1. General Information

The durability of the product materials in the application environment, the correct installation and the loading within the scope of the permissible limits (Technical Data) have a major influence on the safety and the lifetime of our products.

Information on the use of the products and technical data is primarily provided on the respective product pages of the catalog in the text section and in the tables cited there. The **selection tables** A1-A13 group similar products in an overview and enable the comparison of products, and therefore an optimized selection based on major product properties (e.g. “permissible temperature range”, “per missible bending radius”) and based on major parameters for use (e.g. “outside, unprotected outside”).

A focus of the **‘Technical Tables’** (T1-T30) is:

- Chemical resistance (T1, T24), resistance to weathering and oil (T15), radiation resistance (T28)
- Installation of Profibus and industrial Ethernet cables (T2), installation of cables for power chains (T3)
- Installation of cables for conveyor systems (T4, T5)
- Installation/Run/Fixation of cables in special cases (T19)
- Installation – Thread dimensions and tightening torques for screwed cable glands (T21)
- Ampacity by electric current, conversion factors, type of installation according to VDE, Germany (T12)
- Ampacity by electric current, type of installation according to NEC, USA (T13)
- Capability with regard to thermal loading and tensile strain (T19)
- Conductor cross-sections and different systems of units (T16)

This and the following explanations on special product groups/special topics is a guideline for the handling and use of our products. However, not all aspects of competent configuration for electrical equipment can be covered here.

When in doubt?
– Ask us. We’ll be happy to advise you –
Tel. +49 18 05/10 12 12-93 00

2. Cables and cords

The use of cables and cords is particularly diverse and is regulated accordingly in the various standards organizations (IEC, EN, NEC etc.) by a large number of application standards.

Here the international standard IEC 60204-1:2009, (Electrical Equipment of Machines – Part 1: General Requirements) with reference to cables and cords and their conditions for use serves as an example.

The fulfillment of these general requirements makes it absolutely necessary that a professional check is conducted by the user to determine whether a specific product standard with other/expanded requirements exists, which has precedence.

The product pages in the catalog with product and application standards provides assistance. For example: ‘oil-resistant according to VDE0473-811’ or ‘railway applications: EN 50306-2’.

For the area of harmonized low-voltage power cables (e.g. H05VV5-F/ÖLFLEX® 140), DIN VDE 0298-300 provides a list of requirements and criteria under Table 4A. In most cases, these can also be applied to other low-voltage cables and provide information on recommended uses.

DIN VDE 0298-300 is the german version of the harmonisation document HD 516 S2:1997 + A1:2003 + A2:2008. In extension of that – for electric cables with a rated voltage not exceeding 450/750 V the IEC-publication 62440:2008-02 Ed. 1.0 as a ‘Guide to use’ must be observed.

In the following, a selection of important aspects, taken from the above mentioned standards for using cables and cords is summarized.

General information
Conductors, cables and cords must be selected so that they are suitable for the operating conditions which occur (e.g. voltage, current, protection against electric shock, accumulation of cables and cords) and for external influences (e.g. ambient temperature, presence of water or corrosive substances, mechanical loads, including loading during installation, fire hazards).

Electrical voltage
The control and connection cables listed in the catalog are subject to **2006/95/EC – ‘Low-Voltage Directive’ for electrical operating equipment with a nominal voltage between 50 and 1.000 volts (alternating voltage) and between 75 and 1.500 volts (direct voltage)**. The nominal voltage is the reference voltage for which the cables and cords are designed and tested. The nominal voltage of cables and cords for use in alternating-current power supplies must be greater than or equal to the nominal supply voltage. With a direct-current power supply, the nominal supply voltage must not be higher than 1.5 times the nominal voltage of the cable. The continuous operating voltage of alternating-current and direct-current power supplies may exceed their nominal voltage by 10 %.

The nominal voltage of cables and lines is expressed in volts by the ratio U/U_0; here:

- **U_0** is the effective value of the voltage between an external conductor and ground (metallic casing/(shielding) of the cable/cord or surrounding medium)
- **U** is the effective value of the voltage between two external conductors of a multi-core cable/cord or of a system of single-core cables.

