# Power distribution system unimes H

System Manual

:hager

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# 1 About this System Manual

### Introductory information

This section provides introductory and general information on the System Manual.

### Chapter index

## 1.1 Subject of the System Manual

**Users**

This System Manual is an integral part of the unimes H power distribution system. It is aimed at users of the unimes H power distribution system:

- specifiers,
- manufacturers,
- operators,
- users

of switchgear and controlgear assemblies according to EN 614391/-2.

**Objective**

This System Manual describes the structure, function and use of Hager's unimes H power distribution system.

It also contains information regarding the efficient use of the unimes H power distribution system, as well as guidance on its intended use, structure, function, assembly, installation, operation, decommissioning, and disassembly along with technical data.

## 1.2 Observe related documents

Observe the current operating instructions and technical documentation for each of the enclosures and devices used.

### Accompanying documents

The documents listed below are also applicable and must always be read in conjunction with this System Manual. The instructions and notices contained in these documents supplement this System Manual and must be observed.

### Manuals for the enclosure types

**Basic enclosure types**

| | |
|---|---|
| U-PWE/<br>U-PWK | ACB incoming/outgoing/coupling enclosure<br>- 630-4000 A |
| U-TE/<br>U-TK | ACB incoming/outgoing/coupling enclosure<br>- 800-2000 A<br>- 2500-3200 A<br>- 4000 A |
| U-T2 | ACB double incoming/outgoing/coupling enclosure |
| U-LE/<br>U-LK | LBS incoming/outgoing/coupling enclosure<br>- 12502000 A<br>- 20002500 A |
| U-CW(I) | combiway outgoing enclosure |
| U-S(I) | HRC outgoing enclosure slimline horizontal |
| U-SV | HRC outgoing enclosure LL/sasil/ slimline vertical |
| U-FL | HRC outgoing enclosure fuseline |
| U-MUN | Modular enclosure univers N |
| U-BS(I) | Universal basic enclosure |
| U-ES | Corner enclosure |
| aSLB | Active arc fault protection system agardio.arc |
| pSLB | Passive arc fault protection |

### Operator

- Manuals of the individual enclosure types
- Design verification

### Specifier

- Hager catalogues for power distribution systems with technical information
- Guidelines for project planning and design of switchgear according to DIN EN 61439 (VDE 0660-600)
- Component selection, lists and production drawings from the hagercad planning software
- The manuals of the individual enclosure types
- Design verification

**Panel builder/electrical engineer**

- Assembly instructions for enclosure components
- Manuals/instructions for the enclosure types and equipment
- Guidelines for project planning and design of switchgear according to DIN EN 61439 (VDE 0660-600)
- Component selection, lists and production drawings from the hagercad planning software
- Record for routine verification (routine test report)
- Checklist for the conformity assessment procedure
- Design verification

**Electrical engineer**

- Manuals for the individual enclosure types
- Manuals/instructions for the operating equipment
- Design verification

**Storing the documents**

This System Manual is an integral part of the unimes H power distribution system.

- ➢ Store the System Manual at the operating site of the switchgear and controlgear assembly. The authorised personnel must have access to the System Manual at all times.
- ➢ The operator is responsible for storing the documents.

## 1.3 Imprint

### Copyright



### Liability note

Hager reserves the right to modify or supplement the product or the documentation at any time without prior notice. Hager assumes no liability for typographical errors and any damage which may arise from them.

### Revisions

unimes H power distribution System Manual

| Revision number | Date | Name | Document no. |
|---|---|---|---|
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## 1.4 Symbols and warning signs used

### Structure of warning messages

| ⚠ Signal word |
|---|
| **Type and source of the danger!**<br>**Consequences if the danger is ignored**<br>➢ Measures for averting the danger |

### Danger levels in warning messages

| Colour | Signal word | Consequences of non-compliance |
|---|---|---|
| | DANGER | Death, serious personal injury |
| | WARNING | Death or serious personal injury possible |
| | CAUTION | Personal injury |
| | *ATTENTION* | Property damage |

### Procedural instructions with a fixed order:

| Step | Action |
|---|---|
| 1 | Procedural instruction step 1 |
| 2 | Procedural instruction step 2 |

### Additional symbols and their meaning

| Symbol | Meaning |
|---|---|
|  | The work must only be performed by an electrically skilled person. |
|  | The product is intended for indoor installation or indoor use. |

### Lists and instructions

| Visual representation | Meaning |
|---|---|
| 1., 2., 3., etc. | Numbered lists with a fixed order |
| - | Lists and procedural instructions without a fixed order |
| ➢ | Measure / procedural instruction for averting danger |

## 1.5 Main terms

### Group of users of the switchgear and controlgear assembly

The unimes H power distribution system is set up to establish switchgear and controlgear assemblies according to the series of standards EN 61439, Part 1 and Part 2.

According to the series of standards EN 61439, a distinction is made among the group of users between the manufacturer of the switchgear and controlgear assembly/switchgear and the user.

The following responsibilities apply according to EN 614391:

| Project participants | Responsibilities according to EN 61439: Overview |
|---|---|
| **Specifier** | Specifies a requirement profile for a switchgear and controlgear assembly according to the black box principle<br>- Connection to the mains<br>- Circuits and consumers<br>- Installation and ambient conditions<br>- Operation and maintenance/servicing. |
| **Original manufacturer** | Is responsible for verifying the design based on verification tests, calculations or the design rules according to EN 61439 |
| **Manufacturer** | Constructs the finished switchgear and controlgear assembly and is responsible for:<br>- Measuring the switchgear and controlgear assembly according to the specifier data<br>- Compliance with the design verification of the original manufacturer<br>- Identification of the system and documentation<br>- Performance of the routine verification<br>- Declaration of conformity. |
| **Operator** | - Receives a switchgear and controlgear assembly according to EN 61439 and the necessary certificates for verifying the conformity<br>- Commissions the system manager<br>- Instructs the personnel<br>- Develops a safety concept/risk assessments<br>- Arranges suitable safety measures. |

### Original manufacturer

The original manufacturer is responsible for the original construction of the system components. This is generally the producer of matched and tested system components, for example, Hager. The original manufacturer must provide verification of the design based on tests, calculations or the design rules and make this data available to the manufacturer as the basis for their calculation of the specific switchgear and controlgear assembly developed. In the case of systems over 1600 A, the original manufacturer must provide verification based on tests that the heat occurring on the equipment does not reach the permissible overtemperature limits. The switchgear and controlgear assembly may be manufactured and/or assembled according to EN 614391/2 by someone other than the original manufacturer.

**Switchgear and controlgear assembly manufacturer**

The manufacturer of the switchgear and controlgear assembly is responsible for the finished switchgear and controlgear assembly. That is generally the panel builder. The panel builder's area of responsibility includes, among other things:

- measuring the system according to the nominal data agreed on with the user, or the specified nominal data,
- compliance with the design verification of the original manufacturer as well as calculation of the system based on this information,
- the identification and documentation of the system,
- completion of the routine verification.

**NOTICE**

If a manufacturer carries out changes on a system that are not included in the design verification of the original manufacturer, they shall become the original manufacturer. This also applies when replacing switchgear and equipment from different manufacturers.

**User**

According to EN 61439, the user is an involved party who specifies, purchases, uses and/or operates the switchgear and controlgear assembly. The user may also be someone who acts in the name of the involved party.

**Specifier**

As a representative of the customer, the specifier specifies the requirements profile of a switchgear and controlgear assembly according to the black box principle. In doing so, the specifier takes into account connection to the mains, the circuits and consumers, the installation and ambient conditions as well as operation and repairs.

## 1.5.1 Personnel and authorisations

**Authorised personnel**

Assembly, installation, operation, handling and repairs may only be carried out by authorised personnel. According to EN 61439-1, authorised personnel refers to an electrically skilled person or an electrically instructed person. This person is authorised to perform specific work.

**Electrically skilled person**

The electrically skilled person can assess the work assigned to them and identify any dangers present. All of the following minimum requirements for an electrically skilled person must be fulfilled:

- technical training in the field of electrical engineering (vocational training and in-house training),
- knowledge and experience in the field of activity,
- knowledge of the relevant regulations, such as accident prevention regulations and standards,
- the ability to assess the assigned work: For their own safety and the safety of others,
- the ability to identify danger.

**Electrically instructed person**

An electrically instructed person may only carry out activities on high-voltage systems if:

- they have been instructed by the electrically skilled person,
- they perform limited and precisely described activities in high-voltage systems,
- they know the local conditions,
- they have been instructed about the possible hazards in the case of incorrect behaviour,
- they know the relevant protective devices, protective measures and safety distances,
- they work with a clear objective provided by the work supervisor,
- they work with safe and intact work equipment and suitable protective equipment,
- the system has been secured by the work supervisor according to the 5 safety rules.

  ➢ All of the requirements must be fulfilled.

**Additional training of the electrically instructed person**

Instruction is often not sufficient for the following tasks. For the following tasks, the instructed person must be specially trained for the activities:

- cleaning electrical systems (if work in the absence of voltage is ensured),
- work in the vicinity of live parts,
- determining the absence of voltage,
- operating devices or equipment in the vicinity of active parts,
- testing portable equipment using suitable testing equipment.

**Limitations for electrically instructed personnel**

- Electrically instructed personnel may only enter electrical systems and operating sites if this is necessary for the work and provided the systems have been approved for work by an electrically skilled person.

- When working in the vicinity of live system parts, the electrically instructed person must maintain the safety distances. In particular, the safety distances apply when handling metal parts, ladders and tools.
- Changes and repairs to the electrical equipment may not be performed by the electrically instructed person. Changes and repairs are reserved for the electrically skilled person.

**Non-professional electrical personnel**

Anyone who is not an electrically skilled person or an electrically instructed person should always be considered as an ordinary person with no electrical skills. Even a job over several years in the field of electrical engineering alone is not sufficient to be considered an electrically skilled person or an electrically instructed person.

- Non-professional, ordinary persons should never perform work in electrical systems independently or on their own authority.
- When performing non-electrical work inside or in the vicinity of electrical systems, non-professional electrical personnel must be supervised. Authorised personnel refers to an electrically skilled person or an electrically instructed person.
- Non-professional electrical personnel must generally maintain the safety distance for non-electrical work.

**Work supervisor**

According to EN 50110, a work supervisor is a person who is commissioned to bear the direct responsibility for performing the work. Some duties associated with this responsibility can be delegated to other people. At the very least, an electrically instructed person must be deployed as a work supervisor, depending on the type of activity and the electrical hazard. Hager recommends deploying a qualified electrically skilled person as work supervisor.

**System manager**

The system manager bears direct responsibility for operation of the electrical system. The system manager is commissioned for this by the operator. Some duties associated with this responsibility can be delegated to other people.

## 1.5.2 Working methods

**Working methods**

All work on an electrical system must be planned. One of the three working methods is selected based on a hazard and risk assessment and depending on the situation:

- Work in a voltage-free state
- Work in the vicinity of live parts
- Work on live parts

## 1.5.3 Enclosure system, system components, switchgear and controlgear assembly

**Enclosure**

Standalone and self-supporting cover for housing electrical and electronic equipment. The unimes H power distribution system facilitates switchgear and controlgear assemblies with enclosures mounted in a row.

**Enclosure system/power distribution system**

An enclosure system is an assembly of standalone and self-supporting covers for holding electrical and electronic equipment. As the original manufacturer, Hager defines a complete range of mechanical and electrical components with the unimes H power distribution system. This range of mechanical and electrical components can be assembled into individual switchgear and controlgear assemblies in accordance with EN 61439-1/-2 following the instructions/manuals of the original manufacturer Hager.

**System components**

Unit, assembly or equipment as an integral part of a system or subsystem. Hager is a producer of matched and tested system components. Hager has provided verification of the design by means of tests, calculations or by applying the design rules and makes this data available to the manufacturer of the switchgear and controlgear assembly. The manufacturer uses this data as the basis for their calculation of the specific switchgear and controlgear assembly developed.

**System/switchgear**

A system is an assembly of various units at a specific location. Switchgear comprises a switchgear and controlgear assembly. Switchgear comprises an assembly of switch components with corresponding control, measurement, protection and regulation devices as well as assemblies made up of corresponding devices and equipment. Switchgear also comprises the corresponding electrical and mechanical connections, accessories, encapsulations and supporting frames.

**Switchgear and controlgear assembly**

Switchgear and controlgear assemblies are developed and manufactured according to the requirements of EN 61439-1 and EN 61439-2 and compliance with the standards is verified. Switchgear and controlgear assemblies are also referred to as power switchgear or a power distribution system.

A switchgear and controlgear assembly is a low-voltage switchgear and controlgear assembly in industrial, commercial and similar applications, which is not intended to be operated by ordinary persons according to EN 61439-2. It is used to distribute and control electrical energy for all types of loads. It is crucial for the operational safety of an electrical system. Power switchgear must comply with

the applicable standards on designing and constructing low-voltage switchgear and controlgear assemblies.

### 1.5.4 Project planning and constructing power switchgear

**Planning and assembly**

The planning, manufacturing (assembly and installation), testing and documentation of a switchgear and controlgear assembly (power switchgear) must be carried out in compliance with the relevant standard EN 61439 Part 1 and Part 2.

The project planning and construction of a user-specific switchgear and controlgear assembly usually require five main steps:

| Step | Action |
|---|---|
| 1 | Define or select influences, operating conditions and interface parameters. The user should specify these parameters. |
| 2 | Design of the switchgear and controlgear assembly by the manufacturer. The agreements, parameters and functions that specifically apply for the application must be fulfilled. The manufacturer of the switchgear and controlgear assembly must obtain Hager's design verification of the parts used. If this verification is not available or if the manufacturer does not use type-tested parts, the manufacturer of the switchgear and controlgear assembly must provide the design verification. |
| 3 | The switchgear and controlgear assembly is mounted according to the instructions and documentation of the device manufacturer and the original manufacturer of the system. Hager is the original manufacturer of the unimes H power distribution system. |
| 4 | The manufacturer issues a routine verification record for each switchgear and controlgear assembly. |
| 5 | The conformity assessment procedure must be carried out. If necessary, a declaration of conformity can be prepared and a CE marking issued as a result of the conformity assessment procedure.<br>Low-voltage switchgear and controlgear assemblies in EU member states are subject to the European Low Voltage Directive and the EMC Directive, as well as their respective national legal implementations. In Switzerland, low-voltage switchgear and controlgear assemblies are subject to the Swiss Ordinance for Electrical Low-Voltage Products and the Swiss Ordinance on Electromagnetic Compatibility.<br>Additional national and regional regulations must also be observed where appropriate. |

## 1.5.5 Special operating conditions

The user must inform the switchgear and controlgear assembly manufacturer of special operating conditions. The relevant special requirements must also be fulfilled or special agreements must be made between the user and the manufacturer.

**Existence of special operating conditions**

According to EN 61439-1, special operating conditions exist if, for example:

- the values of the operating conditions (ambient temperature, relative humidity, altitude) deviate from the usual operating conditions according to EN 61439-1 (7.1),
- fast temperature or air pressure changes occur so that unusual condensation is to be expected within the switchgear and controlgear assembly,
- the atmosphere can contain a significant amount of vapours, salt, dust, smoke, corrosive or radioactive components,
- strong electrical or magnetic fields have an influence,
- extreme climatic conditions have an influence,
- fungi or small animals have an influence,
- the installation location is located in areas susceptible to fire or explosions,
- heavy shocks, vibrations, impacts and seismic incidents occur,
- the installation affects the current-carrying capacity or the breaking capacity,
- if there is conducted and radiated interference, but no electromagnetic interference has an influence,
- if electromagnetic interference occurs in environments other than those described in section 9.4 of EN 61439-1.

**Consequences of special operating conditions**

Special operating conditions can result in the following (examples):

- necessary current reduction and consideration of reduction factors,
- consideration of reduced heat dissipation,
- adjustment of the application and deployment requirements (planning/project planning, production, installation, operation and maintenance),
- consideration of solutions for earthquake protection,
- adjustment of the safety requirements,
- consideration of increased testing and maintenance requirements.

# 2 Safety

## Read carefully

The safety-related information is provided to help you identify and avoid risks in good time. This information is essential for safe assembly and use of the system.

## Chapter index

## 2.1 Intended use of the unimes H system

**Type-tested power distribution system**

The unimes H power distribution system is a type-tested switchgear and controlgear assembly for switchgear and controlgear assemblies according to EN 614391/2.

**Flexible platform**

The unimes H power distribution system offers a flexible platform for implementing switchgear and controlgear assemblies according to EN 61439-2 (PSC switchgear and controlgear assemblies) for low-voltage main distribution systems. Over 1000 design versions can be assembled from the standardised basic enclosure types that are mounted in a row. The type-tested power distribution system offers enclosure types in two depths (600 mm/800 mm) and two enclosure heights (2000 mm / 2200 mm).

**Low-voltage main distribution systems up to 4000 A**

Low-voltage main distribution systems with a rated current of up to 4000 A can be implemented with the power distribution system. The rated current determines the necessary depth of the enclosures. With rated currents of 2950 A and higher, enclosure depths of 800 mm and 4 Cu busbars for each terminal are used for the main busbar system. Fibreglass bars are used as busbar reinforcements depending on the enclosure, rated current and rated short-time current for increasing the short-circuit resistance of the main busbar system.

**Indoor installation only**

The power distribution system is intended for fixed indoor installation. The switchgear and controlgear assembly is permanently installed and operated in a closed operating area at the installation site. If the switchgear and controlgear assembly is not operated in a closed electrical operating site, switching operations and access to the open switching enclosure by unauthorised personnel must be prevented. The switchgear and controlgear assembly must then be lockable using a lock or tools must be required to open it. The operating conditions for the indoor installation of switchgear and controlgear assemblies in the enclosure design specified in EN 61439-1 (7.1) must be observed at the installation site. For more detailed information, refer to the section "Technical data".

**Not to be operated by ordinary persons**

The units are not intended to be operated or handled by ordinary persons.

**Intended use also includes**

- Reading and observing this System Manual along with any instructions and manuals provided with the components and enclosures of the power distribution system.
- Complying with the safety regulations.

**Misuse**

Any other or additional use is considered misuse. Hager does not assume any liability for damages resulting from misuse.

**Danger due to electric shock, arc faults or fires in the case of misuse**

Misuse of the power distribution system parts can result in dangerous situations due to high voltages and high currents. This may result in serious injuries and even death.

- Never operate the power distribution system, the enclosure types and the components outside the specifications and ranges specified in the technical data.
- Observe the manuals for the respective enclosure types used.
- Always observe the requirements for personnel qualifications.
- Observe the technical data, specifications and tolerance values specified in this manual.

## 2.2 Safety instructions for the power distribution system

**Electrical hazards**

| DANGER | |
|---|---|
|  | **An electric shock results in serious burns and life-threatening injuries and even death.**<br>➢ Prior to starting work on the system, observe the following 5 safety rules:<br>1. Disconnect completely (all poles and all sides).<br>2. Secure against reconnection.<br>3. Verify the absence of voltage.<br>4. First earth and then short-circuit.*<br>5. Cover or shield any adjacent live parts. |

* When working on low-voltage systems, the step for earthing and short-circuiting the system may only be omitted if there is no danger of voltage transmission or feedback.

**Risk to life due to electric shock if contact is made with live parts in the switching enclosure**

- ➢ Work on live parts must only be carried out by electrically skilled personnel or electrically instructed personnel.
- ➢ Make sure that ordinary persons do not have access to the open switching enclosure and danger zone.
- ➢ Keep the switching enclosure locked or ensure operating sites are locked.

**Essential rules**

| DANGER | |
|---|---|
|  | **An electric shock results in life-threatening injuries or death.**<br>➢ In addition to the 5 safety rules, observe the 5 essential rules when handling electricity:<br>1. Ensure clear orders.<br>2. Deploy suitable personnel.<br>3. Use safe work equipment.<br>4. Wear suitable protective equipment.<br>5. Only commission tested systems. |

## 2.3 Preventing arc faults

Provoked arc fault if there is no arc fault protection system. The occurrence of arc faults can cause deadly accidents.

Significant damage in the system with high subsequent costs following an arc fault.

**Risk of accidents due to arc faults**

Arc faults occur without warning. Possible effects include temperatures of several thousand degrees °C, shock waves and flying parts, as well as toxic gases and dusts. This can result in serious burns, damage to eyesight, hearing damage and other injuries and even death. There is frequently significant system damage and subsequent costs.

- Only suitable specialists may work on live systems.
- Only work on live systems in exceptional cases.
- Wear suitable protective equipment against arc faults and take additional protective measures.
- Observe possible causes for arc faults.

**The causes of arc faults**

The most common causes for arc faults occurring can be divided into three categories:

1st Operational errors

- Insufficient clearances and creepage distances,
- Insufficient insulation,
- Excessive packing densities of the devices,
- Overloaded busbars,
- Overvoltages,
- Poor contacts.

2nd Assembly defects/maintenance and inspection errors

- Quantities of dust, moisture due to insufficient maintenance,
- Errors during assembly, maintenance and work performed on a live system,
- Errors when replacing fuses and connections,
- Forgetting tools or work materials.

3rd Damage due to rodents, reptiles.

### Active arc fault protection system

Active arc fault protection systems should be selected which, when an arc fault occurs, quickly initiate the suppression of the arc fault and simultaneously disconnect the fault location from the mains if:

- arc faults are to be expected in electrical systems,
- special fire protection requirements exist,
- special availability requirements exist.

### Ensure the power supply of the active arc fault protection system

If the switchgear and controlgear assembly is equipped with a Hager active arc fault protection system, a permanent power supply must be guaranteed. The active arc fault protection system must also be securely supplied with voltage during maintenance and may not be switched off. Only then can the arc fault protection system always react.

### Ensure permanent power supply

**⚠ DANGER**

**Danger due to arc faults if there is no power supply**

- ➢ You must guarantee a permanent power supply to the active arc fault protection system.
- ➢ The active arc fault protection system must be securely supplied with voltage and may not be switched off. Only then can the arc fault protection system always react.
- ➢ To guarantee the safety and reliability of an arc fault protection system, the active arc fault protection system must be supported at all times by a reliable, uninterruptible power supply (secure power supply, uninterruptible power supply (UPS)).
- ➢ **Do not switch off the protection system or its power supply:**
- during maintenance work,
- in the case of a power outage.

### Passive arc fault protection

To increase personal safety, Hager offers passive arc fault protection in enclosures of designs 2-4. This is guaranteed by means of spatial distribution and barriers on the inside.

## 2.4 Basic safety measures

**Observe safety objectives**

The dangers of electricity are frequently underestimated - even by electrically skilled personnel. To prevent accidents with consequences even up to death, the safety objectives must be observed.

- ➢ Make sure to observe the following safety objectives:

- Protection against electric current passing through the human body (electrification, internal burns, ventricular fibrillation),
- Protection against arcs (heat, blinding, shock waves, flying parts, poisoning due to gases or dusts),
- Protection against subsequent damage (fall, fire and additional subsequent damage).

**Observe the manuals/instructions and project planning rules**

- ➢ Observe the assembly instructions enclosed with the components.
- ➢ Observe the assembly instructions in this System Manual and in the manuals for the enclosure types.
- ➢ Observe the project planning rules specified for the respective installation systems. They are important for preventing overheating and resulting hazards.

**The system must only be operated by authorised personnel**

- ➢ Switchgear and controlgear assemblies must only be operated by appropriately trained and authorised personnel who are familiar with the System Manual and can work according to it.

**Pay attention to residual energies and static discharge**

- ➢ Secure stored energies. Dangerous residual energies may be present in electrical systems.
- ➢ Prior to starting activities during installation work, disconnect the system and make sure it is statically discharged before touching the devices. Static voltages can result in personal injuries.

**Notes about connections, devices and functional earth**

- The functional earth (FE) must be connected to the protective earth (PE) or the potential equalisation. The installer is responsible for establishing this connection.
- Connection and signal lines must be installed so that inductive and capacitive interference do not adversely affect the automation functions.
- The automation technology devices and their controls must be installed so that they are protected against unintentional operation.
- Ensure that the low voltage for the 24 volt supply features safe electrical isolation. Only power supply units that fulfil the requirements of the IEC 60364-4-41 HD 60364-4-41 (DIN VDE 0100-410) may be used.

**Observe the tolerance of the mains voltage**

- ➢ Observe the specified mains voltage tolerances. Mains voltage fluctuations or deviations from the nominal value may not exceed the tolerance limits specified in the technical data. If the tolerance limits are exceeded, functional failures and hazardous conditions cannot be excluded.

**Risk of electric shock in the vicinity of live parts!**

The dangerous proximity to live parts is underestimated time and time again. It may result in electric current passing through a human body and even death.

- Observe the permissible proximities for live parts.
- Ensure protection by maintaining distance.
- Protect yourself by covering, blocking off and shielding the active parts for the duration of the work.
- Use insulating covers to protect against unintentional contact for all work in the vicinity of live parts.
- Do not work in the vicinity of live parts unless suitable measures have been taken to ensure that live parts cannot be touched.

**Ensure the following before switching on:**

- the access rights are clearly established,
- only authorised personnel stay in the work area of the system.
- nobody can be injured when commissioning the system.
- the system is only operated in perfect working order.

**Before switching on each time**

- check the system for visible damage.
- report identified defects to the supervisor immediately.
- remove materials/objects from the danger zone of the system if they are not required for operation.

**Risk of accidents when performing assembly work in the surrounding area of the switchgear**

Invisible dangers are often underestimated when performing assembly work or drawing in cables in the surrounding area of the switchgear and controlgear assembly. Accidents may occur if the switchgear or its equipment, such as cables, is misused. Hazardous situations can occur due to short circuits or arc ignition. The consequences are severe burns or death.

- Before performing any work in the surrounding area of the switchgear, carry out a risk assessment.
- Do not improvise. Instead, take planned actions with a clear objective.
- If necessary, disconnect the switchgear.
- Observe the 5 safety rules and the 5 essential rules.
- Only authorised personnel may work in the surrounding area of the switchgear.
- Use suitable aids and appliances, such as scaffolding and ladders, for performing work above the switchgear. Never use the switching enclosure as a working platform, climbing aid or storage space.
- Do not run the risk of falling.
- Depending on the work, cover the enclosures to protect them from drops, welding spatter, dust or similar.

**Risk of accident from entering or climbing on the switching enclosure**

Accidents can happen when entering or climbing on the switching enclosure during assembly work or when drawing in cables. The casing of a switchgear and controlgear assembly is not designed for loads.

Entering or climbing on the switching enclosure can bend sheet metal parts. Bending such parts can result in short circuits or adversely affect the protective function.

- Only authorised personnel may work in the surrounding area of the switchgear.
- Do not enter or climb on the switching enclosure.
- Use suitable aids and appliances, such as scaffolding and ladders, for performing work above the switchgear.
- Never use the switching enclosure as a working platform or climbing aid.

**Regular testing and maintenance**

Regular testing and maintenance are important for ensuring the safety of personnel and for avoiding malfunctions.

- Observe the inspection and maintenance intervals in this System Manual, the manuals for the respective enclosure type as well as the components and equipment.
- In the case of special operating conditions or ambient conditions, shorten the inspection intervals.
- Perform separate tests if there are special circumstances, such as moisture, condensation, water entering the switchgear room, contamination, pollution or vibrations.
- When performing tests and maintenance, secure the system against unauthorised activation or reconnection.
- Before performing maintenance work, block access to the system work area from unauthorised personnel.

## 2.5 Safety during packaging and transport

**Risk of accidents if the enclosure tips over or slips during transport or assembly!**

If the load is not evenly distributed, there is a risk that the enclosure may tip over or slip. Personnel may be seriously injured or killed due to crushing.

- Observe the weight, the centre of gravity and make sure that the load is secured. Depending on the configuration, an individual enclosure weighs up to 900 kg. The maximum weight is 1440 kg. The centre of gravity depends on the switching enclosure configuration.
- When transporting with a forklift or pallet truck, remove any attached bases. When transporting with a forklift or pallet truck, make sure that the forks are slip-resistant and completely moved under the enclosure.
- Always secure the enclosure on the transport equipment using a suitable fixing.
- When transporting with a forklift or pallet truck, never lift the enclosure any higher than absolutely necessary.
- Secure the danger zone so it cannot be accessed by unauthorised personnel.
- After transport, immediately fasten the enclosure to the floor.
- Make sure that the enclosure is not used as a climbing aid or for support purposes during assembly. Suitable ladders and scaffolding must be used to ascend to the appropriate height for performing work above the enclosure.
- When mounting the enclosure on the wall, secure it by means of an additional fixing using a wall bracket.

**Risk of accident due to suspended loads during crane transport!**

During crane transport, the suspended loads can fall or oscillation movements can be triggered resulting in accidents. This may result in bodily injuries or even death.

- Make sure that suitable transport equipment with sufficient load capacity is used.
- Observe the weight and centre of gravity of the enclosures. Depending on the configuration, an individual enclosure weighs up to 900 kg. The maximum weight is 1440 kg.
- Make sure that enclosures mounted in a row are connected with at least 4 suitable connections inside the enclosures.
- An individual enclosure or two connected enclosures mounted in a row are transported as standard. Do not transport more than 3 interconnected enclosures.
- When transporting 3 interconnected enclosures, observe the maximum weights of the outer enclosures during transport. The maximum weight of the two outer enclosures is 700 kg each with the lifting cables inclined at 30° (lifting cable angle 60°).
- Prior to crane transport, make sure that the ring screws MES-TR, with a thread size of 12, are correctly aligned and fastened or that the combination lifting lug MES-KT is correctly fastened.
- During crane transport, make sure that the minimum lifting cable angle is 45° to the enclosure roof surface (maximum angle of inclination 45°). Note that when the angle of inclination increases, the forces in the lifting tackle and lifting points increase. An increase in the angle of inclination reduces the load-carrying capacity.
- Make sure that the load is evenly distributed on the ring screws/combination lifting lugs. Position the crane hook above the centre of gravity.
- Make sure that nobody is in the danger zone.

**Risk of accident due to the enclosure tipping at the assembly site!**

If the enclosure is entered during assembly and the load is unevenly distributed, there is a risk of the enclosure tipping over. Personnel may be seriously injured or killed.

- ➢ Immediately after transport, secure the enclosure at the installation site by fastening it to the floor.
- ➢ If necessary, secure it with an additional fixing on the wall via a wall bracket. Wall mounting brackets MES-WW are suitable for this.
- ➢ Make sure that enclosures mounted in a row are interconnected on the inside using at least 4 suitable connections.
- ➢ Make sure that assembly personnel or other personnel do not use the enclosure as a climbing aid or for support purposes.

**Observe the principles of safe transport**

- ➢ Observe the principles of safe transport and storage:

- Are sufficiently maintained and suitable transport aids available?
- Is an even, solid and clean surface available for the transport or storage/installation?
- Is the surface suitable for the weight of the enclosure?
- Avoid inclines. Is it possible to brake or coast?
- Are the transport routes illuminated and secured?
- Are personnel wearing personal protective equipment and high-visibility clothing if necessary?
- Are the protection objectives guaranteed during transport:

  - head protection,
  - foot protection,
  - hand protection.

**Observe the weight and centre of gravity and make sure that the load is secured**

- ➢ Determine the weight of the enclosure or the enclosures mounted in a row.
- ➢ Observe the centre of gravity of the individual enclosure or the centre of gravity position of the load for enclosures mounted in a row. The centre of gravity of the individual enclosure depends on the level of expansion.
- ➢ Make sure that the load is secured as required during transport. This also includes sufficient labelling of the load and warning of hazards (centres of gravity, attachment points, security measures).

**Secure and fixed transport**

- When the enclosure is transported with installed equipment, it must be sufficiently secured and fixed.

**Secured unloading**

- ➢ When unloading or transporting the enclosure with a forklift, secure it to the forklift using retaining straps. Observe the weight and centre of gravity of the individual enclosure. The centre of gravity of the enclosure depends on the level of expansion.

**Secure the enclosure immediately after transport**

- Visually inspect the exterior of the enclosure for transport damage.
- After transport, immediately fasten the enclosure to the floor. In the case of temporary storage, make sure that enclosures are firmly positioned and secure them against slipping or tipping.
- Make sure that enclosures mounted in a row are interconnected on the inside using at least 4 suitable connections. The enclosures must be connected with at least 2 enclosure connection perforated plates MES-FV on every two struts in the front and middle enclosure profile. Alternatively, 2 enclosure connection bolts MES-FVB are suitable on every two struts in the front and middle enclosure profile. The combination lifting lug MES-KT is also suitable for connecting enclosures on the enclosure roof.
- During assembly, make sure that the enclosures are aligned perpendicularly. The base levelling screw MES-NIV helps level the enclosure with the base.

**Plan device replacements and system expansions**

Before replacing electrical equipment with other types of devices or expanding the system, a new project must be planned and the switchgear and controlgear assembly must be tested according to EN 61439.

If the manufacturer of the switchgear and controlgear assembly makes changes, with replacement of the equipment, that are not included in the design verification of the original manufacturer, Hager, the manufacturer of the switchgear and controlgear assembly becomes the original manufacturer for these changes. A design verification must then be drawn up. A routine verification is not sufficient in this case.

- Observe the following when expanding or retrofitting the system:

- Each expansion or retrofitting measure must be planned. Observe the respective manuals and project planning guidelines for the enclosure types.
- When expanding or modifying an existing system, you must verify and confirm that the safety of the existing system is not adversely affected.

## 2.6 Personnel requirements

### Product life cycle phase

The following is an overview of the requirements for personnel during the life cycle phases of the switchgear and controlgear assembly.

| Product life cycle phase | Training, qualification or skills |
|---|---|
| Planning | Electrical engineer, master electrician, panel builder, electrically skilled person |
| Switchgear manufacture, assembly | Panel builder, electrically skilled person |
| Transport | Transport specialist personnel |
| Assembly | Electrically skilled person, electrically instructed person |
| Installation | Electrically skilled person |
| Commissioning | Electrically skilled person with testing experience, sometimes with special training |
| Operation, handling | Electrically skilled person, electrically instructed person |
| Cleaning | Electrically skilled person; specially trained electrically instructed person if work in the absence of voltage is ensured |
| Conversions, expansions | Electrically skilled person, manufacturer/specifier |
| Troubleshooting | Electrically skilled person |
| Maintenance, servicing | Electrically skilled person with testing experience |
| Decommissioning | Electrically skilled person |
| Disassembly | Electrically skilled person; instructed personnel for clearly defined mechanical and electrical work |
| Disposal | Electrically skilled person, electrically instructed person |

### Working on live equipment

Working on live equipment (W.o.L.) requires higher minimum requirements from the authorised personnel than working in the vicinity of live parts ("in the vicinity"):

| Requirements | W.o.L.[1] | In the vicinity[2] |
|---|---|---|
| Approval from system manager | x | x |
| Instruction from work supervisor | x | x |
| Detailed written work instruction | x | |
| Electrically skilled person | x | |
| Electrically instructed person3 | x | |
| Special worker training | x | |

[1] W.o.L.: Work on live equipment
[2] in the vicinity: Working in the vicinity of live parts
[3] Protection type / degree of protection at least IP2X / IPXXB

- Work on live equipment may only be performed if the safety and health protection of all personnel involved in the work are ensured.
- Work on live equipment must be performed according to the accepted engineering standards.
- Work on live equipment may only be performed by electrically skilled personnel or electrically instructed personnel who

- have received relevant special training for the respective work
- have received the necessary follow-up training and
- have the equipment and personal protective equipment (PPE) necessary for the relevant work and test it before use.

- Work on live equipment may only be performed if written work instructions have been defined by the work supervisor after a risk and hazard assessment has been carried out.

**Additional protective measures**

Additional protective measures for working on live equipment, for example, include using:

- covers, cover plates,
- insulating mats,
- locking caps,
- protective hoods.

**NOTE**
The specific company and personnel qualification requirements are defined at national level, i.e. may vary from country to country.

**Wear personal protective equipment**

To ensure safe system operation, the electrotechnical specialist personnel / electrically skilled person or the electrotechnically instructed person must use suitable tools, depending on the activity. Personal protective equipment (PPE) must be worn during switching and any live work.

- Check the personal protective equipment for visible damage prior to each use.
- The personal protective equipment includes wearing a suitable helmet with face shield or a flame-retardant hood.
- The personal protective equipment includes wearing suitable, flame-retardant, and arc-tested work clothing and standing on an insulating mat.

## 2.7 Operator obligations

**Operator responsible**

The operator responsible for the power switchgear must at least ensure that

- the switchgear is only used for its intended purpose and only in perfect working order,
- the safety equipment is regularly checked,
- maintenance and cleaning are regularly performed,
- the required personal protective equipment is available and worn by authorised personnel,
- the manuals for the power distribution system and for the relevant enclosure types are always available in complete and legible condition at the operating site of the switchgear,
- only qualified, expert and authorised personnel transport, assemble, install, commission, operate and repair, decommission, disassemble and dispose of the switchgear,
- all safety and warning messages attached to the switchgear are always legible. Missing or damaged safety and warning messages must be replaced.

**Safety concept/risk assessments**

The operator responsible for the switchgear must develop a safety concept for their systems. As part of this concept, the operator must at least instruct personnel who have access to the operating area, perform operational activities or work on the systems.

Personnel with access to the operating area must be re-instructed periodically. The interval in-between is based on:

- the training level of the relevant personnel,
- the work to be performed
- and the type of the system.

Instruction must at least provide knowledge about:

- the hazards when approaching live parts and protective measures against accidental contact by measures, such as covers, shielding or maintaining distance.
- the immediate measures and assistance in the event of accidents,
- indication/instruction about escape routes and emergency contact points in the systems to be entered,
- what to do in the event of a fire,
- what to do in case of moisture and water damage.

The power switchgear operator designates one person for each job, who is responsible for the necessary protective measures and safe execution of the work. The operator must ensure that the deployed personnel cannot be endangered, including by third parties, and arrange the appropriate measures.

### Standards and certificates

| | | |
|---|---|---|
| Fulfilled standards | Low-voltage switchgear and controlgear assemblies – power switchgear and controlgear assemblies | EN IEC 61439-1 |
| | (PSC switchgear and controlgear assemblies) | EN IEC 61439-2 |
| | Low-voltage switchgear and controlgear assemblies – assemblies for power distribution in public networks<br>*) Without U-MUN | EN IEC 61439-5* |
| | Low-voltage switchgear and controlgear assemblies – busbar trunking systems (BTS) | EN IEC 61439-6 |
| | Low-voltage switchgear and controlgear assemblies – arcing due to internal system fault | EN IEC TR 61641<br>EN IEC TS 63107 |
| | Tests under earthquake conditions<br>IEC 60068-3-3 (time-history test method)<br>IEC 60068-2-57 (time-history test method)<br>IEC 60068-2-6 (sine sweep)<br>IEEE 693 (only the RRS values as load levels)<br>ESTI NO. 248 Version 1012d (not included in the accreditation) | <br>EN IEC 60068-3-3<br>EN IEC 60068-2-57<br>EN IEC 60068-2-6<br>IEEE 693<br>ESTI NO. 248 |
| | Shock test | Technical directive concerning shock resistance (TW Schock 1995)<br>LS OB 05-909 |

## 2.8 Applying the standards

### Applying the standards

Low-voltage power distribution systems (power switchgear/switchgear and controlgear assemblies) must meet the generally accepted engineering standards.

All the requirements for observing the protection objectives are defined in the DIN VDE (EN/IEC) regulations:

- Personal protection
- Property protection
- System protection

The legal requirements for compliance with the low-voltage directive, EMC directive and national stipulations are met by complying with the standards.

The unimes H power distribution system is set up for the implementation of switchgear and controlgear assemblies within the meaning of power switchgear and controlgear assemblies (PSC switchgear and controlgear assemblies).

At least the standard from the EN 61439 Part 1 and Part 2 series must be applied for switchgear and controlgear assemblies.

### Hager training programmes

Hager offers regular training programmes on the standards as well as on planning and setting up low-voltage systems.

# 3 unimes H power distribution system

## Important features

This section describes the important features of the unimes H power distribution system.

## Chapter index

## 3.1 Introducing the system

### Over 1000 design versions

Switchgear and controlgear assemblies with enclosure depths of up to 800 mm and incoming units up to 4000 A are implemented from the components of the type-tested unimes H power distribution system.

Over 1000 design versions can be assembled from the standardised enclosure types based on the basic enclosure U-BS(I). The spatial distribution inside the enclosures is clear and well laid-out and enables the expansion of internal separations up to Form 4b according to EN 614391/2.

The enclosure types can be combined for control engineering and communication applications. A control compartment or the univers N expansion kit can be integrated for individual enclosure types for this purpose.

The drill-free connection to the main busbar system (H-SaS) enables short connections and assembly times of incoming units and return lines. Assembly without the need for drilling also avoids reductions in cross sections.

## 3.1.1 Expansion technology - Principles

**Type of electrical connection according to EN 61439**

The user can specify the electrical connection of functional units within the switchgear combination. A three-digit code identifies the type of electrical connection of the functional unit:

- 1st letter: Feeding the main circuit to the functional unit
- 2nd letter: Outlet of the main power circuit from the functional unit
- 3rd letter: Connection of auxiliary power circuits

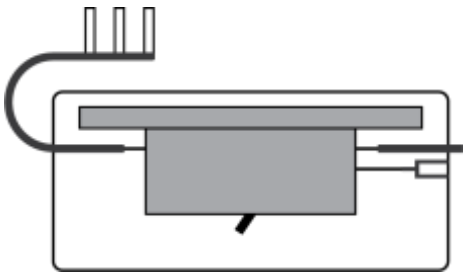
The following letters stand for the relevant type of connection:

- F: For fixed connections,
- D: For releasable connections,
- W: For guided connections.

A functional unit with the code allocation FFD has, for example, fixed feed connections, fixed outlet connections and releasable auxiliary circuits.

**Electrical connection - Overview and personnel qualifications**


**Plug-in technology/fixed installation -F**



**Main power circuit**

- with permanently installed functional units
- Permanently installed entry and outlet

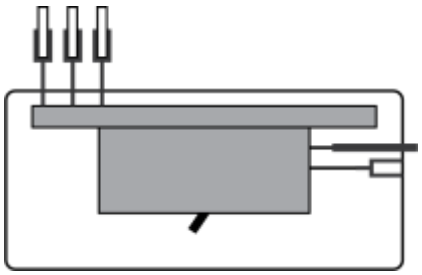
**Auxiliary power circuit**

- permanently installed or plugged-in

**Connection according to EN 61439-1**

- FFF or FFD

### Plug-in technology -R



**Main power circuit**

- With removable functional units, can be replaced while live without load
- Input plugged in
- Permanently connected outlet

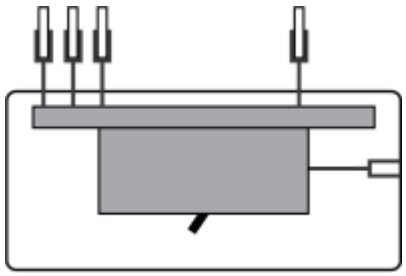
**Auxiliary circuit**

- Permanently installed or plugged in

**Connection according to EN 61439-1**

- WFF or WFD

### Plug-in insertion technology -W



**Main power circuit**

- With functional units which are switched from the operating position to the disconnected position
- Input plugged in
- Outlet plugged in

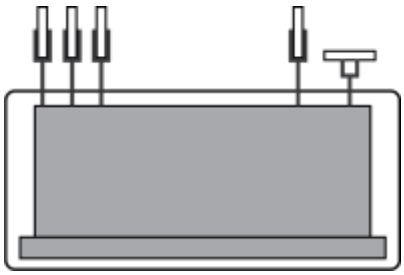
**Auxiliary circuit**

- Plug connection must be disconnected or connected by hand.

