

E-mobility – charging cables



The Quality Connection

LEONI

Charging cables



Billions are being invested worldwide in research for electric vehicles. The German government forecasts that, by 2020, electric car sales will have grown to more than 1 million units in Germany alone. Government and the business community are agreed that electric power will determine the future in the long term.

Along with electric vehicles, power supply is a subject of great importance. Catchphrases like “smart grid” are a given nowadays in any discussion on this topic. Area-wide building of infrastructure has already begun in large urban conurbations of Germany and Europe. Experience from the pilot projects of energy supply companies (e.g. RWE, Vattenfall) and OEMs (e.g. BMW and Daimler in Berlin, Renault in the Ruhr region) is incorporated in the further development of technology and products.

LEONI, with its development expertise, is forging ahead with solutions in the field of e-mobility together with development partners. The focus in this respect is on charging cables, which serve as the link between the vehicle and the power grid of the electricity provider by

way of charging stations. The new cables are suitable for operation with charging systems that are IEC 61851-compliant and for use with IEC 62196 components for single and three-phase power grids.

Options for charging electric vehicles

Charging the electric vehicles is one of the challenges in this respect. Various scenarios for supplying the vehicle with energy are being discussed to resolve the infrastructure issue.

One option for charging the vehicle batteries is conductive charging with the aid of charging stations. And here there is also debate over various different models for “filling up with electricity”. The requirement is for charging of electric vehicles to be possible at home just as at public electric charging stations in fast-charge mode.

Due to the various charging methods, differing charge currents involving different conductor cross sections also have to be taken into account. A version with a 16 mm² cross section would, for example in household use, be significantly oversized because of the current-carrying capacity combined with the available energy.



The following is an overview of the various charging options.

Ways of charging		
Changing battery systems	Charging stations (conductive loading systems)	Magnetic induction

Breakdown of charging currents in Europe:

Situation	Power supply	Charging facility	Cable cross section
Domestic power up to 16 A per phase	1 phase up to 3.7 kW	Domestic power with plug and socket system	2.5 mm ²
Domestic power up to 16 A per phase	3 phases up to 11 kW	Domestic power with plug and socket system	2.5 mm ²
Type-bound up to 32 A per phase	1 phase up to 7.4 kW	Domestic power supply and public charging stations	6 mm ²
Type-bound up to 32 A per phase	3 phases up to 22 kW	Domestic power supply and public charging stations	6 mm ²
Type-bound up to 63 A per phase	1 phase up to 14.5 kW	Public charging stations	16 mm ²
Type-bound up to 63 A per phase	3 phases up to 43.5 kW	Public charging stations	16 mm ²

International outlook in the development of charging cables

The conductive charging system for electric vehicles is already prescribed in an IEC/DIN EN 61851 standard. Plugs, sockets as well as vehicle connector systems and vehicle plugs are likewise normatively stipulated in the DIN EN 62196 standard for the charging of electric vehicles. A national or international cable standard does not yet exist. The leading cable manufacturers are working on a requirements profile.

