The document refers to the EU Regulation 2023/988 on General Product Safety (GPSR)

CAUTION - WARNING

Improper connection and use of wago products can result in fire or even death by electrocution.

Installation, replacement or repair may only be carried out by a qualified person.

It is essential to read the operating instructions before use.

1. Keep out of reach of children - choking hazard
2. use products only for their intended purpose
3. Before use, ensure that the installation is disconnected from the power supply
4. The length of the stripped cable must be suitable for the WAGO product in question
5. During installation use tools that are compatible with the respective WAGO product 6.
6. When installing WAGO products, remember that only one wire should be placed per clamp
7. Store away from water and protect from direct UV radiation
8. All components must be dry during assembly
9. Verify the correctness of the connections before starting the installation
10. Installation should only be carried out by authorised persons
11. The used product must not be disposed of with normal waste. It is your responsibility to take your used equipment to a designated collection point for proper treatment. Everyone has a direct stake in protecting the environment; that is why, together with our customers, we are protecting our planet and promoting sustainable development.

Safe and compliant products at all times

According to EU legislation, a product may only be placed on the market if it complies with the essential requirements of the relevant EU directives, where these exist for the product in question. According to EU Regulation 765/2008, by affixing the CE marking to a product, the EU manufacturer, distributor or authorised representative declares that 'the product complies with the applicable requirements set out in Community harmonisation legislation providing for its affixing'.

The installation fittings are subject to the provisions of the Low Voltage Directive 2014/35/EU.

The list of standards of the Low Voltage Directive lists the standards of the EN 60998 series as the standards used for installation fittings. All WAGO installation fittings have been tested by independent testing bodies on the basis of the standards of this series and have been certified accordingly. Based on the results of these tests and the certificates awarded, WAGO declares compliance with the requirements of the Low Voltage Directive for its products and affixes the CE mark to them.

In addition, WAGO marks its installation fittings with the ENEC mark. This mark may only be used if, in addition to positive external test results for the product type in question, further requirements are fulfilled during the production of the product, which have been confirmed by an external testing institute (e.g. use of a quality system at least at the ISO 9000 level, regular testing of end products and documented production controls). Compared to similar certificates from national testing institutes (such as VDE), the ENEC mark confirms compliance not only with the applicable national standards. The ENEC mark, irrespective of the awarding body, covers at the same time all certificates from all national test institutes that have joined the ENEC agreement. There are currently 25 renowned test institutes that can issue ENEC certificates. These include VDE Prüf- und Zertifizierungsinstitut GmbH, SGS Fimko Ltd, DEKRA Certification BV and the British Standards Institution.

Standards and certification marks for installation fittings

DIN VDE 0100 520 for cabling and wiring systems in buildings clearly states: when installing these solutions, only connectors which comply with the applicable European standards or the corresponding German product standards may be used to connect the cables. In this respect, DIN EN 60998 (VDE 0613) applies for installation connectors and DIN EN 60947 (VDE 0611) for strip connectors. In emergency situations, the system installer must prove that the products he is using comply with these standards. That is why WAGO has all connectors tested according to these standards by independent certification bodies in order to provide installers with products that guarantee maximum safety. The awarded certification marks are placed on packaging and products. Certificates are also available from WAGO on request.

Tested and reliable

There are three certification procedures which authorise the couplings for use throughout Germany and the rest of Europe and grant various certification marks. The approvals also differ in which product standards they apply to and in which countries they apply (see table).

New approvals for installation fittings according to EN 60998 are carried out by WAGO according to the ENEC procedure. This procedure corresponds to the procedure for obtaining the VDE mark, but is valid throughout Europe after only one test. Since the ENEC procedure does not provide for approvals for slatted connectors according to EN 60947, and approval for these products is required throughout Europe, new approvals for slatted connectors are carried out according to the CCA procedure. The CCA procedure is based on a national approval in a European country and is confirmed by the award of the corresponding national certification mark. An additional CCA certificate extends the validity of the national approval to the whole of Europe.