**Connection according to EN 61439-2**

- WWD

### Insertion technology -W



**Main power circuit**

- With functional units which are switched from the operating position to the disconnected position
- Input plugged in
- Outlet plugged in

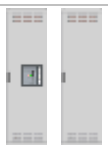
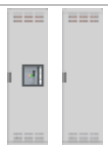
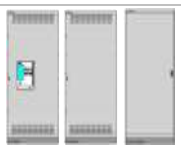
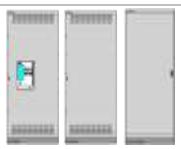
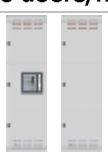
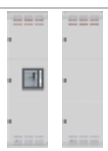
**Auxiliary circuit**

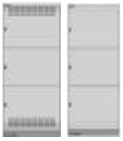
- Plugged in

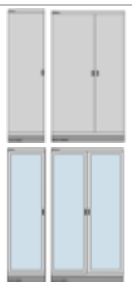
**Connection according to EN 61439-2**

- WWW

## 3.1.2 System overview

| U-PWE | U-PWK | U-TE | U-TK | U-T2 |
|---|---|---|---|---|
|  |  |  |  |  |
| **ACB incoming/ outgoing enclosure** | **ACB coupling enclosure** | **ACB incoming/ outgoing enclosure** | **ACB coupling enclosure** | **ACB incoming/ outgoing/coupling enclosure** |
| - Incoming units<br>- Outgoing units | - Couplings<br>- Cross couplings | - Incoming units<br>- Outgoing units | - Couplings<br>- Cross couplings | - Double incoming unit/ -double outgoing unit<br>- Double cross coupling<br>- Incoming unit/ outgoing unit and cross coupling |
| **Expansion technology** | | | | |
| - Plug-in technology<br>- Insertion technology | - Plug-in technology<br>- Insertion technology | - Plug-in technology<br>- Insertion technology | - Plug-in technology<br>- Insertion technology | - Plug-in technology<br>- Insertion technology |
| **Device rated current** | | | | |
| ≤ 4000 A | ≤ 4000 A | ≤ 4000 A | ≤ 4000 A | ≤ 1600 A |
| **Device installation position** | | | | |
| - Vertical | - Vertical | - Vertical | - Vertical | - Vertical |
| **Devices can be operated** | | | | |
| - from the outside FE1<br>- behind the door HF | - from the outside FE1<br>- behind the door HF | - from the outside FE1 and FE2<br>- behind the door HF | - from the outside FE1 and FE2<br>- behind the door HF | - from the outside FE1 |
| **Device operation** | | | | |
| - Manual drive<br>- Motor drive | - Manual drive<br>- Motor drive | - Manual drive<br>- Motor drive | - Manual drive<br>- Motor drive | - Manual drive<br>- Motor drive |
| **Form of internal separation** | | | | |
| 1-4b | 1-4b | 1-4b | 1-4b | 1-4b |
| **IP protection type** | | | | |
| IP3x: FE1<br>IP4x: HF | IP3x: FE1<br>IP4x: HF | IP2xC: FE1, FE2<br>IP3x: FE1<br>IP4x: HF | IP2xC: FE1, FE2<br>IP3x: FE1<br>IP4x: HF | IP2xC: FE1<br>IP3x: FE1 |
| **Enclosure front configurations** | | | | |
| **Vertical enclosure door** | | | | |
|  |  |  |  | - |
| **Module doors/module front** | | | | |
|  |  |  |  |  |

| U-LE | U-LK | U-CW(I) | U-S(I) | U-SV |
|---|---|---|---|---|
|  |  |  |  |  |
| **LBS incoming/ outgoing enclosure** | **LBS coupling enclosure** | **Outgoing enclosure combiway** | **HRC outgoing enclosure slimline horizontal** | **HRC outgoing enclosure LL/sasil/slimline vertical** |
| - Incoming units<br>- Outgoing units | - Couplings<br>- Cross couplings | - Field incoming unit<br>- Cable outlets | - Field incoming unit<br>- Cable outlets | - Field incoming unit<br>- Cable outlets |
| **Expansion technology** | | | | |
| - Fixed system | - Fixed system | - Fixed system<br>- Removable system<br>- Withdrawable system to plug in<br>- Withdrawable system | - Removable system | - Removable system |
| **Device rated current** | | | | |
| ≤ 2500 A | ≤ 2500 A | ≤ 630 A | ≤ 630 A | ≤ 630 A |
| **Device installation position** | | | | |
| - Vertical | - Vertical | - Horizontal | - Horizontal | - Vertical |
| **Devices can be operated** | | | | |
| - from the outside FE1<br>- behind the door HF | - from the outside FE1<br>- behind the door HF | - from the outside FE1<br>- behind the door HF | - from the outside FE1<br>- behind the door HF | - from the outside FE1<br>- behind the door HF |
| **Device operation** | | | | |
| - Manual drive | - Manual drive | - Rocker arm drive<br>- Rotary drive<br>- Motor drive | - Manual drive<br>- Motor drive | - Manual drive<br>- Motor drive |
| **Form of internal separation** | | | | |
| 1-4b | 1-4b | 1-4b | 1-4b | 1-4b |
| **IP protection type** | | | | |
| IP4x: FE1<br>IP4x: HF | IP4x: FE1<br>IP4x: HF | IP3x: FE1<br>IP4x: HF | IP3x: FE1<br>IP4x: HF | IP3x: FE1<br>IP4x: HF |
| **Enclosure front configurations** | | | | |
| **Enclosure-height door** | | | | |
|  |  |  |  |  |
| **Module doors/module front** | | | | |
|  |  |  |  |  |

| U-FL | U-MUN | U-BS(I) | U-ES |
|---|---|---|---|
|  |  |  |  |
| **HRC outgoing enclosure fuseline** | **Modular enclosure univers N** | **Basic enclosure universal** | **Corner enclosure** |
| - Field incoming unit<br>- Cable outlets | - Incoming unit<br>- Cable outlets | - Cable enclosure<br>- Traversal<br>- Control enclosure<br>- Measuring enclosure | - Traversal<br>- Horizontal busbar routing |
| **Expansion technology** | | | |
| - Fixed system | - Fixed system | - | |
| **Device rated current** | | | |
| ≤ 1000 A | ≤ 1600 A | ≤ 1600 A | |
| **Device installation position** | | | |
| - Vertical | - Horizontal/vertical | - Horizontal/vertical (both possible) | - |
| **Devices can be operated** | | | |
| - from the outside FE1 and FE2<br>- behind the door HF | - behind the door HF | - from the outside FE2<br>- behind the door HF | - |
| **Device operation** | | | |
| - Manual operation | - Rocker arm drive<br>- Rotary drive<br>- Motor drive | - Device-dependent | - |
| **Form of internal separation** | | | |
| 1-3b | 1-2b | 1-2b | 1 |
| **IP protection type** | | | |
| IP3x: FE1, FE2<br>IP4x: HF | IP4x | IP3x: FE2<br>IP4x: HF | IP4x |
| **Enclosure front configuration** | | | |
| **Vertical enclosure door** | | | |
|  |  |  | - |
| **Module doors/module front** | | | |
|  | - | - | - |

| Traversal | aSLB | pSLB |
|---|---|---|
|  |  |  |
| **Traversal** | **Active arc fault protection system** | **Passive arc fault protection** |
| - Traversal<br>- Vertical busbar routing without protection devices | - System enclosures unimes H | - System enclosures unimes H |
| **Device rated current** | | |
| - | ≤ 2x4000 A | ≤ 2x4000 A |
| **Device installation position** | | |
| - | - horizontal / vertical (both possible) | - horizontal / vertical (both possible) |
| **Devices can be operated** | | |
| - | - from outside FE1 and FE2<br>- Behind the door HF | - from the outside FE1<br>- Behind the door HF |
| **Device operation** | | |
| - | - Manual operation | - |
| **Form of internal separation** | | |
| 1-2b | 1-4b | 2-4b |
| **IP protection type** | | |
| IP4x | IP4x | IP4x |

## Different expansion stages

The standard delivery of the enclosures is distinguished by different expansion stages.

As a standard version (Form 1), the delivery includes the basic enclosure without rear panel depending on the enclosure type. However, the enclosures can also be ordered in additional expansion stages depending on the enclosure type.

## Areas of application

The unimes H power distribution system is used in the following areas:

- Infrastructure, e.g. railway, airports, motorway tunnels
- Commercial buildings, e.g. hotels, shopping centres, sports facilities
- Data centres, data processing centres
- Hospitals and care units
- Office buildings, e.g. banks, universities, administration buildings
- Industry, e.g in the chemical industry

**Integration of univers N**

The complete system technology of univers N and univers N HS with rated currents up to 1600 A can be integrated via modular enclosure univers N (U-MUN). This extends the range of applications of the unimes H to include the kits with all the accessories of the univers N system for low-voltage building distribution units.

**Safety features**

- Design up to Form 4b
- Short-circuit resistance up to 120 kA ($I_{cw}$ (1 s))
- N conductor cross section up to 200%
- Plug-in insertion technology and insertion technology (can be replaced under voltage with protective equipment)
- Arc fault test according to IEC/TR 61641 as verification of personal and system protection
- Active arc fault protection system (optional)
- Passive arc fault protection (optional)
- Earthquake resistance
  (according to IECEN 6006833, IECEN 60068257, IECEN 6006826, IEEE 693 and ESTI NR. 248)

**Earthquake resistance**

The unimes H enclosures are earthquake-resistant as standard. Earthquake resistance was tested in accordance with the requirements set out in IEEE 693 / IEC 60068.

The enclosures can be reinforced additionally if the requirements are higher.

**Accessories**

Hager offers a comprehensive range of accessories and system components, such as:

- Assembly material
- Busbar systems
- Busbar supports
- Moulded case circuit breakers and air circuit breakers
- Fuse switch disconnector strips
- HRC fuse switch disconnectors
- Load break switch with fuse in bar design
- Fuse links
- The complete range of univers N and univers N HS accessories

**NOTE**

The currently available accessories can be found in the Hager catalogues, in Hager's hagercad planning software and in the relevant product range overview currently available. (National or regional delivery programmes may vary)

## 3.2 Spatial concept of enclosures

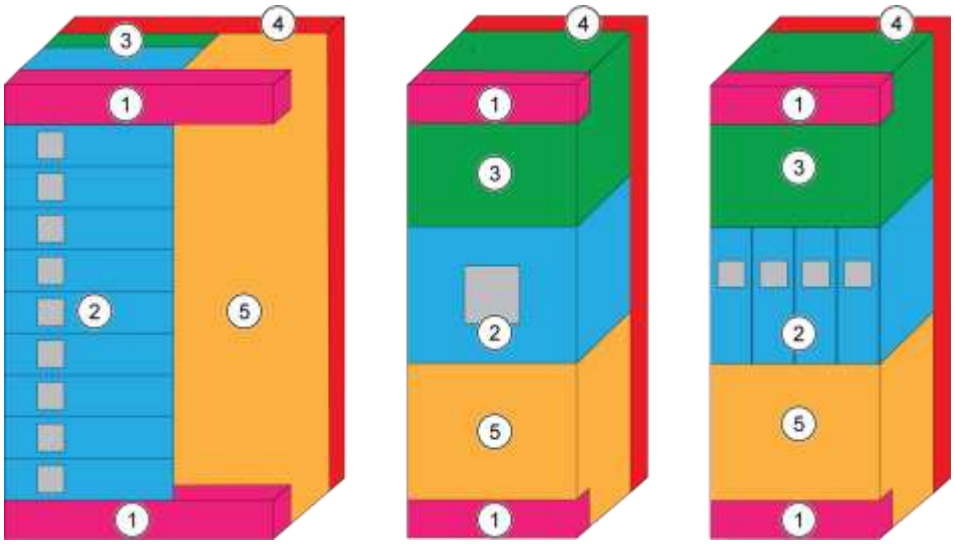
### Sophisticated spatial concept

The unimes H power distribution system is characterised by a sophisticated spatial concept:

- a modular structure allows for a wide range of different design versions,
- combinations can be created in the modular design,
- extensions are easy to implement,
- standardised coppering between the compartments reduces the planning requirements and the production times,
- the optimum space requirement can be determined,
- internal separations via partitions increase passive arc fault protection.

### Spatial distribution

The spatial distribution of the individual enclosure types varies depending on the enclosure type and the installation position (horizontal/vertical) of the mountable devices.




| Device installation position, horizontal | Device installation position, horizontal | Device installation position, vertical |
|---|---|---|

| | | | |
|---|---|---|---|
| **1** | Main PE and cross wiring compartment | **4** | Busbar compartment |
| **2** | Device compartment | **5** | Terminal compartment and cable compartment |
| **3** | Field connection compartment | | |

Well laid-out spatial distribution guarantees a clear overview and the functional areas can be ideally separated from each other. In addition, the various internal separations can also meet individual requirements.

The clear layout of the functional areas also increases operational and operator safety.

This layout of the available space facilitates the implementation of the most common designs 2b, 3b and 4a/b. It also minimises the probability of arc faults occurring and thus increases safety.

### 3.2.1 Functional areas

**Busbar compartment**

- The rated current $I_{nA}$ determines the necessary depth of the enclosure:
  - 600 mm (max. 2950 A)
  - 800 mm (max. 4000 A)
- 3 different positions of the main busbar system H-SaS are possible, of which 2 can be simultaneously loaded
- End-to-end main busbar for enclosures mounted in a row via transport divider U-TT/U-TTS or U-TTK.

**Device compartment**

- The device determines the necessary space. The power distribution system provides the appropriate enclosure width for selection.
- Pre-assembled components simplify device assembly.
- The structure of the device compartment is customised to the device type.

**Terminal compartment and cable compartment**

- The cable compartment can be integrated into the enclosure (U-BSI, U-SI, U-CWI) or arranged on the side as a basic enclosure (can then also be used as a shared cable compartment for two enclosures).
- Cable compartment position on the left or right if the cable compartment is integrated (KRI)
- Cable compartment position at the top or bottom in the case of vertical device arrangement
- Various cable compartment widths are available depending on the space requirements of the outgoing units.

**Main PE and cross wiring compartment**

- Prepared cross wiring compartment at the top and bottom.

**Multifunctional compartment depending on the enclosure type**

Some enclosure types offer a multifunctional compartment. The following can be installed in the multifunctional compartment:

- A control compartment
- A univers N expansion kit.

The control compartment is used for installing communication modules supplied by the auxiliary circuit, surge protection devices or measuring devices. The control compartment is located in the multifunctional compartment of the following enclosures: U-S(I) partial extension, U-SV, U-FL and U-BS(I).

The univers N system range can be installed in the multifunctional compartment in several enclosure types using a univers N expansion kit. The univers N expansion kit can be found in the multifunctional compartment of the following enclosures: U-SV, U-FL and U-BS(I).

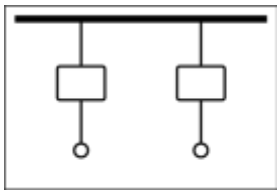
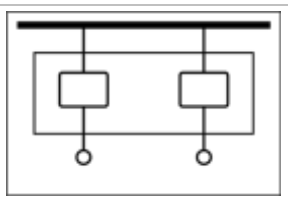
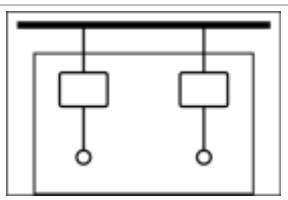
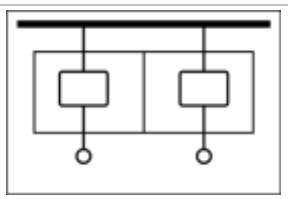
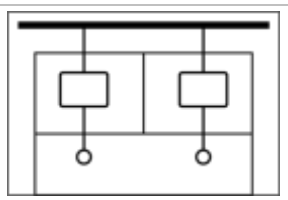
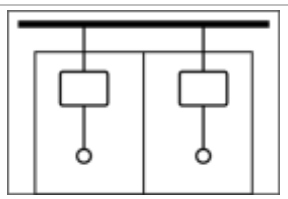
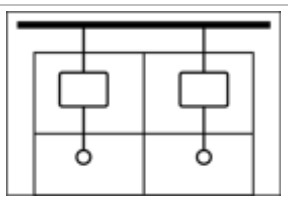
## 3.2.2 Internal separation

### Form of internal separation

Internal separation from Form 1 to Form 4b according to EN 61439-1 created by means of partitions enable

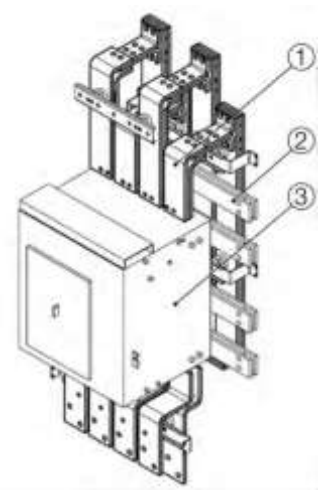
- passive arc fault protection and limits arc migration by the standard partition,
- high current-carrying capacity, also with partitions,
- an arc fault test performed by Hager according to IEC/TR 61641.

### Forms of internal separation according to EN 61439

| Form | Internal separation | Connections for conductors brought in from the outside. | Symbol image |
|---|---|---|---|
| 1 | none | |  |
| 2 a | between busbars and functional units | **not** divided by the busbars |  |
| 2b | | divided by the busbars |  |
| 3 a | - between busbars and functional units<br>- between all functional units among each other<br>- of connections for conductors brought in from the outside from the functional units, but not from those of other functional units | **not** divided by the busbars |  |
| 3b | | divided by the busbars |  |
| 4 a | - between busbars and **all** functional units<br>- between all functional units among each other<br>- of the connections belonging to a functional unit for conductors brought in from the outside from those of all other functional units and from the busbars | in the same compartment as the allocated functional unit |  |
| 4b | | **not** in the same compartment as the allocated functional unit but arranged in a separate, individual space or compartment, protected by a cover |  |

**Functional areas/functional compartments**

Example for the clear distinction of the functional areas (in this case, no expansion to Form 2b of internal separation via bushing partitions and device partitions).



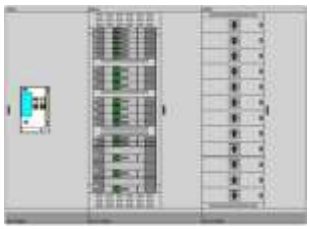

| | |
|---|---|
| 1 | Distribution busbar system F-SaS |
| 2 | Main busbar system H-SaS |
| 3 | Functional unit<br>- Equipment carrier, frame and brackets<br>- Device/equipment<br>- Connections (device connections, additional copper busbars)<br>- Device cladding, sheathing<br>- Cover plates |

## 3.3 Front concept of enclosures

### Modular front concept

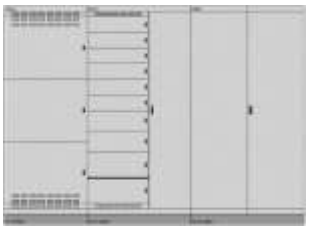
The modular front concept fulfils the requirements for flexible front equipment. Depending on the enclosure type and the mountable devices, you can choose between:

- **Front installation FE1:**
  In fixed front or with (module) door: Visible device state,
  device operation from the enclosure front.
- **Front installation FE2:**
  With cover plates (without door) by panel builder: Visible device state, device operation from the enclosure front.
- **Behind front HF:**
  Devices behind solid door, glazed door or module front (module doors).
  Devices cannot be operated from the outside.



Front installation FE1

Front installation FE2



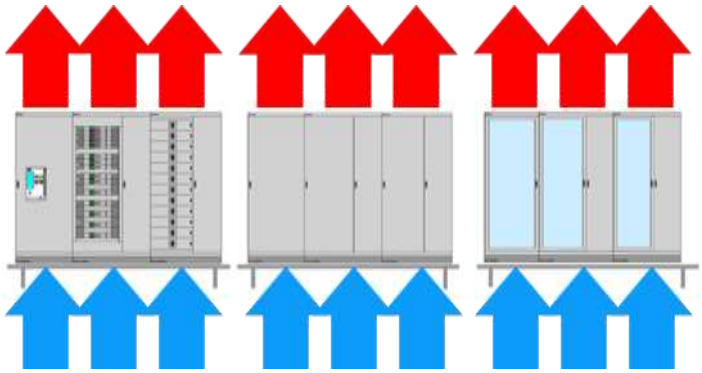
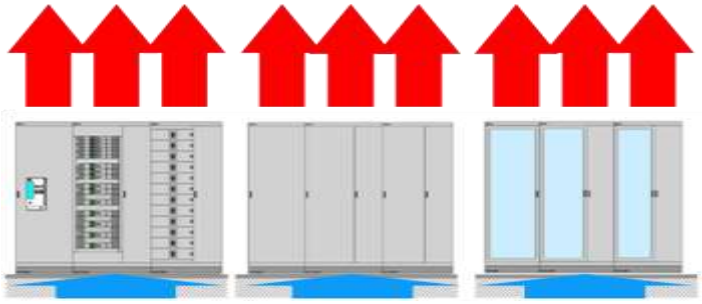
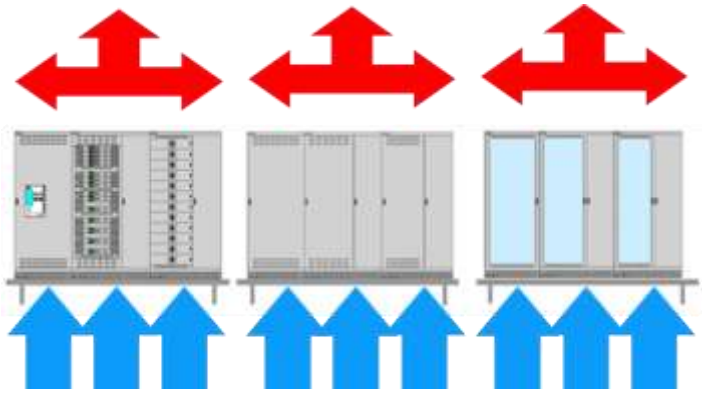
Behind front HF

## 3.4 Ventilation concept of enclosures

### Air conditioning

The adapted ventilation concept always ensures a safe climate in the enclosure.

## Ventilation concept/aeration and ventilation types

| | | | |
|---|---|---|---|
| Raised floor - Module roof with ventilation |  | | |
| | IP20/IP30 | IP40 | IP40 |
| Concrete floor - Module roof with ventilation |  | | |
| | IP20/IP30 | IP40 | IP40 |
| Raised floor - Module roof with ventilation including front – front ventilation |  | | |
| | IP20/IP30 | IP30 | IP40 |
| Concrete floor - Module roof with ventilation including front – front ventilation |  | | |
| | IP20/IP30 | IP30 | IP30 |

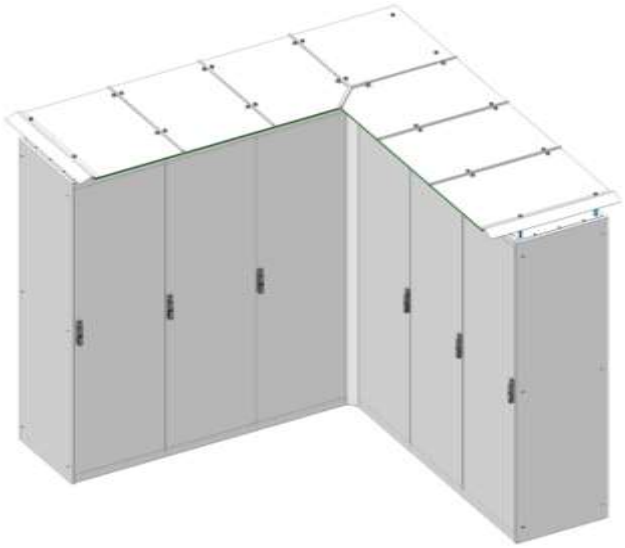
**Concrete floor (floor closed) – cover plate closed without ventilation**

IP30

IP40

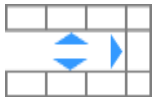
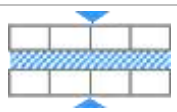
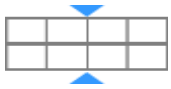
## Cover plate

All unimes H configurations with offset cover plate IPx1 possible.

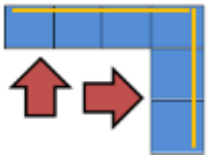
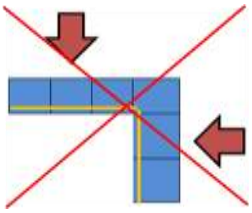
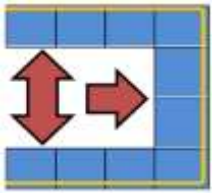
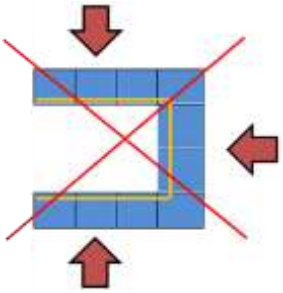


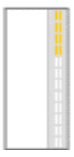
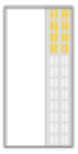
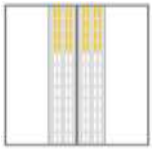
## 3.5 Installation options of the switchgear and controlgear assembly

### System installation options

| | | | |
|---|---|---|---|
| Series installation | With / without base | Wall installation<br>Room installation<br>Niche installation |  |
| L / U installation | with / without base | Wall installation<br>Room installation |  |
| Parallel installation and operating gangway | with / without base | Wall installation<br>Room installation |  |
| Back-back installation | with / without base | Room installation |  |

### Busbar routing in corner enclosure, only internal corner possible

| | | | |
|---|---|---|---|
| **L installation**<br>Internal corner |  | **L installation**<br>External corner<br><br>**Not possible** |  |
| **U installation**<br>Internal corner |  | **U installation**<br>External corner<br><br>**Not possible** |  |

| | | | | |
|---|---|---|---|---|
| **Single front** | Busbar position<br><br>Rated current<br>Enclosure depth | top<br>middle<br>bottom<br>≤ 2950 A<br>600 mm | Wall installation<br>Room installation<br>Niche installation |  |
| **Single front** | Busbar position<br><br>Rated current<br>Enclosure depth | top<br>middle<br>bottom<br>≤ 4000 A<br>800 mm | Wall installation<br>Room installation<br>Niche installation |  |
| **Double front** | Busbar position<br><br>Rated current<br>Enclosure depth | top<br>middle<br>bottom<br>≤ 2x2950 A<br>2x600 mm | Room installation |  |
| **Double front** | Busbar position<br><br>Rated current<br>Enclosure depth | top<br>middle<br>bottom<br>≤ 2x4000 A<br>2x800 mm | Room installation |  |

## 3.6 Arc fault protection systems

**Protective devices against arc faults**

Protective devices against arc faults, that quickly initiate the suppression of the arc fault and simultaneously disconnect the fault location from the mains, should be selected if:

- arc faults are to be expected in electrical systems,
- special fire protection requirements exist,
- special availability requirements exist.

Hager provides an active arc fault protection system and an optional passive arc fault protection system for the unimes H power distribution system.

The reaction time is shortened with an active arc fault protection system:
While passive arc fault protection takes about 100 ms to take effect, the active arc fault protection system needs only 2 to 3 ms.

### 3.6.1 Active arc fault protection system agardio.arc

**Microprocessor-based arc fault protection system**

Hager's active arc fault protection system is a microprocessor-based arc fault protection system with integrated self-monitoring.

The system consists of components that 'monitor' the critical points of the switchgear. In the event of danger, a precisely calculated chain reaction is triggered: First, the arc fault is detected by a dual sensor system, the suppression units are triggered after 2 to 3 ms, the complete system can be automatically switched off after 30 to 50 ms.

The electronic components of the arc fault detection system comply with the current standards for protective relays and thus offer reliable functionality as required, for example, in hospitals, data centres or in the chemical processing industry.

**Planning**

The active arc fault protection system should already be taken into consideration during planning.

**Short system downtimes**

The incident energy of the arc fault is almost completely eliminated right at the start: The arc fault is suppressed before it can cause any damage. However, the system is slightly contaminated by the short circuit: There are light traces of powder. It can, however, be quickly restarted – after the fault has been rectified, possibly even after only 30 minutes.

If the switchgear and controlgear assembly is equipped with an active arc fault protection system, you can find additional information and instructions in the manual for the active arc fault protection system, agardio.arc.

**Use in unimes H switchgear and controlgear assemblies**

The components of the arc fault protection system are designed for use in unimes H switchgear and controlgear assemblies according to EN 614392. Both individual solutions and extensive power distribution systems can be monitored thanks to the modular structure of the system.

By reducing the arc fault burning time, the converted energy is vastly limited and enables optimum protection of personnel and equipment. The time limit not only

influences the thermal effects of the arc fault, but all other exposure variables such as pressure, sound and toxic gases are also significantly reduced.

Switchgear and controlgear assemblies that are fitted with Hager's agardio.arc active arc fault protection system provide arc fault protection that far exceeds the requirements of the currently valid standard.

**Personal safety and system protection**

With its short arc fault suppression times of approx. 2 ms, Hager's active arc fault protection system offers a high level of personal safety as well as protection for the system and system function. System function protection is defined as a level of protection that allows the switchgear to be restarted after a short downtime.

## 3.6.2 Passive arc fault protection

**Personal safety and system protection**

Hager's passive arc fault protection offers personnel and system protection up to 85 kA, 500 V. The protection can be limited to one enclosure or extend to the entire system (system function protection).

System function protection is defined as a level of protection that allows the switchgear to be either fully or partially restarted.

**Safety requirements according to DIN EN 614391/2**

The passive arc fault protection meets the safety requirements of DIN EN 61439-1/-2, implemented by means of clear spatial distribution of the system, passive arc fault protection by means of internal partitions in designs from 2-4 as well as reinforced components and high short-circuit resistances.

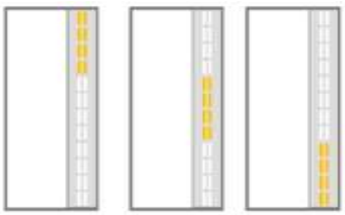
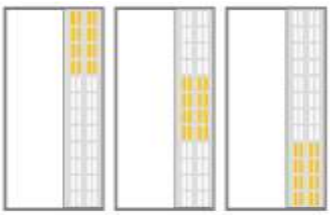
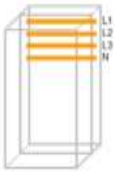
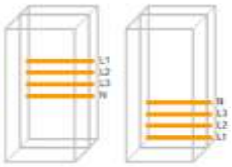
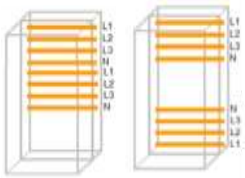
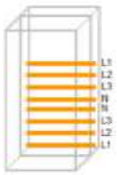
Personal protection is the ultimate objective of all protection measures.

## 3.7 Main busbar system

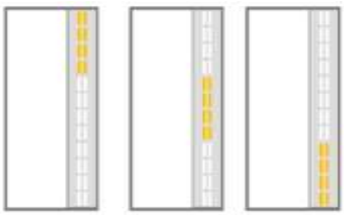
**Mechanical characteristics MBB**

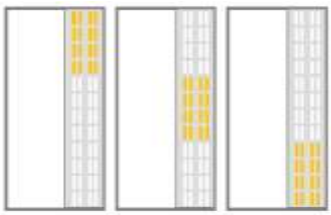
| | | |
|---|---|---|
| Busbar layer | Enclosure rear | |
| Busbar installation position | Horizontal<br>Vertical (traversal) | |
| Material | Flat copper Cu-ETP-R240 | |
| Bar support arrangement | II<br>II 2x 30 x 10<br>II 2x 40 x 10<br>II 2x 60 x 10<br>II 2x 80 x 10 | II II 4x 60 x 10<br>II II 4x 80 x 10 |
| Busbar distance between centres | 150 mm | |
| Max. distance between supports<br>*) Fibre glass bars | 660 mm => standard $I_{cw}$ values on busbar<br>330 mm => increased $I_{cw}$ values on busbar with FG* | |
| Distance between sub-conductors | 22 mm ► suitable for M12 (air distance 12 mm) | |
| Bar connections | No drill holes, via M12 screws | |
| Busbar connector type | Cu transport divider compact (with slider TTK) or Cu brackets with screw connections (TT) | |
| Busbar connector access | Enclosure front (TT / TTK)<br>Enclosure rear (TTK) | |

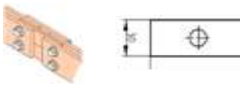
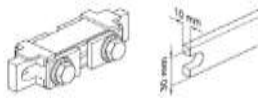
## Electrical features - Rated current

| | |  |  |
|---|---|---|---|
| **Enclosure depth** | **[mm]** | **600** | **800** |
| Rated current per busbar system initial supply | [A] | ≤ 2950 | ≤ 4000 |
| Rated current $I_{nA}$ (H-SaS top)  | [A] | 2x 30 x 10: 1250<br>2x 40 x 10: 1600<br>2x 60 x 10: 2000<br>2x 80 x 10: 2850 | 4x 60 x 10: 3200<br>4x 80 x 10: 4000 |
| Rated current $I_{nA}$ (H-SaS bottom/middle)  | [A] | 2x 30 x 10: 1250<br>2x 40 x 10: 1600<br>2x 60 x 10: 2000<br>2x 80 x 10: 2950 | 4x 60 x 10: 3200<br>4x 80 x 10: 4000 |
| Rated current $I_{nA}$ (2x H-SaS top/middle or top/bottom)  | [A] | 2x H-SaS 2 x 30 x 10: 1250<br>2x H-SaS 2 x 40 x 10: 1600<br>2x H-SaS 2 x 60 x 10: 2000<br>2x H-SaS 2 x 80 x 10: 2500 | 2x H-SaS 4 x 60 x 10: 3200<br>2x H-SaS 4 x 80 x 10: 4000 |
| Rated current $I_{nA}$ (2x H-SaS middle/bottom)  | [A] | 2x H-SaS 2 x 30 x 10: 1250<br>2x H-SaS 2 x 40 x 10: 1600<br>2x H-SaS 2 x 60 x 10: 2000<br>2x H-SaS 2 x 80 x 10: 2600 | 2x H-SaS 4 x 60 x 10: 3200<br>2x H-SaS 4 x 80 x 10: 4000 |

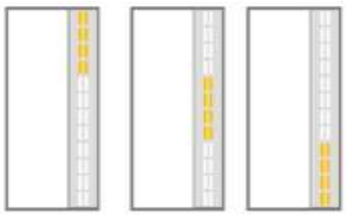
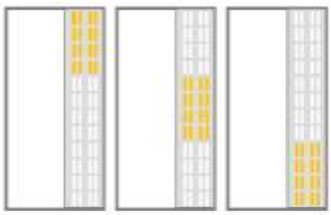
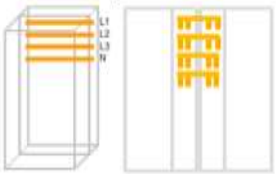
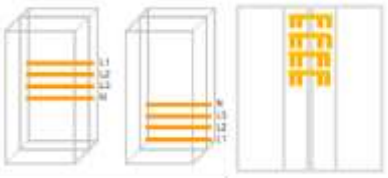
## Electrical features - Short-circuit resistance





| **Enclosure depth** | **[mm]** | **600** | **800** |
|---|---|---|---|
| Rated short-time withstand current $I_{cw}$ (1 s) (system-related distance between supports) | [kA] | 2x 30 x 10: 60<br>2x 40 x 10: 65<br>2x 60 x 10: 85<br>2x 80 x 10: 85<br>2x 60 x 10: 100 with FG*<br>2x 80 x 10: 100 with FG* | 4x 60 x 10: 85<br>4x 80 x 10: 85<br>4x 60 x 10: 120 with FG*<br>4x 80 x 10: 120 with FG* |
|  <br>H-SaS with round hole | | | |
|  <br>H-SaS with elongated hole<br>*) Fibre glass bar | | | |
| Rated peak withstand current $I_{pk}$ (1 s)(system-related distance between supports)<br><br>*) Fibre glass bar | [kA] | 2x 30 x 10: 133<br>2x 40 x 10: 145<br>2x 60 x 10: 188<br>2x 80 x 10: 188<br>2x 60 x 10: 220 with FG*<br>2x 80 x 10: 220 with FG* | 4x 60 x 10: 188<br>4x 80 x 10: 188<br>4x 60 x 10: 268 with FG*<br>4x 80 x 10: 268 with FG* |

## Electrical features - Back-back installation

| | |  |  |
|---|---|---|---|
| **Enclosure depth** | **[mm]** | **600** | **800** |
| Rated current $I_{nA}$ (H-SaS top)  | [A] | 2x 30 x 10: 1250<br>2x 40 x 10: 1600<br>2x 60 x 10: 2000<br>2x 80 x 10: 2850 | 4x 60 x 10: 3200<br>4x 80 x 10: 4000 |
| Rated current $I_{nA}$ (H-SaS bottom/middle)  | [A] | 2x 30 x 10: 1250<br>2x 40 x 10: 1600<br>2x 60 x 10: 2000<br>2x 80 x 10: 2950 | 4x 60 x 10: 3200<br>4x 80 x 10: 4000 |
| Rated short-time withstand current $I_{cw}$ (1 s) double front  | [kA] | 1x 60 x 10: 85<br>1x 80 x 10: 85<br>2x 60 x 10: 100<br>2x 80 x 10: 100 | 4x 60 x 10: 100<br>4x 80 x 10: 100 |
| Rated peak withstand current $I_{pk}$ (1 s) system-related distance between supports | [kA] | 1x 60 x 10: 190<br>1x 80 x 10: 190<br>2x 60 x 10: 223<br>2x 80 x 10: 223 | 4x 60 x 10: 223<br>4x 80 x 10: 223 |

## Special versions

**NOTICE**

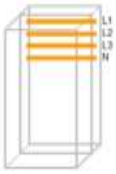
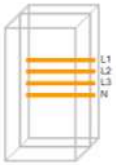
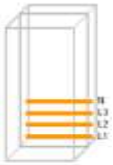
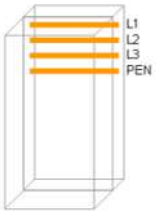
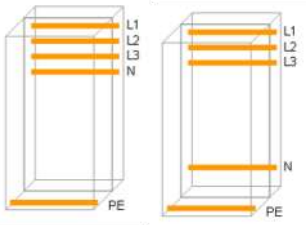
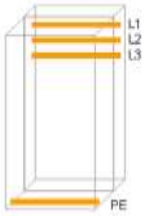
**Special version for enclosure depth of 800 mm**

When installing 2 x nn x 10 busbar systems, the busbar system must be placed closer to the device compartment. The space in the area around the rear panel thus remains free.

**Special version for enclosure depth of 800 mm with pSLB**

➢ Follow the instructions in the relevant manual on passive arc fault protection for the correct implementation.