The dielectric strength of the insulation of conductors, cables and cords must be sufficient for the required test voltage. For cables and cords operated with voltages above 50 VAC or above 120 VDC, the test voltage is at least 2.000 VAC for a period of 5 min. For alternating voltages with a maximum of 50 V and direct voltages with a maximum of 120 V (typically SELV or PELV systems), the test voltage must be at least 500 VAC for a period of 5 min.

The test alternating voltages are listed on the individual product pages in the catalog under ‘Technical Data’, and also enables a selection of cables for which U/U_0 cannot practically be named.

2. Cables and cords – Cont.

Tensile strains
Up to a maximum value of 1.000 Newtons for the tensile strain of all conductors, the following applies:

Conductor Cross-Sections and different Systems of Units
IEC 60228 as a relevant international standards describes conductors that are specified in metric sizes. North America and certain other regions at present use conductor sizes according to the American Wire Gauge (AWG) system and kcmil for larger sizes. To support the safe alternative use of cables from both of these unit systems pls. find under T16 a table for assistance.

Max. 15 N per mm² conductor cross-section (without calculating in shields, concentric conductors and divided-up protective conductors) with static tensile strain in the operation of moving/flexible cables and cables for/in fixed installation.

Max. 50 N per mm² conductor cross-section (without calculating in shields, concentric conductors and divided-up protective conductors) with static tensile strain for the installation of cables for/in fixed installation.

Cables for applications in power chains (see Selection Table A2)
These cables are marked with the addition 'FD' in the product name. In addition to the generally applicable information on installation and configuration in the Technical Table T3, especially those specifications must be observed which refer to individual cables and are listed on the related product pages in the catalog.

In particular, these are:
- Restrictions of the travel length (e.g.: ...up to '10 meters')
- Restriction of the minimum bending radius for flexible applications. The radius designed with the power chain must not be below the minimum bending radius of the cable! The inner radius to the surface of the curved cables is defined as the minimum bending radius.

Transport and storage
Cables and cords that are not intended for outdoor use must be stored in dry indoor rooms and must also be protected from exposure to direct sunlight there.

With outdoor storage, the ends of cables and cords must be closed off to prevent the entry of moisture.

The ambient temperature during transport and storage is to be in the range from -25 °C to +55 °C (max. +70 °C for not longer than 24 hours) . Especially in the range of low temperatures, mechanical loading through vibration, shock, bending and twisting is to be avoided. This especially applies to PVC-insulated cables and lines.

3. Industrial connectors

Do not connect or disconnect connectors under electrical load! Make sure that the function of the ground connection is assured when installing the connector. This can be done by using the metallic conductive EPIC® connector housings or by other appropriate measures taken by the user during the installation. The user has to ensure that any special applications, which have not been specified by Lapp for the products shown in this catalogue, are in accordance with the requirements fo technical sandards other than those specified. We reserve the right to make design changes to improve the quality, enhancement of the product or because of production requirements. The information in the catalogue are specifications of the components and are no warranty for particular product features. Confirmation of the technical properties of the components can only be given if all the components are supplied by Lapp, otherwise the onus of verification and approval will be the responsibility of the user. Otherwise, the verification and approval shall be for the user.

Certificates:
VDE, Approval Number
40016270, 40011894, 40013251, 40019264
UL, file number:
E75770, E249137, E192484
CSA files: E75770, E249137, E192484
TÜV

4. Cable glands and cable entries

SKINTOP® and **SKINDICHT®** cable glands and cable entries stand for high quality and for over 30 years of know-how in their areas of application.

In addition to the quality, the correct use is the most important factor with regard to operating safety. For this reason, we would like to draw your attention to the pertinent standards which you must observe for your application purposes.

