical advice and commercial support. On-site support can also be provided.

Cross-checking:

After the production of a trial length, this is then tested again in our lab.

Compound manufacture:

Compounds from small quantities of 100 kg to silo deliveries of around 25 t are manufactured under continuous quality control. Our production process is naturally certified to ISO 14001.

Delivery:

Our work is characterised by short delivery times and flexible handling of change requests.

Flexibility and experience are our strengths

Our comprehensive experience as a designer and producer of special cables and compounds makes us the people to talk to when you need a partner for a tailor-made solution.

Leading cable producers have relied on the superior quality of LEONI compounds for many years, and value us as a competent and dependable partner.

Thanks to the flexible deployment of our systems and our experienced teams, we can adapt and respond to customer needs within a very short time frame. Our many years of experience as a product manufacturer and cable maker means that we can also offer you first-class technical expertise.



Firm formulations – whether for extreme heat or freezing cold

Product range: Our broad-based product portfolio includes compounds with excellent heat resistance as well as compounds specially developed for (sub)polar environments.

Automotive applications

We supply the automotive sector with high-temperature compounds that are certified for use in 125 °C/3000 h applications. These compounds are optimised for minimum wall thicknesses and high extrusion rates.

UL applications

Our portfolio also includes several compounds for use in cable designs intended for temperature ranges of up to 105 °C; these compounds undergo regular inspection by Underwriters Laboratories.

FRLS compounds

Our **F**lame **R**etardant, **L**ow **S**moke compounds feature excellent flame resistance, low smoke density in the event of fire, and minimal release of corrosive gases. With these compounds, we are offering future-proof products for a rapidly growing market.

PVC/NBR compounds

Based on modified elastomers, these types of compounds are available for applications requiring high levels of flexibility and rubber-grip characteristics. This compound from our Business Unit Industrial Projects offers an inexpensive alternative to elastomer materials for indoor usage.

Radiation cross-linkable compounds

Radiation cross-linkable compounds is another speciality segment. Electron beam irradiation is used to significantly increase the resistance of the material to abrasion, chemicals and temperature fluctuations.

Tailor-made compounds

We can offer special formulations to meet customer requests for transparent, highly flexible and termite-resistant products, for example.

Low temperature applications – Frilon

Offering superb cold flexibility, our Frilon compound can be used for applications in (sub)polar regions and with operating temperatures around –50 °C. Frilon is designed to be extremely flame-retardant and easily passes stringent fire tests such as the IEC 60332-3-22 bunched cable test. A broad range of cables using this compound has already been tested and certified by the Russian testing agency Elektrocert according to the EAC and GOST-R inspection standards.

Oil- and chemical-resistant compounds

Our portfolio is rounded off by PVC compounds specially designed to handle direct contact with aggressive service fluids such as oil, petrol and chemicals. An oil-resistant specialised compound has been tested and certified as petroleum-resistant by the German Federal Institute for Materials Research and Testing (BAM).



Excerpt from our portfolio of PVC compounds

The following pair of tables offers examples of characteristic profiles for selected PVC compounds from our product range.

PVC compounds for insulated coverings

| Type designation | Y1100 BF | Y1400 BF | Y2100 BF | Y6100 BF | Y0200 BF | Y0500 BF |
|---|--|---------------------|--------------------------------------|---------------------------------|-----------------------------------|-----------------------------------|
| Properties | heat resistant, automotive applications | heat resistant (UL) | very good electrical characteristics | good electrical characteristics | standard quality | flexible usage |
| Density (g/cm³) | 1.35 | 1.31 | 1.31 | 1.36 | 1.46 | 1.48 |
| Shore hardness A/D | 54 D | 48 D | 56 D | 49 D | 43 D/92 A | 89 A |
| REACH & RoHS conformity, lead-free | yes | yes | yes | yes | yes | yes |
| Dielectric constant | 4.8 | 5 | 4.4 | 4.7 | 5.2 | – |
| Max. operating temperature (°C) | 90 (EN 50290) | 105 (UL) | 70 (EN 50290) | 70 (EN 50290) | 90 (IEC 60502-1) 70 (EN 50290) | 90 (IEC 60502-1) 70 (EN 50290) |

Types according to

| | | | | | | |
|--|------------|---------|------------|------------|--------------------------|--------------------|
| IEC 60502-1 | Type PVC/A | – | Type PVC/A | Type PVC/A | Type ST2 & Type PVC/A | Type ST2 |
| EN 50290-2-21 & EN 50290-2-22 | TI53 | – | TI54 | TI54 | TI51, TI52 | TI51, TI52 |
| VDE 0819 Part 101/VDE 0276 Part 603 | TI53 | – | TI54 | TI54 | DMV6, DIV4 TI51, TI52 | DMV5 TI51, TI52 |
| Underwriters Laboratories (UL) | – | UL 1581 | – | – | – | – |
| Extrusion temperature, recommended (°C) | 185–195 | 185–195 | 190–195 | 190–195 | 180–190 | 170–180 |
| Extrusion temperature, max. (°C) | 200 | 200 | 205 | 200 | 195 | 185 |