## Main busbar layers

| | | |
|---|---|---|
|  |  |  |
| **Top M-BB position** | **Middle M-BB position** | **Bottom M-BB position** |
|  |  |  |
| **TN-C** | **TN-S** | **IT** |

## Main protective conductor (main PE)

The main PE can be routed at the top or bottom in the unimes H system. In some enclosures, an outgoing-protective conductor can be mounted opposite the main-PE.

| | |
|---|---|
| Position of the PE rail in the enclosure | - Enclosure roof and/or enclosure base<br>- Front or rear of the enclosure |
| Installation of the PE rail | - Lying<br>- Upright |
| Material | Flat copper - Cu ETP-R240/Cu-ETP-R250 |

## Main PE dimensions

The cross section of the PE rail corresponds to at least ¼ of the cross section of main busbars L1-L2-L3-N.

| Rated current main busbar L1-L2-L3-N [A] | Dimensions of L1-L2-L3-N Number x width x height [mm] | Dimensions of PE Number x width x height [mm] |
|---|---|---|
| ≤ 2000 | 2 x 60 x 10 | 1 x 30 x 10 |
| 2950 | 2 x 80 x 10 | 1 x 40 x 10 |
| 3200 | 4 x 60 x 10 | 1 x 60 x 10 |
| 4000 | 4 x 80 x 10 | 1 x 80 x 10 |

## Main PE traversal dimensions

When arranging enclosures with different positions of the main PE, one or multiple PE traversals must be installed. The cross sections are the same as for the main-PE.

| Rated current main busbar L1-L2-L3-N [A] | Dimensions of main PE number x width x height [mm] | Dimensions of PE-traversal number x width x height [mm] |
|---|---|---|
| ≤ 2000 | 1 x 30 x 10 | 1 x 30 x 10 |
| 2950 | 1 x 40 x 10 | 1 x 40 x 10 |
| 3200 | 1 x 60 x 10 | 1 x 60 x 10 |
| 4000 | 1 x 80 x 10 | 1 x 80 x 10 |

# 3.8 Power distribution system enclosures

## 3.8.1 U-PWE/U-PWK 630-4000 A

### ACB incoming/outgoing/coupling enclosure 6304000 A

**Area of application**

- Incoming units, outgoing units up to 4000 A
- Cable outlets up to 4000 A
- Cross couplings up to 4000 A

**Design options**

- Device installation: hw+ air circuit breaker (HW1, HW2, HW4)
- Measurement: Field measurement
- Connection type: Cable connection enclosure roof and base, busbar connection up to 4000 A
- Either with 1 or 2 control compartments, installation position above or under the device

### General characteristic features

| | | |
|---|---|---|
| **Dimensions** | | |
| Enclosure widths | ≤ 2500 A: 600 mm, number of device terminals: 3-pole/3-pole+NT/4-pole<br>≤ 4000 A: 800 mm, number of device terminals: 3-pole/3-pole+NT/4-pole | |
| Enclosure heights (without base) | 2000 mm = 36 MU<br>2200 mm = 36 MU | |
| Enclosure depths | H-SaS ≤ 2950 A: 600 mm<br>H-SaS ≤ 4000 A: 800 mm | |
| **Ventilation** | | |
| With convection | Door ventilation<br>Door and roof ventilation<br>Base-front ventilation<br>Base-roof ventilation | IP30<br>IP30 (with module roof)<br>IP30<br>IP40 (with module roof) |
| Without convection | Enclosure closed | IP40 |
| **Protection type** | | |
| With convection | Devices can be operated from the outside<br>Devices behind the door<br>With additional roof | IP3X<br>IP3X<br>IPX1 |
| Without convection | Devices can be operated from the outside<br>Devices behind the door<br>With additional roof | IP3X<br>IP4X<br>IPX1 |
| **Miscellaneous** | | |
| Form of internal separation | With solid door<br>With 3 module doors | Form 1<br>Form 1, 2b, 3b, 4b |
| Device operation | Can be operated from the outside<br>Can be operated behind the door | FE1<br>HF |
| Type of functional unit design | Plug-in technology/fixed installation -F<br>Plug-in insertion technology -W | FFF/FFD<br>WWD |
| Enclosure colour | RAL 7035, RAL of choice | |

## Device compartment: Functional units with hw+ air circuit breaker

| hw+ | HW1 | | HW2 | | HW4 | |
|---|---|---|---|---|---|---|
| hw+ device type | 1600 A | | 2500 A | | 4000 A | |
| Equipment carrier | Horizontal support frame | | | | | |
| Device size | HW1... | | HW2... | | HW4... | |
| Switch/circuit breaker designation | HW1XXXXXX | | HW2XXXXXX | | HW4XXXXXX | |
| Rated current switch/circuit breaker $I_{nc}$ | 630 A - 1600 A | | 630 A - 2500 A | | 1000 A - 4000 A | |
| Field connection positions from ACB to the main busbars | up to 4000 A at top and bottom, up to 3200 A in middle | | | | | |
| Enclosure width | 600 mm | | | | 800 mm | |
| Rated operational voltage $U_e$ | 400 V | 690 V | 400 V | 690 V | 400 V | 690 V |
| Rated short-circuit breaking capacity $I_{cu}$ | 66 kA | 42 kA | 85 kA | 66 kA | 110 kA | 85 kA |
| Rated peak withstand current $I_{pk}$ | 145 kA | 92 kA | 187 kA | 145 kA | 242 kA | 187 kA |
| Rated short-circuit making capacity $I_{cm}$ | 65 kA | - | 85 kA | - | 110 kA | - |

| | |
|---|---|
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device outlet<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>D = drawable connection (without tools) W = guided connection | **-F**: FFF, FFD<br>**-W**: WWD |
| Number of installable circuit breakers | 1 |
| Number of terminals | 3P, 4P |
| Module heights | 12 MU = 600 mm |
| Device installation position | Vertical |
| Type of N/PEN separation | Neutral conductor disconnector up to 2000 A (NP1250, NP2250), detachable separation |
| Position of N/PEN separation | Terminal compartment or device compartment |

## Terminal compartment

| | |
|---|---|
| Module heights | 12 MU = 600 mm |
| Connection direction | Enclosure roof and base |
| Connection type | Cable connection, current bar connection up to 1600 A |
| Cable connection cross-sections (copper) | |
| - 630 A | 4 x (2 x 185 mm²) |
| - 800 A | 4 x (2 x 240 mm²) |
| - 1000 A | 4 x (4 x 240 mm²) |
| - 1250 A | 4 x (4 x 240 mm²) |
| - 1600 A | 4 x (4 x 240 mm²) |
| - 2000 A | 4 x (8 x 150 mm²) |
| - 2500 A | 4 x (7 x 240 mm²) |
| - 3200 A | 4 x (8 x 240 mm²) |
| - 4000 A | 4 x (12 x 240 mm²) |
| Position of the PE conductor | Horizontal, Cu rail lying |

## Connecting surfaces

Size of the connecting surfaces (cable entry areas) for the individual enclosure types.

| Enclosure | U-PWE1 | | U-PWE2 | | U-PWE4 | |
|---|---|---|---|---|---|---|
| |  | |  | |  | |
| hw+ | HW1 | | HW2 | | HW4 | |
| Enclosure width | 600 mm | | 600 mm | | 800 mm | |
| Enclosure depth | 600 mm | 800 mm | 600 mm | 800 mm | 600 mm | 800 mm |
| Connecting surface width B | 410 mm | 410 mm | 410 mm | 410 mm | 610 mm | 610 mm |
| Connection surface depth T | 327.5 mm | 427.5 mm | 327.5 mm | 427.5 mm | 327.5 mm | 427.5 mm |

## Device compartment

### Control compartment

| | |
|---|---|
| Module heights | 12 MU = 600 mm |
| Expansion | - Control compartment, swivelled (mounting plate)<br>- Control compartment, fixed (clear polycarbonate plate) |

## 3.8.2 U-TE/U-TK 800-2000 A

### ACB incoming / outgoing / coupling enclosure 8002000 A

**Area of application**

- Incoming units / outgoing units up to 2000 A
- Cable outlets up to 2000 A
- Cross couplings up to 2000 A

**Design options**

- Device installation: Air circuit breaker tempower2
- Measurement: Field measurement
- Connection type: Cable connection enclosure roof and base, Busbar connection up to 2000 A
- Either with 1 to 2 touch protection devices (fixed or swivel-mounted) with installation position over / under the device

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths [mm]<br>*) Limitation, only first H-SaS position possible | | ≤ 1600 A: 450, number of device terminals: 3-pole/3-pole+NT*<br>≤ 2000 A: 600, number of device terminals: 3-pole/3-pole+NT/4-pole | |
| Enclosure heights [mm]<br>(Specifications without base) | | 2000 ► 36 MU<br>2200 ► 36 MU | |
| Enclosure depths [mm] | | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP2xC, IP3x*<br>IP3x<br>IPx1 |
| | Without convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP2xC, IP3x*<br>IP4x<br>IPx1 |
| *) Door flange with rubber seal required | | | |
| Form of internal separation | | 1, 2b Vertical enclosure door<br>4a, 4b 3 module doors | |
| Device operation | | Can be operated from the outside<br>Can be operated behind the door | FE1<br>HF |
| Type of functional unit design<br>*) Enclosure width ≥ 600 mm | | Plug-in technology -F<br>Insertion technology -W | FFF, FFD*<br>WWW |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment: Functional units with air circuit breaker

| | | | | | |
|---|---|---|---|---|---|
| Device type<br>TemPower2 | | AR2…S ► 2000 A (front connection) | | | |
| Equipment carrier | | Horizontal support frame | | | |
| Device size | | AR2… | | | |
| Switch/circuit breaker designation | | AR208S | AR212S | AR216S | AR220S |
| Rated current switch/circuit breaker $I_{nc}$ | [A] | 800 | 1250 | 1600 | 2000 |
| Field connection positions from ACB to the main busbars | | top<br>middle<br>bottom | top<br>middle<br>bottom | top<br>middle<br>bottom | top<br>middle<br>bottom |
| Enclosure width | [mm] | 450<br>600 | 450<br>600 | 450<br>600 | -<br>600 |
| Rated operational voltage $U_e$ | [V] | 400<br>690 | 400<br>690 | 400<br>690 | 400<br>690 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 65<br>50 | 65<br>50 | 65<br>50 | 65<br>50 |
| Rated peak withstand current $I_{pk}$ | [kA] | 141<br>111 | 141<br>111 | 141<br>111 | 141<br>111 |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device outlet<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>W = guided connection<br>D = drawable connection (without tools)<br>*) -F version only in 600-mm-wide enclosures | | **-F**:<br>FFF, FFD*<br>**-W:**<br>WWW | **-F**:<br>FFF, FFD*<br>**-W:**<br>WWW | -**F**:<br>FFF, FFD*<br>**-W:**<br>WWW | **-F**:<br>FFF, FFD*<br>**-W:**<br>WWW |
| Number of installable circuit breakers | | 1 | 1 | 1 | 1 |
| Number of terminals<br>*) ACB 4-pole only in 600 mm wide enclosures | | 3P<br>4P* | 3P<br>4P* | 3P<br>4P* | 3P<br>4P* |
| Module heights | [mm] | 12 MU ► 600 | | | |
| Device installation position | | Vertical | | | |
| Type of N/PEN separation | | Neutral conductor disconnector up to 2000 A (NP1250, NP2250)<br>detachable N separation | | | |
| Position of N/PEN separation | | Enclosure width 450 mm: Terminal compartment<br>Enclosure width 600 mm: Terminal compartment or device compartment | | | |

## Terminal compartment

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection<br>Busbar connection up to 2000 A |
| Connection cross sections<br>Cable connection | 800 A<br>1250 A<br>1600 A<br>2000 A | 4 x (2 x 240 $mm^2$)<br>4 x (4 x 240 $mm^2$)<br>4 x (4 x 240 $mm^2$)<br>4 x (8 x 150 $mm^2$) |
| Position of the PE conductor | | U-TE standard: rear, Cu rail upright<br>U-TE alternative: front, Cu rail lying<br>U-TK: front, Cu rail lying |

## Device compartment: Extended touch protection

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Expansion | | Swivelled extended touch protection (mounting plate)<br>Fixed extended touch protection (clear PC plate) |

## 3.8.3 U-TE / U-TK 2500-3200 A

### ACB incoming / outgoing / coupling enclosure 25003200 A

**Area of application**

- Incoming units / outgoing units 3200 A
- Cable outlets 3200 A
- Cross couplings 3200 A

**Design options**

- Device installation: Air circuit breaker tempower2
- Measurement: Field measurement
- Connection type: Cable connection, enclosure roof and base
  Busbar connection up to 3200 A
- Either with 1 to 2 touch protection devices (fixed or swivel-mounted) with installation position over / under the device

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | ≤ 3200 A: 800 number of device terminals: 3-pole/4-pole | |
| Enclosure heights (Specifications without base) | [mm] | 2000 ► 36 MU<br>2200 ► 36 MU | |
| Enclosure depths | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30 | |
| | | Front-roof ventilation IP30 (module roof IP40) | |
| | | Base-front ventilation IP30 | |
| | | Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP2xC, IP3x* |
| | | Devices can be operated behind the door | IP3x |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP2xC, IP3x* |
| | | Devices can be operated behind the door | IP4x |
| | | With additional roof | IPx1 |
| *) Door flange with rubber seal required | | | |
| Form of internal separation | | 1, 2b Vertical enclosure door | |
| | | 4a, 4b 3 module doors | |
| Device operation | | Can be operated from the outside | FE1 |
| | | Can be operated behind the door | HF |
| Type of functional unit design | | Plug-in technology -F | FFF, FFD |
| | | Insertion technology -W | WWW |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment: Functional units with air circuit breaker

| | | | | | |
|---|---|---|---|---|---|
| Device type<br>tempower2 | | AR3…S ► 3200 A (front connection) | | | |
| Equipment carrier | | Horizontal support frame | | | |
| Device size | | AR3… | | | |
| Switch/circuit breaker designation | | AR325S | | AR332S | |
| Rated current switch/circuit breaker $I_{nc}$ | [A] | 2500 A | | 3200 A | |
| Field connection positions from ACB to the main busbars | | top<br>middle<br>bottom | | top<br>middle<br>bottom | |
| Enclosure width | [mm] | 800 | | 800 | |
| Rated operational voltage $U_e$ | [V] | 400 | 690 | 400 | 690 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 85 | 65 | 85 | 65 |
| Rated peak withstand current $I_{pk}$ | [kA] | 178 | 132 | 178 | 132 |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device outlet<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>W = guided connection<br>D = drawable connection (without tools) | | **-F**:<br>FFF, FFD<br>**-W:**<br>WWW | | **-F**:<br>FFF, FFD<br>**-W:**<br>WWW | |
| Number of installable circuit breakers | | 1 | 1 | 1 | 1 |
| Number of terminals | | 3P<br>4P | 3P<br>4P | 3P<br>4P | 3P<br>4P |
| Module heights | [mm] | 12 MU ► 600 | | | |
| Device installation position | | Vertical | | | |
| Type of N/PEN separation | | Neutral conductor disconnector up to 3200 A<br>Detachable N separation | | | |
| Position of N/PEN separation | | Terminal compartment or device compartment | | | |

## Terminal compartment

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection<br>Busbar connection (up to 3200 A) |
| Connection cross-sections<br>Cable connection | 2500 A<br>3200 A | 4 x (7 x 240 mm²)<br>4 x (8 x 240 mm²) |
| Position of the PE conductor | | U-TE standard: rear, Cu rail upright<br>U-TE alternative: front, Cu rail lying<br>U-TK: front, Cu rail lying |

## Device compartment: Extended touch protection

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Expansion | | Extended touch protection swivelled (mounting plate)<br>Fixed extended touch protection (clear PC plate) |

## 3.8.4 UTE / UTK 4000 A

### ACB incoming/outgoing/coupling enclosure 4000 A

**Area of application**

- Incoming units / outgoing units up to 4000 A
- Cable outlets up to 4000 A
- Cross couplings up to 4000 A

**Design options**

- Device installation: Air circuit breaker tempower2
- Measurement: Field measurement
- Connection type: Roof and base cable connection
  Busbar connection up to 4000 A
- Either with 1 to 2 touch protection devices (fixed or swivel-mounted) with installation position over / under the device

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | ≤ 4000 A: 1000 number of device terminals: 3-pole/4-pole | |
| Enclosure heights (Specifications without base) | [mm] | 2000 ► 36 MU<br>2200 ► 36 MU | |
| Enclosure depths | [mm] | H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside<br>With additional roof | IP2xC, IP3x*<br>IPx1 |
| *) Door flange with rubber seal required | Without convection | Devices can be operated from the outside<br>With additional roof | IP2xC, IP3x*<br>IPx1 |
| Form of internal separation | | 1, 2b Vertical enclosure door<br>4a, 4b 3 module doors | |
| Device operation | | Can be operated from the outside | FE1 |
| Type of functional unit design | | Plug-in technology -F<br>Insertion technology -W | FFF, FFD<br>WWW |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment: Functional units with air circuit breaker

| | | | |
|---|---|---|---|
| Device type<br>tempower2 | | AR4…S ► 4000 A (rear connection) | |
| Equipment carrier | | Horizontal support frame | |
| Device size | | AR4… | |
| Switch/circuit breaker designation | | AR440S | |
| Rated current switch/circuit breaker $I_{nc}$ | [A] | 4000 | |
| Enclosure width | [mm] | 1000 | |
| Field connection positions from ACB to the main busbars | | Top, bottom | |
| Module heights | [mm] | 12 MU ► 600 | |
| Rated operational voltage $U_e$ | [V] | 400 | 690 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 100 | 75 |
| Rated peak withstand current $I_{pk}$ | [kA] | 226 | 171 |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device outlet<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>W = guided connection<br>D = drawable connection (without tools) | | **-F**: FFF, FFD<br>**-W:** WWW | |
| Device installation position | | Vertical | |
| Number of installable circuit breakers | | 1 | |
| Number of terminals | | 3-pole or 4-pole | |
| Type of N/PEN separation | | Neutral conductor disconnector for 4000 A<br>Detachable N separation | |
| Position of N/PEN separation | | Enclosure width 1000 mm: | Terminal compartment or device compartment |

## Terminal compartment

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection<br>Current bar connection |
| Cable connection cross-sections | 4000 A | 4 x (12 x 240 mm²) |
| Position of the PE conductor | | U-TE standard: rear, Cu rail upright<br>U-TE alternative: front, Cu rail lying<br>U-TK: front, Cu rail lying |

## Device compartment: Extended touch protection

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Expansion | | Extended touch protection swivelled (mounting plate)<br>Extended touch protection fixed (clear PC plate) |

## 3.8.5 U-T2

### ACB incoming / outgoing / coupling enclosure 8001600 A

**Area of application**

- Double feed/double outgoing unit up to 1600 A
- Double cross coupling up to 1600 A
- Feed/outgoing unit and cross coupling up to 1600 A

**Design options**

- Device installation: Air circuit breaker tempower2
- Measurement: 2-part field measurement
  Measuring device compartment with current transformer
- Connection type: Roof or base cable connection

### General characteristic features

| | | | |
|---|---|---|---|
| **Enclosure widths** | [mm] | ≤ 1600 A: 450 Number of device terminals: 3-terminal<br>≤ 1600 A: 600 Number of device terminals: 3-terminal/4-terminal | |
| Enclosure heights (Specifications without base) | [mm] | 2000 ▶ 36 MU<br>2200 ▶ 40 MU | |
| Enclosure depths | [mm] | M-BB ≤ 2950 A: 600<br>M-BB ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Closed enclosure IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP2xC, IP3x* |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP2xC, IP3x* |
| *) Door flange with rubber seal required | | With additional roof | IPx1 |
| Form of internal separation | | 1, 2b, 4a, 4b | Module doors |
| Device operation | | External operation possible | FE1 |
| Type of functional unit design | | Plug-in technology | WWW |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment: Functional units with air circuit breaker

| | | | | |
|---|---|---|---|---|
| Device type<br>tempower2 | | AR2.. S ▶ 1600 A (front connection) | | |
| Device support | | Horizontal support frame | | |
| Device size | | AR2… | | |
| Rated current switch $I_{nc}$ | [A] | 800 | 1250 | 1600 |
| Enclosure width | [mm] | 450<br>600 | | |
| Field connection positions from ACB to the main busbars | | top, middle, bottom | | |
| Module heights | [mm] | 12 MU ▶ 600 | | |
| Rated operational voltage $U_e$ | [V] | 400<br>690 | | |
| Rated short-time withstand current $I_{cp}$ | [kA] | 65<br>50 | | |
| Rated peak withstand current $I_{pk}$ | [kA] | 141<br>111 | | |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device output<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>W = guided connection<br>D = disconnectable connection (without tools) | | **-W**: WWW | | |
| Device installation position | | Vertical | | |
| Number of installable circuit breakers | | 2 | | |
| Number of terminals<br>*) ACB 4-terminal only in 600 mm wide enclosures | | 3-terminal<br>4-terminal* | | |
| Type of N/PEN separation | | N separator up to 1600 A (NP1250, NP2250)<br>Disconnectable N separation | | |
| Position of N/PEN separation | | Enclosure width 450 mm:<br>Enclosure width 600 mm: | Connection compartment<br>Connection or device compartment | |

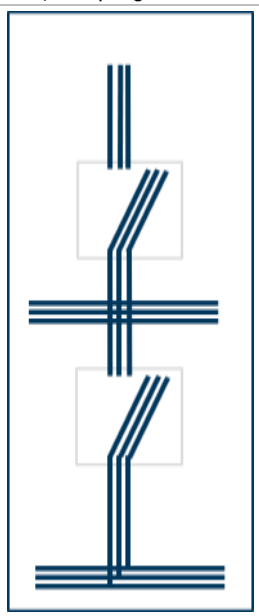
## Device compartment: Measuring device compartment with current transformer

| | | |
|---|---|---|
| Module heights | [mm] | 4 MU ▶ 200 mm |

## Terminal compartment

| | | |
|---|---|---|
| Module heights<br>*) For outlet at top and H=2000mm, only 100mm<br>**) For outlet at top and H=2200mm, only 200mm | [mm] | 4 MU ▶ 200* for enclosure height 2000 mm<br>6 MU ▶ 300** for enclosure height 2200 mm |
| Connection direction | | Enclosure roof or enclosure base |
| Connection type | | Cable connection |
| Connection cross sections<br>Cable connection | 800 A<br>1250 A<br>1600 A | 4 x (2 x 240 mm²)<br>4 x (4 x 240 mm²)<br>4 x (4 x 240 mm²) |
| Position of the PE conductor | | Front, Cu rail lying |

## Applications for enclosure height 450 mm

| ...KK<br>2000 / 2200<br>(Coupling / Coupling) | ...EK<br>2000 / 2200<br>(Feed / Coupling) | ...EK<br>2000* / 2200**<br>(Feed / Coupling) | ...EE<br>2000* / 2200**<br>(Feed / feed) |
|---|---|---|---|
|  |  |  |  |

| | | |
|---|---|---|
| Version | | FE1 |
| Enclosure width | [mm] | 450 |
| Enclosure depth | [mm] | 600<br>800 |
| ACB version | | -W |
| Copper rated current<br>Copper cross section in enclosure same for both ACBs, no differentiation | [A] | 1x 50 x 10: 800<br>2x 50 x 10: 1250<br>2x 50 x 10: 1600 |
| ACB rated current | [A] | 800<br>1250<br>1600 |
| Number of terminals | | 3-terminal |
| Cable connection compartment beneath cover plate<br>*) Attention: If the outgoing unit is at the top and the enclosure height is 2000 mm, the cable connection compartment is only 100 mm.<br>**) Attention: If outgoing unit is at the top and the enclosure height is 2200 mm, cable connection compartment is only 200 mm. | [mm] | 2000 ▶ 100*<br>2200 ▶ 200** |

## Applications for enclosure height 600 mm

| ...KK<br>2000 / 2200<br>(Coupling / Coupling) | ...EK<br>2000 / 2200<br>(Feed / Coupling) | ...EK<br>2000* / 2200**<br>(Feed / Coupling) | ...EE<br>2000* / 2200**<br>(Feed / feed) |
|---|---|---|---|
|  |  |  |  |

| | | |
|---|---|---|
| Version | | FE1 |
| Enclosure width | [mm] | 600 |
| Enclosure depth | [mm] | 600<br>800 |
| ACB version | | -W |
| Copper rated current<br>Copper cross section in enclosure same for both ACBs, no differentiation | [A] | 1x 50 x 10: 800<br>2x 50 x 10: 1250<br>2x 50 x 10: 1600 |
| ACB rated current | [A] | 800<br>1250<br>1600 |
| Number of terminals<br><br>***) NT = neutral conductor disconnector (disconnectable N connection)<br>***) DN = pulled through N (disconnectable N connection) | | 3-terminal<br>3-terminal with NT**<br>3-terminal with DN***<br>4-terminal |
| Cable connection compartment beneath cover plate<br>*) Attention: If the outgoing unit is at the top and the enclosure height is 2000 mm, the cable connection compartment is only 100 mm.<br>**) Attention: If outgoing unit is at the top and the enclosure height is 2200 mm, cable connection compartment is only 200 mm. | [mm] | 2000 ▶ 100*<br>2200 ▶ 200** |

## 3.8.6 U-LE / U-LK 1250-1600 A

### LBS incoming / outgoing / coupling enclosure 12501600 A

**Area of application**

- Incoming units, outgoing units 1250-1600 A
- Cable outlets 1250-1600 A
- Cross couplings 1600 A

**Design options**

- Device installation: Switch disconnector
- Measurement Field measurement
- Connection type: Roof and base cable connection
- Alternatively with 1 or 2 control compartments
- Swivelled control compartment with removable mounting plate or bracket kit for universal N removal with installation position above / below the device

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths<br>Limitation, only first H-SaS position possible | [mm] | 600, number of device terminals: 3-pole/4-pole | |
| Enclosure heights<br>(Specifications without base) | [mm] | 2000 ▶ 36 MU<br>2200 ▶ 40 MU | |
| Enclosure depths | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP3x, IP4x<br>IP3x, IP4x<br>IPx1 |
| | Without convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP4x<br>IP4x<br>IPx1 |
| Form of internal separation | | 1, 2b<br>4a, 4b | Vertical enclosure door<br>3 module doors |
| Device operation | | Can be operated from the outside<br>Can be operated behind the door | FE1<br>HF |
| Type of functional unit design | | Plug-in technology -F | FFF |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment

| | | | |
|---|---|---|---|
| Device type | | HA… ► (front connection) | |
| Device support | | Vertical support structure | |
| Device size | | B7 | |
| Switch designation | | HA362<br>HA462 | HA364<br>HA464 |
| Rated current switch $I_{nc}$ | [A] | 1250 | 1600 |
| Maximum power loss $P_V$ | [W] | 85 | 122 |
| Possible field connection positions from LBS to the main busbars | | Top<br>Middle<br>Bottom | Top<br>Middle<br>Bottom |
| Enclosure width | [mm] | 600 | 600 |
| Rated operational voltage $U_e$ | [V] | 415 | 415 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 50 | 50 |
| Rated peak withstand current $I_{pk}$ | [kA] | 111 | 111 |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device output<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools) | | **-F**:<br>FFF | **-F:**<br>FFF |
| Number of installable circuit breakers | | 1 | 1 |
| Number of terminals | | 3P<br>3P+N<br>4P | 3P<br>3P+N<br>4P |
| Module heights | [mm] | 12 MU ► 600 | |
| Device installation position | | Vertical | |
| Type of N/PEN separation | | N separator up to 1600 A (NP1250, NP2250)<br>Disconnectable N separation | |
| Position of N/PEN separation | | Enclosure width 600 mm: | Connection or device compartment |

## Terminal compartment

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection |
| Connection cross-sections<br>Cable connection | 1250 A<br>1600 A | 4 x (4 x 240 mm²)<br>4 x (4 x 240 mm²) |
| Position of the PE conductor | | U-LE standard: rear, Cu rail upright<br>U-LE alternative: front, Cu rail lying<br>U-LK: front, Cu rail lying |

## Device compartment: Extended touch protection

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Expansion | | Swivel-mounted control compartment with removable mounting plate<br>Bracket kit for univers N extension |

## 3.8.7 U-LE / U-LK 2000-2500 A

### LBS incoming / outgoing / coupling enclosure 20002500 A

**Area of application**

- Incoming units, outgoing units 2500 A
- Cable outlets 2500 A
- Cross couplings 2500 A

**Design options**

- Device installation: Switch disconnector
- Measurement: Field measurement
- Connection type: Roof and base cable connection
- Alternatively with 1 or 2 control compartments
- Swivelled control compartment with removable mounting plate or bracket kit for universal N removal with installation position above / below the device

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths [mm]<br>Limitation, only first H-SaS position possible | | 600, number of device terminals: 3-pole/4-pole | |
| Enclosure heights [mm]<br>(Specifications without base) | | 2000 ▶ 36 MU<br>2200 ▶ 40 MU | |
| Enclosure depths [mm] | | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP3x, IP4x |
| | | Devices can be operated behind the door | IP3x, IP4x |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP4x |
| | | Devices can be operated behind the door | IP4x |
| | | With additional roof | IPx1 |
| Form of internal separation | | 1, 2b<br>4a, 4b | Vertical enclosure door<br>3 module doors |
| Device operation | | Can be operated from the outside<br>Can be operated behind the door | FE1<br>HF |
| Type of functional unit design | | Plug-in technology -F | FFF |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Device compartment

| | | | |
|---|---|---|---|
| Device type | | HA… ► (front connection) | |
| Device support | | Vertical support structure | |
| Device size | | B8 | |
| Switch designation | | HA365<br>HA465 | HA366<br>HA466 |
| Rated current switch $I_{nc}$ | [A] | 2000 | 2500 |
| Maximum power loss $P_V$ | [W] | 140 | 205 |
| Possible field connection positions from LBS to the main busbars | | Top<br>Middle<br>Bottom | Top<br>Middle<br>Bottom |
| Enclosure width | [mm] | 600 | 600 |
| Rated operational voltage $U_e$ | [V] | 415 | 415 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 50 | 50 |
| Rated peak withstand current $I_{pk}$ | [kA] | 111 | 111 |
| Type of functional unit design<br>Position 1, main circuit/device input<br>Position 2, main circuit/device output<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools) | | -F:<br>FFF | -F:<br>FFF |
| Number of installable switch disconnectors | | 1 | 1 |
| Number of terminals | | 3P<br>3P+N<br>4P | 3P<br>3P+N<br>4P |
| Module heights | [mm] | 12 MU ► 600 | |
| Device installation position | | Vertical | |
| Type of N/PEN separation | | N separator up to 2000 A (NP1250, NP2250)<br>Disconnectable N separation | |
| Position of N/PEN separation | | Enclosure width 600 mm: | Connection or device compartment |

## Terminal compartment

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection |
| Connection cross-sections<br>Cable connection | 2000 A<br>2500 A | 4 x (8 x 150 $mm^2$)<br>4 x (7 x 240 $mm^2$) |
| Position of the PE conductor | | U-LE standard: rear, Cu rail upright<br>U-LE alternative: front, Cu rail lying<br>U-LK: front, Cu rail lying |

## Device compartment: Extended touch protection

| | | |
|---|---|---|
| Module heights | [mm] | 12 MU ► 600 |
| Expansion | | Extended touch protection swivelled (mounting plate)<br>Fixed extended touch protection (clear PC plate) |

## 3.8.8 U-CW(I)

### Outgoing enclosure without/with integrated cable compartment

**Area of application**

- Outgoing cables up to 630 A
- Field feed up to 2000 A

**Design options**

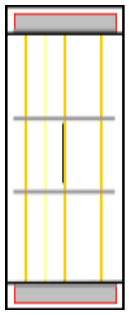
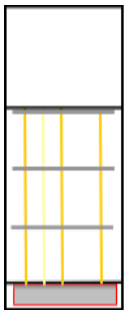
| | | |
|---|---|---|
| - | Device installation: | - Compact circuit breaker h3+<br>- Load switching strips LL |
| - | Measurement: | Outgoing measurement |
| - | Connection type: | Cable connection enclosure roof and base |
| - | Multifunctional compartment: | Control compartment, mounting kit univers N |

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure width U-CW | [mm] | 700 | |
| Enclosure widths U-CWI<br>Device compartment width<br>Cable compartment width | [mm] | 1100 (700+400) or 1300 (700+600)<br>700<br>400, 600 | |
| Enclosure heights<br>(Specifications without base) | [mm] | 2000 ▶ 36 MU<br>2200 ▶ 40 MU | |
| Enclosure depths | [mm] | 600 | 1 x H-SaS ≤ 2950 A<br>2 x H-SaS ≤ 2600 A |
| | | 800 | 1x H-SaS ≤ 4000 A<br>2x H-SaS ≤ 3800 A |
| Ventilation | Convection | Front-front ventilation IP30 | |
| | | Front-roof ventilation IP30 (module roof IP40) | |
| | | Base-front ventilation IP40 | |
| | | Base-roof ventilation IP30 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP30 (rotary drive) |
| | | Devices can be operated behind the door | IP30 |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP30 (rotary drive) |
| | | Devices can be operated behind the door | IP40 |
| | | With additional roof | IPx1 |
| Form of internal separation | | 1, 2b | Can be operated from the outside: Module and device doors<br>Can be operated behind the door: Enclosure-height door |
| | | 4b | Can be operated from the outside: Module and device doors<br>Can be operated behind the door: Enclosure-height door |
| Device operation | | Can be operated from the outside (FE1): | Rotary drive, motor drive LL devices |
| | | Can be operated behind the door (HF): | Rocker arm drive, motor drive |

| | | |
|---|---|---|
| Type of functional unit design | Fixed system/fixed installation -F | FFF, FFD |
| | Removable system -R | WFF, WFD |
| | Withdrawable system to plug in -W | WWD |
| | Withdrawable system -W | WWW |
| Enclosure colour | RAL 7035, RAL of choice | |

## Characteristic features of field distribution busbars

| | | | | |
|---|---|---|---|---|
| Busbar installation position | | Vertical | | |
| Material | | Flat copper Cu-ETP-R240 | | |
| Distance between phases | [mm] | 185 | | |
| Rated current $I_{nc}$ | [A] | | | |
| Devices can be operated from the outside FE1 | | 1250 | 1600 | 2000 |
| Devices can be operated behind the door HF | | 1250 | 1600 | 2000 |
| Rail cross section | [mm] | 60 x 10 | 80 x 10 | 100 x 10 |
| Rated short-time withstand current $I_{cw}$ (1 s) | [kA] | | | |
| Distance between supports 628 mm | | 65 | 65 | 70 |
| Distance between supports 488 mm | | 80 | 80 | 90 |
| Rated peak withstand current $I_{pk}$ (1 s) | [kA] | | | |
| Distance between supports 628 mm | | 143 | 143 | 160 |
| Distance between supports 488 mm | | 176 | 176 | 203 |
| Rated operational voltage $U_e$ | [V] | ≤ 690 | ≤ 690 | ≤ 690 |
| Field distribution busbar configuration options<br><br>Limitations:<br>- Not built separately over supports<br>- Feed only possible M-BB top and bottom | |  Full extension | |  Partial extension |
| Field connection positions at the main busbars | | | | |
| Full extension | | Top, middle, bottom | | |
| Partial extension | | Top or bottom, middle | | |

## Device compartment

| | |
|---|---|
| Expansion | Swivel-mounted control compartment with removable mounting plate<br>Bracket kit for univers N extension |
| Module heights [mm] | 600 ► 12 MU |
| Type of N/PEN separator | - N separator (NS160, NS250, NS630)<br>- Disconnectable N separation |
| Position of N/PEN separator | Cable compartment |
| Measurement | Outgoing measurement via current transformer in the device |

## Device compartment: Functional units with compact circuit breaker h3+ MCCB

| | | | | |
|---|---|---|---|---|
| Device type | | Hager h3+ series (TM / MAG / LSnI / LSI / LSIG / Energy) | | |
| Equipment carrier | | Module carrier | | |
| For device field width | [mm] | 700 | | |
| Device size | | P160 | P250 | P630 |
| Rated current switch/circuit breaker $I_{nc}$ | [A] | ≤ 160 | ≤ 250 | ≤ 630 |
| Module heights | MU | | | |
| | 3-pole | 3/4 | 3/4 | 4/5/6 |
| | 4-pole | 3/4 | 4/5 | 4/5/6 |
| Rated operational voltage $U_e$ | [V] | 400 | 400 | 400 |
| | | 690 | 690 | 690 |
| Rated short-time withstand current $I_{cp}$ | [kA] | 70 | 70 | 110 |
| | | 6 | 10 | 12 |
| Type of functional unit design<br>-F = Fixed<br>-R = Removable<br>-W= Withdrawable<br>-D= Plug-in auxiliary circuit<br>*) = With plug-in socket or module carrier | | -F: FFF, FFD<br>-R: WFF, WFD<br>-W: WWD*<br>-W: WWW | | |
| Device installation position | | Horizontal | | |

## Device compartment: Functional units with load switching strips LL

| | | | | | |
|---|---|---|---|---|---|
| Device type | | Hager LL | | | |
| For enclosure widths | [mm] | - 700<br>- 1100 (700 + 400)<br>- 1300 (700 + 600) | | | |
| Size | | 00 | 1 | 2 | 3 |
| Rated device current $I_{nc}$ | [A] | ≤ 160 | ≤ 250 | ≤ 400 | ≤ 630 |
| Device module height | MU | | | | |
| | 3-terminal | 1 | 1.5 | 3 | 3 |
| | 4-terminal | 2 | 3 | 6 | 6 |
| Type of functional unit design | | -R: WFD | | | |
| Device installation position | | Horizontal | | | |
| Number of terminals | | - 3-terminal/4-terminal | | | |

## Terminal compartment (only for U-CWI)

| | | |
|---|---|---|
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection |
| Connection cross sections<br>Cable connection | 125 A | 50 mm² |
| | 160 A | 70 mm² |
| | 250 A | 120 mm² |
| | 400 A | 240 mm² |
| | 630 A | 2 x 185 mm² |
| Position of N/PEN conductor | | In the cable compartment vertical at the rear on the left and/or right |
| Position of the PE conductor | | In the cable compartment at the front or rear vertical on the left and/or right |

## 3.8.9 U-S(I)

### HRC outgoing enclosure slimline horizontal

Area of application

- Outgoing cables up to 630 A
- Field feed up to 2000 A

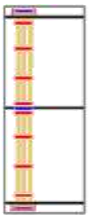
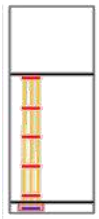
**Design options**

- Device installation: slimline
- Measurement: Outgoing measurement
- Connection type: Cable connection, enclosure roof and base
- **univers N mounting kit not possible**

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure width U-S | [mm] | 700 | |
| Enclosure widths U-SI<br>Device compartment width<br>Cable compartment width | [mm] | 1100 (700+400), 1300 (700+600)<br>700<br>400, 600 | |
| Enclosure heights, full extension<br>(Specifications without base) | [mm] | 2000 ► 34 MU<br>2200 ► 38 MU | |
| Enclosure heights, partial extension<br>(Specifications without base) | [mm] | 2000 ► 23 MU (1150 mm+control compartment 600 mm)<br>2200 ► 27 MU (1350 mm+control compartment 600 mm) | |
| Enclosure depths | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP30<br>IP30<br>IPx1 |
| | Without convection | Devices can be operated from the outside<br>Devices can be operated behind the door<br>With additional roof | IP30<br>IP40<br>IPx1 |
| Form of internal separation | | 1, 2b Can be operated from the outside: Module and device doors<br>4a, 4b Can be operated behind the door: Vertical enclosure door<br>Can be operated from the outside: Module and device doors<br>Can be operated behind the door: Vertical enclosure door | |
| Device operation | | Can be operated from the outside: Rotary drive, motor drive<br>Can be operated behind the door: Rotary drive | |
| Type of functional unit design | | Plug-in technology -R | WFF |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Characteristic features of field distribution busbars

| | | | | |
|---|---|---|---|---|
| Busbar installation position | | Vertical | | |
| Material | | Flat copper Cu-ETP-R240 | | |
| Distance between phases | [mm] | 185 | | |
| Rated current $I_{nc}$ | [A] | | | |
| FE1 Devices can be operated from the outside | | 1250 | 1600 | 2000 |
| HF Devices can be operated from behind the door | | 1250 | 1600 | - |
| Rail cross section | [mm] | 1x 60 x 10 | 1x 80 x 10 | 1x 100 x 10 |
| Rated short-time withstand current $I_{cw}$ (1 s) | [kA] | | | |
| Distance between supports 600 mm | | 65 | 65 | 70 |
| Distance between supports 450 mm | | 80 | 80 | 90 |
| Rated peak withstand current $I_{pk}$ | [kA] | | | |
| Distance between supports 600 mm | | 143 | 143 | 160 |
| Distance between supports 450 mm | | 176 | 176 | 203 |
| Rated operational voltage $U_e$ | [V] | ≤ 690 | | |
| Field distribution busbar configuration options<br>**Not built separately over support, feed only possible M-BB top and bottom.** | |  |  |  |
| | | Full extension, entire height | Full extension, separated in the middle | Partial extension |
| Field connection positions on the main busbars | | | | |
| Full extension | | Top, middle, bottom | | |
| Partial extension | | Top or bottom, middle | | |

## Device compartment: Functional units with switch connector with fuses

| | | | | | |
|---|---|---|---|---|---|
| Device type | | slimline | | | |
| Device size | | 00 | 1 | 2 | 3 |
| Rated device current $I_{nc}$ | [A] | ≤ 160 | ≤ 250 | ≤ 400 | ≤ 630 |
| Enclosure widths | [mm] | 700<br>1100 (700 + 400)<br>1300 (700 + 600) | | | |
| Device module height | [MU] 3-terminal | 1 | 2 | 4 | 4 |
| | 4-terminal | 2 | 3 | 5 | 5 |
| Type of functional unit design | | **-R**: WFF | | | |
| Device installation position | | Horizontal | | | |
| Device outlet within a field | | Top or bottom,<br>combination not possible | | | |
| Number of terminals | | 3- or 4-terminal | | | |
| Type of N/PEN separation | | N separator (NS160, NS250, NS630)<br>Disconnectable N separation | | | |
| Position of N/PEN separation | | Cable compartment | | | |
| Measurement | | Outgoing measurement via current transformer in the device | | | |

### Device compartment

| | | |
|---|---|---|
| Module heights | [mm] | 600 ▶ 12 MU |
| Expansion | | Swivel-mounted control compartment with removable mounting plate |

### Terminal compartment (U-SI only)

| | | |
|---|---|---|
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection |
| Connection cross-sections<br>Cable connection | 125 A<br>160 A<br>250 A<br>400 A<br>630 A | 50 $mm^2$<br>70 $mm^2$<br>120 $mm^2$<br>240 $mm^2$<br>2 x 185 $mm^2$ |
| Position of N/PEN conductor | | In the cable compartment vertical at the rear on the left and/or right |
| Position of the PE conductor | | In the cable compartment at the front or rear vertical on the left and/or right |

## 3.8.10 U-SV

### HRC outgoing enclosure LL/sasil/slimline vertical

**Area of application**

- Cable outlets up to 630 A
- Field incoming unit up to 2000 A

**Design options**

- Device installation: LL strips/slimline
- Measurement: Outgoing measurement
- Connection type: Cable connection, enclosure roof and base

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | 600, 850, 1100, 1350 | |
| Enclosure heights, full extension (Specifications without base) | [mm] | 2000<br>2200 | |
| Enclosure depth | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30 | |
| | | Front-roof ventilation (module roof IP40) | |
| | | Base-front ventilation IP40 | |
| | | Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP30 |
| | | Devices can be operated behind the door | IP30 |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP30 |
| | | Devices can be operated behind the door | IP40 |
| | | With additional roof | IPx1 |
| Form of internal separation | | 1, 2b Can be operated from the outside: Module and device doors<br>4a, 4b Can be operated behind the door: Vertical enclosure door<br>Can be operated from the outside: Module and device doors<br>Can be operated behind the door: Vertical enclosure door | |
| Device operation | | Can be operated from the outside: | Rotary drive, motor drive |
| | | Can be operated behind the door: | Rotary drive |
| Type of functional unit design | | Plug-in technology | LL strips: **-R** WFD<br>slimline: **-R** WFF |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Characteristic features of field distribution busbars

| | | | | |
|---|---|---|---|---|
| Busbar installation position | | Vertical | | |
| Material | | Flat copper Cu-ETP-R240 | | |
| Busbar distance between centres | [mm] | 185 | | |
| Rated current $I_{nc}$ | [A] | | | |
| FE1 Devices can be operated from the outside | | 1250 | 1600 | 2000* |
| HF Devices can be operated from behind the door | | 1250 | 1600 | - |
| Rail cross section | [mm] | 1x 60 x 10 | 1x 80 x 10 | 1x 100 x 10 |
| Rated short-time withstand current $I_{cw}$ (1 s) | [kA] | 75 | 75 | 90 |
| Rated peak withstand current $I_{pk}$ | [kA] | 167 | 167 | 201 |
| Rated operational voltage $U_e$ | [V] | ≤ 690 | | |
| Field connection position on the main busbar | | Top, middle, bottom | | |

*) not possible for an enclosure with a width of 600 mm

## Device compartment: Functional units with load break switch with fuses

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Device type | | LL strips | | | | slimline | | | |
| Device size | | 00 | 1 | 2 | 3 | 00 | 1 | 2 | 3 |
| Rated device current $I_{nc}$ | [A] | ≤ 160 | ≤ 250 | ≤ 400 | ≤ 630 | ≤ 160 | ≤ 250 | ≤ 400 | ≤ 630 |
| Enclosure widths | [mm] | 600 ► 9 MU<br>850 ► 14 MU<br>1100 ► 19 MU<br>1350 ► 24 MU | | | | | | | |
| Device module height | [MU] 3-pole | 1 | 1.5 | 3 | 3 | 1 | 2 | 4 | 4 |
| | 4-pole | 2 | 3 | 6 | 6 | 2 | 3 | 5 | 5 |
| Type of functional unit design | | LL strips **-R**: WFD<br>slimline **-R**: WFF | | | | | | | |
| Device installation position | | Vertical | | | | | | | |
| Device outlet within a field | | Top or bottom,<br>combination not possible | | | | | | | |
| Number of terminals | | 3-pole or 4-pole | | | | | | | |
| Type of N/PEN separation | | Neutral conductor disconnector (NS160, NS250, NS630)<br>Detachable N separation | | | | | | | |
| Position of N/PEN separation | | Cable compartment | | | | | | | |
| Measurement | | Outgoing measurement via current transformer in the device | | | | | | | |

## Device compartment

| | | |
|---|---|---|
| Module heights | [mm] | 450 ► 9 MU<br>600 ► 12 MU |
| Expansion | | Swivel-mounted control compartment with removable mounting plate<br>Bracket kit for univers N extension |

### Terminal compartment

| | | |
|---|---|---|
| Connection direction | | Enclosure roof or enclosure base |
| Connection type | | Cable connection |
| Connection cross-sections | 125 A | 50 $mm^2$ |
| | 160 A | 70 $mm^2$ |
| | 250 A | 120 $mm^2$ |
| | 400 A | 240 $mm^2$ |
| | 630 A | 2 x 185 $mm^2$ |
| Position of N/PEN conductor | | Horizontal, rear compartment |
| Position of the PE conductor | | Standard: rear, Cu rail upright<br>Alternative: front, Cu rail lying |