Guaranteed safety with WAGO products

Responsibility for the selection of approved products and correct installation rests with the installer. Thanks to the approval that all connectors from the extensive WAGO product range have received, installers do not have to worry about their compliance with the applicable standards. In addition, all WAGO connectors are subjected to in-house testing, which sets even higher quality requirements. Only after passing these tests do the products reach the market, guaranteeing users the high level of safety and reliability for which WAGO is known.

International certification marks and information on WAGO installation fittings

WAGO installation connectors are used by electrical installers all over the world. The prerequisite for their global applicability is their approval according to the applicable standards. For this reason, WAGO installation connectors and their packaging bear national and international certification marks as well as additional information relevant to the area of application. These inform the user that he or she has installation materials that comply with the applicable standards.

Within Europe, WAGO certifies its installation fittings according to the ENEC procedure, which ensures compliance with the European standard EN 60998 and corresponds to the procedure for obtaining the VDE mark.

Thanks to this single test, WAGO products are approved for use throughout Europe. This approval is confirmed by the ENEC certification mark. The certification mark is followed by a number, which is the identification number of the certification body. Technical information on rated voltage, rated current and connectable cable types and cross-sections is also given. Information on cable types is given in English. WAGO installation connectors marked with the letter ‘r’ (rigid) allow the connection of single and multi-stranded conductors. WAGO installation fittings marked with ‘s’ or ‘sol.’ (solid) for connecting single-wire conductors. WAGO installation fittings marked with ‘str. (stranded) allow the connection of multi-stranded conductors. The letter ‘f’ (flexible) on WAGO installation connectors means, that they allow the connection of solid conductors.

WAGO installation connectors that were approved before the introduction of ENEC certification received national certification marks such as the VDE mark, the KEMA KEUR mark (Netherlands) or the DEMKO mark (Denmark). These certification marks were also followed by the corresponding technical specifications. Usually, only the cross-sectional area of the conductor is given and the cross-sectional range is not specified. According to EN 60998, in addition to conductors with one specific cross-section, conductors with a minimum of two further smaller cross-sections can also be connected using WAGO installation connectors.

In addition to European approvals, WAGO installation fittings have also received approvals for the North American market. These are in particular the approvals issued by the ‘Underwriters Laboratories’ (UL) for the USA and the ‘Canadian Standards Association’ (CSA) for Canada. In the past, these two certification bodies have introduced a common certification mark, the so-called cULus mark. According to the requirements of the standard, the certification mark is followed by information on the area of application.

Unlike in Europe, North America does not use the metric system for wire cross-sections (given in mm2), but the ‘American Wire Gauge’ (AWG) system.

WAGO installation connectors are also used by Japanese electricians. For this purpose, they comply with the requirements of the Product Safety Electrical Appliance and Material Safety Law, published by the ‘Japan Electrical Testing Laboratories’ (JET). Here, too, information is provided on the standard-compliant application and the diameter of the conductor that can be used. In Japan, it is the diameter of the conductor that is specified instead of its cross-section. Due to the optimised dimensions of WAGO installation connectors, it is not always possible to display the certification marks and related information side by side.

Permissible temperature ranges for WAGO installation connectors

The conditions for the use of connectors on sites are just as varied as their applications in electrical installations. Temperature is a particularly important operating condition, as it determines the special temperature rise requirements of the installation material.

The European standard EN 60998 for installation fittings defines three different temperature specifications for the use of installation fittings:

- max. ambient temperature
- max. temperature rise
- max. continuous operating temperature

The decision as to whether or not an installation fitting is suitable for a particular application lies with the electrical installer. When making this decision, he is usually guided only by the maximum ambient temperature. For approved installation fittings according to EN 60998, without further specification, a maximum continuous operating temperature of 85°C applies. Subtracting the normative maximum permissible temperature rise of 45 K (corresponds to 45°C) and assuming that the maximum temperature rise of the connector in question has been used, the maximum ambient temperature of 40°C is still obtained.