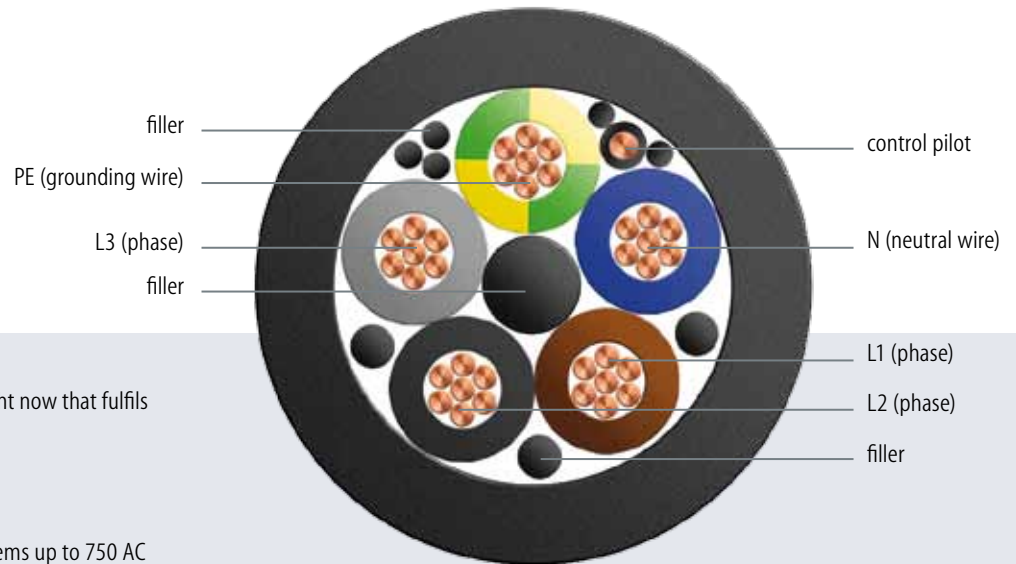
LEONI already manufactures charging cables and is focused on proactively standardising such cables together with its partners. In so doing, LEONI is benefiting from its decades-long experience in cable production and standardisation.

At present, cable approval is possible only by way of what is known as VDE registration. This involves the VDE (Association for Electrical, Electronic & Information Technologies) testing the cable's described properties and issuing its approval on the basis of present regulations governing electrical engineering.

The LEONI cables have already been submitted and we shall therefore soon be able to serve the market with a VDE-approved cable.



Cable solutions by LEONI



LEONI offers its customers a solution right now that fulfils the European requirements.

It covers the following:

- 1 or 3-phase mains connection systems up to 750 AC
- alternating currents up to 63A AC
- max. 2 control cable cores (control pilot, plug present (optional))

Overview of the properties of charging cables for the European market:

- temperature range from $-40\text{ }^{\circ}\text{C}$ to max. $+90\text{ }^{\circ}\text{C}$
- cross-section range of the current-carrying cores $1.5 - 16\text{ mm}^2$ (max. 5 cores) as well as $0.5 - 1.0\text{ mm}^2$ control wires (control pilot, plug present)
- crosslinked insulation
- robust polyurethane jacket
- excellent mechanical and chemical resistance properties
- suitable for coiling
- VDE approval

Product portfolio

(extract)

Cable type LEONI	EVC 1001	EVC 1002	EVC 1003	EVC 1004 ^x	EVC 1005	EVC 1006	EVC 3002	EVC 3003	EVC 3004	EVC 3005	EVC 3006	EVC 3007
Number of phases	1	1	1	1	1	1	3	3	3	3	3	3
Ampacity	16 A	32 A	63 A	16 A	16 A	16 A	16 A	32 A	63 A	63 A	16 A	32 A
Number of cores	3 + 1	3 + 1	3 + 1	3 + 1	3 + 2	3 + 2	5 + 2	5 + 2	5 + 2	5 + 1	5 + 1	5 + 1
Cross sections (phase/pilot)	2.5/0.5	6.0/0.5	16/0.5	2.5/0.5	2.5/0.5	2.5/1.0	2.5/0.5	6.0/0.5	16/0.5	16/0.5	2.5/0.5	6.0/0.5
Outer diameter (mm)	11.1	13.8	21.3	11.1	11.1	11.8	13.7	17.2	26.0	26.0	13.7	17.2

^x high flex

The properties of LEONI's charging cables benefit our customers. They match the requirements of the market and are, also for ecological reasons, a must for environmentally aware customers:

- resistant to media
- resistant to abrasion
- resistant to hydrolysis
- excellent bend flexibility
- excellent for coiling
- thermal load resistance
- halogen free
- flame resistant

How the charging cables are to be fitted to the charging stations is still being discussed. Will these be fixed-connection systems or will consumers have to bring their own charging cables for the charging process? It is similarly still unresolved whether the cables will be fitted straight or in coiled form to the charging facility. No matter which solution is chosen, LEONI has the right cable for any application.

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