In addition to the technical data on the product pages, please also observe the technical tables in our main catalog (T21 – Thread dimensions for cable glands, tightening torques and installation dimensions for cable glands/T22 – degree of protection according to EN 60529), and the included package inserts for using the products (e.g. package inserts for products in accordance with DIN EN 60079-0, DIN EN 60079-7).

5. Cable protection and guide systems

SILVYN® cable protection systems offer additional protection for cables and wires. In accordance with the properties shown on the catalog pages, SILVYN® products can fulfill the properties described when used in the specified system and when professionally properly installed by an authorized electrician.

When designing and equipping the SILVYN® CHAIN, the installation instructions shown in the table T3 Assembly Guideline for ÖLFLEX® FD and UNITRONIC® FD Cables in Power Chains must be followed. For the proper installation of a SILVYN® Power Chain system, please observe additional information in our current SILVYN® CHAIN special catalog.

6. Ready-to-use parts, tools and printers

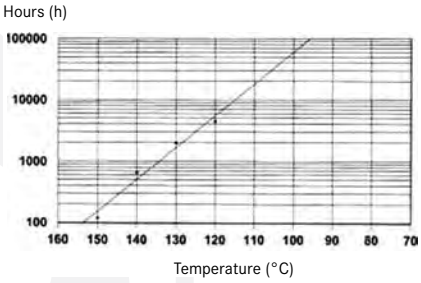
Products in the area of cable accessories are tested in the system to ensure optimum installation results. These products may only be commissioned or processed by authorized electricians while taking the included/attached additional information into account.

7. Lifetime

In addition to the mechanical and chemical loading, the average service life of cables/cords is also always defined in dependence on the operating and/or ambient temperature.

As is common in mechanical engineering, the continuous temperature range of a cable specified in our technical data refers almost exclusively to a time period of at least 20.000 hrs. The example of an aging curve according to Arrhenius at the right shows the behavior of an insulating material in dependence on time temperature.

The material tested here has a temperature index of approx. +110 °C for 20.000 hrs. The material can also be specified with an index of +135 °C, however then only for a period of approx. 3,000 hrs.



8. Connection technology

The quality of an electrical connection is highly dependent on the selection of the suitable components in the respective nominal cross-sections and the processing with recommended tools.

Size differences between conductors and cable lugs/wire end ferrules result from the fact that Class 5 and 6 flexible leads – even with different designs (bunched conductor, stranded or compressed conductor) can be crimped with only one crimp contact. Despite sleeves which appear to be too large for the respective cross-sections, a gas-tight crimping can be ensured with the right combination off conductor, contact and tool. The dimensional accuracy at the connection points mentioned above is governed by the following standards:

- DIN EN 60228 (VDE 0295), September 2005 – “Conductors or Cables and Insulated Cables”
- DIN 46228 – 4, September 1990 – “Wire End Ferrules – Pipe Shape with Plastic Sleeve”
- Quality of crimpings according to DIN 46228-1 and DIN EN 50027

9. Testing and checking

The user must ensure that electrical systems and operating equipment are tested for their proper condition by an electrician or under the direction and supervision of an electrician.

This is to take place before the first start-up and following a change or repair before restarting.

The intervals of checking must be set so that resulting defects which must be expected are promptly determined.

The period of use of Lapp products can often only be determined empirically in the respective applications.

The basis for checking intervals result, for example, from the thermal load – see point lifetime or from the number of permissible alternating bending cycles for cables for power chains – also see information on the respective product pages in the catalog.

In general, it must be assumed that fixed cables and cords have a higher period of use and allow longer checking intervals.

Shortened intervals are recommended for cables and cords that are used at the limits of the permissible range. This especially applies (also see 'Technical Data' and 'Use' on the respective product pages in the catalog):

- with reference to minimum bending radius
- with reference to temperature range
- with radiation (e.g. sunlight)
- with tensile loads
- with influence of surrounding chemical substances and unconfirmed durability
- with water collection or condensation in the area of the connection points

Cables and lines should be subjected to a visual inspection with regard to changes to the appearance, at the latest when it must be feared that unusual (electrical, thermal, mechanical or chemical) overloading has occurred.