Manufacturers can also specify temperatures that deviate from this value.

As a rule, these are also continuous operating temperatures. The maximum permissible ambient temperature is obtained by subtracting the maximum temperature rise of 45 K from the specified temperature.

WAGO makes use of this possibility Unless otherwise specified, a maximum continuous operating temperature of 105°C applies to WAGO installation fittings. After deducting the maximum temperature rise of 45 K, the maximum permissible ambient temperature is 60°C. As a result, WAGO installation fittings are approved for higher temperatures and exceed the normative requirements.

Approval for higher ambient temperatures possible

DIN EN 60998 also stipulates that terminals can be approved for higher ambient temperatures. This is made possible by the fact that manufacturers take various measures with regard to the design of the terminals, such as the use of more or higher quality materials, to ensure that the temperature rise for the terminals is kept low. Fittings that are normatively approved for continuous operation at temperatures higher than 85°C are marked on the certificate with a T mark in accordance with EN 60998, e.g. T55. This marking consists of the letter T followed by a number indicating the maximum ambient temperature permitted for the connector.

Maximum ambient temperature:

The highest ambient temperature expressed in °C at which the fitting can be used; the maximum ambient temperature also corresponds to the normative designation T (e.g. T85).

Maximum temperature rise:

the highest permissible temperature rise in Kelvin under the most unfavourable electrical load,

arising as a result of current flow in the fitting; the maximum temperature rise for installation fittings approved according to EN 60998 is limited to 45 K (this corresponds to a temperature rise of 45°C); fitting manufacturers usually apply this maximum allowable temperature rise when designing their fittings to keep the use of materials for the conductive elements of the fittings within an economical framework.

Maximum long-term operating temperature:

The maximum temperature expressed in °C that a fitting can reach during long-term operation;

is the sum of the maximum permissible ambient temperature and the maximum permissible temperature rise.

With fittings marked in this way, there is no need to calculate the permissible ambient temperature. It is stated here directly as a numerical value. For example, the new COMPACT installation connector from the 221 series for all types of cable has been labelled T85 due to its significantly lower temperature rise than permitted by the standard. This means that it can be used at ambient temperatures of up to 85°C.

Some WAGO installation connectors have been developed for special applications. Therefore, they often have specific maximum temperature ranges, which usually far exceed the normative requirements. The temperatures for WAGO installation connectors are summarised in the table.

Professional evaluation of temperature rise for installation fittings

Requirements according to the new IEC 61439 standard

As of November 2014, all low-voltage switchgear used within the European Economic Area must comply with the new IEC 61439 standard. With the aim of protecting people and equipment in electrical installations, this standard specifies safety requirements for switchgear such as power distribution boards in buildings and industrial applications. This results in new requirements and responsibilities for designers, system builders, electrical installers and end customers.

Responsibility for design verification

The new standard makes a distinction between original manufacturer and prefabricator. According to the standard, the original manufacturer is the one who originally designed the switchgear. According to IEC 61438, he/she has to provide design verification. As part of the design verification, various individual verifications must be carried out, one of which is the verification of the temperature rise limits.

In order to effectively verify the temperature rise limits, the original manufacturer must prove that the power losses of the current-carrying equipment are safely dissipated, so that the temperature inside the switchgear cabinet is not too high.

For switchgear up to 1600 A, verification in accordance with DIN EN 61439 can be done by calculating the power losses of the devices used. For switchgear above 1600 A, the amount of heat generated must be measured.

Calculation of power dissipation for slat connectors and installation fittings

For strip connectors, the power loss is limited by the product standard. According to EN 60947, the maximum permissible voltage drop is 3.2 mV per connector connection at 1/10 of the rated current. A maximum voltage drop of 32 mV at full rated current on a loaded current path can therefore be used to calculate power loss. Some WAGO installation connectors are well below this limit. For example, in the case of the 2003-7642 installation stacked connector, the voltage drop across the connector passage is between 20.8 mV and 25.6 mV at full rated current.