## 3.8.11 U-FL

### HRC outgoing enclosure fuseline

**Area of application**

- Outgoing cables up to 1000 A
- Field feed up to 2000 A

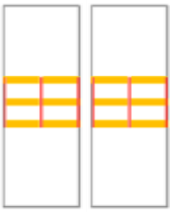
**Design options**

- Device installation: vertigroup, LVS
- Measurement: Outgoing measurement
- Connection type: Cable connection, enclosure roof and base
- Either with control compartment with installation position over or under the devices
- Bracket kit for univers N extension

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | 600, 850, 1100, 1350 | |
| Enclosure heights, full extension (Specifications without base) | [mm] | 2000<br>2200 | |
| Enclosure depths | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | Front-front ventilation IP30 | |
| | | Front-roof ventilation (module roof IP40) | |
| | | Base-front ventilation IP40 | |
| | | Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | Enclosure closed IP40 | |
| Protection type | Convection | Devices can be operated from the outside | IP30 |
| | | Devices can be operated behind the door | IP30 |
| | | With additional roof | IPx1 |
| | Without convection | Devices can be operated from the outside | IP30 |
| | | Devices can be operated behind the door | IP40 |
| | | With additional roof | IPx1 |
| Form of internal separation | | 1, 2b Can be operated from the outside: Device fronts, module doors<br>Can be operated behind the door: Vertical enclosure door<br>3b With additional connection compartment covers, adjustment covers and covers in each case | |
| Device operation | | Can be operated from the outside: | FE1, FE2 |
| | | Can be operated behind the door: | HF |
| Type of functional unit design | | Plug-in technology -F | FFF, FFD<br>Devices screwed or clamped |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Characteristic features of field distribution busbars

| | | | | | |
|---|---|---|---|---|---|
| Busbar installation position | | | Vertical | | |
| Material | | | Flat copper Cu-ETP R240 | | |
| Busbar centre-to-centre distance | | [mm] | 185 | | |
| Rated current $I_{nc}$ | Devices can be operated from the outside | [A] | 1250 | 1600 | 2000 |
| Busbar cross-section<br>*) in the case of the 600 mm-wide enclosure, the field connection is made in the 2 x 50 mm x 10 mm version | | [mm] | 1x 60 x 10 | 1x 80 x 10 | 1x 100 x 10 * |
| Rated short-time withstand current $I_{cw}$ (1 s)<br>**) For 65 kA and enclosure width of 850 mm, at least one device with a minimum size of NH00 (with double adapter) must be installed in the centre of the enclosure. A maximum of 60 kA applies without device(s). **NB: Dummy module is not considered to be a device because there is no coppering.** This rule does not apply if devices with a total width of more than 400 mm are already installed. | | [kA] | 60<br>65 ** | 65 | 70 |
| Rated peak withstand current $I_{pk}$<br>***) For 145 kA and enclosure width 850 m, at least one device with a minimum size of NH00 (with double adapter) must be installed in the centre of the enclosure. A maximum of 60 kA applies without device(s). **NB: Dummy module is not considered to be a device because there is no coppering.** This rule does not apply if devices with a total width of more than 400 mm are already installed. | | [kA] | 132<br>145 *** | 145 | 155 |
| Rated operational voltage Ue | | [V] | ≤ 690 | | |
| Field connection position on the main busbar<br>*) Full extension coupled only possible with busbars of the same size | | |  <br>Full extension | |  <br>Full extension coupled* |
| Field connection positions on the main busbars | | | Top, middle, bottom | | |

## Device compartment: Functional units with fuse switch

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Device type | | vertigroup/LVS | | | | | |
| Equipment carrier | | Horizontal support frame (VIT) | | | | | |
| Device size | | 00 | 1 | 2 | 3 | Transformer bar | Separating strip |
| Device width | [mm] | 50 | 100 | 100 | 100 | 100 | 100 |
| Rated device current $I_{nc}$ | [A] | ≤ 160 | ≤ 250 | ≤ 400 | ≤ 630 | ≤ 910 | ≤ 1000 |
| Rated short-time withstand current $I_{cp}$<br>*) 3-pole switched separating strip with lock | [kA]<br>[V] | 120<br>500 | 120<br>500 | 120<br>500 | 120<br>500 | 35<br>400 | 20/25*<br>690 |
| Enclosure widths | [mm] | 600 | 850 | 1100 | 1350 | | |
| Number of module widths | [nx mm] | 5x 100 | 7x 100 | 10x 100 | 12x 100 | | |
| Device installation position | | Vertical | | | | | |
| Number of terminals | | 3-pole | | | | | |
| Measurement | | Outgoing measurement via single current transformer in the device<br>Outgoing measurement via current transformer block on outgoing side | | | | | |

## Device compartment

| | | |
|---|---|---|
| Module heights | [mm] | 450 ► 9 MU<br>600 ► 12 MU |
| Expansion | | Swivel-mounted control compartment with removable mounting plate<br>Bracket kit for univers N extension |

## Terminal compartment

| | | |
|---|---|---|
| Connection direction | | Enclosure roof and enclosure base |
| Connection type | | Cable connection |
| Connection cross-sections<br>Cable connection | 160 A<br>250 A<br>400 A<br>630 A<br>910 A<br>1000 A | 70 $mm^2$<br>120 $mm^2$<br>240 $mm^2$<br>2 x 185 $mm^2$<br>2 x 240 $mm^2$ (transformer strip)<br>2 x 240 $mm^2$ (separating strip) |
| Type of N/PEN separation | | Neutral conductor disconnector (NS160, NS250, NS630)<br>Detachable N separation |
| Position of N/PEN separation | | With FE1 device installation, upright at rear<br>With HF device installation, upright at front |
| Position of the PE conductor | | Standard: rear, Cu rail upright<br>Alternative: front, Cu rail lying |

## 3.8.12 U-MUN

### Modular enclosure univers N

**Area of application**

- Outgoing cables up to 1600 A
- Field feed up to 1600 A

**Design options**

- Device installation: univers N inner fitting system
  univers N HS inner fitting system
- Connection type: Cable connection, enclosure roof and base

### General characteristic features

| | | |
|---|---|---|
| Enclosure widths<br>(1 MU univers N module width = 250 mm) | [mm] | 600 ► 2 MU<br>850 ► 3 MU<br>1100 ► 4 MU<br>1350 ► 5 MU |
| Enclosure heights<br>(Specifications without base)<br>(1 MU univers N = 150 mm) | [mm] | 2000 ► 12 MU<br>2200 ► 13 MU |
| Enclosure depths | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 |
| Ventilation | Without convection | Enclosure closed: IP40 |
| Protection type | Without convection | Devices can be operated behind the door: IP40 |
| Form of internal separation | | 1, 2b can be operated behind the door: Vertical enclosure door |
| Device operation | | Can be operated behind the door: HF |
| Type of functional unit design | | Plug-in technology -F FFF, FFD |
| Enclosure colour | | RAL 7035, RAL of choice |

### Terminal compartment

| | |
|---|---|
| Connection direction | Enclosure roof and enclosure base |
| Connection type | Cable connection |
| Cable connection cross-sections | As per device specifications |
| Position of N/PEN conductor | Horizontal, rear compartment |
| Position of the PE conductor | Standard: rear, Cu rail upright<br>Alternative: front, Cu rail lying |

## 3.8.13 U-BS(I)

### Universal basic enclosure

**Area of application**

- Cable enclosure separate
- Traversal for vertical busbar routing
- Universal control enclosure
- Measuring enclosure

**Design options**

- Device installation: Freely configurable
- Connection type: Cable connection, enclosure roof and base

### General characteristic features

| | | | | |
|---|---|---|---|---|
| Enclosure widths U-BS (Device compartment or cable compartment) | 1-door<br>2-door | [mm] | 400, 450, 600, 700, 800, 850, 1000<br>1100, 1350, 1600 | |
| Enclosure widths U-BSI (Device compartment width + cable compartment width) | | [mm] | 850 (450 + 400), 1000 (600 + 400), 1100 (700 + 400), 1200 (800 + 400), 1200 (600 + 600), 1300 (700 + 600), 1400 (800 + 600) | |
| Enclosure heights (Specifications without base) | | [mm] | 2000<br>2200 | |
| Enclosure depths | | [mm] | H-SaS ≤ 2950 A: 600<br>H-SaS ≤ 4000 A: 800 | |
| Ventilation | Convection | | Front-front ventilation IP30<br>Front-roof ventilation IP30 (module roof IP40)<br>Base-front ventilation IP30<br>Base-roof ventilation IP40 (module roof IP40) | |
| | Without convection | | Enclosure closed IP40 | |
| Rated short-time withstand current $I_{cw}$ (1 s) (system-related support distances)<br>*) Fibre glass bar | | [kA] | 2x 30 x 10: 60<br>2x 40 x 10: 65<br>2x 60 x 10: 85<br>2x 80 x 10: 85<br>2x 60 x 10: 100 with FG*<br>2x 80 x 10: 100 with FG* | <br><br><br>4x 60 x 10: 85<br>4x 80 x 10: 85<br>4x 60 x 10: 120 with FG*<br>4x 80 x 10: 120 with FG* |
| Rated peak withstand current $I_{pk}$<br>*) Fibre glass bar | | [kA] | 2x 30 x 10: 133<br>2x 40 x 10: 145<br>2x 60 x 10: 188<br>2x 80 x 10: 188<br>2x 60 x 10: 220 with FG*<br>2x 80 x 10: 220 with FG* | <br><br><br>4x 60 x 10: 188<br>4x 80 x 10: 188<br>4x 60 x 10: 268 with FG*<br>4x 80 x 10: 268 with FG* |
| Protection type | Without additional ventilation | | IP40 | |
| Form of internal separation | | | 1, 2b | |
| Type of functional unit design | | | Universal | |
| Enclosure colour | | | RAL 7035, RAL of choice | |

### Terminal compartment

| | |
|---|---|
| Connection direction | Enclosure roof and enclosure base |
| Connection type | Cable connection |
| Cable connection cross-sections | As per device specifications |
| Position of N/PEN conductor | As per expansion of the enclosure |
| Position of the PE conductor | U-BS standard: front, Cu rail lying<br>U- BS alternative: rear, Cu rail upright<br>U-BSI: front, Cu rail lying |

## 3.8.14 Traversal

### Traversal

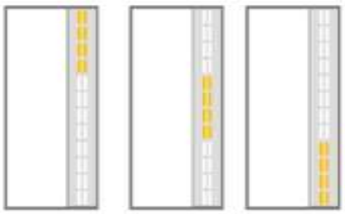
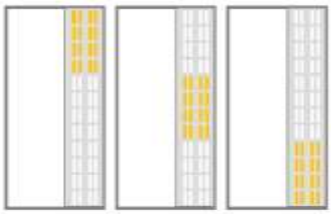
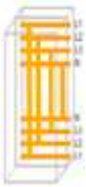
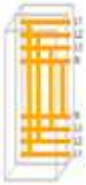
**Area of application**

- M-BB without protection device including measurement
- From M-BB top/middle
- From M-BB top/bottom
- From M-BB middle/bottom

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | 600 | |
| Enclosure heights<br>(Specifications without base) | [mm] | 2000<br>2200 | |
| Enclosure depths | [mm] | 600<br>800 | |
| Rated short-time withstand current $I_{cw}$<br>*) Fibre glass bars | [kA] | 2x 60 x 10: 75<br>2x 80 x 10: 75<br>2x 60 x 10: 100 with FG*<br>2x 80 x 10: 100 with FG* | <br><br>4x 60 x 10: 100 with FG*<br>4x 80 x 10: 100 with FG* |
| Rated peak withstand current $I_{pk}$<br>*) Fibre glass bars | [kA] | 2x 60 x 10: 166<br>2x 80 x 10: 166<br>2x 60 x 10: 223 with FG*<br>2x 80 x 10: 223 with FG* | <br><br>4x 60 x 10: 223 with FG*<br>4x 80 x 10: 223 with FG* |
| Protection type | Without additional ventilation | IP4x | |
| Traversal | | In device field or M-BB field | |
| Form of internal separation | | 1, 2b | |
| Enclosure colour | | RAL 7035, RAL of choice | |

## Characteristic features, traversing M-BB (without protection devices)

| | |  |  |
|---|---|---|---|
| Enclosure depth | [mm] | 600 | 800 |
| Rated current per rail system initial feed | [A] | ≤ 2500 | ≤ 3800 |
| Rated current $I_{nA}$<br>(vertical busbar traversal)<br>  | [A] | 1 x 60 x 10: 1250<br>1 x 80 x 10: 1600<br>2 x 60 x 10: 2000<br>2 x 80 x 10: 2500 | 4 x 60 x 10: 3000<br>4 x 80 x 10: 3800 |
| Rated short-time withstand current $I_{cw}$ (1 s) distance between supports 230 / 300 mm<br>(vertical busbar traversal)<br>*(2x 30 x 10 =>65 kA / 600 ms tested)<br>  | [kA] | 1 x 60 x 10: 75<br>1 x 80 x 10: 75<br>2 x 60 x 10: 100<br>2 x 80 x 10: 100 | 4 x 60 x 10: 100<br>4 x 80 x 10: 100 |
| Rated peak withstand current $I_{pk}$<br>(1 s) = system-related distance between supports<br>*(2 x 30 x 10 =>144 kA / 600 ms tested) | [kA] | 1 x 60 x 10: 166<br>1 x 80 x 10: 166<br>2 x 60 x 10: 217<br>2 x 80 x 10: 223 | 4 x 60 x 10: 223 |

## Terminal compartment

| | |
|---|---|
| Position of the PE conductor | Standard: front, Cu rail lying<br>Alternative: rear, Cu rail upright |

## 3.8.15 U-ES

### Corner enclosure

**Area of application**

- Main busbar routing for 90° internal corner arrangement

**Installation options**

- L-shaped arrangement / internal corner arrangement
- U-shaped arrangement / room arrangement

### General characteristic features

| | | | |
|---|---|---|---|
| Enclosure widths | [mm] | 650<br>850 | |
| Enclosure heights<br>(Specifications without base) | [mm] | 2000<br>2200 | |
| Enclosure depths | [mm] | M-BB ≤ 2950 A: 600 + 50<br>M-BB ≤ 4000 A: 800 + 50 | |
| Rated short-time withstand current $I_{cw}$<br>(1 s) = system-related distance between supports<br>*) Fibre glass bars | [kA] | 2x 30 x 10: 60<br>2x 40 x 10: 65<br>2x 60 x 10: 85<br>2x 80 x 10: 85<br>2x 60 x 10: 100 with FG*<br>2x 80 x 10: 100 with FG* | 4x 60 x 10: 85<br>4x 80 x 10: 85<br>4x 60 x 10: 120 with FG*<br>4x 80 x 10: 120 with FG* |
| Rated peak withstand current $I_{pk}$<br>*) Fibre glass bars | [kA] | 2x 30 x 10: 133<br>2x 40 x 10: 145<br>2x 60 x 10: 188<br>2x 80 x 10: 188<br>2x 60 x 10: 220 with FG*<br>2x 80 x 10: 220 with FG* | 4x 60 x 10: 188<br>4x 80 x 10: 188<br>4x 60 x 10: 268 with FG*<br>4x 80 x 10: 268 with FG* |
| Protection type | Without additional ventilation | IP4x | |
| Form of internal separation | | 1, 2b | |
| Enclosure colour | | RAL 7035, RAL of choice | |

### Terminal compartment

Position of the PE conductor: front, Cu rail lying

## 3.8.16 Active arc fault protection system agardio.arc

### Active arc fault protection system agardio.arc

**agardio.arc**

**Area of application**

- Low voltage
- unimes H system

### General characteristic features

| | |
|---|---|
| Enclosure widths [mm] | All unimes H enclosure widths |
| Enclosure heights (specifications without base) | All unimes H enclosure heights |
| Enclosure depths | All unimes H enclosure heights |
| Protection type | IP4x, IP3x, IP2x, IPx1 |
| Form of internal separation | 1 to 4b |

**Quenching device**
**SPBQD**

| | | |
|---|---|---|
| Rated short-time withstand current $I_{cw}$ | [kA] | 100 |
| Rated peak withstand current $I_{pk}$ | [kA] | 230 |
| QD holding time $U_e$ | [ms] | 300 |
| Rated operational voltage | [V] | ≤ 690 |
| Frequency | [Hz] | 45-62 |
| Arcing class | | C, Black cotton 40g/m² |

## 3.8.17 Passive arc fault protection

### Passive arc fault protection

**Area of application**

- Low voltage
- unimes H system

### General characteristic features

| | | |
|---|---|---|
| Enclosure widths | [mm] | 450-1000<br>(All enclosure widths<br>of unimes H with single doors, no double doors) |
| Enclosure heights (specifications without base) | | All unimes H enclosure heights |
| Enclosure depths | | All unimes H enclosure heights |
| Protection type | | IP4x, IP3x |
| Form of internal separation | | 1 to 4b, according to protection class A,B,C |
| Protection system | | Mechanical, limiting |
| Burning duration | [ms] | 300 |
| Rated short-time withstand current $I_{cw}$ | [kA] | 85<br>70 |
| Rated operational voltage $U_e$ | [V] | 500<br>690 |
| Frequency | [Hz] | 45-62 |
| Arcing class | | A,B,C, Black crettone 150 g/m² |
| Standards | | EN 61439-1 (ed.2)<br>TR 61641 (ed.3) |

## 3.8.18 Earthquake resistance

### Earthquake resistance

**Area of application**

- Low voltage
- unimes H system
- MES-R (empty enclosure)

### General characteristic features

| | | |
|---|---|---|
| Enclosure widths | [mm] | 450 - 1350 enclosure widths of unimes H |
| Enclosure heights (specifications without base) | [mm] | 2000 - 2200 enclosure heights of unimes H |
| Enclosure depths | [mm] | 600 - 800 enclosure depths of unimes H |
| Protection type Without additional ventilation | | IP4x |
| Form of internal separation | | 1 to 4b |

### Ensuring the unimes H is earthquake-resistant

The following information must be defined/clarified by the specifier:

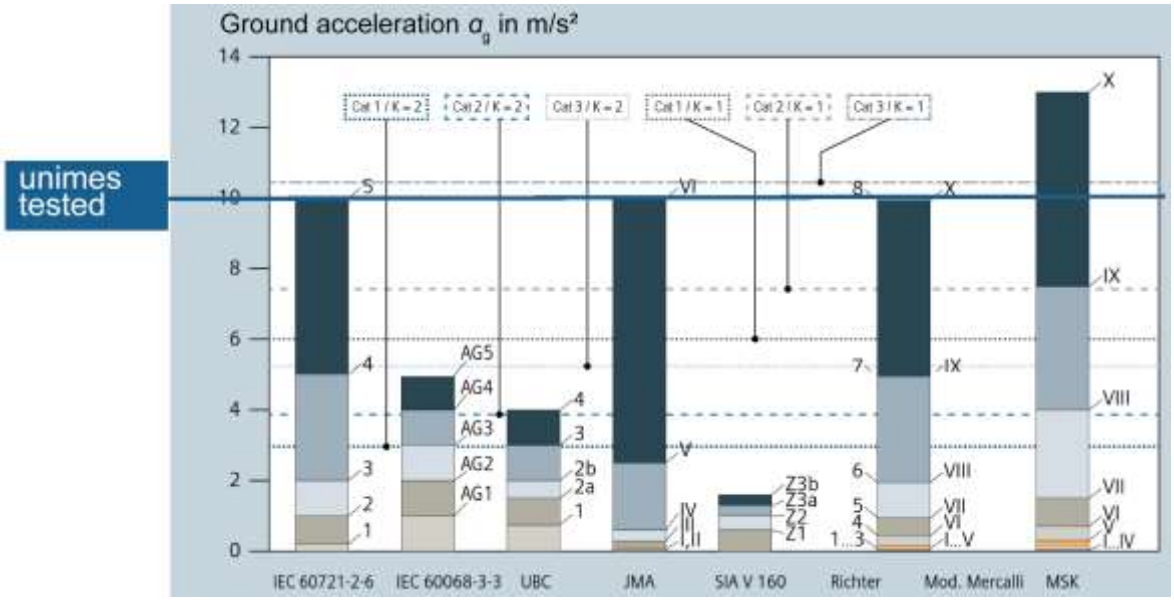
- Geological characteristics of the ground beneath the building
- Structural analysis of the building
- Oscillations per floor (in which the systems are to be installed)
- Fixing material for the floor or hollow floor

Earthquake resistance is guaranteed if the following conditions are met. No additional parts are required.

| Fastening of enclosure to floor | Number of screws | Thread size | Tightening torque [Nm] |
|---|---|---|---|
| on corner piece | 4 | M12 | 60 |
| on the serial base | 4 | M10 | 40 |
| on base frame | 4 or 6 | M10 | 40 |

## Seismic intensities – Richter magnitudes

| Richter magnitudes | Intensity | Effects |
|---|---|---|
| < 2.0 | Micro | Not felt |
| 2.0 - < 3.0 | Minor | Usually not felt but measurable |
| 3.0 - < 4.0 | Minor | Often felt, but very rarely causes damage |
| 4.0 - < 5.0 | Light | Shaking of indoor objects, tremor sounds can be heard, damage is unlikely |
| 5.0 - < 6.0 | Moderate | Can cause damage to poorly constructed buildings; zero to slight damage to all other buildings |
| 6.0 - < 7.0 | Strong | Can cause damage in populated areas |
| 7.0 - < 8.0 | Major | Causes damage to most buildings, felt across great distances |
| 8.0 - < 9.0 | Great | Major damage to buildings, structures likely to be destroyed across extremely large areas |
| 9.0 - < 10.0 | Great | All or near total destruction in areas covering thousands of kilometres |
| ≥ 10.0 | Massive | Has never been measured |



## 3.8.19 Protective earth

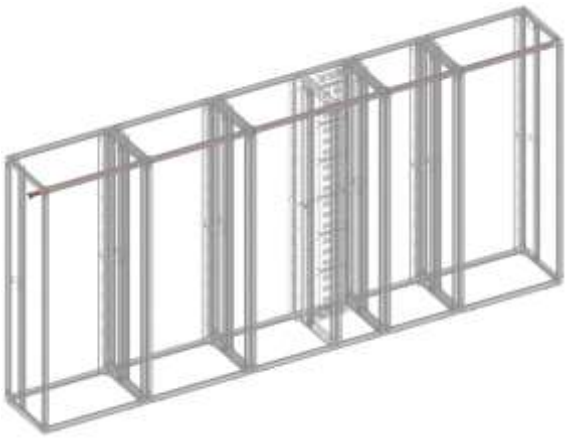
**Arrangement of the main protective earth (main PE)**

The main PE can be routed at the top or bottom in the enclosures of the unimes H system. Various installation positions are possible depending on the enclosure type.

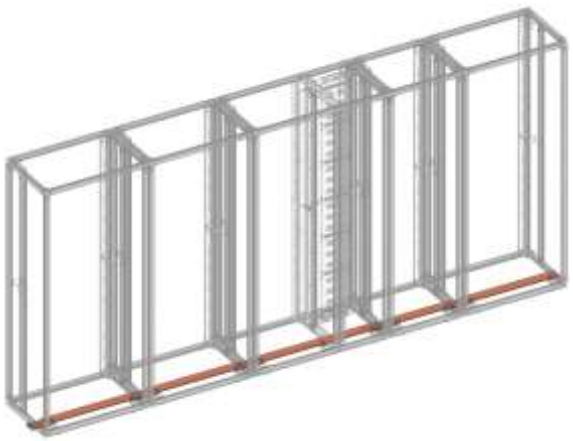
The specifications 'front' or 'back' refer to the position in the enclosure, 'lying' or 'upright' refers to the alignment of the main PE (flat or edgeways).

**Examples for main PE at front, lying**

The installation position 'front, lying' is possible in all unimes H enclosures.



Main PE top, front, lying



Main PE bottom, front, lying

**Examples for main PE at rear, upright**

In some enclosures, the main PE can also be installed at the 'rear, upright'.

Main PE top, front, upright

Main PE bottom, front, upright

### Possible installation positions of the main PE in unimes H enclosures

| Enclosure type | Standard position | Alternative position |
|---|---|---|
| U-PWE | Rear, upright | Front, lying |
| U-PWK | Front, lying | - |
| U-TE | Rear, upright | Front, lying |
| U-TK | Front, lying | - |
| U-T2 | Front, lying | - |
| U-LE | Rear, upright | Front, lying |
| U-LK | Front, lying | - |
| U-CW(I) | Front, lying | - |
| U-S(I) | Front, lying | - |
| U-SV | Rear, upright | Front, lying |
| U-FL | Rear, upright | Front, lying |
| U-MUN | Rear, upright | Front, lying |
| U-BS (device compartment only/cable enclosure) | Front, lying | Rear, upright |
| U-BSI | Front, lying | - |
| U-ES | Front, lying | - |

### Main PE with depth connection

It is not possible to route a main PE at the front and rear in the same enclosure. In the case of enclosures mounted in a row, each with a different arrangement of the main PE, an end-to-end connection is established via an appropriate depth connecting element.

Depth connectors form the connection between a main PE in the rear position and a main PE in the front position (or vice versa).

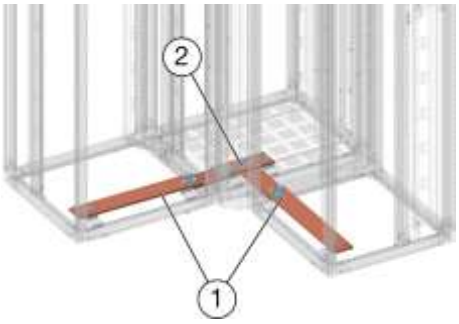
Depth connectors are available in various versions, see the examples below.

Example 1 for main PE, bottom
- Left-hand enclosure: Main PE at front, lying
- Middle enclosure: Main PE at rear, upright
- Right-hand enclosure: Main PE at front, lying

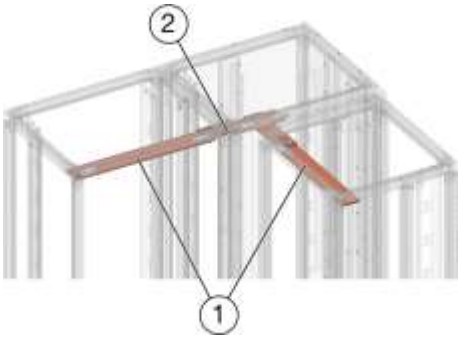
Example 2 for main PE, bottom
- Left-hand enclosure: Main PE at rear, upright
- Middle enclosure: Main PE at rear, upright
- Right-hand enclosure: Main PE at front, lying

### Main PE routing in corner enclosure

Examples for main PE routing in corner enclosure




Main PE bottom, front, lying




Main PE top, front, lying

| | |
|---|---|
| 1 | Main PE |
| 2 | PE transport divider |

### Main PE traversal

There are different ways to implement the main PE traversal from the top to bottom or vice versa:

- at the front in the device compartment
- at the rear in the device compartment
- at the front in the integrated cable compartment (KRI)
- at the front in the corner enclosure U-ES

In the 'at the front in the device compartment' version, it is also possible to route the main PE from the rear to the front and then implement the PE traversal at the front. However, it is not possible to route the main PE from the front to the rear and implement the PE traversal at the rear.

The traversal is always in a 1:1 ratio of the cross sections of the first main PE, the PE traversal and the second main PE. The cross sections are the same as for the main PE ("Main busbar system" page 52).

**Examples of PE traversal**

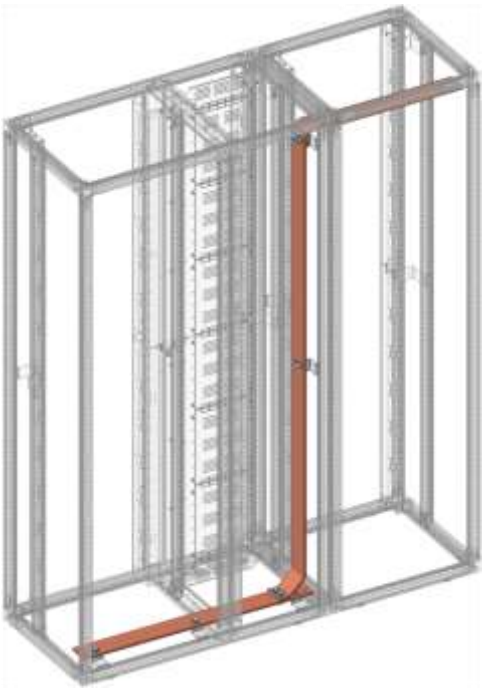
Examples of configuration options for traversals. The corresponding drawings and required fixing angles are provided by the configuration tool. The selected busbar routing can be seen in the assembly plan.

Main PE traversal from the front, bottom, to front top

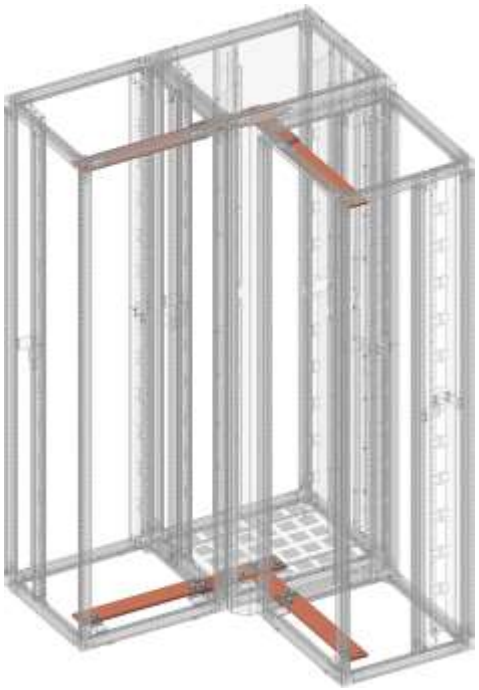
Main PE traversal from the rear, bottom, to rear top

Main PE traversal front the front, bottom, to rear top with the option of an outgoing PE at the bottom

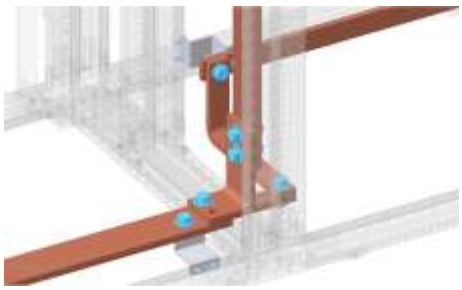
Main PE traversal from the rear, bottom, to front top



Traversal in cable compartment



Traversal in corner enclosure



Outgoing PE bar 30 x10 mm

It is possible to use an outgoing PE bar of 30x10 mm opposite the main PE in selected enclosures.

## Traversal options of the individual enclosure types

| Enclosure type | Additional information | PE traversal | | |
|---|---|---|---|---|
| | | at the front in the device compartment | at the rear in the device compartment | at the front in the integrated cable compart-ment |
| U-PWE | | X | X | - |
| U-PWK | | X | - | - |
| U-TE | | X | X | - |
| U-TK | | X | - | - |
| U-T2 | | X | - | - |
| U-LE | | X | X | - |
| U-LK | | X | - | - |
| U-CW | without integrated cable compart-ment KRI | X (1) | - | - |
| U-CWI | with integrated cable compartment KRI | X (1) | - | X |
| U-S | without integrated cable compart-ment KRI | X (1) | - | - |
| U-SI | with integrated cable compartment KRI | X (1) | - | X |
| U-SV | HF | X | - | - |
| U-SV | FE1 | - | X | - |
| U-FL | HF | X | - | - |
| U-FL | FE1 | - | X | - |
| U-MUN | | X | X | - |
| U-BS | without integrated cable compart-ment KRI | X (2) | X (2) | - |
| U-BS | without integrated cable compart-ment KRI, as separate cable compartment | X (2) | X (2) | X (3) |
| U-BS | without integrated cable compart-ment KRI, as traversal compartment | X (2) | X (2) | - |
| U-BSI | with integrated cable compartment KRI | - | - | X |
| U-ES | | X (4) | - | - |

(1) Only possible opposite device outlet

(2) Since the basic enclosure can be freely expanded, any restrictions must be checked by the customer

(3) The traversal at the front in the basic enclosure without KRI, as a separate cable enclosure, is implemented with the same copper parts as the traversal at the front in the integrated cable compartment (KRI)

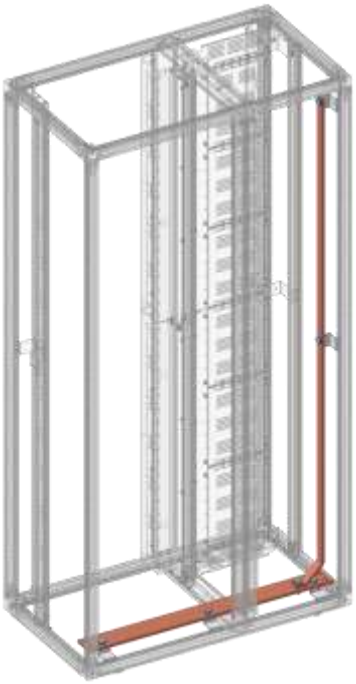
(4) The traversal in the corner enclosure is implemented using the same logic as the traversal at the front in the device compartment

### PE - Outgoing bar in enclosures with integrated cable compartment (KRI)

The PE outgoing bar can be mounted at the front or rear in the integrated cable compartment in enclosures with an integrated cable compartment (KRI).

- In the 400 mm-wide integrated cable compartment, one bar can be mounted at the front and one at the rear.
- In the 600 mm-wide integrated cable compartment, two bars can be mounted at the front and two at the rear.

One PE bar with a cross section of 30 mm x 10 mm is sufficient since the maximum load capacity for outgoing enclosures is 2000 A.



Width 400 mm, 600 mm:

- one main PE at the front
  - if device outlet is on the right: PE on the right
  - if device outlet is on the left: PE on the left

Dimensions: 1 x 30 mm x 10 mm

Position possible in enclosures or enclosure combinations with an integrated cable compartment per enclosure:

- U-CW(I)
- U-S(I)

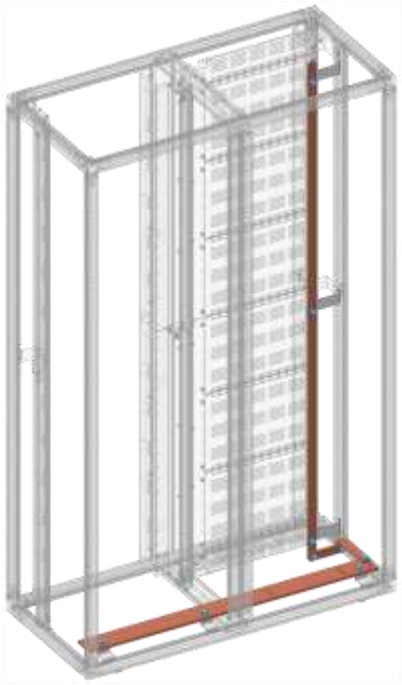
Width 600 mm

- two main PE at the front, on the right and left

Dimensions: 1 x 30 mm x 10 mm on each side

Position **not** recommended for enclosure combinations with only one shared integrated cable compartment for both enclosures:

- 1 x U-CWI and 1 x U-CW
- 1 x U-SI and 1 x U-S



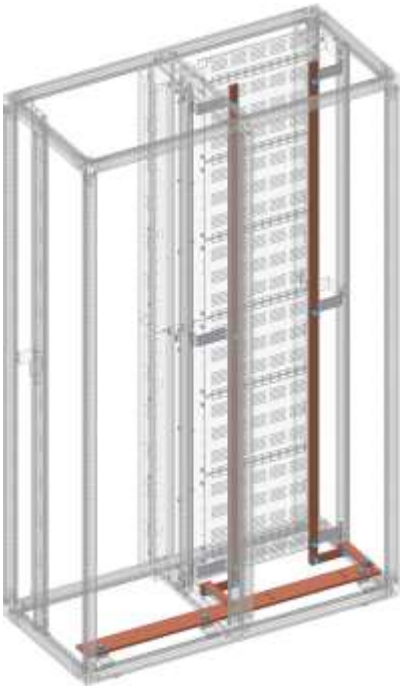
Width 400 mm, 600 mm

- one main PE at the rear
  - if device outlet is on the right: PE on the right
  - if device outlet is on the left: PE on the left

- Dimensions: 1 x 30 mm x 10 mm

Position possible in enclosures or enclosure combinations with an integrated cable compartment per enclosure:

- U-CW(I)
- U-S(I)



Width 600 mm

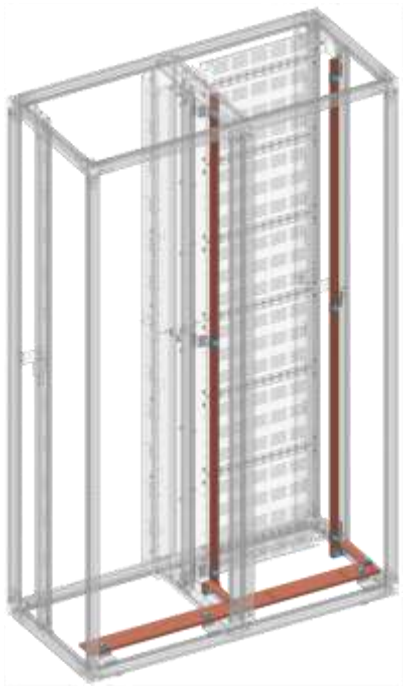
- two main PE at the rear, on the right and left, long version

Dimensions: 1 x 30 mm x 10 mm on each side

Position recommended for enclosure combinations with only one shared integrated cable compartment for both enclosures:

- 1 x U-CWI and 1 x U-CW
- 1 x U-SI and 1 x U-S

Preferred version if **one** neutral conductor is installed in the cable compartment.



Width 600 mm

- two main PE at the rear, on the right and left, short version

Dimensions: 1 x 30 mm x 10 mm on each side

Position recommended for enclosure combinations with only one shared integrated cable compartment for both enclosures:

- 1 x U-CWI and 1 x U-CW
- 1 x U-SI and 1 x U-S

Version if there is **no** neutral conductor installed in the cable compartment or considerable space is required.

**PE outgoing bar in the basic enclosure U-BS**

In basic enclosures without an integrated cable compartment (U-BS), that are only used as a cable enclosure or as a device compartment, PE outgoing bars can be installed for the following configurations.

Width 400 mm, 600 mm, 800 mm or 1000 mm
- PE outgoing at the front
- left or right
- 1 x 30 mm x 10 mm

Width 600 mm, 800 mm or 1000 mm
- PE outgoing at the front
- left or right
- 1 x 30 mm x 10 mm on each side

**PE - Outgoing bar in enclosures with combined outgoing top or bottom**

A combined outgoing top or bottom is possible in some enclosure types. In this case, the main PE is routed to where the main PE of the adjacent enclosures is. An outgoing PE can be installed opposite the main PE at the same time.

- If the main PE is routed at the bottom, rear and upright, then the outgoing PE must be routed at the top, rear and upright.
- It is not possible to have the main PE at the bottom, front and lying and the outgoing PE at the top, rear and upright or vice versa.

Enclosures where a combined cable outlet is possible:

- fuseline U-FL
- Modular enclosure univers N U-MUN
- Basic enclosure U-BS.

**Example:**
- Main PE, bottom, rear, upright
- Outgoing, top, rear, upright

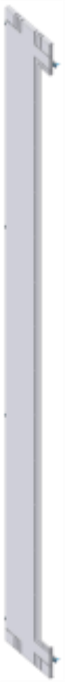
## Enclosure divider for PE traversal

An enclosure divider with pre-punches is required for the PE traversal, with the standard cut-outs for 1 x 30 mm x 10 mm and 1 x 40 mm x 10 mm copper busbars already in place. The cut-outs are enlarged by the customer for 1 x 60 mm x 10 mm or 1 x 80 mm x 10 mm copper busbars.

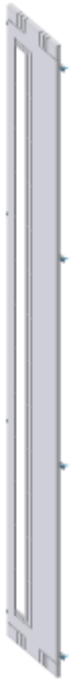
Type 1 and type 2 enclosure dividers are available. The difference between the two is based on the position of the attachment points.

| | Enclosure divider | |
|---|---|---|
| **Enclosure type** | **Type 1** | **Type 2** |
| U-PWE | — | X |
| U-PWK | — | X |
| U-TE | X | — |
| U-TK | X | — |
| U-T2 | X | — |
| U-LE | — | X |
| U-LK | — | X |
| U-CW(I) | — | X |
| U-VL(I) | X | — |
| U-S(I) | X | — |
| U-SV | — | X |
| U-FL | — | X |
| U-MUN | — | X |
| U-BS | X * | X * |
| U-BSI | X * | X * |
| U-ES | X | — |

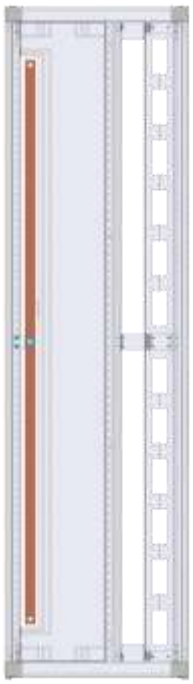
* A collision may occur depending on the customised design



Enclosure divider for traversal at front
- with standard cut-out for
  - 1 x 30 mm x 10 mm and
  - 1 x 40 mm x 10 mm
- with pre-punches for (to be provided by customer)
  - 1 x 60 mm x 10 mm and
  - 1 x 80 mm x 10 mm

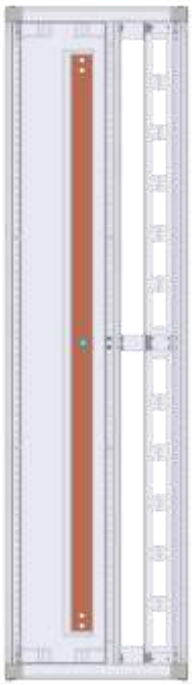


Enclosure divider for traversal at rear
- with standard cut-out for
  - 1 x 30 mm x 10 mm and
  - 1 x 40 mm x 10 mm
- with pre-punches for (to be provided by customer)
  - 1 x 60 mm x 10 mm and
  - 1 x 80 mm x 10 mm



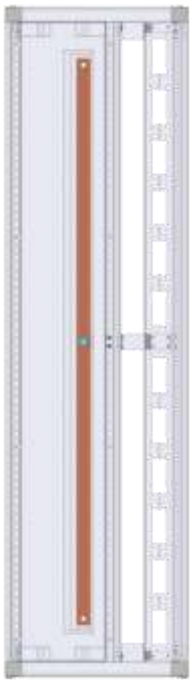
Enclosure divider for traversal at front

- with 1 x 30 mm x 10 mm copper busbar



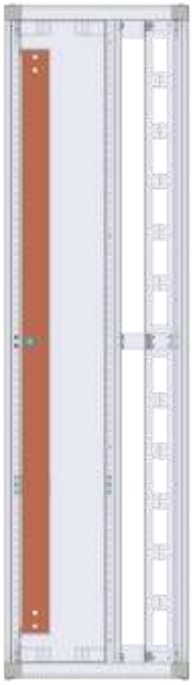
Enclosure divider for traversal at rear

- with 1 x 60 mm x 10 mm copper busbar



Enclosure divider for traversal at rear

- with 1 x 40 mm x 10 mm copper busbar

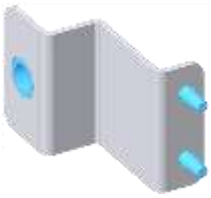
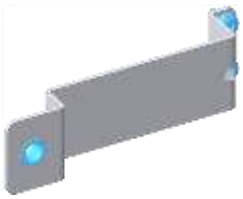


Enclosure divider for traversal at front

- with 1 x 80 mm x 10 mm copper busbar

## Fixing angles

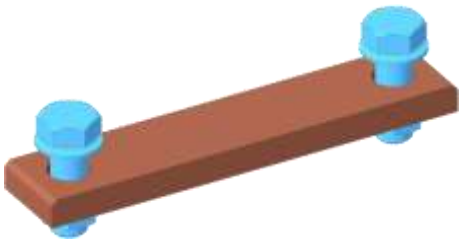
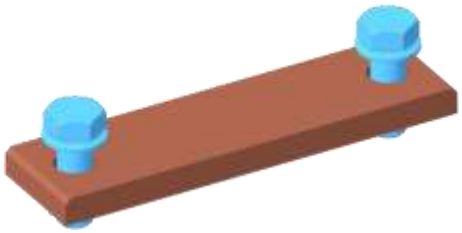
Various fixing angles are used for the PE depending on the type of PE and position.

| | Description | Reference |
|---|---|---|
|  | Main PE at front, lying | U-PEBWV |
|  | Outgoing PE at front/PE traversal at front<br>- in the integrated cable compartment (KRI)<br>or<br>- in the basic enclosure U-BS | U-PEBWV |
|  | PE traversal at front<br>- in the device compartment | U-PETV |
|  | PE traversal at rear<br>- in the device compartment | U-PETH |
|  | Main PE/Outgoing PE at rear, upright | U-PEBWH |
|  | Outgoing PE, long, vertical at rear in the cable compartment | U-PEBBHL |
|  | Outgoing PE, short, vertical at rear in the cable compartment | U-PEBBHL |

## PE transport divider

The same copper connection can be used at the front and rear for the PE transport divider between two enclosures. The 2200 mm-high modular enclosure univers N U-MUN is an exception with a 60 mm x 10 mm or 80 mm x 10 mm main PE at the rear, upright. The transport divider of the main busbar is used in this case.