Chemical resistance

| | | | | | | |
|--------------------------------|--------------------------|---------|---------|---------|---------|------|
| – Oil resistance (IRM no. 902) | CEA S-73-532; 4 h, 70 °C | | | | | |
| – Diluted acids | excellent | | | | | |
| – Diluted alkalis | excellent | | | | | |
| Flexibility | low | limited | low | low | limited | good |
| Cold flexibility | low | good | limited | limited | limited | good |

Excerpt from our portfolio of PVC compounds

The following pair of tables offers examples of characteristic profiles for selected PVC compounds from our product range.

PVC compounds for jackets

| Type designation | Y0500 BF | Y0700 BF | Y0900 BF | Y1500 BF | Y2400 BF | Y4200 BF | Y5200 BF | Y2700 BF |
|---|-----------------------------------|--------------------|---|-----------------------------------|----------------|---------------------------------------|--|-----------------------------------|
| Properties | standard | standard, flexible | exceptional cold flexibility, high flame resistance | high flame resistance | heat resistant | heat resistant, high flame resistance | reduce smoke gas emission, high flame resistance | oil resistant, flame-retardant |
| Density (g/cm³) | 1.48 | 1.39 | 1.42 | 1.51 | 1.46 | 1.45 | 1.56 | 1.46 |
| Shore hardness A/D | 89 A | 76 A | 83 A | 92 A | 42 D | 48 D | 50 D | 78 A |
| REACH & RoHS conformity, lead-free | yes | yes | yes | yes | yes | yes | yes | yes |
| Oxygen index LOI (%) | – | – | 30 | 30 | 30 | 30 | 32 | 28 |
| IEC 60332-3-24 Cat. C-compatible | no | no | yes | yes | yes | yes | yes | yes |
| HCL emission IEC 60754-1 (% max.) | – | – | 21 | 17 | 23 | 23 | 23 | 18 |
| Max. smoke density ASTM D 2843 | – | – | – | – | – | – | 60% | – |
| UV resistance (720 h UL 1581) | – | – | – | yes | yes | yes | yes | yes |
| Max. operating temperature (°C) | 90 (IEC 60502-1) 70 (EN 50290) | 70 (EN 50290) | 90 (IEC 60502-1) 70 (EN 50290) | 90 (IEC 60502-1) 70 (EN 50290) | 105 (UL) | 90 (IEC 60502-1) | 90 (IEC 60502-1) 70 (EN 50290) | 90 (IEC 60502-1) 70 (EN 50290) |

Types according to

| | | | | | | | | |
|--|--------------------|------------|------------|------------|----------|------------|------------|------------------|
| IEC 60502-1 | Type ST2 | – | Type ST2 | Type ST2 | Type ST2 | Type ST2 | Type ST2 | Type ST2 |
| EN 50290-2-21 & EN 50290-2-22 | TM51, TM52 | TM52, TM54 | TM51, TM52 | TM51, TM52 | TM53 | TM53, TM54 | TM51, TM52 | TM51, TM52, TM55 |
| VDE 0819 Part 101/VDE 0276 Part 603 | DMV5 TI51, TI52 | – | DMV5 | DMV5 | DMV6 | DMV6 | DMV5 | DMV6 |
| Underwriters Laboratories (UL) | – | – | – | UL 1581 | UL 1581 | – | – | – |
| Extrusion temperature, recommended (°C) | 170–180 | 160–170 | 160–170 | 170–180 | 170–180 | 175–185 | 175–185 | 175–180 |
| Extrusion temperature, max. (°C) | 185 | 180 | 180 | 185 | 190 | 190 | 190 | 190 |

Chemical resistance

| | | | | | | | | |
|--------------------------------|---------------------------|-----------|-----------|------|---------|---------|---------|-----------------------|
| – Oil resistance (IRM no. 902) | ICEA S-73-532; 4 h, 70 °C | | | | | | | IEC 60811; 7 d, 90 °C |
| – Diluted acids | excellent | | | | | | | |
| – Diluted alkalis | excellent | | | | | | | |
| Flexibility | good | excellent | excellent | good | good | limited | limited | good |
| Cold flexibility | good | good | excellent | good | limited | limited | limited | limited |

Find out more:

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