In order to calculate the temperature rise limits for WAGO's 2003 series stacked installation connectors, a maximum loss power of 1 W per connector can be assumed. This is due to the fact that the connectors are suitable for 4 mm2 conductors with a rated current of 32 A.

Practical tips for installation and use

Safe installation thanks to efficient installation fittings!

Insulation resistance measurement in permanently installed circuits in buildings

Safe installation with efficient installation fittings!

As a general rule, electrical cables must be selected so that they do not heat up above the long-term permissible temperature during operation. The temperature rise in a conductor is mainly due to the current load it is subjected to.

The current-carrying capacity of a cable determines the maximum currents which the cable may be subjected to, subject to certain conditions. In order to guarantee the safety of the electrical installation, installation materials must be used that can withstand the conditions of use at the point of installation.

DIN VDE 0298-4 therefore recommends current-carrying capacity values for conductors, which are determined depending on parameters such as ambient temperature, cross-section or type of installation. Installation types A1, A2, B1 and B2 are of particular practical importance both nationally and internationally. They describe surface-mounted, flush-mounted and underfloor installation, in each case in conduit or conduit. Operating temperature, conductor cross-section and type of installation combine to give the maximum current load.

EN 60998 as the basis for normative testing of installation fittings

Due to their particular practical significance, the maximum load currents have also been included in the product standard EN 60998 for installation fittings. They are therefore the basis for the normative testing of installation fittings. Manufacturers of installation materials have the possibility to limit the parameters of their products. For example, a connector to which a cable with a cross-section of 4 mm2 can be connected may only be approved for a current of 24 A, instead of a current of 32 A, which would optimise the load capacity of the cable. In such circumstances, the installation material becomes a bottleneck. The protective devices must be adapted to the lower parameters of the installation material. Installation connectors WAGO always have the full current carrying capacity of the maximum connectable cable. As a result, they never restrict the current flow in the electrical installation. This saves users from having to design protective devices with lower ratings to protect connecting components.

Note: Measurement of insulation resistance in permanently installed current circuits in buildings

In public buildings, e.g. places of assembly, department stores, hospitals, schools, railway stations and hotels (according to DIN VDE 0100-718) and in buildings with a high fire risk (according to DIN VDE 0100-482), it is compulsory to measure the insulation resistance on a regular basis. It is also an integral part of the E-CHECK test, which is increasingly being carried out on a voluntary basis, for example, by landlords prior to the handover of leased premises in order to document the proper condition of the electrical installation in these properties.

A distinction is made between two cases for standardised measurements: the initial measurement must be carried out in accordance with DIN VDE 0100-600, 2008-06. The insulation resistance must be measured between the two active conductors and the protective conductor connected to earth. A galvanic connection between the L phase and the N neutral conductor is permissible. For repeated measurements, however, DIN VDE0105-100/A1, 2008-06 must be observed.

Additional precautions must be taken to ensure that the periodic inspection does not cause danger to persons or animals. Property or electrical equipment must not be damaged during the measurement, even in the event of an electrical circuit failure. In order to exclude damage to equipment caused by higher test voltages of e.g. 500 V, in accordance with the standard, it is recommended to connect the two working wires L and N during the measurement.

N/L measurement adapter: more safety with less effort

Measuring the insulation resistance with the L and N working conductors connected has two major advantages. Firstly, in the case of undamaged installations, only one measurement is required instead of two individual measurements, which halves the test time and is more efficient for electrical installers. Secondly, this arrangement ensures that the equipment connected in the circuit is protected from being damaged by high test voltages in the event of faults in the installation.

In these systems, installation floor connectors with N-disconnection should be used. This is dictated by the normative requirement that, in any single drain circuit with a cross-section of less than 10 mm2, it must be possible to simply measure the insulation resistance of all conductors with respect to earth without disconnecting the neutral conductor.