- The PE transport divider is a separate component in corner enclosures.
- If traversal brackets are available, they carry out the function of transport divider.

| | Description | Reference |
|---|---|---|
|  | PE transport divider<br>1 x 30 mm x 10 mm<br>- without fixing material<br>- with fixing material | <br><br>U-PETH30<br><br>U-PETHS30 |
|  | PE transport divider<br>1 x 40 mm x 10 mm<br>- without fixing material<br>- with fixing material | <br><br>U-PETH40<br><br>U-PETHS40 |
|  | PE transport divider<br>1 x 30 mm x 10 mm or<br>1 x 40 mm x 10 mm<br>- with main PE at front, lying | <br><br>U-PETHxx<br>UPETHSxx |
|  | PE transport divider<br>2 x 30 mm x 10 mm or<br>2 x 40 mm x 10 mm<br>- with main PE<br>- at front, lying and<br>- rear, upright | <br><br>2 x U-PETHxx<br>2 x U-PETHSxx |
|  | PE transport divider for modular enclosure univers N U-MUN, height 2200 mm<br>- with main PE at rear, upright<br>- 1 x 60 mm x 10 mm or<br>- 1 x 80 mm x 10 mm | U-TTxxx |

## 3.8.20 Central earthing point (CEP) in the incoming enclosure U-TE

**Purpose of a central earthing point (CEP)**

The purpose of a central earthing point is to prevent stray currents ("Take into account stray currents" page 172).

**Copper connection from insulated PEN to the main PE**

The CEP solution (central earthing point) connects the insulated PEN with the main PE in the incoming enclosure U-TE. The cross section of the CEP connection corresponds to that of the main PE.

**Restrictions for planning a CEP in the unimes H system:**

- Only possible for ACB 3P+PEN, not possible for 3-pole or 4-pole ACB
- Only possible for widths 600 mm, 800 mm and 1000 mm, not possible for width 450 mm
- Only for TN-C or TN-C-S, not TN-S or TT
- Main PE at front not the preference
- Only one CEP per system

There is an option to put a current transformer in place. If the current transformer has to be replaced, the customer can create a **temporary** parallel bridge (with cable) from the PEN to the PE connection. This cable connection must be removed after the current transformer has been replaced.

| **DANGER** | |
|---|---|
|  | **The protective measure of the CEP is cancelled when the CEP bridge is removed.**<br>**Danger due to electric shock.**<br>➢ Check that the CEP bridge is installed before commissioning. |

Examples of the CEP bridge, the installation of a current transformer, and the maximum dimensions of the current transformers are provided in the following sections.

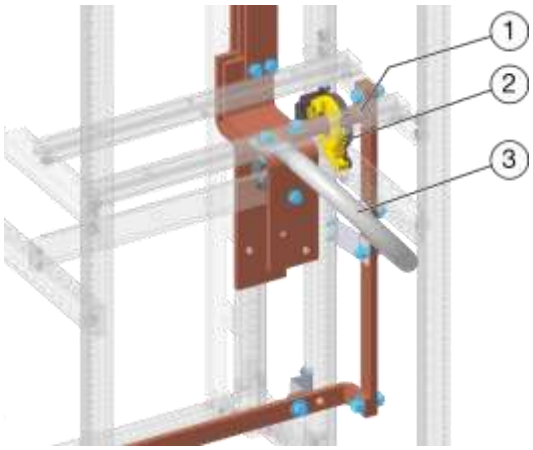
### Copper busbar of the main PE

The main PE can only be routed at the rear, upright. The version 'main PE at rear, upright, with L bar for the traversal' must be used.

### Copper connection flap PEN

The individual part drawings of the connection flaps PEN indicate which holes are for the CEP bridge and which holes are for the parallel bridge.

Example 2000 A with current transformer:




| | |
|---|---|
| 1 | CEP bridge |
| 2 | Current transformer |
| 3 | Parallel bridge (cable) |

### Current transformer dimensions

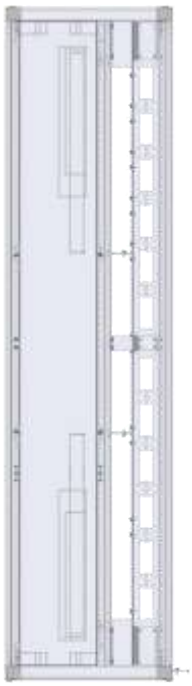
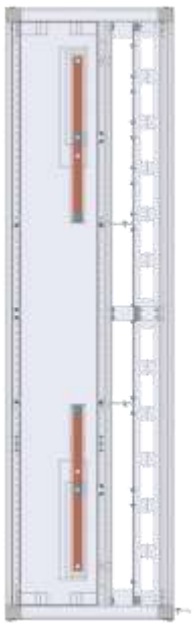
| **CEP connection/ main busbar** | | **Current transformer dimensions** | |
|---|---|---|---|
| **Dimensions [mm]** | **[A]** | **Inside: minimum push-through opening [mm]** | **Outside: maximum size (width x height x depth) [mm]** |
| 1 x 30 x 10 | 800 | - rectangular: 30 x 10<br>- round: Ø32 | 90 x 85 x 165 |
| 1 x 30 x 10 | 1250 - 2000 | - rectangular: 30 x 10<br>- round: Ø32 | 80 x 85 x 165 |
| 1 x 40 x 10 | 2950 | - rectangular: 40 x 10<br>- round: Ø42 | - Version 1: 75 x 250 x 84<br>- Version 2: 57 x 250 x 250 |
| 1 x 60 x 10 | 3200 | - rectangular: 30 x 20<br>- round: Ø37 | - Version 1: 55 x 250 x 74<br>- Version 2: 47 x 250 x 240 |
| 1 x 80 x 10 | 4000 | - rectangular: 40 x 20<br>- round: Ø45 | 45 x 205 x 280 |

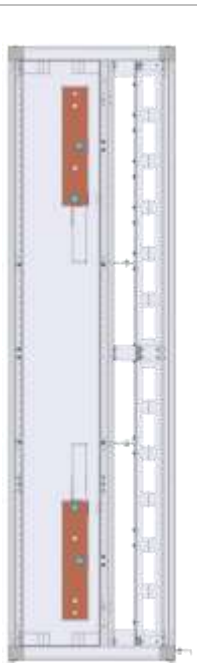
### Adjusting the enclosure divider

The enclosure divider has pre-punches for the copper busbar dimensions used in the CEP solution: 1 x 30 mm x 10 mm or 1 x 40 mm x 10 mm, 1 x 60 mm x 10 mm, 1 x 80 mm x 10 mm. The customer must cut out the appropriate pre-punches at the top or bottom so that the copper busbar has enough space.

| Version | Dimensions | Reference |
|---|---|---|
| Type 1 CEP, galvanised | 2000x400 | U-STWZEP2040 |
| Type 2 CEP, galvanised | 2200x400 | U-STWZEP2240 |

If the CEP bridge is connected to a PE traversal, the divider must be used for the traversal.

| Enclosure height 2000 mm | Enclosure height 2200 mm | |
|---|---|---|
|  |  | With pre-punches for copper busbar:<br>- 1 x 30 mm x 10 mm/ 1 x 40 mm x 10 mm<br>- 1 x 60 mm x 10 mm<br>- 1 x 80 mm x 10 mm<br>The enclosure divider has no cut-outs ex works. |
|  |  | Examples with copper busbar 1 x 30 mm x 10 mm |



Examples with copper busbar
1 x 80 mm x 10 mm

**CEP fixing angle**

The same U-PETH angle is used as for the PE traversal at the rear, see PE fixing angle (page 109).

# 4 Internal fitting by the panel builder

### Assembly instructions for internal fitting by the panel builder

- Observe the instructions in this manual and in the manuals for the enclosure types also.
- Observe the assembly instructions for expanding the respective enclosure types and components (internal separation, for example).

For environmental reasons, not all assembly instructions are available in paper form. If required, they can be downloaded from Hager's website or requested from Hager.

### Chapter index

## 4.1 Material supply

### Transport units

Hager delivers the enclosures in accordance with customer requirements or internal transport guidelines with the following transport units and packaging materials:

Basic system enclosures are usually delivered individually.

- The enclosure itself is protected by film or a cardboard box.
- The enclosure is supplied packaged on a pallet depending on the country of destination.

### Expansion stages

The expansion stage of the ordered items varies as follows for the basic enclosure:

| Reference | Type | Expansion stage |
|---|---|---|
| U-xxxM | 6xx-xxx-xxx | Item is **installed** in the basic enclosure |
| U-xxx | 7xx-xxx-xxx | Item is **enclosed** |

➢ Immediately upon arrival and prior to any onward transport of the enclosure, check the packaging materials and boxes for damage and to ensure they are complete.

We recommend unpacking the enclosure and equipment as close as possible to the location of internal fitting at the panel builder's.

## 4.2 Project planning

### hagercad planning software

Lists, expansion drawings and production drawings from Hager's hagercad planning software can be used for project planning and enclosure expansion:

- Parts lists
- Copper parts lists
- Assembly drawings
- Design drawings
- Production drawings

## 4.2.1 Coppering

### Copper busbar drawings

➢ Pay close attention to the copper busbar drawings and expansion drawings for the coppering. The type test only applies if the supplied copper busbar drawings/expansion drawings are followed.
➢ Observe the instructions in this System Manual for connecting the main busbars, the busbar screw connection and the tightening torques.
➢ Observe the relevant manuals for the enclosure types for the coppering.

## 4.3 Mounting the busbar supports

**Busbar supports with wedge U-FSTK.**

The main busbars are supported by the busbar supports with wedge U-FSTK.. The busbar supports are mounted in the relevant retaining plate for this purpose.

In addition to holding the busbars in place, the busbar supports also prevent the busbars from moving sideways:

- A separate clamping element is therefore not required.

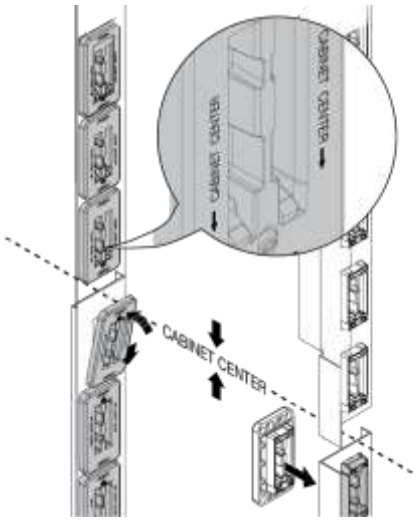
The busbar support U-FSTK.. is available in 4 versions:

| U-FSTK-30 | U-FSTK-40 | U-FSTK-60 | U-FSTK-80 |
|---|---|---|---|
| 30 x 10 flat copper busbar | 40 x 10 flat copper busbar | 60 x 10 flat copper busbar | 80 x 10 flat copper busbar |

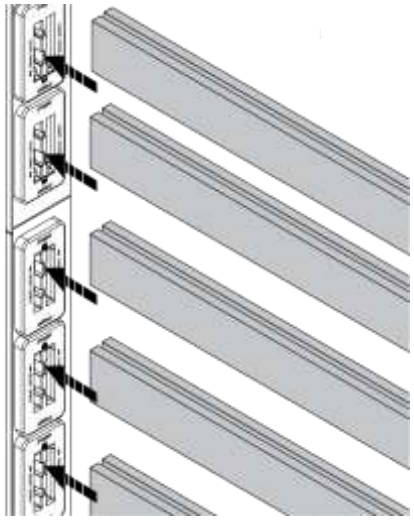
Depending on the rated current and resulting arrangement of the main busbars (2 or 4 copper busbars for each terminal), either 1 or 2 busbar supports are mounted in the retaining plate.

In the case of $I_{nA}$ > 2950 A, 4 copper busbars are always mounted in 2 busbar supports in the relevant retaining plate.

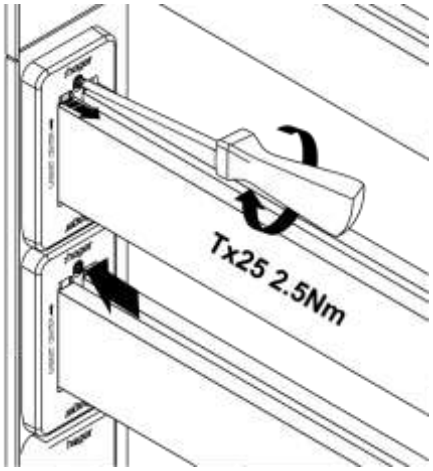
**Assemble the U-FSTK and busbar systems**




- The busbar supports are fastened in the support frame of the enclosure using a click system.
- The upper part of the busbar support is inserted into the retaining plate for this purpose.
- The busbar supports must always be inserted in the direction of the enclosure centre:
  The arrows and label 'CABINET CENTER' point in the direction of the enclosure centre.



- Insert the copper busbar laterally into the busbar supports.




- To fasten the busbars, tighten the screw in the busbar support to a maximum of 2.5 Nm.

The busbar support and busbar systems are thus mounted.

## Mounting aid


The (optional) mounting aid U-MH.. facilitates the correct positioning of the busbar systems.

- U-MH60 for enclosure depth 600 mm
- U-MH80 for enclosure depth 800 mm

### Number of flat busbar supports U-FSTK

| Rated current $In_A$ of the H-SaS [A] | Mains type H-SaS | Quantity and type, enclosure width < 850 mm | Quantity and type, enclosure width > 850 mm |
|---|---|---|---|
| 1250 | 1-pole | 1 x U-FSTK-30-2 | 1 x U-FSTK-30-3 |
| | 3-pole | 1 x U-FSTK-30-6 | 1 x U-FSTK-30-9 |
| | 4-pole | 1 x U-FSTK-30-8 | 1 x U-FSTK-30-12 |
| | 3-pole + N 200% | 1 x U-FSTK-30-8<br>1 x U-FSTK-30-2 | 1 x U-FSTK-30-12<br>1 x U-FSTK-30-3 |
| 1600 | 1-pole | 1 x U-FSTK-30-2 | 1 x U-FSTK-30-3 |
| | 3-pole | 1 x U-FSTK-30-6 | 1 x U-FSTK-30-9 |
| | 4-pole | 1 x U-FSTK-30-8 | 1 x U-FSTK-30-12 |
| | 3-pole + N 200% | 1 x U-FSTK-30-8<br>1 x U-FSTK-30-2 | 1 x U-FSTK-30-12<br>1 x U-FSTK-30-3 |
| 2000 | 1-pole | 1 x U-FSTK-60-2 | 1 x U-FSTK-60-3 |
| | 3-pole | 1 x U-FSTK-60-6 | 1 x U-FSTK-60-9 |
| | 4-pole | 1 x U-FSTK-60-8 | 1 x U-FSTK-60-12 |
| | 3-pole + N 200% | 1 x U-FSTK-60-8<br>1 x U-FSTK-60-2 | 1 x U-FSTK-60-12<br>1 x U-FSTK-60-3 |
| 2950 | 1-pole | 1 x U-FSTK-80-2 | 1 x U-FSTK-80-3 |
| | 3-pole | 1 x U-FSTK-80-6 | 1 x U-FSTK-80-9 |
| | 4-pole | 1 x U-FSTK-80-8 | 1 x U-FSTK-80-12 |
| | 3-pole + N 200% | 1 x U-FSTK-80-8<br>1 x U-FSTK-80-2 | 1 x U-FSTK-80-12<br>1 x U-FSTK-80-3 |
| 3200 | 1-pole | 1 x U-FSTK-60-2 | 1 x U-FSTK-60-3 |
| | 3-pole | 1 x U-FSTK-60-6 | 1 x U-FSTK-60-9 |
| | 4-pole | 1 x U-FSTK-60-8 | 1 x U-FSTK-60-12 |
| | 3-pole + N 200% | 1 x U-FSTK-60-8<br>1 x U-FSTK-60-2 | 1 x U-FSTK-60-12<br>1 x U-FSTK-60-3 |
| 4000 | 1-pole | 1 x U-FSTK-80-2 | 1 x U-FSTK-80-3 |
| | 3-pole | 1 x U-FSTK-80-6 | 1 x U-FSTK-80-9 |
| | 4-pole | 1 x U-FSTK-80-8 | 1 x U-FSTK-80-12 |
| | 3-pole + N 200% | 1 x U-FSTK-80-8<br>1 x U-FSTK-80-2 | 1 x U-FSTK-80-12<br>1 x U-FSTK-80-3 |

## 4.4 Fibreglass bars to increase short-circuit resistance

### Increasing the short-circuit resistance of the H-SaS

A distinction is made between the different short-circuit resistances of the main busbars in the unimes H power distribution system:

- without fibreglass bar or
- with fibreglass bar.

In order to prevent deformation of the busbar in the event of a short-circuit, fibreglass bars (FG) may need to be installed as reinforcements to ensure the required short-circuit resistance of the main busbar system.

Fibreglass bar (Example)

### Number of fibreglass bars required

The use of fibreglass bars depends on the enclosure, the rated current and the rated short-time current.

- In the case of an enclosure depth of 600 mm (H-SaS with 2 x Cu 60 x 10 or 2 x Cu 80 x 10), at least one fibreglass bar is mounted in each case (each between two Cu busbars per terminal).
- In the case of an enclosure depth of 800 mm (H-SaS 4 x Cu 60 x 10 or 4 x Cu 80 x 10), at least 2 fibreglass bars are mounted in each case (each between two Cu busbars per terminal).

### Fibreglass bar design

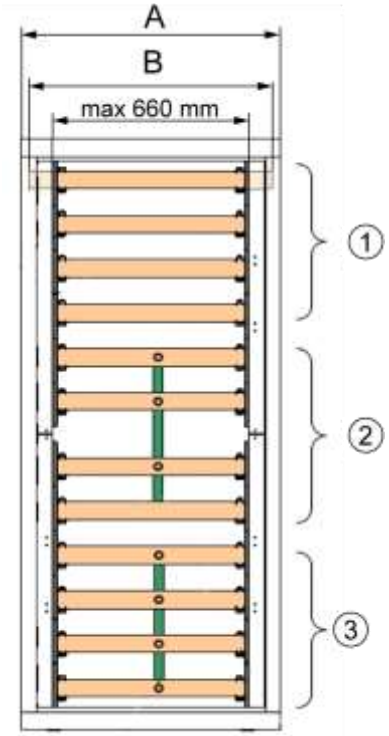
The number of holes, and hole design, in the Cu busbars for mounting the fibreglass bars vary depending on the enclosure width, enclosure type, enclosure version (with/without cable compartment) and busbar dimension (Cu 60 x 10 or Cu 80 x 10).

- Fibreglass bars with a cross section of 30 x 12 mm are required in the H-SaS area.
- Fibreglass bars with a cross section of 30 x 10 mm are used in the field connection (F-SaS).
- Hager provides appropriate production drawings to the panel builder.

**Rated short-time current of the H-SaS > 85 kA**

Fibreglass bars must be used for a rated short-time current of the H-SaS > 85 kA.

**Fibreglass bar - Assembly sketch**




| | |
|---|---|
| 1 | **H-SaS without reinforcement**<br>$I_{cw}$ max. = 85 kA*, distance between supports max. 660 mm |
| 2 | **H-SaS with fibreglass bar reinforcement**<br>$I_{cw}$ max. = 120 kA*,<br>FG bar, middle: U-GFM or U-GFMS (set) |
| 3 | **H-SaS with fibreglass bar reinforcement**<br>$I_{cw}$ max. = 120 kA*<br>FG bar at top/bottom: U-GF or U-GFS (set) |

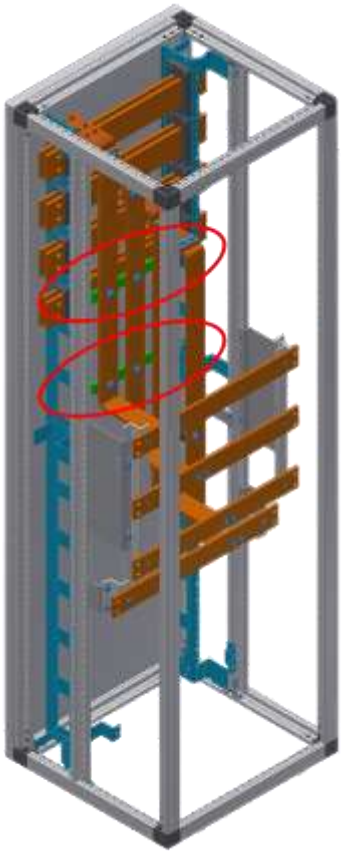
**A**: Enclosure width
**B**: Bar length

*) $I_{cw}$ depends on Cu dimensions (30 x 10, 40 x 10, 60 x 10, 80 x 10 mm) and the Cu busbar arrangement (2 x or 4 x)

**Fibreglass bars to support the field connection**

Fibreglass bars are necessary to support the field connection in specific enclosure types irrespective of the fibreglass bars for increasing the short-circuit resistance of the main busbar system.

- ➢ Observe the manuals for the enclosures for this purpose.

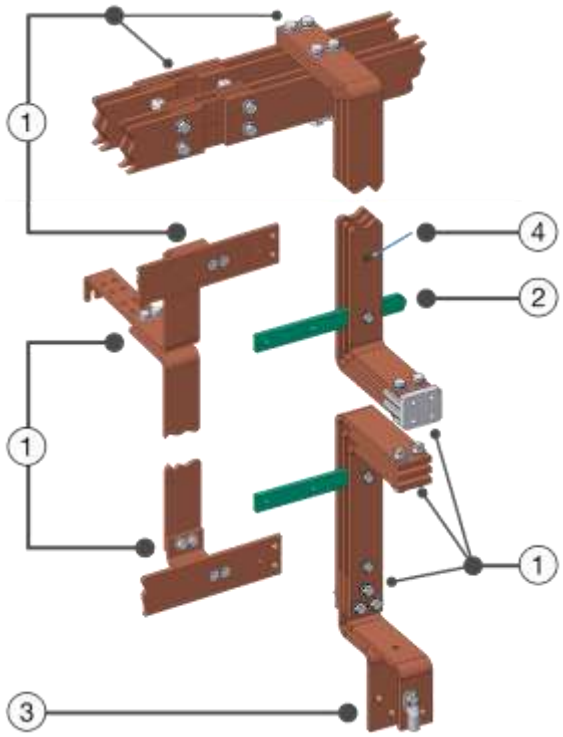


Example: Enclosure type U-FL HRC outgoing enclosure fuseline:
If the H-SaS is mounted in the top or bottom position, 10 mm thick fibreglass bars are required to support the field connection.
Two fibreglass bars each are mounted in this case.
However, if the H-SaS is mounted in the middle position, no bars are required for support.

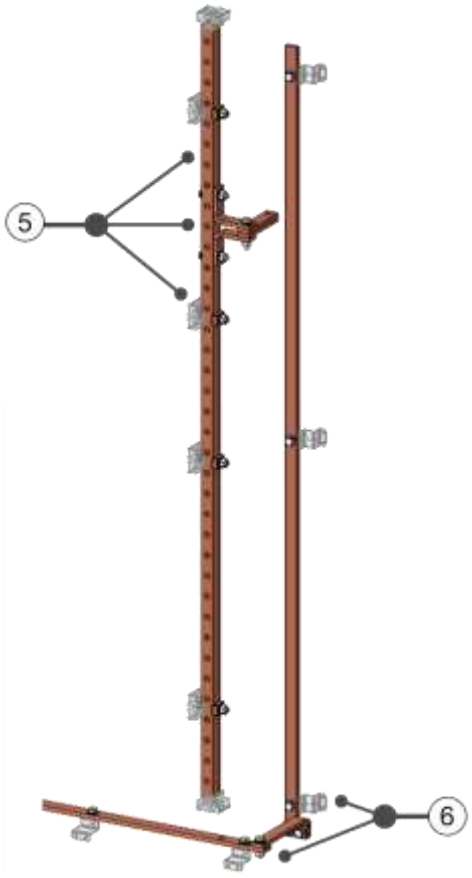
U-FL fuseline: Field connection reinforced with FG bar

## 4.5 Screw connections

The following describes the different types of screw connections, and their implementation, that are integrated and provided for in the unimes H system.




| | |
|---|---|
| 1 | Section 4.5.1<br>Copper connections<br>- H-SaS transport dividers/H-SaS connections<br>- H-SaS connections with F-SaS<br>- Connections to F-SaS<br>- Connections to devices |
| 2 | Section 4.5.2<br>Glass fibre bar connections |
| 3 | Section 4.5.3<br>Cable connections |
| 4 | Section 4.5.4<br>Voltage tap connections |




| | |
|---|---|
| 5 | Section 4.5.5<br>N conductor copper connections<br>- Cable connections<br>- Connections to F-SaS<br>- Connections to enclosure rack |
| 6 | Section 4.5.6<br>PE conductor copper connections<br>- Connections to enclosure rack<br>- Connections to continuing PE conductor |

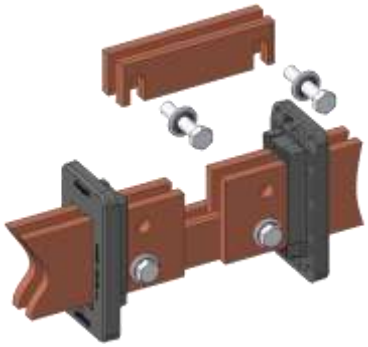
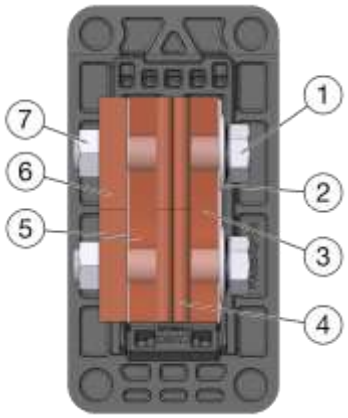
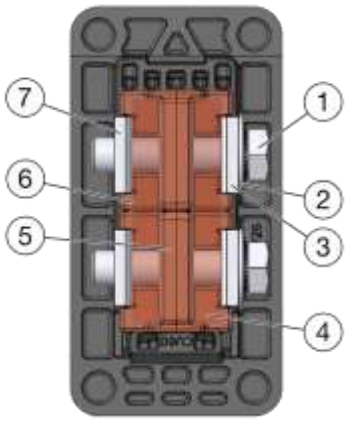
## 4.5.1 Copper connections

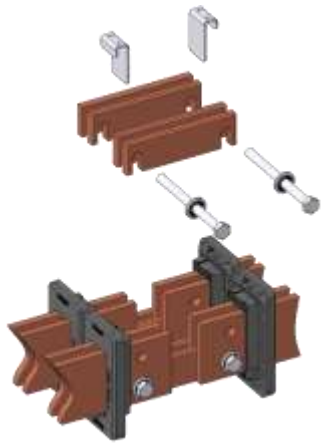
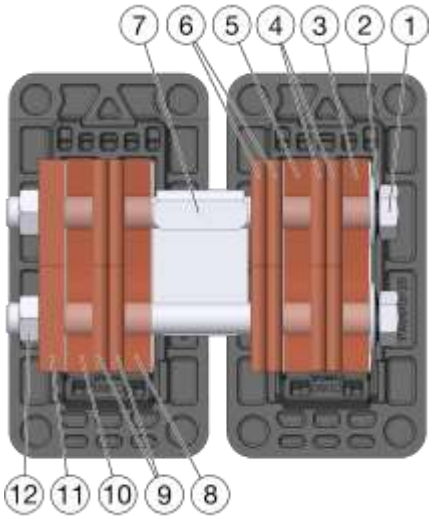
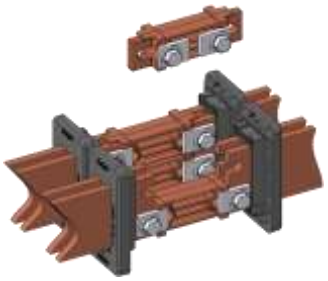
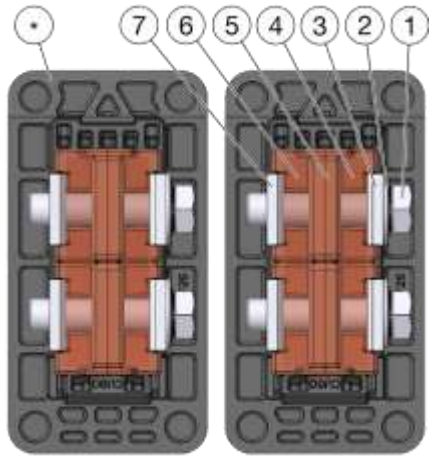
### H-SaS transport dividers/H-SaS connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Enclosure depth 600 mm, U-TTS transport divider** | | | | |
|  |  | 1 | Hexagon screw M12 x 55 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 4 | Copper busbar 6 mm transport divider lug | 2 pcs. |
| | | 5 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 6 | Copper busbar 10 mm transport divider | 1 pc. |
| | | 7 | Hexagon self-clinching nut/clinch nut M12 according to SN 60693 | 1 pc. |
| **Application: Enclosure depth 600 mm, U-TTK transport divider** | | | | |
|  |  | 1 | Hexagon screw M12 x 55 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Slider of transport divider TTK without thread | 1 pc. |
| | | 4 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 5 | Transport divider TTK | 1 pc. |
| | | 6 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 7 | Slider of transport divider TTK with thread M12 | 1 pc. |

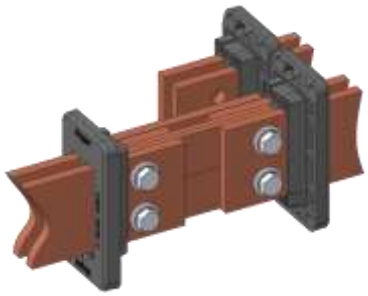
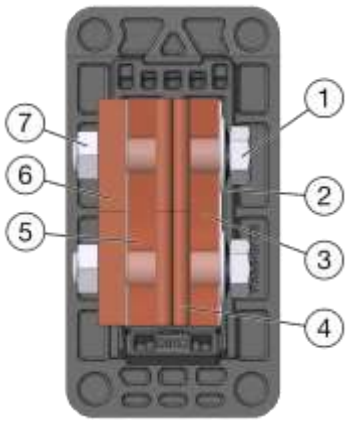
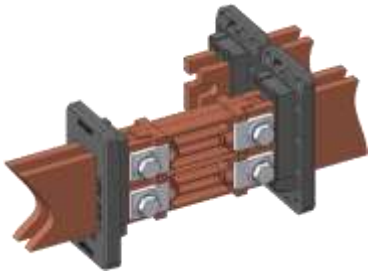
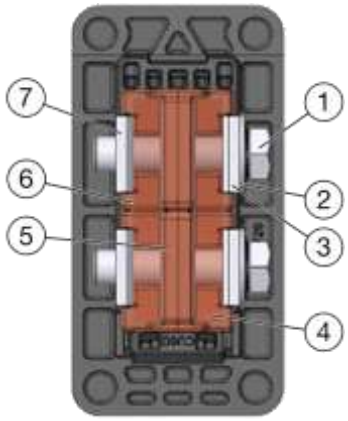
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Enclosure depth 800 mm, U-TTS transport divider** | | | | |
|  |  | 1 | Hexagon screw M12 x 140 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 4 | Copper busbar 6 mm transport divider lug | 2 pcs. |
| | | 5 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 6 | Copper busbar 6 mm transport divider lug | 2 pcs. |
| | | 7 | Spacer bracket | 1 pc. |
| | | 8 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 9 | Copper busbar 6 mm transport divider lug | 2 pcs. |
| | | 10 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 11 | Copper busbar 10 mm transport divider | 1 pc. |
| | | 12 | Hexagon self-clinching nut/clinch nut M12 according to SN 60693 | 1 pc. |
| **Application: Enclosure depth 800 mm, U-TTK transport divider** | | | | |
|  |  | 1 | Hexagon screw M12 x 55 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Slider of transport divider TTK without thread | 1 pc. |
| | | 4 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 5 | Transport divider TTK | 1 pc. |
| | | 6 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 7 | Slider of transport divider TTK with thread M12 | 1 pc. |
| | | | | |
| | | * | The same standard parts must be used for mounting the rear two H-SaS as for the front connections | |

## H-SaS transport divider reduction/H-SaS connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

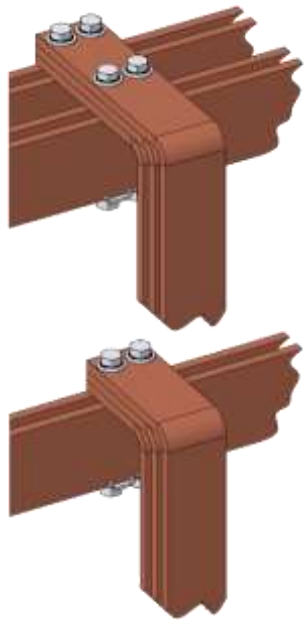
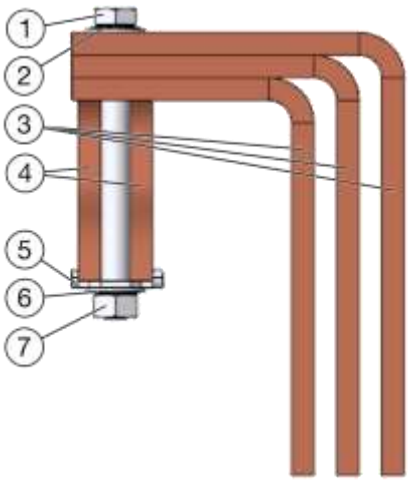
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Enclosure depth 600 mm, U-TTS transport divider reduction** | | | | |
|  |  | 1 | Hexagon screw M12 x 55 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 4 | Copper busbar 6 mm transport divider lug | 2 pcs. |
| | | 5 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 6 | Copper busbar 10 mm transport divider | 1 pc. |
| | | 7 | Hexagon self-clinching nut/clinch nut M12 according to SN 60693 | 1 pc. |
| **Application: Enclosure depth 600 mm, U-TTK transport divider reduction** | | | | |
|  |  | 1 | Hexagon screw M12 x 55 mm according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Slider of transport divider TTK without thread | 1 pc. |
| | | 4 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 5 | Transport divider TTK | 1 pc. |
| | | 6 | Copper busbar 10 mm H-SaS | 1 pc. |
| | | 7 | Slider of transport divider TTK with thread M12 | 1 pc. |

## H-SaS connections with F-SaS

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

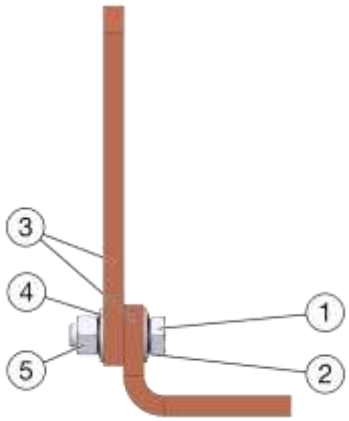
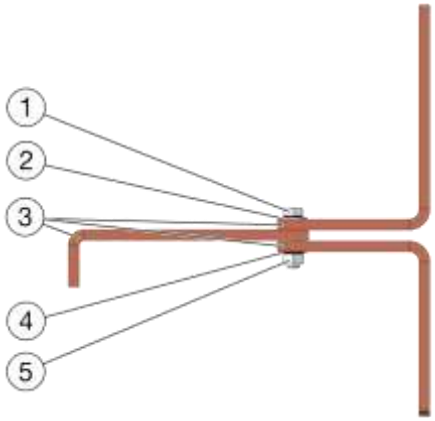
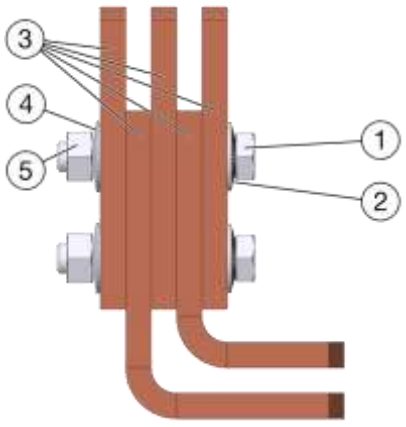
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Enclosure depths 600 mm/800 mm** | | | | |
|  |   | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 1 to 4 pcs. |
| | | 4 | Copper busbar 10 mm H-SaS | 2 pcs. |
| | | 5 | Clamping piece | 1 pc. |
| | | 6 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 7 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

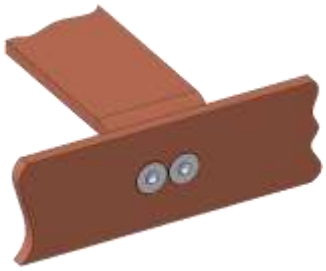
## Connections to F-SaS

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Connection with a sub-conductor** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 2 pcs. |
| | | 4 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |
| **Application: Connection with two sub-conductors** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 3 pcs. |
| | | 4 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |
| **Application: Connection with multiple sub-conductors** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 5 pcs. |
| | | 4 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

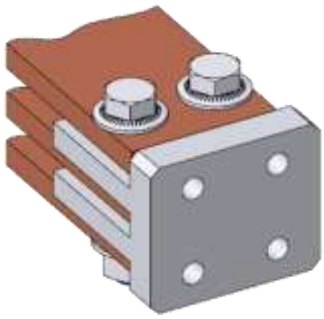
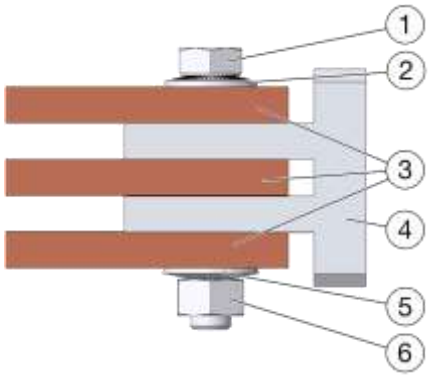
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Connection with countersunk screws** | | | | |
|  |  | 1 | Countersunk screw M12 according to SN 60062 | 1 pc. |
| | | 2 | Copper busbar 10 mm F-SaS | 2 pcs. |
| | | 3 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 4 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## Connections to devices

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

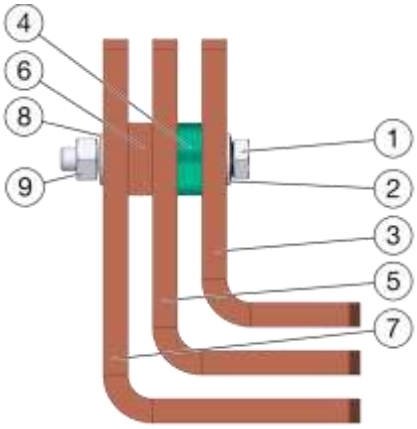
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Connection to all devices in the unimes H system** | | | | |
|  |  | 1 | Hexagon screw M12/M10 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12/M10 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 1 to 4 pcs. |
| | | 4 | Connection device accessories | 1 pc. |
| | | 5 | Spring washer M12/M10 according to DIN 6796 | 1 pc. |
| | | 6 | Hexagon nut M12/10 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## 4.5.2 Glass fibre bar connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

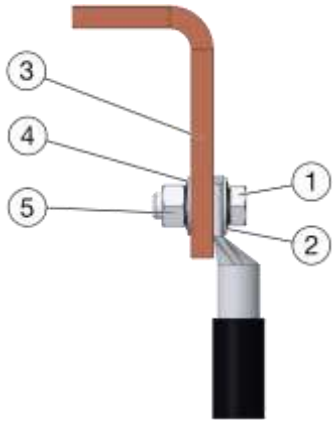
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Glass fibre bar, with spacer** | | | | |
|  |  | 1 | Hexagon screw M10 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M10 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 4 | GF bar 10 mm | 1 pc. |
| | | 5 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 6 | Spacer 10 mm | 1 pc. |
| | | 7 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 8 | Spring washer M10 according to DIN 6796 | 1 pc. |
| | | 9 | Hexagon nut M10 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## 4.5.3 Cable connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: General** | | | | |
|  |  | 1 | Hexagon screw according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 4 | Spring washer according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

**Conductor connection terminals for cables and lines that have not been pre-terminated according to DIN 43673**

| Cross section min. - max. [mm²] | Clamping screw | Screw form according to | Max. tightening torque [Nm] |
|---|---|---|---|
| 1.5 - 16 | 2 x M4 x 11 | EN ISO 1207 | 4 |
| 1.5 - 16 | 1 x M5 x 11 | EN ISO 1207 | 4 |
| 1.5 - 35 | 1 x M8 x 14 | EN ISO 1207 | 8 |
| 16 - 70 | 1 x M8 x 32 | EN ISO 4017 | 8 |
| 16 - 70 | 1 x M8 x 25 | EN ISO 4018 | 8 |
| 16 - 120 | 1 x M8 x 22 | EN ISO 4017 | 8 |
| 16 - 150 | 1 x M10 x 38 | DIN EN ISO 8676 | 12 |

**Screwed cable gland for terminated cables and lines with cable lug on flat copper busbars**

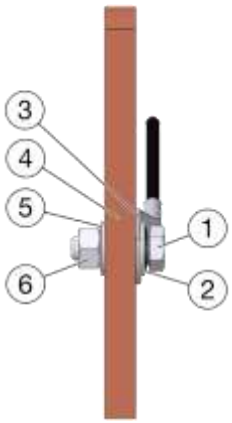
| Connection thread | Tightening torque recommended according to DIN 43673 Part 1 [Nm] |
|---|---|
| M4 | 1.5 |
| M5 | 2.5 |
| M6 | 4.5 |
| M8 | 10 |
| M10 | 20 |
| M12 | 40 |
| M16 | 80 |

## 4.5.4 Voltage tap connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

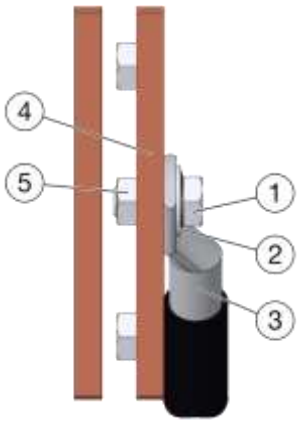
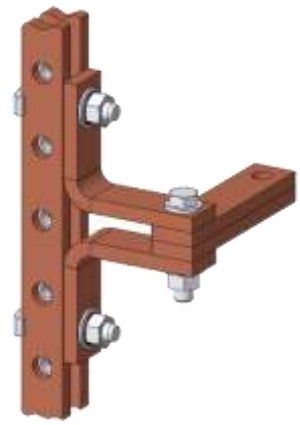
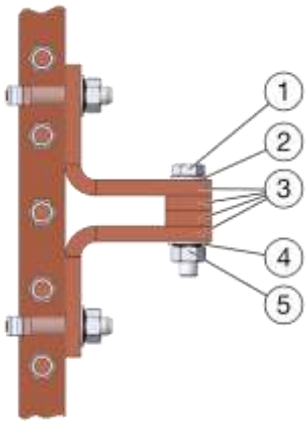
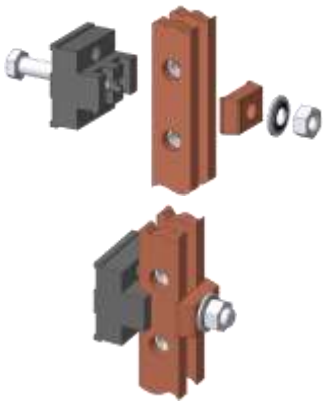
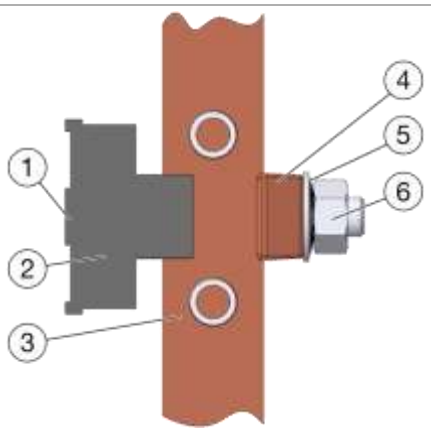
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: General** | | | | |
|  |  | 1 | Hexagon screw according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer | 1 pc. |
| | | 3 | Cable lug | 1 pc. |
| | | 4 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 5 | Spring washer according to DIN 6796 | 1 pc. |
| | | 6 | Hexagon nut according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## 4.5.5 N conductor copper connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

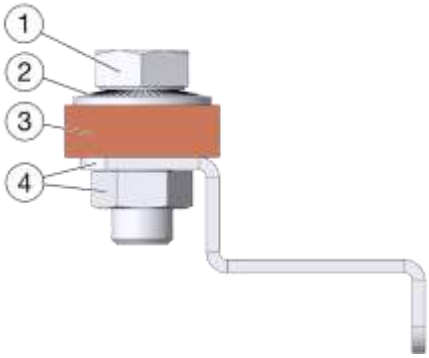
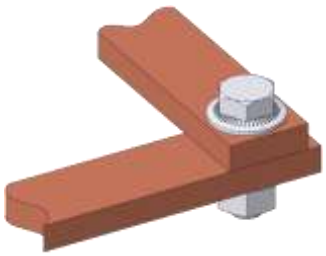
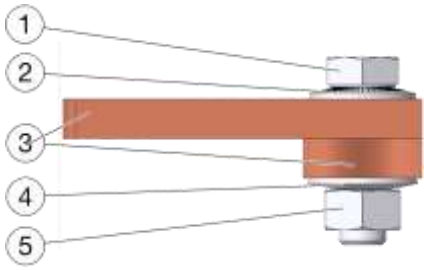
| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Cable connections** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Cable lug M12 | 1 pc. |
| | | 4 | Copper busbar 10 mm F-SaS | 2 pcs. |
| | | 5 | Hexagon self-clinching nut/clinch nut M12 according to SN 60693 | 1 pc. |
| **Application: Connection to F-SaS** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 4 pcs. |
| | | 4 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |
| **Application: Connection to enclosure rack** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | N conductor busbar support | 1 pc. |
| | | 3 | Copper busbar F-SaS | 2 pcs. |
| | | 4 | Copper busbar F-SaS support | 1 pc. |
| | | 5 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 6 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## 4.5.6 PE conductor copper connections

The following tightening torques apply to **all** screw connections.

**Tightening torque (Nm) for indoor or outdoor applications**

| M6 | M8 | M10 | M12 | M16 |
|---|---|---|---|---|
| 5.5 | 15 | 30 | 60 | 120 |

| Isometric view | Side view | Item | Standard parts | Quantity |
|---|---|---|---|---|
| **Application: Connection to enclosure rack** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 1 pc. |
| | | 4 | PE holding bracket with hexagonal self-clinching nut/clinch nut M12 according to SN 60693 | 1 pc. |
| **Application: Connection to continuing PE conductor** | | | | |
|  |  | 1 | Hexagon screw M12 according to DIN EN ISO 4014 (DIN 931) / DIN EN ISO 4017 (DIN 933) | 1 pc. |
| | | 2 | Rip-Lock™ BN 13292 - lock washer M12 | 1 pc. |
| | | 3 | Copper busbar 10 mm F-SaS | 2 pcs. |
| | | 4 | Spring washer M12 according to DIN 6796 | 1 pc. |
| | | 5 | Hexagon nut M12 according to DIN EN ISO 8673 (DIN 934) | 1 pc. |

## 4.5.7 Tightening torques for Cu screw fittings

- ➢ The tightening torques listed below must be applied if no specific values are provided for the connection.
- ➢ Observe the manufacturer's instructions for equipment.

**Tightening torques for busbar screw connections**

- To DIN 43673 Part 1.
- The table specifications apply to Cu screw fittings for DC and AC up to 60 Hz.
- For AC above 6300 A we recommend A2-70 screws to DIN 267 Part 11.

| | | Indoor | Indoor and outdoor | |
|---|---|---|---|---|
| **Screw** | Strength class | 8.8 or higher according to ISO 898-1 | 8.8 or higher according to ISO 898-1 | A2-70 or A4-70 to ISO 8892 (DIN 267-11) |
| | Corrosion protection | A2G, A4G (gal Zn) B2G, B4G (gal Cd) according to ISO 4042 (DIN 267-9) | tZn (hot galvanised) according to ISO 10684 (DIN 267-10) | - |
| **Nut** | Strength class | 8 or higher according to ISO 898-2 | 8 or higher according to ISO 898-2 | A2-70, A2-80 or A4-80 according to ISO 8892 (DIN 267-11) |
| | Corrosion protection | A2G, A4G (gal Zn) B2G, B4G (gal Cd) according to ISO 4042 (DIN 267-9) | tZn (hot galvanised) according to ISO 10684 (DIN 267-10) | - |
| **Spring element** | Spring washer* | According to ISO 10670 / DIN 6796 corrosion-protected | Corrosion-protection according to ISO 10760 /DIN 6769<br>With an M12 thread and busbars made of E-Alp or E-ALF 6.5 to E-ALF 10, additional washers are required, e.g. DIN 7349-13 St washer | |
| **Lubricant** | Threads and washer faces lubricated | Oil or grease | $MoS_2$-based lubricants | |
| **Nominal tightening torque (Nm) for threads** | **M4** | 1.5 | 2.0 | |
| | **M5** | 2.5 | 3.0 | |
| | **M6** | 4.5 | 5.5 | |
| | **M8** | 10.0 | 15.0 | |
| | **M10** | 20.0 | 30.0 | |
| | **M12** | 40.0 | 60.0 | |
| | **M16** | 80.0 | 120.0 | |

* Suitable spring elements must be used to compensate thermal expansion so that the pressure does not fall below the specified contact pressure at all temperatures, e.g. from -5°C to +120°C or, in case of a short circuit, at +250°C.

Other spring elements that are suitable for maintaining the required contact pressure may also be used. If necessary, washers must also be installed.

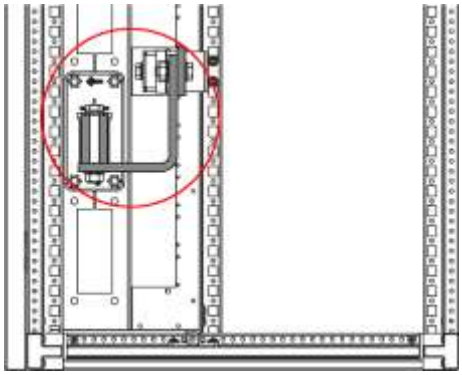
This ensures that sufficient contact pressure is maintained and prevents the screw connections from working loose due to transport or during operation due to shocks, vibration and similar.

Nominal tightening torques for connecting elements without lubrication are not specified due to the high friction variability.

## 4.6 Neutral conductor routing and earthing

### Alternative coppering of the N outgoing bar

**Additional N outgoing bar**

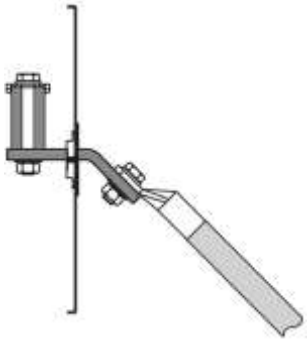


Side view with alternative coppering of the N outgoing bar

- An additional N conductor bar can be installed at the rear of the enclosure.
- It is secured using two holding brackets U-HW and two insulators U-SI410.

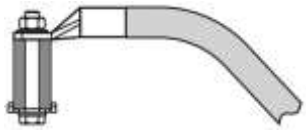
### Alternative connection versions for N outgoing unit/N incoming unit

**Internal separation according to Form 2b**



- In the case where only a few N conductors are supplied and internal separation according to Form 2b and higher has been implemented, an angled connection bracket from the main busbar space can make it easier to connect the N conductors.
- The figure shows an N conductor routed from below and connected via such a bracket to the N conductor of the main busbar system H-SaS. In this case, the bracket is connected from below in accordance with the busbar symmetry and the bushing is provided by the bushing partitions, which are compatible with the system.
- When feeding the N conductors from above, the bracket must be connected symmetrically to the top surface of the main busbar accordingly.

**Without internal separation (Form 1)**



- When designing the enclosures without internal separation (Form 1), the N conductor that is fed from the outside can also be connected to the N conductor of the main busbar system H-SaS directly.

## 4.7 N conductor in the cable compartment

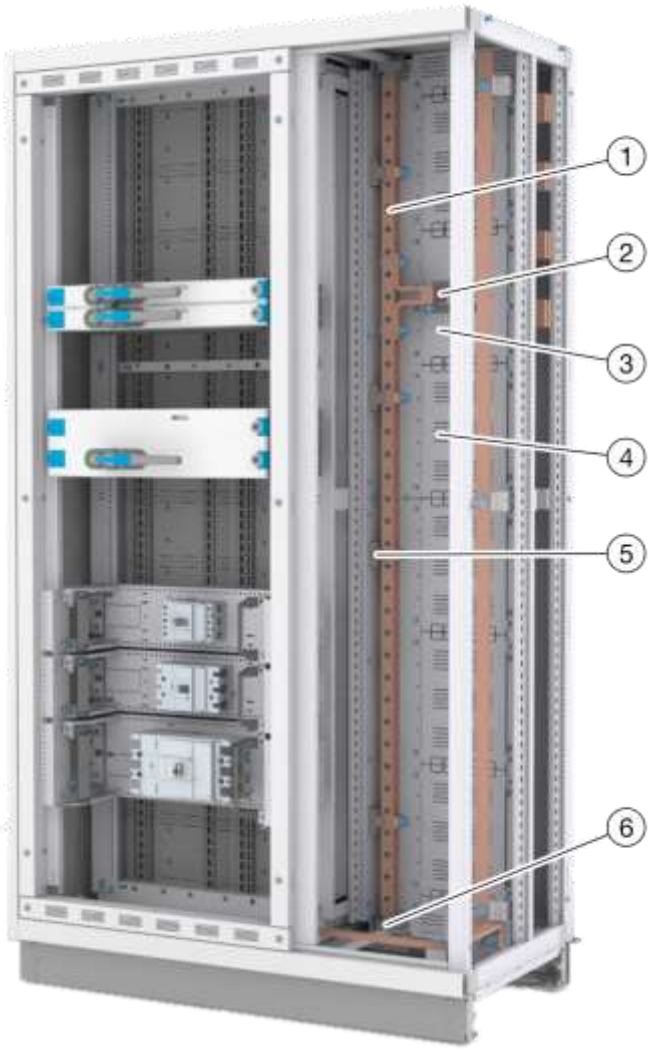
Depending on the market, Hager provides 2 fastening types for the N conductor in the cable compartment.

**N/PEN conductor on N/PEN support in the integrated cable compartment**

For outgoing enclosures with integrated cable compartment, Hager supplies sets with N/PEN bar supports and connection elements for the outgoing N bar. Hager also supplies the cover for the N connection to the H-SaS and the N touch protection as accessories.

**Versions:**

- Full extension or partial extension
- Full extension, separated in the middle
- Mounting possible on the left and right in the KRI and U-BS
- 1-pole or 2-pole (1 or 2 Cu busbars)
- Busbar cross section: 1x30x10, 1x40x10, 1x50x10, 2x30x10, 2x40x10, 2x50x10
- Drill-free assembly of bar(s) on N/PEN supports (4 pieces)
- Element for connecting N bar to the field connection 1xCu.. or 2xCu.. available (U-AEAN..)
- N conductor touch protection (optional)
- N connection touch protection (optional)




| | |
|---|---|
| **1** | N/PEN conductor |
| **2** | Insulating piece for field connection entry to the H-SaS |
| **3** | Bushing partitions ME3<br>- 2 bushing partitions replace 1 partition for H-SaS space to cable compartment |
| **4** | Partition for H-SaS space to cable compartment |
| **5** | N/PEN supports |
| **6** | Bottom bar support |

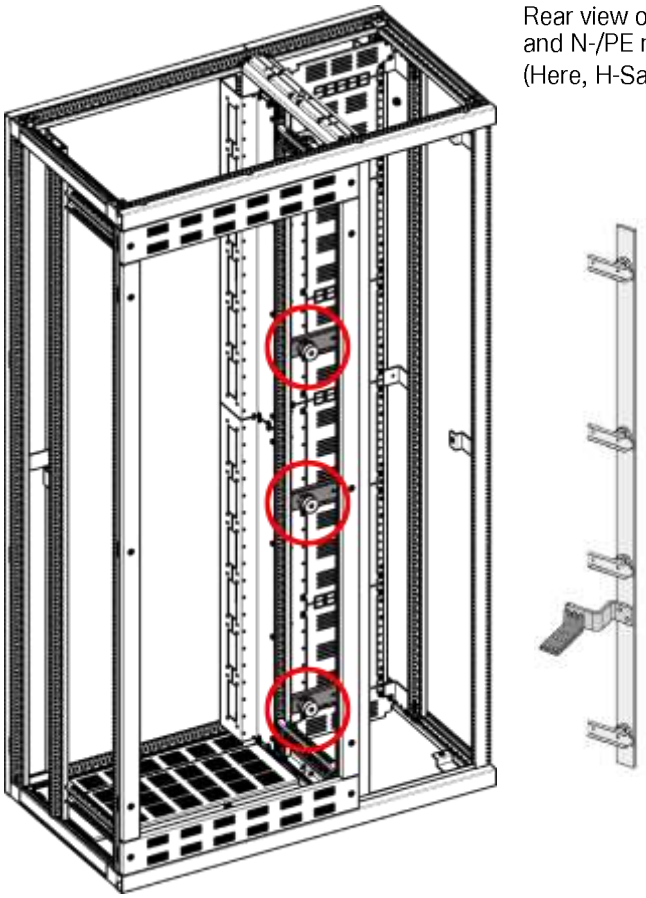
Sample enclosure

## N/PE/PEN on insulators in the integrated cable compartment

For enclosures with integrated cable compartment, Hager supplies sets with N/PEN bar supports and connection elements as well as insulators for the N/PEN bar. Hager also supplies the cover for the N connection to the H-SaS and the N touch protection as accessories.

### Versions

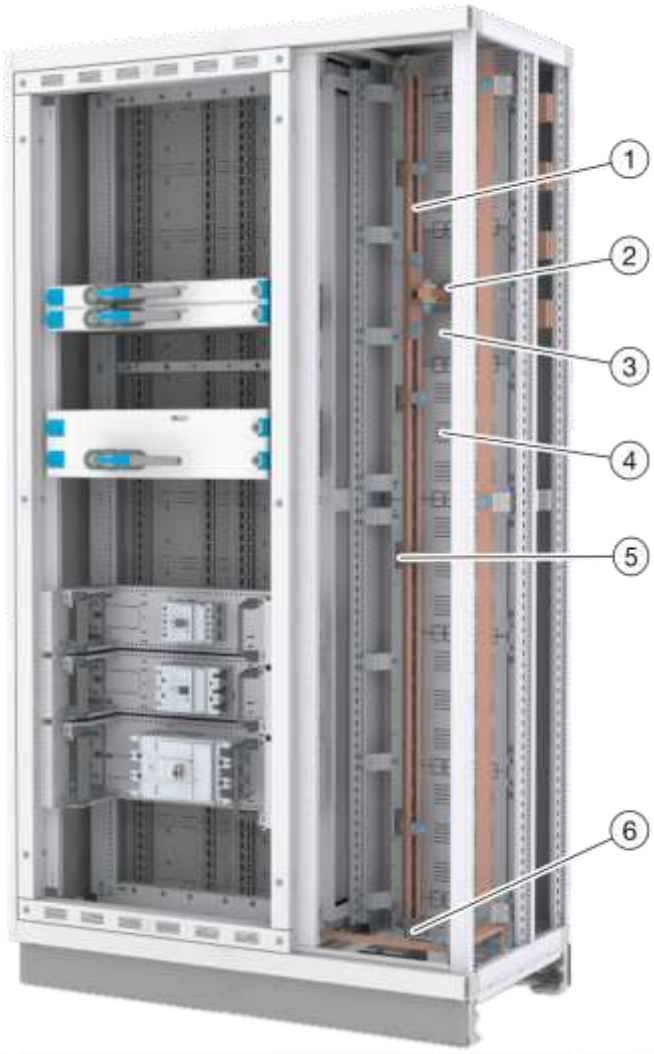
- 1-pole (1 Cu busbar)
- Busbar cross section 1x60x10, 1x80x10, 1x100x10
- Cu busbar is drilled according to the production drawings (depending on the enclosure and H-SaS position)
- Cu busbar assembly on 4 N/PE mounting plates, each with a post insulator/insulator (U-PEN4BB: N/PE assembly plate: an additional PE conductor can be assembled)



Rear view of Cu busbar with insulators and N-/PE mounting plates
(Here, H-SaS at bottom)

### N/PEN conductor on N/PEN support in integrated cable compartment rotated 45°

For outgoing enclosures with integrated cable compartment, Hager supplies a 45° rotated N conductor connection for different installation requirements.



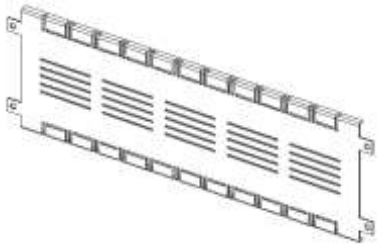

Sample enclosure

| | |
|---|---|
| **1** | N/PEN conductor rotated 45° |
| **2** | Insulating piece for field connection entry to the H-SaS (rotated 45°) |
| **3** | Bushing partitions ME3<br>- 2 bushing partitions replace 1 partition for H-SaS space to cable compartment |
| **4** | Partition for H-SaS space to cable compartment |
| **5** | N/PEN support for 45° rotated mounting |
| **6** | Bottom bar support for 45° rotated mounting |

### Bushing partitions

To avoid the generation of eddy currents in the area of the N connection to the N main busbar, the steel blank partition must be replaced by two bushing partitions made of aluminium.

The aluminium bushing partitions are provided as sets with assembly material for cable compartment widths 400 and 600 mm.



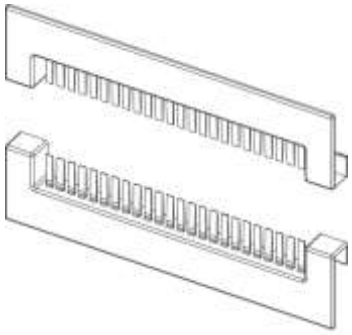
Bushing partition U-DS..(Alu)

### Break out the bushing partitions

- Observe the manual for the relevant enclosure type when breaking out the openings in the bushing partitions.

### Insulating pieces

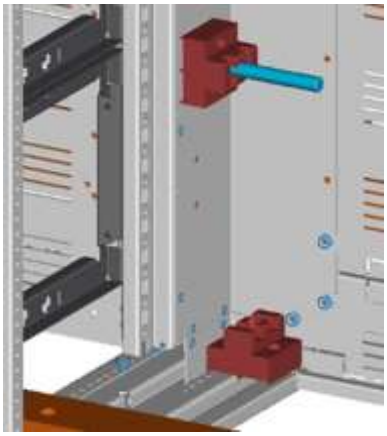
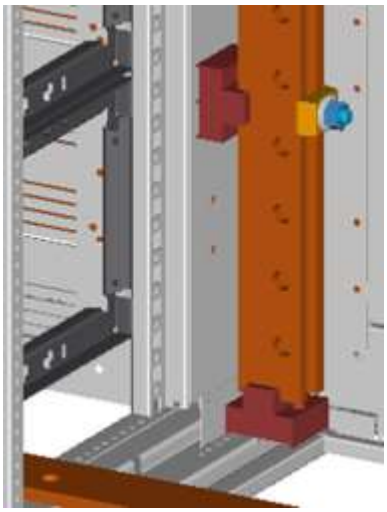
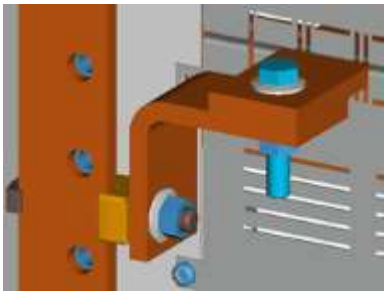
Insulating pieces U-IS must be used for routing cables between the main busbar space and cable compartment.

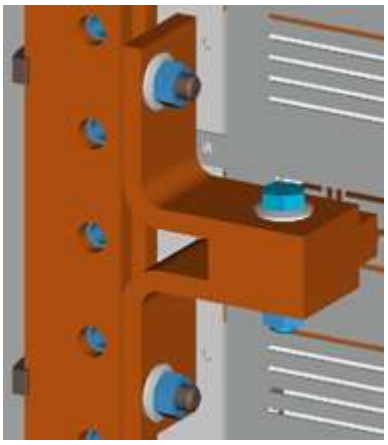
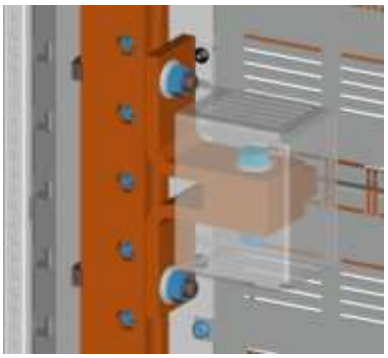
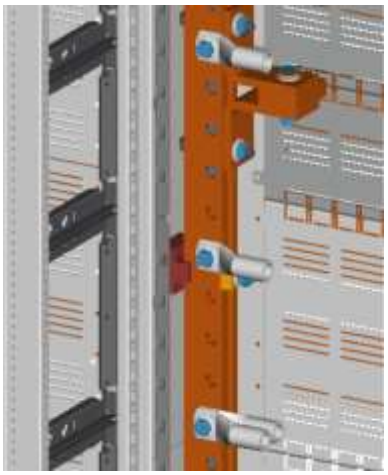
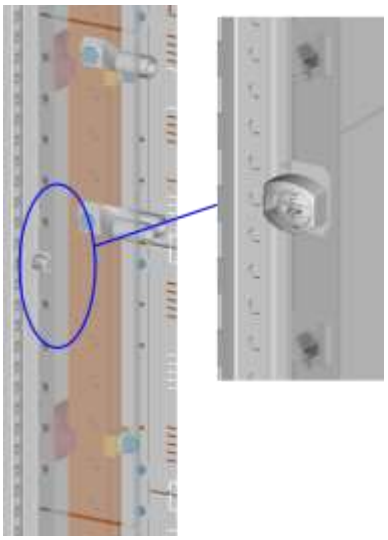


Insulating piece U-IS

### Steps for assembling the N/PEN in the integrated cable compartment

Steps for assembling the N conductor with N conductor touch protection in the integrated cable compartment.

| Step | Action | |
|---|---|---|
| 1 | Mount the N/PEN bar support on fixing angle<br>- Tightening torque: 3 Nm |  |
| 2 | Place the N bar(s) in the bar supports and secure with connection blocks<br><br>Fastening one copper busbar<br>- 400 A: Cu 30x10<br>- 800 A: Cu 40x10<br>- 1000 A: Cu 50x10<br>- Tightening torque: 3 Nm |  |
| | **or**<br>Fastening two copper busbars<br>- 1250 A: Cu 2x30x10<br>- 1600 A: Cu 2x40x10<br>- 2000 A: Cu 2x50x10<br>- Tightening torque: 3 Nm |  |
| 3 | Connect N conductor to H-SaS (establish N field connection)<br><br>Principle of connecting element 1 x U-AEAN:<br>- Connection of 1 copper busbar<br>- Tightening torque: 40 Nm |  |

| Step | Action | |
|---|---|---|
| | **or**<br>Principle of connecting element 2 x U-AEAN:<br>- Connection of 2 copper busbars<br>- Tightening torque: 40 Nm |  |
| 4 | Fit the cover cap of the N field connection (optional) |  |
| 5 | Attach the cable lugs to the copper bus-bar |  |
| 6 | Fasten the touch protection bracket (optional) | |
| 7 | Mount the cover plates of the N bar with the quick-action fastener (optional) |  |

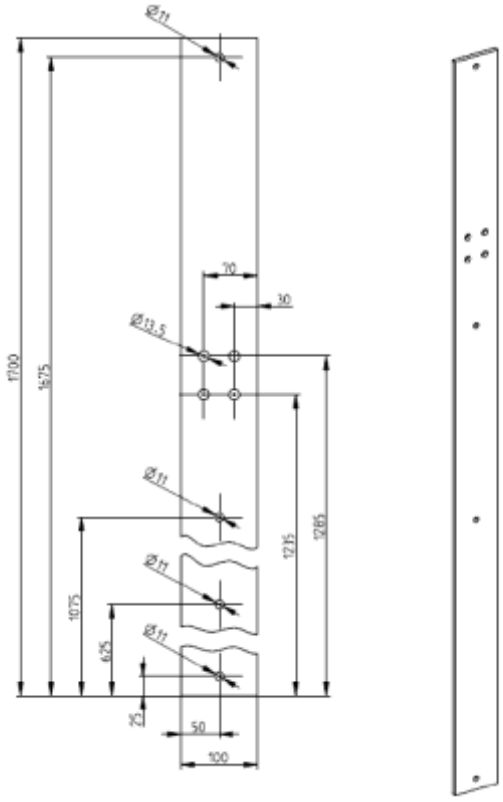
| ATTENTION |
| --- |
| Insulating pieces may need to be used if a partition is replaced with a bushing partition. |

### Steps for assembling N/PE/PEN conductors on insulators

| Step | Action |
| --- | --- |
| 1 | Drill the Cu busbar according to Hager's production drawing |
| 2 | Determine the installation height of the Cu busbar |
| 3 | Replace the H-SaS partition to the cable compartment on the Cu bushing with bushing partitions and insulating pieces |
| 4 | Assemble the N-PE mounting plates and insulators |
| 5 | Assemble the Cu busbar with field connection to H-SaS (N conductor) |

### Production drawings for Cu busbar

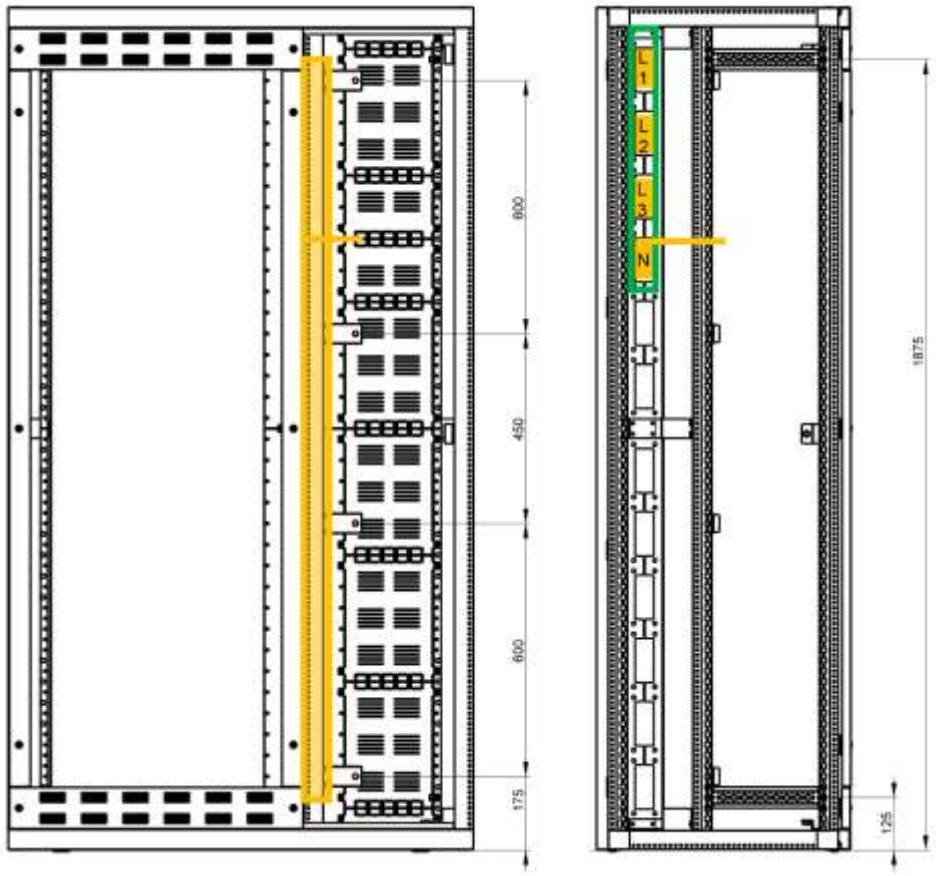
Hager provides the panel builder with enclosure type-specific assembly drawings and individual component drawings for producing the individual copper parts. On receipt of the Cu production drawings, the panel builder can produce the individual Cu parts before the switching enclosures are delivered. This optimises the processing time.




Example: Production drawing Cu 1x100x10 for H-SaS at the top. The drill holes in the dimensional drawings depend on the mounting position of the H-SaS and the bar cross section.

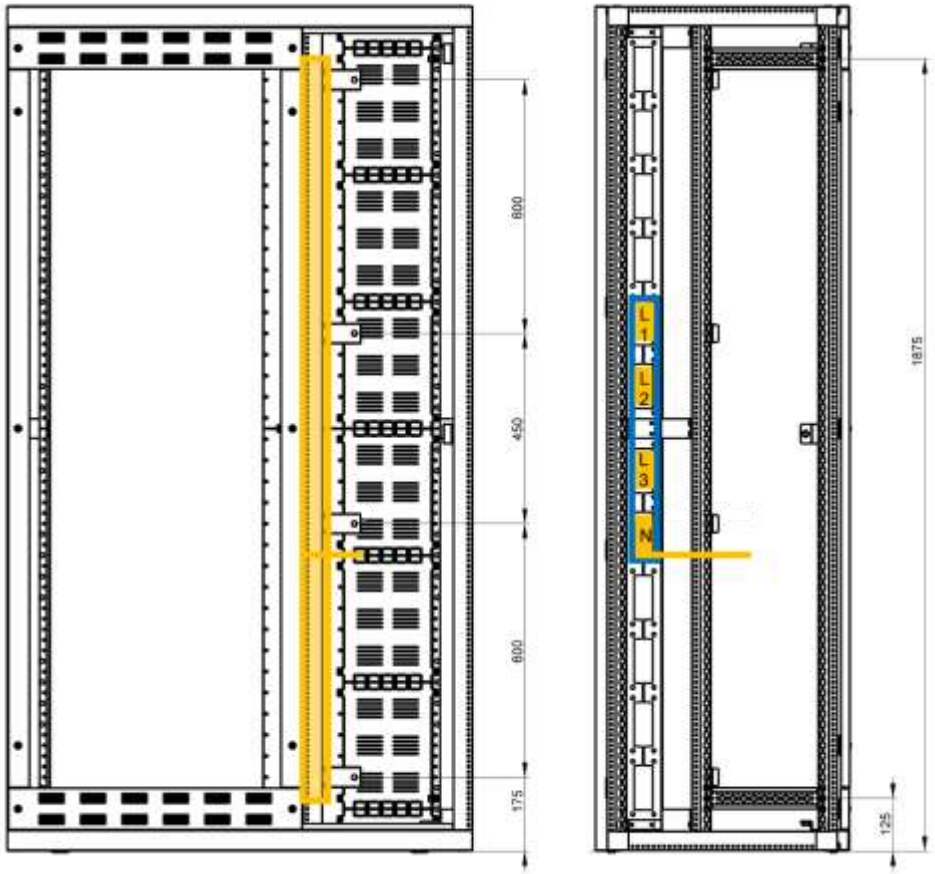
## Determine the installation height of the Cu busbar

### Installation height of H-SaS at the top (CH, DE, NL)



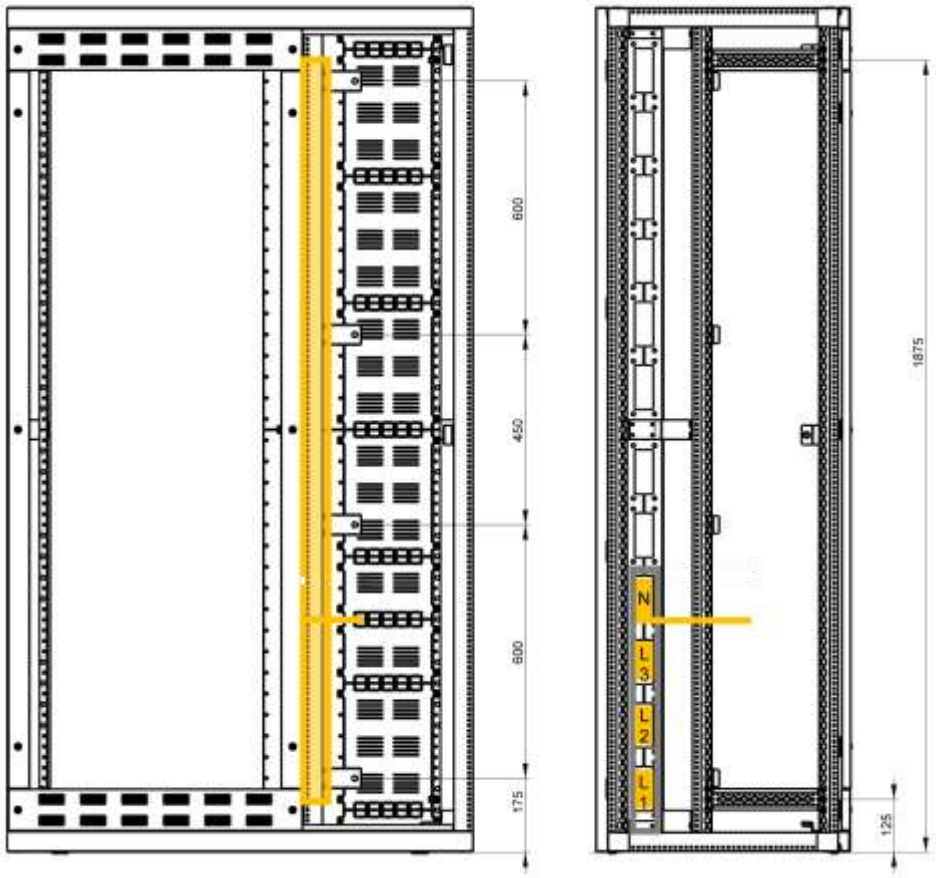

Enclosure front view/enclosure side view: Installation height of the connection to the H-SaS. In this example (H-SaS at the top), the second highest partition from the H-SaS to the cable compartment is removed and replaced by two bushing partitions with insulating pieces to implement the Cu connection.

**Installation height of H-SaS in the middle (CH, DE, NL)**



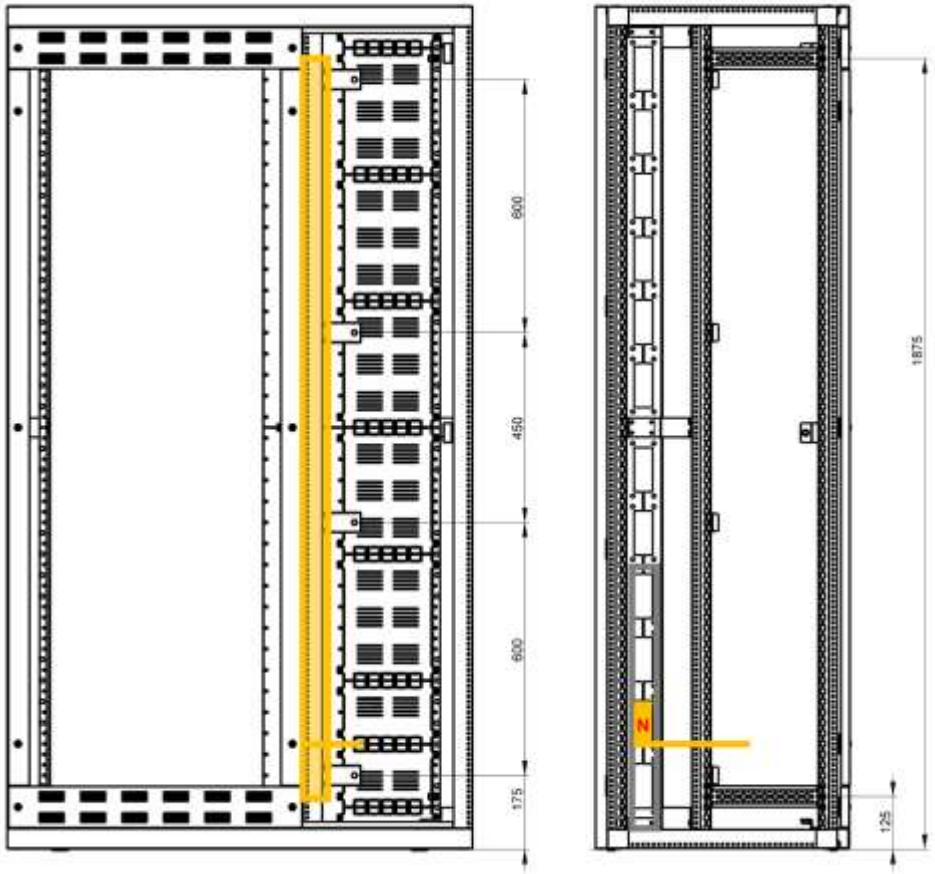

The partition from the H-SaS to the cable compartment is removed and replaced by two bushing partitions with insulating pieces to implement the Cu connection.

**Installation height of H-SaS at the bottom (CH, DE, NL)**




The second lowest partition from the H-SaS to the cable compartment is removed and replaced by two bushing partitions with insulating pieces to implement the Cu connection.

**Installation height of H-SaS at the bottom: N in second lowest position (only DE)**




The lowest partition from the H-SaS to the cable compartment is removed and replaced by two bushing partitions with insulating pieces to implement the Cu connection.

## Assemble the N-PE mounting plates and insulators

N/PE mounting plate in the cable compartment (U-PEN4BB)

- Set of 4 pieces with insulator and fixing material
- An additional PE conductor can be assembled

## Assemble the Cu busbar with field connection to H-SaS (N conductor)

➢ Observe the tightening torques

**Cover the access openings in the retaining plate**

To meet Form 2b of internal separation, the access openings in the retaining plates must be covered.

For enclosure types and enclosure depths (600 mm/800 mm), Hager offers suitable:

- Blank covers, height = 150 mm
- Access covers (PC), height = 150 mm.


| | | |
|---|---|---|
| 1 | Access cover (PC)<br>- For covering access openings occupied by H-SaS<br>- H-SaS behind access cover |  |
| 2 | Blank covers<br>- For covering access openings that are not required<br>- No H-SaS behind blank cover |  |

Assembled blank covers and access covers (PC) in the retaining plate

Blank covers and access covers (PC) are supplied in sets with snap elements. The snap elements enable time-saving assembly of the blank covers or access covers without the use of tools. The snap elements are protected against falling out or down.

## 4.8 Assembling the blank covers and access covers (PC)

### Assembling the blank covers and access covers (PC)

No tools are required to establish a vibration-resistant connection using the snap elements.

| Step | Action |
|---|---|
| 1 | First insert the snap elements from the front into the designated installation openings of the access cover or blank cover. |
| 2 | Position the cover in the designated location. |
| 3 | Secure the cover by pushing in the snap element.  |

### Disassembling the blank covers and access covers (PC)

The access covers and blank covers can be easily and quickly opened with the snap elements, for example, to access the busbars if desired.

| Step | Action |
|---|---|
| 1 | Unlock all of the snap elements of the access cover or blank cover by turning the slit drive of the snap element a 1/4 rotation to the left.  |
| 2 | Take the cover and the snap elements out of the retaining plate. The snap elements remain captively pre-assembled in the cover. |

# 5 Packaging and transport

## Transporting enclosures safely

This section provides instructions on packaging and transporting the enclosures of the power distribution system

## Chapter index

## 5.1 Weight specifications

**Guideline values for weights and maximum dimensions**

Observe the specified limit values for the weight:

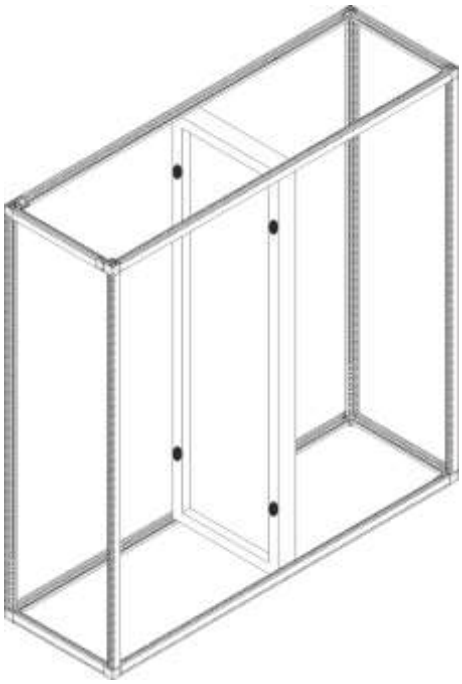
- A completely filled enclosure weighs 200 to 900 kg.
- The maximum weight is 1440 kg.
- The maximum dimensions of a transport unit depend on the ordered enclosure size.

## 5.2 Enclosure connections

Note that when transporting enclosures mounted in a row, they must be secured as a unit.