The TOPJOB®S internal disconnected floor connectors of the 2003 series are equipped with the possibility of disconnection inside the connector on its upper floor, e.g. of the N potential. A specially designed N/L measurement adapter (2003-499) connects the two upper floors of the connectors in the disconnected state, thus enabling simple and safe insulation resistance measurement.

Benefit overview:

- high rated currents for numerous applications and safe operation
- innovative N/L measuring adapter for quick connection of working conductors and additional protection of the connected equipment
- base connector with plug-in double fuse holder for use as a fuse connection in the standard cut-out of the switchgear cover
- compact dimensions providing ample space for wiring
- installation floor terminal blocks with disconnection inside the terminal block for use in the centre of terminal blocks with busbars (10 x 3 mm)

Can spare wires be coiled?

The solution to the problem of unused wires in switchgear is, or rather was, to coil them. However, the standards do not allow this solution. To ensure contact protection, it is best to connect the spare conductor to an additional connector. The use of a connector for this purpose has several advantages: it prevents contact with active components and thus a dangerous breakdown of voltage. In addition, if the space required for the spare connectors is taken into account when planning the switchgear, there is no need for additional modifications in the event of plant expansion. Ideally, a suitable connector will always be on hand. General information on the suitability and handling of spare conductors can be found in DIN EN 60204-1:2006 (VDE 0113, Part 1). Section 13.4.7 'Spare conductors' states: 'Consideration should be given to the provision of additional conductors for maintenance or repair purposes. If spare conductors are provided, they must be connected to spare connectors or insulated in such a way as to prevent contact with active parts.'

Fittings in the cable duct?

Can electrical conduits in cable ducts be connected using installation connectors? In some circumstances, yes, because the conduit can in a sense be considered a conduit box or installation box.

Why is this important? DIN VDE 0100-520:2003-06, section 526.5, requires that conduit connections are made in electrical boxes or boxes - even for conduits with sleeves.

Connections can also be made inside electrical equipment, but only if the manufacturer has provided a space with permanently installed connectors for this purpose.

Therefore, according to the standards, it is also possible to use connectors in cable ducts if their cover can only be removed with a tool (e.g. a screw-on cover). Furthermore, the electrical installer must ensure that all connection points are mechanically relieved and stress-free.

N-disconnecting connectors: where are they mandatory?

Neutral wire disconnecting connectors: where they are mandatory and why they can also be useful outside the applications dictated by the requirements of the standard.

Contrary to popular belief, neutral wire disconnection is not always mandatory in electrical installations, such as in the construction of private houses. Nevertheless, it can also be useful where it is not directly required. Why and where is it actually compulsory? Let's take a look at the individual standards.

Where should N wire disconnection be used?

According to DIN VDE0100-718, the N-core disconnecting element is mandatory in public facilities, workplaces or buildings where people congregate, such as restaurants, shopping centres, railway stations, airports, multi-storey car parks, high-rise buildings, cinemas or stadiums. Because it is necessary to carry out cyclic insulation resistance measurements in such facilities. For cross-sections of less than 10 mm2, this must be done without disconnecting the conductors. The use of a disconnecting element is therefore mandatory for the N conductor, which is also required by the VdS 2033 directive for fire-hazardous rooms.

Why is disconnecting the N conductor useful?

With disconnectable connectors, insulation resistance measurements can be carried out without disconnecting the neutral conductors in accordance with DIN VDE 0100-482. There is also a practical advantage to this solution. N-disconnectable connectors considerably speed up the troubleshooting of the electrical installation thanks to the circuit disconnection function. Simply switch off all fuses, remove all N-disconnectors from the N busbar and then reconnect the individual circuits with the residual current device switched on. After all, both in private and in business, it is a waste of time and money to spend hours troubleshooting.

Neither the manufacturer nor the seller shall be liable for improper use of the product

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