**At least 4 internal connections**

Enclosures mounted in a row must be bolted together for transport. Each enclosure must be bolted to the adjacent enclosure by 4 connections, i.e. a total of 8 internal connections are required for 3 enclosures.



Position of the 4 internal connections

- Mount at least 4 internal enclosure connections between two cabinets at a time prior to transport.

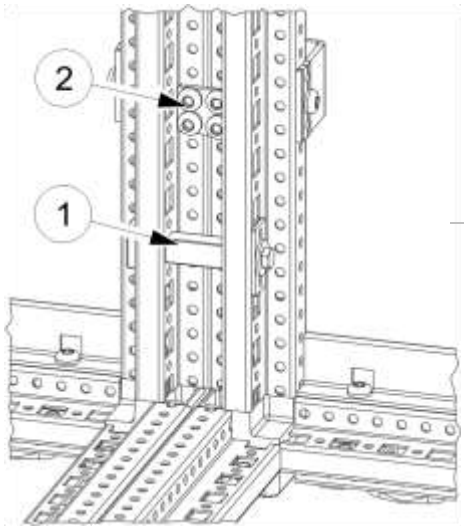
**Enclosure connection with perforated plate or bolt depending on accessibility**

The internal enclosure connection can be made with enclosure connection plates MES-FV or enclosure connection bolts MES-FVB.

The following are required for this:

- at least 2 x MES-FV or 2 x MES-FVB each at the strut in the front enclosure profile as well as
- at least 2 x MES-FV or 2 x MES-FVB each at the strut in the middle or rear enclosure profile.

➢ Observe the tightening torque of the bolt set: 15 Nm.



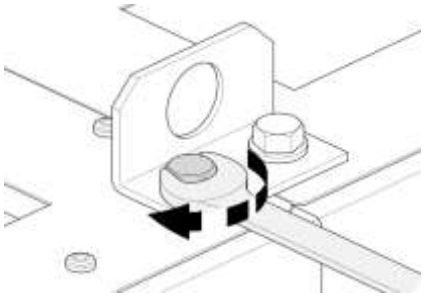

| | |
|---|---|
| 1 | Enclosure connection bolt<br>MES-FVB (in the set)<br>- Assembly direction: In enclosure width<br>- Material: Die-cast aluminium<br>- Screw drive: WAF 10<br>- Tightening torque: 15 Nm |
| 2 | Enclosure connection plate (perforated plate) MES-FV<br>- Assembly direction: In enclosure depth<br>- Material: Galvanised steel plate<br>- Material thickness: 3 mm |

Internal connection: Options

**Combination lifting lug MES-KT to the outer enclosure connection**

The combination lifting lug MES-KT is used for lifting the enclosures and also connects the enclosures on the enclosure roof. The internal enclosure connections are still required for transport.

➢ Observe the tightening torque for the screws enclosed in the set: 40 Nm.



Mounted combination lifting lug MES-KT

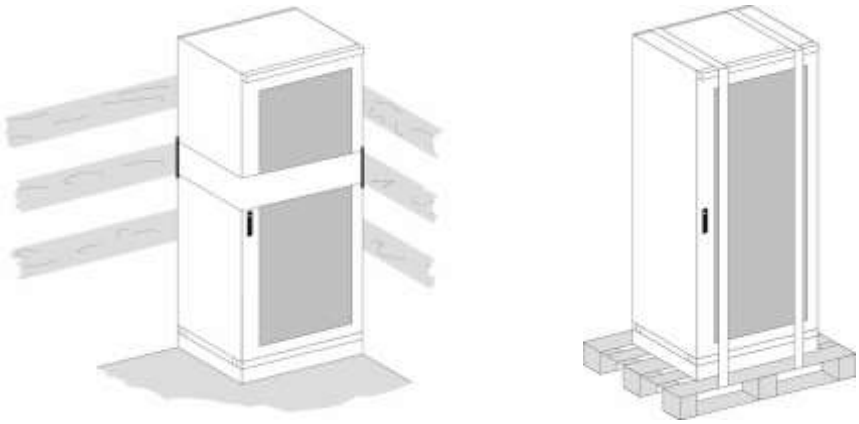
Combination lifting lug MES-KT
- Assembly: on the enclosure roof (at the corners of two enclosures mounted in a row)
- Screw connection via M12 thread directly to the supporting enclosure racks
- Screw drive, hexagon WAF 19
- Tightening torque, screws: 40 Nm
- Hole diameter for transport equipment: 30 mm
- Material: steel plate
- Material thickness: 2.5 mm

## 5.3 Securing for transport

- Observe the safety instructions for this section.
- Before transporting enclosures mounted in a row, ensure that there are at least 4 suitable internal connections between each enclosure mounted in a row. This is explained in the section "Enclosure connections".

### Upright transport

- Observe the centres of gravity and the weight of the transport unit.
- Secure the enclosure against tipping.

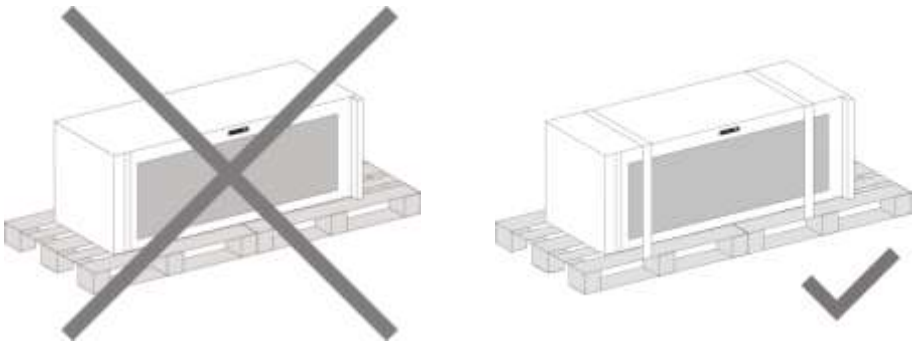


Schematic diagrams:
Securing the enclosure against tipping, securing measures performed by qualified transport specialist personnel

- Transport the enclosure secured and upright.
- When transporting the enclosure using a forklift or pallet truck, make sure not to lift the enclosure higher than absolutely necessary. There is a risk of tipping.
- Make sure that the enclosure is set down slowly and evenly.

### Horizontal transport

- Secure the enclosure against slipping.
- After transporting, check the location, position and firm connection of the components again.

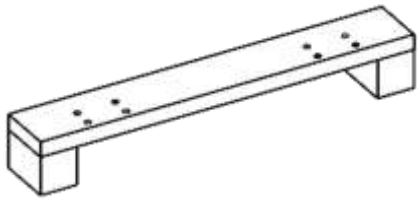


- Only secured transport allowed
- The components must be checked after horizontal transport

### Transporting with wooden skids

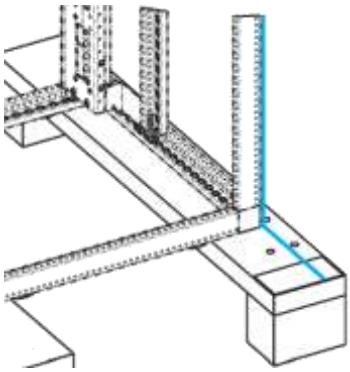
As an alternative to the Euro pallet, the unimes H power distribution system can be ordered with pre-assembled wooden skids ex works using the Configurator

tool. The advantage of the wooden skids is that no additional transport aids are required for moving the system in a truck or in the workshop from the time of ordering to final assembly. The wooden skids are also available in two different versions depending on customer and project requirements.



Wooden skid for transporting

**Option 1: Wooden skid overlapping**

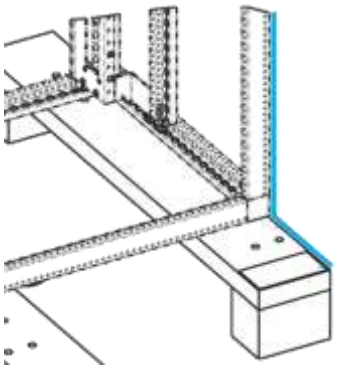


Wooden skid overlapping

Advantages:

- Avoids potential collision of enclosure with protruding parts
- Copper transport connections can be prepared
- There is always space for the necessary side panels, various enclosure accessories or prepared auxiliary circuit wiring.

**Option 2: Wooden skid flush**



Wooden skid flush

Advantages:

- An assembly of multiple enclosures can remain on the skids from acceptance to final installation
- The enclosures are simply moved to the required positions as required.

This simplifies tasks for the panel builders, e.g. factory tests, commissioning tests, various tests relating to protective conductors or insulation tests.

**NOTE: Only lift from under the wooden skids**

Lift **only** from under the wooden skids

**DO NOT** lift from under the enclosure

- The wooden skid assembly is designed in such a way that a forklift truck or pallet lifting truck always has sufficient load-bearing length to transport the enclosure sideways.
- It is imperative that the enclosure units be transported as shown in the graphic in order to avoid damage (i.e. lift **only** from under the wooden skids).

## 5.4 Unloading and transporting

Observe the instructions in the section "Safety during packaging and transport".

The enclosures can be lifted using 2 methods:

- from above using a crane,
- ground transport with a forklift, pallet truck or roller devices from underneath.

**Crane transport**

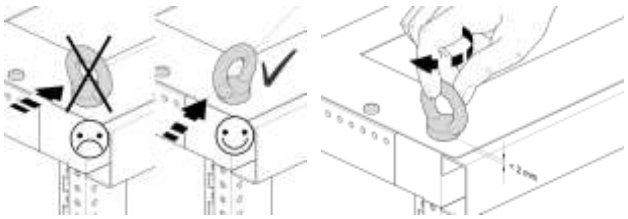
➢ Before transporting enclosures mounted in a row, ensure that there are at least 4 internal connections between 2 enclosures, see section "Enclosure connections".

The following are used for this:

- enclosure connection plates MES-FV or
- enclosure connection bolts MES-FVB.

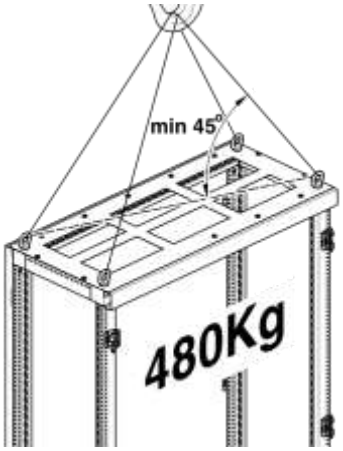
To transport by crane, lift the enclosure as follows:

- On 4 ring screws MES-TR (thread size M12; hole diameter 30 mm, material: cast steel), screwed into the designated openings in the enclosure frame on the enclosure roof,
- On 4 combination transport lugs MES-KT (screw drive, hexagon, WAF 19; hole diameter 30 mm, material: steel plate 2.5 mm), that are also used to lift and connect enclosures from above. Tightening torque: 40 Nm.
- Never hang the lifting equipment/lifting cable on the enclosure frame but only on the ring screws or combination lifting lugs.
- In the case of an enclosure combination consisting of 3 enclosures, only the middle enclosure is lifted with 4 ring screws MES-TR or 4 combination transport lugs MES-KT. The middle enclosure hangs on 4 lifting cables, of the same length where possible, at an angle of at least 45° to the enclosure surface (maximum angle of inclination 45°).



Note that the direction of force F caused by the lifting cable must be applied diagonally for the ring screws MES-TR: The ring screws must be permanently assembled, with their ring pointing toward the enclosure centre. The ring of the ring screws must not run parallel to an enclosure wall.

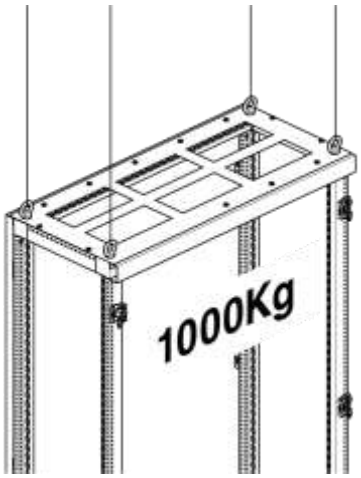
Ring screws must point diagonally toward the enclosure centre




The crane hook is positioned over the centre of gravity. When lifting an enclosure with a crane, the enclosure hangs in a balanced position on 4 lifting cables, of the same length where possible, at an angle of at least 45° to the enclosure surface (angle of inclination must not exceed 45°). The smaller the angle of inclination, the higher the maximum load.

**Permissible load with ring screws MES-TR:**

Angle of inclination 45°/lifting cable angle 45°:
480 kg




- Angle of inclination 0°/lifting cable angle 90°:
  1000 kg

**Crane transport of enclosure combinations mounted in a row**

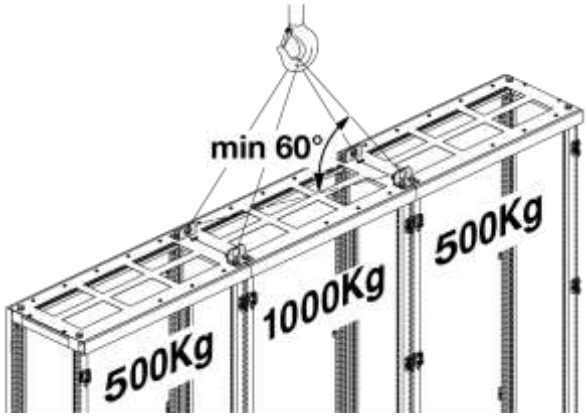
Before lifting an enclosure combination consisting of enclosures mounted in a row, check that the outer enclosures are correctly fastened to the inner enclosure via enclosure connection bolts.

When lifting an enclosure combination consisting of 3 enclosures, only the middle enclosure is lifted with 4 combination lifting lugs MES-KT. The enclosures mounted in a row are also bolted to the corner piece by means of combination lifting lugs.

The crane hook is positioned over the centre of gravity. Observe the relevant maximum weight when lifting an enclosure combination consisting of 3 enclosures with the combination lifting lug MES-KT:

The enclosures hang in a balanced position on 4 lifting cables, of the same length where possible, at an angle of at least 60° to the enclosure surface.

**Permissible load with combination lifting lug MES-KT at an angle of inclination of 30°/lifting cable angle 60°:**




- the outer enclosures: 500 kg max.,
- the inner enclosure: 1000 kg max.

Lifting an enclosure combination consisting of 3 enclosures with internal connections and connections at the top via combination lifting lugs MES-KT.
(This is also possible with the roof frame spaced.)

**Ground transport with a forklift, pallet truck or roller devices**

- Secure the enclosure against tipping on the transport equipment.
- Secure the enclosure against slipping.
- Prevent the enclosure from tipping or tilting.
- Do not lift the enclosure higher than absolutely necessary (only a few millimetres).

## 5.5 Temporary storage

The power distribution system and all the accompanying components are designed for fixed indoor installation. Switching enclosures, devices and components must therefore be stored or temporarily stored as follows:

- upright at a dry, clean and ventilated indoor location,
- protected against rain and moisture or condensation,
- with relative humidity below the maximum value of 50% at 40°C,
- protected against extreme temperatures (storage temperature -5°C to 40°C),
- protected against dust, sand and chemicals,
- protected against external damage,
- protected against slipping or falling,
- the stability is secured on a stable, solid surface or by fixing against falling. The weight and centre of gravity of the enclosures must be observed.

The user determines special requirements for the storage packaging according to DIN EN 61439-1, supplementary sheet 1, section 10.5, if there are special application requirements.

Hager recommendations: Use undamaged transport packaging until the final assembly at the installation site.

**Precautionary measures prior to subsequent transport**

During subsequent transport:

- ➢ Prior to transport, perform a visual inspection for foreign objects left behind.
- ➢ Check the stability of the components and the entire switching enclosure.
- ➢ If necessary, clean the enclosure exterior and replace any missing parts.
- ➢ Observe the instructions for safe transport.
- ➢ Before transporting the enclosure again, have the ring screws or combination transport lugs checked by an expert:

- for mechanical damage, such as deformations, indentations,
- for cracks in the material,
- for fixed, correct positioning.

- ➢ Replace damaged ring screws or combination transport lugs.

# 6 Installation and assembly

**Assembly at the installation site**

Instructions for setting up and mounting the installed enclosures at the installation site.

**Chapter index**

## 6.1 Requirements and preparations

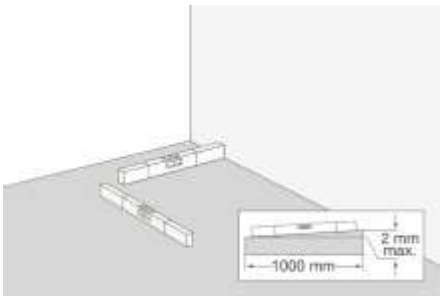
**Requirements**

- Level and load-bearing installation surface
- In case of unevenness, use U profiles or I profiles or the optionally available base levelling set mes-NIV.
- Clean and dry installation site; if necessary, apply a dust protection floor coating to the floor.

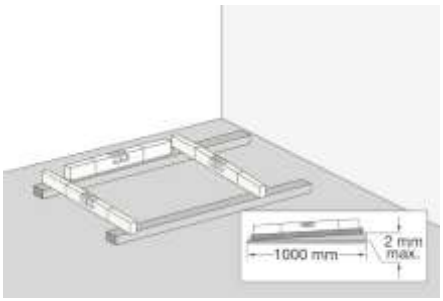
**Preparing the location**

Prepare the location of the switchgear and controlgear assembly:

➢ Ensure a level surface. The maximum tolerance to ensure safe assembly is +/- 2 mm/m. In case of unevenness, use suitable compensation material.




Level surface required




Maximum tolerance: +/- 2 mm/m

➢ Observe the weight load on the surface at the location. If an intermediate floor is used for supporting the connection cable, it must be designed to support the weight of the enclosure, including all equipment and devices.
➢ Take the permitted bending radii for cable entries and cable feeds into account.
➢ The ambient temperature must be within the range of the enclosure operating conditions, the installed devices and the routing conditions for the equipment.
➢ Ensure adequate lighting of the work environment.

**Maintaining free spaces**

➢ Maintain the required free spaces (minimum specifications):

- Minimum spacing of cabinet surface to the ceiling: 500 mm
- Minimum passage height below covers or enclosures: 2000 mm
- Minimum gangway width in front of the switching cabinet: 700 mm (in front of switching cabinets with withdrawable parts in the isolated position: 600 mm). With distribution units whose doors open against the escape direction, the necessary escape route of 500 mm must also be available when the doors area opened at 90°. If necessary, wider gangways must be selected so that cabinet doors can be opened and withdrawable parts can be completely removed.

- The width and dimensions of the access points must be suitable at all times
  - For operation and maintenance,
  - In emergencies,
  - As an emergency exit and
  - For transporting equipment.

## 6.2 Setting up and securing the switching enclosures

### Setting up and securing the switching enclosures

Various options are possible for setting up and securing the enclosures:

- Floor mounting
  - Mount with screws and dowels or anchor bolts on the base corner piece
  - Mount with additional floor mounting lug MES-BBL for easier access
  - Mount with additional base levelling unit MES-NIV to level differences in height
  - Mount on U profiles or I profiles
- Floor and wall mounting
  - Floor mounting and
  - Wall mounting bracket MES-WW

### Securing screw connections according to specifications

Observe the strength classes and tightening torques specified in this manual, in the assembly instructions and the instructions for the devices and equipment for the screw connections. This is the only way to guarantee the type-tested properties of the product. You thus avoid:

- overexpansions or breaks,
- lower current-carrying capacity,
- higher transition resistances,
- increased heating.

Instructions about the screw connections are provided in the section "Internal fitting by the panel builder".

### Recommendation

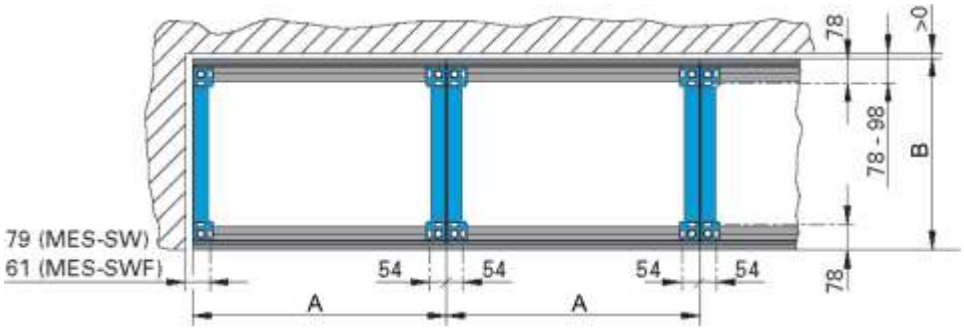
Mark the nuts, screws and counterparts that you tightened to the specified tightening torque. Colour, smudge-proof and heat-resistant acrylic paint is suitable for the narrow coating of paint.


1) screw connection tightened to the tightening torque marked with blue paint

Example of marking screw connections

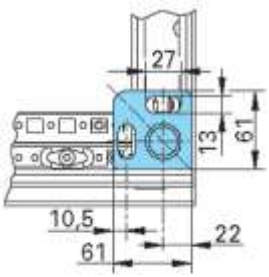
## Setting up and aligning the first enclosure

| Step | Action |
|---|---|
| 1 | Set up the first enclosure. The first enclosure is the outer enclosure on the left or right. |
| 2 | Fasten the first enclosure to the floor before you line it up to the following enclosure. When fastening the enclosure, make sure the enclosure is vertically aligned, for example, using the base levelling unit MES-NIV. The enclosure must be fastened to the floor with at least 4 screws.<br>If the unit is fastened to the floor and wall using the wall mounting bracket MES-WW, the first enclosure is also fastened to the wall. |




Perforation for floor mounting

A: Field width
B: Field depth




Detail dimensions of corner perforation

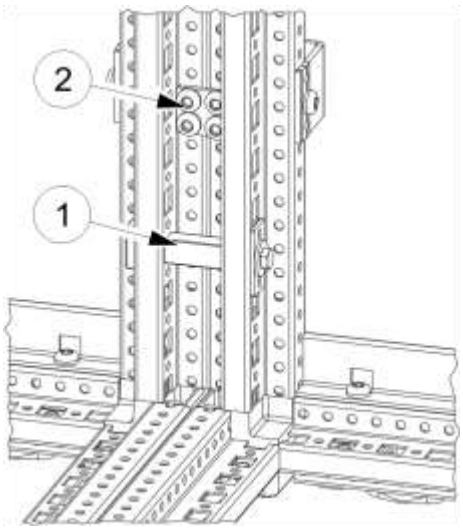
Floor mounting with base corner piece

Use of floor mounting lug MES-BBL for easier accessibility

Base levelling unit with MES-NIV

### Connecting the second enclosure

| Step | Action |
|---|---|
| 1 | Transport the next enclosure in the planned order for assembly at the installation site. |
| 2 | Fasten the second enclosure to the floor. When fastening, make sure the enclosure is vertically aligned. The enclosure height must be level with the first enclosure. The fronts of both enclosures must also be aligned. The second enclosure must be fastened to the floor with at least 4 screws. |




Internal connection options
of enclosures mounted in a row:

| | |
|---|---|
| 1 | with bolts MES-FVB (set) |
| 2 | with perforated plate MES-FV |

Position of internal connections of enclosures mounted in a row, at least 4 connections

- The connections can be additionally supplemented by the combination transport lug MES-KT on the roofs

### Connecting additional enclosures in a row

➢ Connect the remaining enclosures in a row following the same procedure.

### With double-front installation: Rear panel removed

➢ Leave out one rear panel out when combining enclosures in depth.

In the case of double-front installation (combination of two enclosures in depth and back-to-back assembly), one enclosure with a rear panel is assembled with another enclosure without a rear panel. Omitting the rear panel on one of the enclosures serves to prevent noise due to vibrations.

### Connecting and checking main busbars

➢ To connect the main busbars, refer to the section "Internal fitting by the panel builder".
➢ On completion of the work, refit the removed covers (blank covers and access covers).

# 7 Installation and connection

### Work for electricians

The electrical installation and connection to the mains is carried out by an electrically skilled person or an electrically skilled person with special training.

### Chapter index

## 7.1 Cable routing

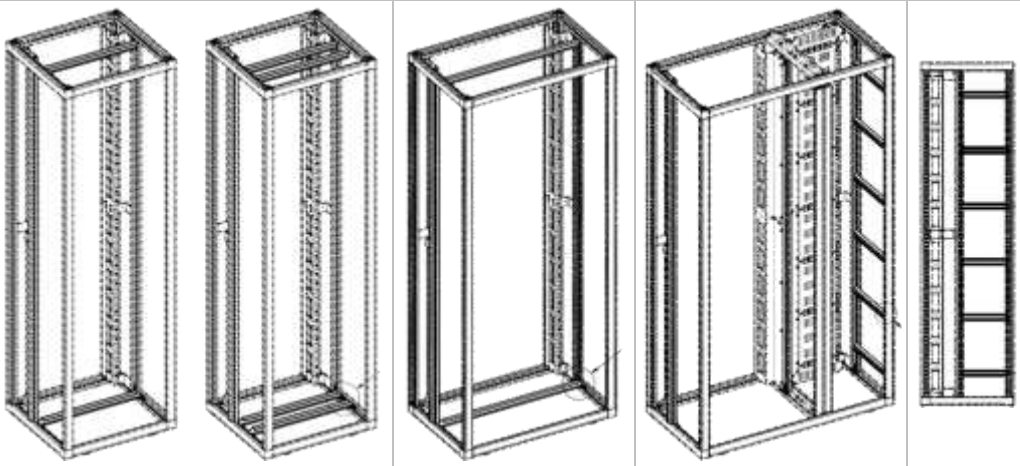
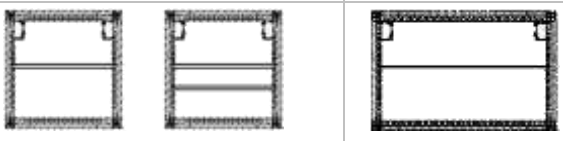
For optimum cable routing and cable installation, the following strain relief rails can be selected and ordered as individual items or pre-assembled ex works.

### Overview of strain relief rails

| Enclosure type | Enclosure width | Enclosure depth | Rated current | Quantity [1] | Product number | Reference | Product number pre-assembled |
|---|---|---|---|---|---|---|---|
| U-PW powerway | 400 mm | 600 / 800 mm | < 1000 A | 1 | 753-411-140 | U-CSRPWS14 | 653-411-140 |
| U-PW powerway | 600 mm | 600 / 800 mm | < 1000 A | 1 | 753-411-160 | U-CSRPWS16 | 653-411-160 |
| U-PW powerway | 600 mm | 600 / 800 mm | < 1000 A | 2 | 753-411-260 | U-CSRPWS26 | 653-411-260 |
| U-PW powerway | 800 mm | 600 / 800 mm | < 1000 A | 2 | 753-411-280 | U-CSRPWS28 | 653-411-280 |
| U-PW powerway | 1000 mm | 600 / 800 mm | < 1000 A | 2 | 753-411-200 | U-CSRPWS20 | 653-411-200 |
| U-FL fuseline | 600 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-060 | U-CSRO060 | 653-413-060 |
| U-FL fuseline | 850 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-085 | U-CSRO085 | 653-413-085 |
| U-FL fuseline | 1100 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-110 | U-CSRO110 | 653-413-110 |
| U-FL fuseline | 1350 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-135 | U-CSRO135 | 653-413-135 |
| U-SV sasil vertical | 600 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-060 | U-CSRO060 | 653-413-060 |
| U-SV sasil vertical | 850 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-085 | U-CSRO085 | 653-413-085 |
| U-SV sasil vertical | 1100 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-110 | U-CSRO110 | 653-413-110 |
| U-SV sasil vertical | 1350 mm | 600 / 800 mm | (all) | 1 [2] | 753-413-135 | U-CSRO135 | 653-413-135 |
| U-CW(l) combiway | (all) | 600 / 800 mm | (all) | 6 [3] | 753-414-006 | U-CSROC | 653-414-006 |
| U-S(l) slimline | (all) | 600 / 800 mm | (all) | 6 [3] | 753-414-006 | U-CSROC | 653-414-006 |

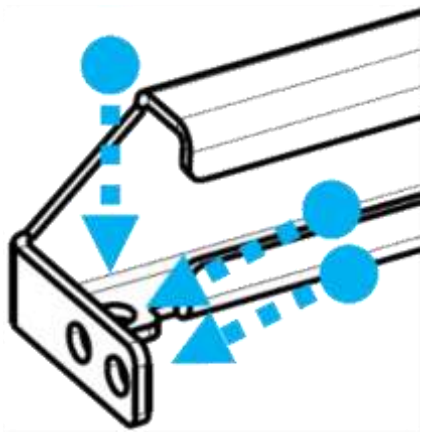
[1] Quantity of strain relief rails included in the product number
[2] Set includes one strain relief rail per enclosure. Specify additional strain relief rails in parts list.
[3] Set includes six strain relief rails per enclosure. Specify additional strain relief rails in parts list.

### Strain relief rail sample illustrations

| Enclosure | U-PW powerway | U-FL fuseline<br>U-SV sasil vertical | U-CW(l) combiway<br>U-S(l) slimline |
|---|---|---|---|
| Isometric view and side view |  | | |
| Top view |  | | |

### Strain relief rail screw fitting

The strain relief rails can be mounted from above (1 x) and from the side (2 x) with screw fittings.



Mounting positions of screw fittings

- Both screw fittings can be used at the same time for additional stability and if there is sufficient space.
- If the side screw fitting only is possible, two screw fittings must be mounted on each side.

### Connecting outgoing cables

➢ Observe the following basic recommendations when connecting the outgoing cables to the installed devices.

- In the case of Form 4b of internal separation by cable partitions for the outgoing cables, you must pull the cable through the cable partitions before fastening it in the devices. Observe the manuals for the enclosure types for this purpose.

➢ Observe the minimum bending radii.
➢ Avoid high loads on the outgoing connections of the devices. To do this, install cable guides and clamps in the vicinity of the outgoing units to provide strain relief and pressure relief.

- The cables must not be routed between active copper busbars. They must not touch any active copper busbars either.
- The outgoing connections of the devices must be established with the correct torque in accordance with the specifications of the device manufacturers.

➢ Route the cables into the planned spaces. Install cable entries, a cable insertion flange or cable entry grommets to meet the required protection type.
➢ Fasten the cables every 400 mm.

## 7.2 Compliance with EMC rules

When installing ready-to-connect switchgear and controlgear assemblies, electromagnetic compatibility must be ensured. The electrician must observe the known installation regulations as well as the manufacturer's regulations. This is done to rule out mutual interference of the installed equipment and the immediate surroundings.

When assembling, fitting and wiring low-voltage switchgear and controlgear assemblies, observe the following supplementary assembly or installation rules:

- As a rule, only CE-marked equipment may be installed, insofar as you are regulated by EU guidelines. Observe additional assembly rules and installation rules regarding EMC in exceptional cases. It may be necessary to read about them in the technical documentation of the built-in devices.
- EMC environment (according to EN 61439-1): The user specifies the requirements for environment A or B. During intended operation in environment A, environment B or another environment, restrictions may apply depending on the individual case. The user may be required to take appropriate countermeasures to avoid causing unwanted electromagnetic interference. The manufacturer/installer is then required according to EN 61439-1 (supplementary sheet 1, section 8.11) to provide a corresponding note in the operating instructions.

**EMC environment B**

Refers to public low-voltage networks, such as for residential, commercial and light manufacturing sectors. Strong sources of interference, such as arc welding equipment, are not covered by this environment.

**EMC environment A**

Refers to non-public or industrial low-voltage networks/areas/equipment including strong sources of interference.

**Failure effects if installation is not EMC-compliant**

If installation is not EMC-compliant, at least the following failure effects may occur:

- Malfunction of measuring devices
- Malfunction of communication devices
- Failure of regulations
- Malfunction of other electrical devices operated on the high-voltage network
- Coupling of high-frequency faults of frequency converters into the network
- Radiation of high-frequency parts by clocked output voltages
- Interference voltages in neighbouring lines by high-frequency leakage currents to earth
- Errors that occur sporadically
- Failures up to the destruction of devices or parts of the system
- Occurring interfering sources or interference sinks

Installation is not EMC-compliant if, for example

- the shielding was not carried out properly,
- the functional earthing was not carried out properly,
- the forward conductor and return conductor are routed separately,
- the lower-level cable routing was not performed in an orderly fashion,
- if metallic casing parts are not connected in a HF-compliant manner.

**Testing and verifying immunity and interference**

EMC requirements must be verified by tests in accordance with the EN 61439 standard for finished switchgear and controlgear assemblies.

- Installed operating equipment must be designed according to the defined environment (environment A or environment B) with regard to its immunity.
- Installed operating equipment must comply with the relevant EMC product standards and generic standards.

**Conditions eliminating the need to check immunity and interference**

- It is not necessary to check and verify the EMC immunity and EMC interference of the switchgear and controlgear assembly if
  - the installed operating equipment is designed according to the defined environment (environment A or environment B) and complies with the relevant EMC product standards and generic standards and
  - the specifications of the operating equipment manufacturer for installation, wiring and arrangement in relation to mutual interference are observed and
  - the EMC specifications set forth in the EN 61439-1 standard, including the annex J, are observed.
- It is not necessary to check and verify the EMC immunity and EMC interference of the switchgear and controlgear assembly if the switchgear and controlgear assembly does not contain any integrated electronic circuits and electronic operating equipment.
- It is not necessary to check the immunity
  - if the switchgear and controlgear assembly does not contain any electronic operating equipment under normal operating conditions. Electromagnetic interference is only generated during occasional switching operations. The duration of the interference only lies in the millisecond range. The requirements for electromagnetic interference are considered fulfilled.
  - for devices that only have passive components in the electronic circuits.

**Minimum scope of test for EMC immunity**

The test for EMC immunity is based on environment A or environment B and includes at least the following:

- Testing the immunity against the discharge of static electricity
- Testing the immunity against high-frequency electromagnetic fields
- Testing the immunity against fast transient electrical interference/bursts
- 1.2/50 µs and 8/20 µs test of the immunity against surge voltages
- Testing the immunity against conducted high-frequency electromagnetic fields
- Testing the immunity against power-frequency electromagnetic fields
- Testing the immunity against voltage drops and temporary interruptions
- Testing the immunity against harmonics in the supply

  ➢ Observe the specifications in the EN 61439 and EN 61000 standards.

## 7.3 Measures to ensure EMC-compliant installation

**Measures to ensure EMC-compliant installation**

An electrical installation (system, devices, components) must operate in a manner that is intended in a specified electromagnetic environment without influencing this environment in an unauthorised manner through electromagnetic effects.

- Electrical installations may not interfere with the intended use of other installations or equipment in an unauthorised manner.
- Electrical installations may not be disrupted in an unauthorised manner.
- All installed electrical equipment must meet the relevant requirements for electromagnetic compatibility (EMC) and the applicable guidelines and standards. The protection objective is to prevent the mutual electromagnetic interference of devices.
- EMC components in this case include the electrical system, including line system, reinforcement structures and corresponding air-conditioning systems.

**Observing basic EMC aspects**

At least the following EMC aspects are essential:

- ➢ Consider a system in its entirety.
- ➢ Include the internal and external lightning protection in the EMC analysis. The electromagnetic compatibility (EMC) of switchgear is directly connected with the measures for internal and external lightning protection.
- ➢ Observe the sources and sinks of interference of all high-voltage equipment and low-voltage equipment.
- ➢ Observe the network structures with regard to the EMC requirements and stray currents.
- ➢ Optimise the equipotential bonding system, including the line paths (routes) and metal structures as well as shields.

**Implementing the spatial separation of EMC areas**

Spatial separation of the EMC areas in the switching enclosure is beneficial. With its clear spatial distribution, the unimes H power distribution system supports the functional and spatial separation of the functional areas. Make sure to divide into different EMC areas of different power/interference levels in the enclosure.

- ➢ Position high outputs and low outputs in separate areas where possible.
- ➢ Separate the different output levels using internal partitions/partition walls. Observe the arrangement of the components in the switching enclosure and the manufacturer's instructions/manuals.
- ➢ Ensure the protection of sensitive assemblies and components by encapsulation using shielded casing or compartmentalised assembly supports in the switching enclosure.
- ➢ Also observe the EMC area classification for the cabling and clamping devices.

- Maintain sufficient distance between the cabling routes of EMC-sensitive line networks.
- Divide the terminal compartments into EMC-sensitive groups.
- Observe the space for the shielding measures of incoming cables.

**Line routing and cabling**

- ➢ Spatially separate the different line groups.
- ➢ Route the lines that are susceptible and sensitive to interference separately.

- Avoid routing the lines that are susceptible and lines that are sensitive to interference in one cable compartment.
- The distance between the interfering lines and lines that are sensitive to interference must be at least 100 mm.
- Cross the interfering lines and lines sensitive to interference at a right angle in the switching enclosure.

- ➢ Keep the lines in the switching enclosure as short as possible.
- ➢ Avoid large conductor loops: Route the current-carrying cables as close as possible to the reference potential.
- ➢ Route the forward conductor and the return conductor together along the entire length.

**Use and earth shielded lines**

- ➢ Use shielded lines, especially for lines susceptible to interference such as signal lines. We recommend closed metal cable ducts for unshielded lines. To use the shield effect, route unshielded cables in the corners of the cable duct. The cable ducts must be interconnected across their entire surface and connected to the functional earth.
- ➢ Earth the line shields:

- for the entry into and exit out of the switching enclosure (directly at the entry point or exit point),
- on the devices,
- several times for long lines,
- always at least on both sides.

- ➢ Include line shields and unused cores in the equipotential bonding on both sides. This will prevent dangerous contact voltages.
- ➢ Make sure that no equipotential bonding current is routed via the shield.
- ➢ Create screwed cable glands that are EMC-compliant.

**Implement continuous equipotential bonding**

- ➢ Implement continuous and well-conducting equipotential bonding that is as densely intermeshed as possible between all metallic masses, casings, enclosure covers, enclosure frame and system parts. Extensive metallic and paint-free connections and connections with earthing strips that can handle high frequencies are suitable for this.
- ➢ Equipotential bonding bars are preferred over wire connections.
- ➢ Use the largest possible cross section for the equipotential bonding with earthing strips. Fasten the flat earthing strips with a spring washer to paint-free and grease-free surfaces.
- ➢ Make sure the fastening for the equipotential bonding connections is low inductance with a large conductive surface area.
- ➢ To achieve a better high-frequency connection, screw connections may only be used as an earth connection between bare and unpainted parts.
- ➢ After screwing on metallic parts, check the screw connection for a tight fit with the recommended tightening torque.

**Integrate the cable ducts in the equipotential bonding system**

- Metallic cable ducts that are integrated in the equipotential bonding system between two switching enclosures must be unpainted, metallic bare connections fixed directly on the switching enclosure.
- Metallic cable ducts must be conductively connected and fastened. Earthing strips with a large cross section are suitable for this on metallic bare connection points.

## 7.4 Take into account stray currents

Currents that do not flow over the electrical supply network L1 – L3 and N/PEN during normal operation are referred to the stray currents.

**Impairment of property protection due to stray currents**

Stray currents impair property protection due to

- corrosion, pitting,
- transmission of interfering magnetic fields,
- coupling of low-frequency fields,
- voltage transfers,
- burning shields. Signal cable shields can burn if they do not offer sufficient current-carrying capacity.

**Ensure property protection and personal protection**

Stray currents are not new. They have always been and still are present. The influence of the changed neutral conductor load plays an increasingly important role in stray currents. With the ever-evolving networking of communication and power, the reliability of property protection must be taken into account without neglecting personal protection when designing electrical installations.

**Legal and regulatory requirements (excerpt)**

Protection objective: Electrical devices must function as intended in a defined environment without interfering with or being interfered with by other devices. All electrical equipment must meet the appropriate requirements for electromagnetic compatibility (EMC) and the applicable EMC standards. This means that specifiers and installers of electrical systems must observe the EMC specifications in the guidelines and standards.

- EMC Directive 2014/30/EU and its implementation in national legislation in the EU,
- Ordinance on Electromagnetic Compatibility OEMC, SR 734.5 in Switzerland,
- VDE 0100-443:2016-10/IEC 60364-4-44:2007/A1:2015 (HD 60364-4-443:2016)
- EN 61439 (at least Part 1 and Part 2)
- Basic EMC standards of EN 61000-4-x ... series

**Distribution of PEN conductors in IT systems**

If a significant number of IT devices are expected in buildings, the PEN conductors must be divided into protective earths (PE) and neutral conductors (N) downstream of the feed point. Neutral conductor currents on signal lines must be reduced to prevent electromagnetic compatibility (EMC) problems on the shields of the signal lines.

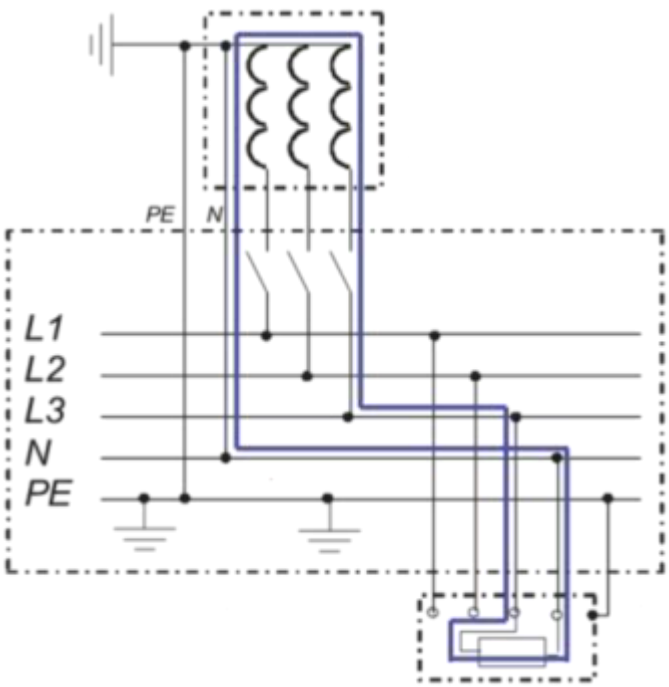
## 7.5 Avoiding stray currents

### Avoiding stray currents

Stray currents can be avoided by selecting the right network system and corresponding earthing concept based on the transformer star point.

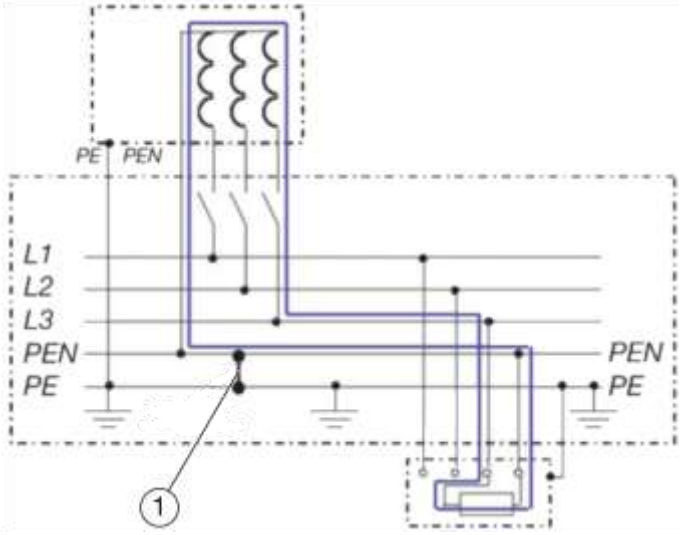
- For reasons of personal and property protection, the PE in the switchgear should be connected to the earthed parts as often as possible.
- In the case of a single supply, a TN-S system or a TN-S system with a central earthing point (CEP) must be provided.
- In the case of multiple incoming units, a TN-S system with a central earthing point (CEP) must be provided.
- The PEN must be routed in such a way that it is insulated along the entire course for the connection from the transformer star point to the central earthing point.
- The low-impedance, earthed N conductor (although it belongs to the active conductors) and the PEN conductors are not dangerous to touch. It is therefore not necessary to route these conductors in the switchgear with protection against accidental contact.
- To reduce low-frequency magnetic fields in the switchgear, the PEN/N conductor should be routed as close as possible to the outer conductors.

### TN-S network system with single supply




TN-S system:
- Recommended for new systems
- No stray currents

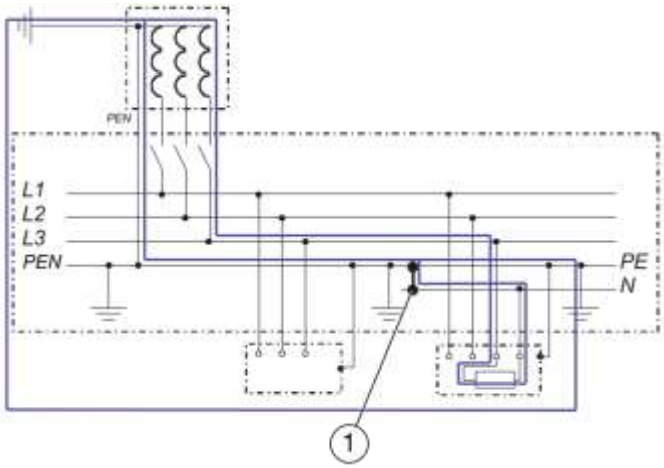
### TN-S network system with an insulated PEN installed with single supply




TN-S system with an insulated PEN installed:
- Recommended for new systems
- No stray currents

- A bridge (1) marked green/yellow between the insulated PEN and PE anywhere in the switchgear is the central earthing point (CEP).
- Attach a notice also: 'Removing the bridge disables the protective measure.'
- Connect the outgoing N conductor or N distribution busbars to the insulated PEN installed.
- The transformer box is connected to the switchgear PE or the equipotential bonding system. Pay attention to the conductor cross section.

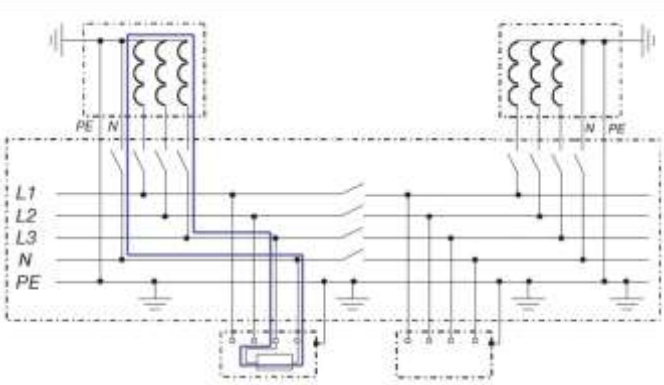
### TN-C-S network system with single supply




TN-C-S system:
- Not recommended for new systems
- Stray currents cannot be avoided

- Bridge (1) between PEN and N must be marked blue

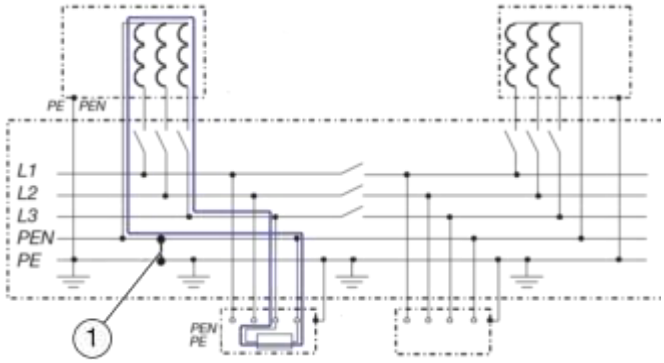
### TN-S network system with multiple incoming units




TN-S system:

- Recommended conditionally
- Stray currents are only avoided with 4-pole switches/circuit breakers in the incoming unit and coupling

### TN-S system with an insulated PEN installed




TN-S system with an insulated PEN installed:

- Recommended
- No stray currents

- A bridge (1) marked green/yellow between the insulated PEN and PE anywhere in the switchgear is the central earthing point (CEP).
- Attach a notice also: 'Removing the bridge disables the protective measure.'
- Connect the outgoing N conductors or N distribution busbars to the insulated PEN installed.
- The transformer box is connected to the switchgear PE or the equipotential bonding system. Pay attention to the conductor cross section.

# 8 Commissioning

**Experienced electrically skilled person**

Commissioning instructions are provided in this section.

**Chapter index**

## 8.1 Commissioning safety instructions

**Hager maintenance service**

Some initial tests require special training with verification according to national regulations. This applies to specific components such as air circuit breakers for example. Hager offers a maintenance service that can also include commissioning services. Qualified Hager service technicians or Hager-licensed panel builder sales partners provide support for commissioning low-voltage power distribution systems and for installing, converting, adjusting and controlling switchgear as well as replacing original accessory parts and performing tests and measurements. Contact your local office about this.

**Risk to life due to electric shock or arc faults!**

Errors in the switchgear can result in electric shocks or arc faults, even after careful inspections. As a result, the first time the system is switched on can be particularly dangerous. This may result in life-threatening injuries and even death.

- Thoroughly clean the switchgear prior to commissioning (vacuum cleaner).
- Remove all foreign bodies.
- The inspection must be performed by an experienced or specially trained electrically skilled person.
- Testing must be performed by an experienced or specially trained electrically skilled person.
- Check all mechanical and electrical connections.
- Carefully check all contacts, operating equipment and devices.
- Personnel not involved in switching must leave the danger zone.

## 8.2 Instructions for commissioning

**Check connections and tightening torques**

- Check the stability of all connections and tightening torques:

- of the electrical connections,
- of the mechanical connections,
- of the switching enclosure fastenings.

- The tightening torques of the operating equipment and at the connections of the installed devices are determined by the manufacturer's instructions.
- All connections must be secured to ensure they do not come loose on their own.
- Test tightening torques are 15 percent less than tightening torques. Observe the tightening torques in the section "Internal fitting by the panel builder".

**Carry out a visual inspection**

The initial test must be performed by a suitable electrically skilled person with the corresponding experience or relevant special training. The initial test must be performed so that no risks arise due to accidents, fires or explosions.

The initial test consists of:

- Inspections,
- commissioning,
- testing.

**Inspection**

The inspection includes checking the electrical switchgear, including the operating equipment and devices, to ensure they are in perfect working order. This step checks whether the selected operating equipment meets the safety requirements of the operating equipment standards and established engineering standards. The inspection includes both the equipment exterior/environment and the internal fittings. The initial test requires time and a high level of attention. The initial test includes at least the following:

- In particular, check protection against direct and indirect contact of active parts and the protective measures against electric shock.
- Check the basic protection and basic insulation.
- Check the additional insulation for fault protection.
- Check all necessary covers for personal protection.
- Check protection against thermal influences.
- Check the selection of operating equipment, such as lines, with regard to the current-carrying capacity and voltage drop.
- Check the protective devices and monitoring devices.
- Check the identification of the protective earth and neutral conductor as well as the identification of the circuits and protective devices.
- Check that the operating equipment is easily accessed for maintenance purposes.
- Check the installation for obvious insulation errors, such as

- clamped conductors or damaged cables,
- faulty connection points,
- moisture.

### Initial commissioning after testing and inspection

| WARNING | |
|---|---|
|  | **Risk due to electric shocks, arc faults, burns or explosions.**<br>**Due to undetected errors, the first time the system is switched on can be dangerous. It may result in serious bodily injuries or death.**<br>➢ Comprehensive testing and inspection prior to initial commissioning<br>➢ Initial commissioning only by experienced or specially trained electrically skilled personnel<br>➢ Secure the danger zone |

After the inspection, an electrically skilled person with the relevant experience or special training performs tests and measurements. Only measuring devices that have been developed with a particular focus on safety may be used for measurements during the initial test. They must meet the safety standards.

At least the following tests are performed by means of testing and measurements:

| Step | Action |
|---|---|
| 1 | Measure the consistency of the conductors and protective earths |
| 2 | Measure system insulation resistance |
| 3 | Ensure protection via protective separation |
| 4 | Measure insulation impedance in non-conductive environment |
| 5 | Test automatic deactivation of the power supply |
| 6 | Measure voltages, polarity, phase sequence of the conductors |
| 7 | Carry out functional testing of the devices and operating equipment |
| 8 | Carry out functional testing of the additional equipment |

### Safety measures prior to recommissioning

Observe the following precautionary measures if the switching enclosure was switched off for a longer time period:

- Perform a visual inspection, including all fastenings and connections,
- Observe the instructions for initial commissioning when doing this,
- Make sure that no foreign bodies, aids or tools have been left behind in the switching enclosure,
- Clean all components,
- Check the insulation by inspecting it,
- Take insulation measurements,
- If necessary, remove moisture and condensation.

**Identification of the switchgear and controlgear assembly**

Identification, name plates and warning signs must:

- be attached in legible condition,
- and be permanently legible. If necessary, have them cleaned by an electrically instructed person or an electrically skilled person.

According to EN 61439-2, the information on the identification plates for switchgear and controlgear assemblies includes:

- Name of the manufacturer of the switchgear and controlgear assembly or their trademark
- Unique type designation or identification number or another symbol for requesting the necessary information from the manufacturer of the switchgear and controlgear assembly,
- Identification of the date of manufacture,
- Information in relation to the relevant part of standard EN 61439.

If the switchgear and controlgear assembly contains operating equipment that may have residual contact current and charges by capacitors after disconnection, for example, a warning message must be provided
(EN 61439-1 (section 8.4.5)).

**Create or supplement routine verification**

A routine verification must be performed on each finished switchgear and controlgear assembly (according to EN 61439-1 (section 11) and EN 61439-1, supplementary sheet 1 (section 14.2) and EN 61439-2 (section 11)). The system and operating equipment inside the system are subject to design verifications. However, these do not prevent errors from creeping in during assembly or generally during the production process for example.

- The routine verification is used to detect errors in materials and production. Routine verification contributes to the safe functioning of the finished switchgear and controlgear assembly.
- Routine verification must include the construction requirements for the switchgear and controlgear assembly as well as the behaviour of the switchgear and controlgear assembly.

**NOTICE**

- ➢ The panel builder can find planning instructions and checklists for the declaration of conformity as well as a writeable record for the routine verification in the Hager guidelines for 'Project planning and design of switchgear according to DIN EN 61439 (VDE 0660-600)'.
- ➢ The panel builder must observe any additional safety requirements or standards depending on the country where the system is installed.
- ➢ Also observe the instructions for the installed components/devices.

## 8.3 Final commissioning work

**Perform sealing measures**

- Perform sealing measures to meet the required protection type.
- Carry out corrections as necessary.

**Complete installation work**

- At the end of the installation work, perform cleaning and another visual inspection.

**Remove transport locks**

- Remove any installed transport locks.

**Mount loose equipment**

- Mount any loose equipment.
- Fasten loose parts.

**Clean insulating parts**

- Clean all insulating parts with a (lint-free), anti-static cloth.

**Remove foreign bodies**

- Remove all remaining pieces of cable and foreign bodies from the enclosures.
- Also remove all residual dust from the enclosures and on the exterior of the enclosures.
- After cleaning, use a light to check that there are no other foreign objects or tools left in the enclosures.

***NOTICE***

**Do not use compressed air for cleaning.**

- Use a vacuum cleaner for final cleaning.

When using compressed air, there is a risk that remnants will accumulate on current-carrying parts.

# 9 Control and operation

### Not to be operated by ordinary persons

This section provides instructions on control measures, operation and faults occurring during operation. The switchgear and controlgear assembly is not intended to be operated by ordinary persons.

### Chapter index

## 9.1 Personnel requirements

**Operation of the systems**

Operation includes all activities that are necessary for the electrical system to function.

This includes:

- Switching,
- Monitoring,
- Performing tests and configuring settings,
- Repair and electrotechnical and non-electrotechnical work.

**Control**

Controlling electrical systems and electrical operating equipment includes activities such as:

- Observation,
- Switching,
- Controlling,
- Regulating,
- Adjusting,
- Monitoring,
- Repair activities.

**No operation of the power switchgear and controlgear assembly by laypersons**

The electrical system must not be repaired by non-professional electrical personnel. Operating procedures may only be performed on a power switchgear and controlgear assembly:

- By electrically skilled personnel or electrotechnical specialist personnel or
- By electrically instructed personnel.

Access and switching operations by unauthorised personnel must be prevented and all disconnectors and actuator equipment must be secured against reconnection:

- By effective barriers,
- With padlocks,
- By blocking elements
- And suitable prohibition signs.

**Wear personal protective equipment**

To ensure safe system operation, the electrotechnical specialist personnel / electrically skilled person or the electrotechnically instructed person must use suitable tools, depending on the activity. Personal protective equipment (PPE) must be worn during switching and any live work.

- Check the personal protective equipment for visible damage prior to each use.
- The personal protective equipment includes wearing a suitable helmet with face shield or a flame-retardant hood.
- The personal protective equipment includes wearing suitable, flame-retardant, and arc-tested work clothing and standing on an insulating mat.

## 9.2 Operating protective devices under loads

| WARNING | |
|---|---|
|  | **Risk due to electric shocks, arc faults, burns or explosions. Unauthorised, accidental or careless switching can result in serious accidents. They may result in serious bodily injuries or death.**<br>➢ Only authorised personnel may perform switching operations.<br>➢ Prevent access and switching operations by unauthorised personnel.<br>➢ Suitable protective equipment must be worn for each switching operation.<br>➢ Observe the five essential rules and the five safety rules before and after all work performed on the system. |

Switching operations on and operating the HRC fuses under voltage/load may only be performed:

- By authorised personnel (electrically skilled person or electrotechnically instructed personnel),
- While wearing protective equipment.

Access and switching operations by unauthorised personnel must be prevented and all disconnectors and actuator equipment must be secured against reconnection:

- By effective barriers,
- With padlocks,
- By blocking elements,
- And suitable prohibition signs.

Switching operations and the actuation of HRC fuses under load are only allowed by authorised personnel if the authorised person:

- Checks the personal protective equipment for visible damage prior to each use,
- Uses a permanently attached cuff for HRC fuses and HRC plug-in grips,
- Wears a suitable helmet with face protection or a flame-retardant hood,
- And wear suitable, flame-retardant and arc-fault-tested work clothing and
- Stands on an insulating mat.

With switch disconnectors, sudden switching operations must be observed by authorised personnel to prevent burn-up hazards.

## 9.3 What to do in the case of faults

In the case of faults, such as a short circuit, observe the following points:

- The system manager must be notified immediately.
- Faults may only be rectified by electrically skilled personnel.
- Faulty electrical operating equipment must not be used if there are immediate dangers associated with its handling. Faulty electrical operating equipment must be decommissioned until it is repaired.

If, due to operational reasons, faulty operating equipment cannot be decommissioned, you must:

- ➢ immediately notify the system manager about this,
- ➢ limit the hazard using suitable measures, such as blocking off the area and using signs.

After the faults are rectified, an electrically skilled person with experience in testing must perform and document tests verifying that the switchgear is in proper condition. Tests are explained in sections "Commissioning" and section "Inspection and maintenance".

## 9.4 Repairs

Errors frequently result in high currents. This may, for example, result in damage to:

- Covers,
- Devices, components and equipment,
- Busbars.

If errors occur:

- the system manager must be notified,
- the switchgear must be disconnected by an electrically skilled person.

In the event of faults, repairs may only be carried out by an electrically skilled person. On completion of repairs, if there is no corresponding confirmation from a repair company, an electrically skilled person with experience in testing must check to ensure that the switchgear is in proper working order. This test must be documented and incorporates the scope of the initial test.

**Hager customer service**

This manual is not to be considered as work instructions for performing major repair work. Hager customer service or a Hager-licensed panel builder sales partner will be happy to perform this work for you. If errors occur, please contact the local Hager office for this.

## 9.5 Cleaning

For operational safety reasons, contamination or pollution must be removed.
During cleaning, observe at least the following safety points:

**Cleaning work performed on disconnected systems by an electrically skilled person**

- Cleaning work must be performed by electrically skilled personnel. Electrotechnically instructed personnel must have been specially trained for cleaning work and it must be ensured that work is performed in a voltage-free state.

  ➢ The system must be disconnected for cleaning work.
  ➢ Observe residual energies and static discharge:

  - Secure stored energies. There may be dangerous residual energies present in electrical systems.
  - With existing compensation systems, you have to wait at least two minutes after you have switched off the capacitors. The main fuses may only be removed and maintenance work may only be performed after this waiting time.
  - Prior to starting activities during installation work, disconnect the system and make sure it is statically discharged before touching the devices. Static voltages can result in personal injuries.
- During cleaning work, an electrostatic charge in the jet nozzle may result in direct and indirect hazards to personnel.
- Observe external voltages.
- Observe hot surfaces and resulting burn risks

**Only in exceptional cases: Cleaning work under voltage**

- Cleaning work under voltage may only be performed in exceptional cases.
- If necessary cleaning work is performed on a switchgear and controlgear assembly that has not been disconnected, the protective measures for working under voltage must be taken into consideration.
- Arc faults must always be expected when performing cleaning work under voltage.

  ➢ When performing cleaning work under voltage, personal protective equipment must be used to protect against arc faults.
  ➢ During cleaning work, an electrostatic charge in the jet nozzle may result in direct and indirect hazards to personnel.

# 10 Inspection and maintenance

## Important information for safe operation

This section provides information on inspection, maintenance and recurring tests. Preventive maintenance is important for the safe operation of power distribution systems.

## Chapter index

## 10.1 Requirements of personnel for inspection and maintenance

Maintenance refers to measures that contribute to delaying wear and tear and prolonging the service life of the enclosures. They must be carried out during the usage period of the enclosures.

**General information on maintenance:**

- An initial test of the switchgear must be performed after expansion, modifications, retrofitting and repairs.
- In the case of faults, such as short circuits, the switchgear must be tested.
- Tests must be performed at suitable intervals.
- Tests and maintenance are important for ensuring safety and preventing faults.
- Tests and maintenance extend the service life of the products.

**Maintenance measures:**

- Inspections,
- Measurements,
- Testing,
- Documenting test results,
- Eliminating the identified defects,
- Documenting the performed work and changes.

**Testing only by electrically skilled personnel with testing experience**

Tests must not result in hazards. The requirements for the personnel performing the tests are therefore particularly high:

- Tests must be performed by an electrically skilled person who has testing experience.
- A test requires in-depth knowledge of:
  - Regulations on protective measures,
  - The measuring devices to be checked and only then to be used.
- Some tests require special training with verification according to national regulations. This applies to specific components such as air circuit breakers for example. Hager offers a maintenance service by qualified service technicians. If you are interested, please contact your local Hager office.
- Electrically instructed personnel may only perform tests under the direction and supervision of an electrically skilled person if the measuring and test devices are available for the measurement and testing tasks.

## 10.2 Testing intervals for recurring tests

In the interest of ensuring a high level of operational safety, the switchgear should be tested at least every 4 years by an electrically skilled person and verified that it is in perfect working order (recommendation by German Social Accident Insurance regulation 3 (DGUV) (formerly BGV A3). National or insurer regulations may extend or shorten the test interval. Shortened intervals may be defined to verify proper functionality and safe operation due to:

- the demands on the operating equipment,
- external influences,
- changes to the operating parameters and ambient conditions,
- special kinds of rooms and installations according to DIN VDE 100 group 700,
- complex operating conditions,
- the specifications of the device or operating equipment manufacturers set forth in their instructions,
- applicable national standards and regulations.

Hager recommends performing the following at least once a year:

- a visual inspection (external inspection),
- switching operations of the individual protection devices and switchgear,
- document all tests, for example, in an inspection book.

**Recommended recurring tests**

| System/equipment | Test interval | Type of test | Tester |
|---|---|---|---|
| Electrical systems and stationary operating equipment | 4 years<br>5 years in Switzerland | For perfect working order | Electrically skilled person |
| Electrical systems and stationary operating equipment in operating sites, special kinds of rooms and installations according to DIN VDE 100 group 700 | 1 year | For perfect working order | Electrically skilled person |
| Protection devices, such as<br>- Air circuit breakers/ACB<br>- Disconnector<br>- Moulded case circuit breakers/MCCB<br>- Load break switches<br>- NH fuse switches | 1 year<br>Recommendation | - External visual inspection<br>- Switching operation/functional test | Electrically skilled person |

## 10.3 Test scope

The following minimum maintenance conditions must be met in the unimes H power distribution system (based on VDE 0100 Part 610 for switchgear and controlgear assemblies):

The recurring tests during commissioning, in the event of changes, after faults or at suitable intervals include:

- Inspections,
- Measurements,
- Testing,
- Documenting test results,
- Eliminating the identified defects, for example, by replacing the faulty operating equipment or devices,
- Documenting the performed work and changes.

**Testing based on inspection**

The inspection includes checking the electrical switchgear, including the operating equipment and devices, to ensure they are in perfect working order. It includes an outside inspection and an inspection of the internal fittings.

- ➢ Check the protection against direct and indirect contact of active parts.
- ➢ Check the basic protection and basic insulation.
- ➢ Check the additional insulation for fault protection.
- ➢ Check all necessary covers for personal protection.
- ➢ Check for signs of ageing effects.
- ➢ Check for mechanical, chemical, electrical and thermal stress.

| External inspections, tests | Test values, comments, remedy |
|---|---|
| Test the ambient conditions | - Effectiveness of the ventilation system and heating of operating space,<br>- Room temperature, relative humidity, aggressive air components, dust |
| Accessibility, minimum distances | Escape routes, minimum distance over the roof |
| Visual inspection of covers and jacketings | Damage that adversely affect the protection type, such as:<br>- Missing parts<br>- Locks on doors, enclosure walls<br>- Paintwork damage<br>- Ventilation openings<br>- Roof plate<br>- Position of withdrawable part (operating position, disconnected position) |
| Fitting devices in the device compartment | - According to planning documentation,<br>- According to project planning rules |

| Internal inspections, tests | Test values, comments, remedy |
|---|---|
| Visual inspection of the individual operating equipment and devices in the device compartment | - Switchgear: See separate list<br>- According to manufacturer instructions/manuals<br>- Internal conditions after contamination, pollution, moisture<br>- Form or colour changes that may result due to thermal influences<br>- Insulation values<br>- Contact distances<br>- Contacts |
| Cables and connections in the cable compartment | - Incoming units and outgoing units according to the planning documents<br>- Strain relief, bending radii<br>- Insulation distances<br>- Covers, partitions, touch protection |
| Visual inspection of contact points | If necessary, retighten with the corresponding tightening torques or replace the connections |
| Inspection of the contact points in main circuits | - If necessary, retighten with the corresponding tightening torques or replace the connections<br>- Check the transport connections<br>- Check the busbar insulation: Flashovers, contamination, pollution, discolourations, cracks, creepage distances |
| Visual inspection for damage of individual conductors | Insulation state |
| Visual inspection of the busbars | - Discolourations, pollution, contamination, cracks<br>- Screw connection |

### Testing based on trials

Trials are used to determine the key variables for operational safety. This includes, for example:

- The effectiveness of switches, test buttons and locking mechanisms.
- The functionality of the signalling equipment,
- The mobility of the withdrawable technology in rail guides.

| Tests | Test values, comments, remedy |
|---|---|
| Functional inspection of switchgear | - Protection devices: see separate list<br>- According to manufacturer instructions/manuals |
| Functional inspection of the installed measuring devices (if installed) | Instructions/manuals for measuring devices |
| Check the adjustment values of the operating equipment and devices according to the switching documents | Instructions/manuals, circuit diagram, routine verification |

**Tests based on measurements**

- Check the measuring devices before each use.
- Check the insulation condition by measuring the insulation resistance.
- Perform measurements and control tests according to the switching documents.

**Hager Service**

In order to ensure its systems operate with a high degree of reliability, Hager offers a maintenance and service concept implemented by qualified service technicians that conforms to standards. These services include commissioning, conversion and maintenance.

- Contact your local office about this.

## 10.4 Testing the installed components

### Minimum scope of tests

When testing and carrying out maintenance on installed components, observe at least the following points:

- ➢ Take the respective instructions of the protection device manufacturer into consideration
- ➢ Before working on the system, disconnect it from the power supply.

- If, in justified exceptions, work has to be performed under voltage, observe the regulations for working on live parts.
- If, in justified exceptions, the work must be performed in the vicinity of live parts, observe the regulations for working in the vicinity of live parts.

- ➢ If necessary, carry out a risk assessment before starting the work.
- ➢ Check whether the operating equipment is suitable for the influences at the place of use. In this case, check the incurred:

- electrical loads,
- thermal loads,
- chemical loads,
- physical loads.

- ➢ Check the effectiveness of the protective earth connection.

- Hager recommends switching the system on and off at least once a year for ACBs and MCCBs.
- We recommend: Check the casing, the load break switches (HRC strips) and/or NH fuse switches, the electronics if applicable, transformers and the fuse links at least for the possible adverse effects and damage specified below.

- ➢ After tripping of the switchgear
- ➢ Also, always check the downstream protection devices.

### Check the casing

| **Impairment/damage** (The minimum instructions to be observed) | **What to do?** |
|---|---|
| Casing is damaged on the outside | Replace the casing or casing part |
| Lock is damaged | Replace the lock, removable cover or device |
| Contamination and the resulting impairment of the function or insulation properties of the casing | Clean, replace if necessary |
| Insects have penetrated the system or plant growth | Clean, replace if necessary |
| The enclosure ventilation is damaged | Clean, remove elements hindering thermal convection, test according to the project planning rules/enclosure type manual |
| Attachments missing | Replace parts |
| Fastenings are loose | Secure the fastenings, observe the assembly instructions/manual |
| Components/operating equipment were assembled loosely | Risk assessment, secure the components according to the assembly instructions |

| Impairment/damage (The minimum instructions to be observed) | What to do? |
|---|---|
| Mechanical lock damaged | Lubricate with water-repellent, anti-corrosion and lubricating agent |
| Mobility of the withdrawable part of the load break switches damaged | Remove dust, lubricate rail guides with water-repellent, anti-corrosion and lubricating agent |

## Test the load break switches/NH fuse switches

| Impairment/damage (The minimum instructions to be observed) | What to do? |
|---|---|
| Protection device is damaged externally | Replace the protection device |
| The actuating elements are no longer in the necessary position or the spring-operated switchgear for the load break switches is damaged | Replace the protection device |
| Contamination impairs function or insulation properties | Clean, if necessary replace the protection device |
| Required identification plates are missing | Retrofit the identification plates, if necessary, replace the lid |
| Attachments missing | Perform risk assessment, supplement attachments |
| Covers are loose | Perform risk assessment, reattach covers |
| Faulty cable assembly | - Assemble the cables according to the instructions<br>- Tighten to the corresponding torque according to the manufacturer's instructions |
| Faulty cable and terminal combination with regard to the material type or cable cross sections | Replace terminals or load break switches, if necessary replace cables |
| Visible traces of increased heating | - Perform risk assessment<br>- Temperature measurement with suitable measuring devices<br>- If necessary, switch off<br>- Redimension the circuit with new project plan/plan<br>- Document |
| Designed load contradicts the actual load of the protection device | - Perform risk assessment<br>- Switch off<br>- Redimension the protection device and/or fuses with new project plan/plan<br>- Document |
| Connected current transformers contradict the actual load | If necessary, replace the current transformers |
| Monitoring elements do not function | - Perform risk assessment<br>- Reinstall or replace the protection device |

**Check the HRC blade fuse links**

| **Impairment/damage**<br>(The minimum instructions to be observed) | **What to do?** |
|---|---|
| Fuse links are not positioned correctly | Position correctly or insert new fuse links |
| Fuse link does not correspond to the application | Replace the fuse link to suit the application |
| External damage to a fuse link | Replace the fuse link |
| Fire extinguishing sand trickling out | - Replace the fuse link<br>- Remove the sand |
| Visible traces of increased heating | - Temperature measurement with suitable devices<br>- Perform risk assessment<br>- If necessary, switch off<br>- Redimension the circuit with new project plan/plan<br>- Document |
| Actual load of the fuse link contradicts the designed load | - Perform risk assessment<br>- If necessary, switch off the system<br>- Replace protection device or redimension the fuse link |
| Information about the data and brands of the initial fitting missing | Subsequently enter the missing information |
| Different fuse link types were used | - Perform risk assessment,<br>- Insert new and uniform fuses |

## 10.4.1 Test the ACB and MCCB

**Tests for ACB and MCCB**

- Test all line connections on the circuit breaker, function and connections
- Test the contact strength of the circuit breaker's main terminals
- Mechanical and electrical testing of the switching functions of all switchgear
- Check for correct functioning of the electrical and mechanical accessory parts
- Trigger test of the switchgear according to the manufacturer's specifications and documentation
- Check the auxiliary contact connections
- Functional test of the motor drive
- Functional test of operating voltage/undervoltage triggers
- Functional test of switch-on triggers
- Functional test of the locking mechanism
- Functional test of the switching position indicators
- Functional test of the drives
- Technical update of the devices according to the manufacturer's specifications

  ➢ Document the tests and measurements for each switchgear in the corresponding reports.

# 11 Storage, decommissioning and disposal

## Decommissioning, recycling

Observe the instructions in this section for storage, decommissioning and disposal.

## Chapter index

## 11.1 Personnel requirements

Switchgear and controlgear assemblies and individual enclosures must only be decommissioned by electrically skilled personnel and electrotechnically instructed personnel. Decommissioning requires:

- precise knowledge of the work assigned by an electrically skilled person,
- precise knowledge of possible hazards in case of improper behaviour,
- precise knowledge of the necessary protection devices and protective measures.

## 11.2 Decommissioning

Faulty electrical operating equipment must not be used if there are immediate dangers associated with its handling. Faulty electrical operating equipment must be decommissioned until it is repaired.

If, due to operational reasons, the system cannot be decommissioned, you must:

- notify the system manager immediately,
- limit the hazard through suitable measures, such as blocking off the area and using signs.

To decommission an enclosure, observe the following points:

- Secure the work area.
- De-energise the system.
- Verify that the system is free of voltage.
- In doing so, observe the 5 safety rules and the 5 essential rules.
- When working in the vicinity of live parts, perform additional safety measures, such as:

- protection through covers or safety barriers,
- protection through distance.

## 11.3 Storing switching enclosures and components

The power distribution system and all the accompanying components are designed for fixed indoor installation. Switching enclosures, devices and components must therefore be stored or temporarily stored as follows:

- upright at a dry, clean and ventilated indoor location,
- protected against rain and moisture or condensation,
- with relative humidity below the maximum value of 50% at 40°C,
- protected against extreme temperatures (storage temperature -5°C to 40°C),
- protected against dust, sand and chemicals,
- protected against external damage,
- protected against slipping or falling
- The stability is secured on a stable, solid surface or by fixing against falling. Observe the weight of the enclosures and their centre of gravity.

The user determines special requirements for the storage packaging according to EN 61439-1, supplementary sheet 1, section 10.5, if there are special application requirements.

Hager recommendations: Use undamaged transport packaging until the final assembly at the installation site.

**Precautionary measures after storage**

During subsequent transport:

- ➢ Prior to transport, perform a visual inspection for foreign objects left behind,
- ➢ Check the stability of the components and the entire switching enclosure,
- ➢ If necessary, clean the enclosure exterior and replace any missing parts,
- ➢ Observe the instructions for safe transport.

In the case of subsequent commissioning:

- ➢ Allow the switching enclosure to acclimatise for several hours and open the doors
- ➢ Perform an initial test and check all fastenings and connections,
- ➢ Observe the instructions for initial commissioning and maintenance,
- ➢ Make sure that no foreign bodies, aids or tools have been left behind in the switching enclosure,
- ➢ Clean all components,
- ➢ Check the insulation,
- ➢ If necessary, remove moisture and condensation.

## 11.4 Disposal and recycling

**Recycling HRC fuses**

Worn-out HRC fuses contain valuable materials even after disconnection. We recommend: Dispose of worn-out HRC blade fuse links via the appropriate recycling system. The HRC/HH recycling system in Germany or similar systems in other countries is suitable for this, for example. You can also recycle small quantities in an environmentally-friendly manner for free:

- at electrical/electronic equipment retailers,
- at electricity suppliers,
- small collection points,
- and other collection points.

**Disposing of components and operating equipment**

If environmentally hazardous substances are disposed of incorrectly, significant damage to the environment may occur. To protect the environment, observe the following points:

- ➢ Observe the local applicable environmental and health protection regulations.
- ➢ Observe the local applicable recycling regulations.
- ➢ Dispose of the following correctly and in an environmentally-friendly manner:

- electrical operating equipment and electrical components,
- metal parts, rubber and plastic parts,
- paint and coating material.

- ➢ Observe the disposal and recycling instructions provided in the manuals for the operating equipment.

# 12 Technical data

**NOTE**

The technical data listed may change as part of the ongoing development of Hager products.

**Technical data for enclosure types**

The technical data for the unimes H system enclosure types are listed with the description of the corresponding enclosures.

**Current technical data**

The current technical data can be viewed on the Hager homepage.

**Chapter index**

## 12.1 General data

### General characteristic features of the switchgear and controlgear assembly interfaces

| | | | | |
|---|---|---|---|---|
| Degree of pollution | 3 | | | |
| Rated insulation voltage $U_i$<br>Material group<br>Minimum creepage distances | 250 V<br>I<br>3.2 mm | 250 V<br>II<br>3.6 mm | 250 V<br>IIIa<br>4 mm | 250 V<br>IIIb<br>4 mm |
| Rated insulation voltage $U_i$<br>Material group<br>Minimum creepage distances | 400 V<br>I<br>5 mm | 400 V<br>II<br>5.6 mm | 400 V<br>IIIa<br>6.3 mm | 400 V<br>IIIb<br>6.3 mm |
| Rated insulation voltage $U_i$<br>Material group<br>Minimum creepage distances | 630 V<br>I<br>8 mm | 630 V<br>II<br>9 mm | 630 V<br>IIIa<br>10 mm | 630 V<br>IIIb<br>10 mm |
| Rated insulation voltage $U_i$<br>Material group<br>Minimum creepage distances | 1000 V<br>I<br>12.5 mm | 1000 V<br>II<br>14 mm | 1000 V<br>IIIa<br>16 mm | - |
| Relationship between nominal voltage of the power supply and the rated peak withstand current of the equipment<br>(IEC EN 61439-1 Table G.1) | Overvoltage category | | III | IV |
| | 230 / 400 V | | 4 kV | 6 kV |
| | 400 / 690 V | | 6 kV | 8 kV |
| | 690 / 1000 V | | 8 kV | 12 kV |

| | | |
|---|---|---|
| Type of earth connection | TN-S | Neutral conductor (N) and protective earth (PE) are routed separately in the entire system. |
| | TN-C | Neutral conductor (N) and protective earth (PE) are consolidated in a single conductor, the PEN conductor, in the entire system |
| | TN-C-S | In the distribution network, the neutral conductor (N) and the protective earth (PE) are combined (PEN conductor) and separated in the consumption system. |
| | TT | With the TT network, the star point of the transformer and the bodies of the equipment are directly earthed. The protective earth is thus not in contact with the neutral conductor. |
| | IT | The IT network does not have a direct connection between active conductors and earthed parts; the bodies of the electrical system are earthed. |
| Installation site | Fixed indoor installation | |
| Protection type | Devices which can be operated from the outside ≤ IP3x<br>Devices which can be operated from behind the door ≤ IP4x | |
| Access permission | - Electrically skilled person<br>- Electrically instructed person<br>- Authorised person (restricted access only) | |
| Outer design | Enclosure design | |
| Protection against mechanical influence | IK8 | Configurations with glazed doors |
| | IK10 | Configurations with solid and module doors including fixed fronts |
| Type of functional unit design<br>Explanation:<br>Position 1, main circuit/device input<br>Position 2, main circuit/device outlet<br>Position 3, auxiliary circuit<br>F = fixed connection (with tools)<br>W = guided connection<br>D = drawable connection (without tools) | **Fixed system -F (fixed installation)**<br>Device input and device outlet with fixed connection technology: FFF, FFD<br>**Removable system -R**<br>Device input with guided connection technology, device outlet with fixed connection technology: WFF, WFD<br>**Withdrawable system to plug in-W**<br>Device input and device outlet with guided connection technology, auxiliary circuit pluggable: WWD<br>**Withdrawable system -W**<br>Device input, device outlet and auxiliary circuit with guided connection technology: WWW | |

## Service index IS (for U-CW(I) only)

| | |
|---|---|
| Fixed system/fixed installation (-F) | - 111 (h3+ MCCB only) |
| Withdrawable technology (-R) | - 123 (for h3+ MCCB and LL bars)<br>- 323 (for h3+ MCCB) and 223 (for LL bars) |
| Withdrawable system to plug in (-W) | - 333 (h3+ MCCB only) |
| Withdrawable system (-W) | - 333 (h3+ MCCB only) |
| Explanation:<br>Position 1: Operation<br>Position 2: Maintenance<br>Position 3: Expansion | Service index definition see.<br>1xx<br>x1x<br>xx1 |

1 = Switch off complete system
2 = Switch off relevant functional unit
3 = Switch off power to relevant functional unit, test in test position

## Additional characteristics

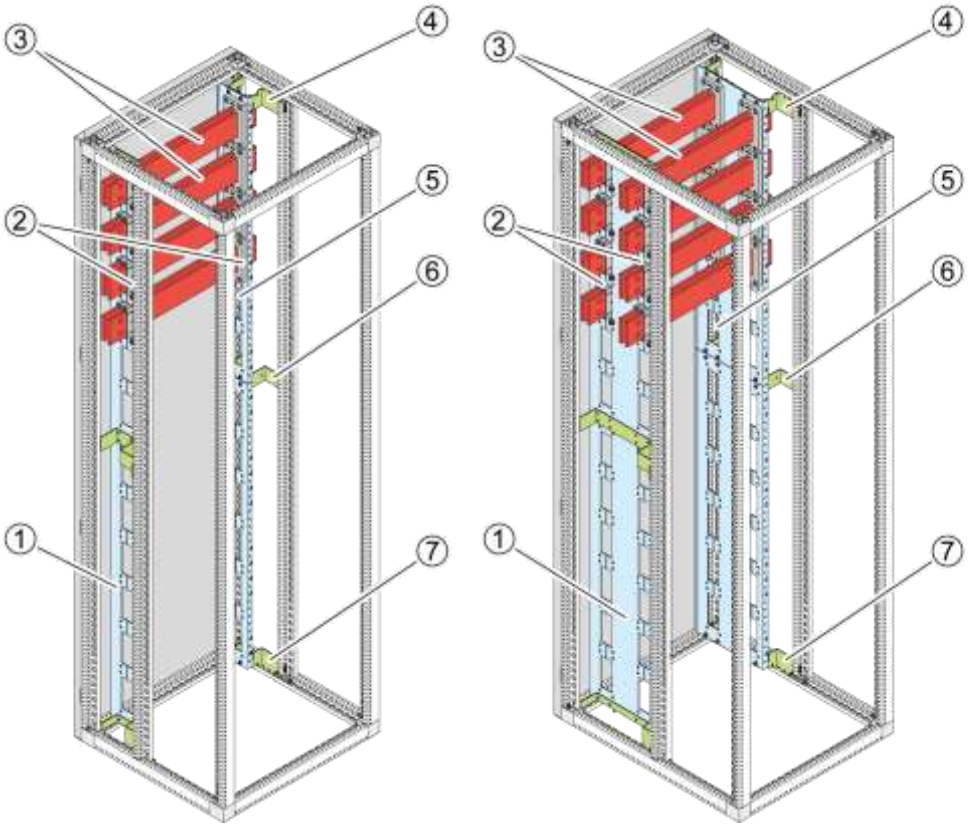
| | | |
|---|---|---|
| Type of short-circuit protective devices | Distribution and final circuit: Circuit breaker or fused devices | |
| Device operation | HF = behind front<br>FE1 = front installation level 1 (in front)<br>FE2 = front installation level 2 (front with cover plate) | |
| Measures for protection against electric shock | Basic protection (covers and casings) ≥IP2xB, IP2xD<br>fault protection | |
| Dimensions | Enclosure widths | Individual for each enclosure type |
| | Enclosure heights | 2000 mm, 2200 mm |
| | Enclosure depths | H-SaS ≤ 2950 A: 600 mm<br>H-SaS ≤ 4000 A: 800 mm |
| | Base heights | 100 mm, 200 mm |

## General operating conditions

| | |
|---|---|
| Ambient temperature | -5°C to 40°C<br>24 h average value ≤ 35°C |
| Humidity | ≤ 50% at 40°C |
| Altitude | ≤ 2000 m above sea level |

## 12.2 Main busbar system (H-SaS)

### H-SaS components in the basic enclosure




Enclosure depth 600 mm
(2 x Cu for each terminal)

Enclosure depth 800 mm
(4 x Cu for each terminal)

| | |
|---|---|
| 1 | Retaining plate |
| 2 | Busbar support U- FSTK.. for main busbars of the main busbar system H-SaS |
| 3 | Main busbars/busbars of the H-SaS<br>2 x Cu for each terminal (enclosure depth 600 mm): Rated current $I_{nA}$ max. 2950 A<br>4 x Cu for each terminal (enclosure depth 800 mm): Rated current $I_{nA}$ max. 4000 A |
| 4 | Mounting bracket for top/bottom retaining plate |
| 5 | Access opening in the retaining plate: For Form 2b of internal separation, it must be covered with:<br>- Access cover (if H-SaS behind access cover)<br>- Blank cover (if no H-SaS behind blank cover) |
| 6 | Mounting bracket of the middle retaining plate |
| 7 | Mounting bracket for top/bottom retaining plate |

### Characteristics of the main busbar system

- H-SaS installed in the rear of the system allows space for expansion
- short-circuit proof up to $I_{cw}$ (1s) 120 kA/$I_{pk}$ 268 kA
- high short-circuit resistance with large distance between supports at the same time
- type-tested according to EN 61439-1/ 2
- increases system safety
- 6 defined rated current levels
- N conductor cross section up to 200%

- H-SaS can be positioned at 3 different heights
- simultaneous load possible at 2 different heights, the position of the H-SaS can be changed without any space loss on the side (via U-TK ACB coupling enclosure)
- design in standard copper busbars Cu-ETP-R240
- H-SaS does not protrude over the enclosure width, allowing the individual enclosures to be replaced and simplifying transport
- short connection paths to the distribution busbars
- high system availability after an incident
- limited mechanical damage after an incident, limited to enclosure width (ability to replace individual enclosure)
- end-to-end H-SaS for enclosures mounted in a row via the busbar brackets to the transport divider U-TT/U-TTS or U-TTK
- service-friendly accessibility via access covers/U-TTK transport dividers (U-TTK accessible from the front and rear)
- cable entry and cable outlets can be arranged individually at the top or bottom
- easy and fast support assembly via pre-assembled retaining plates
- saves assembly time thanks to easy and simple assembly principle
- drill-free screw connection with standard M12 screws

**Advantages of the H-SaS connection technology**

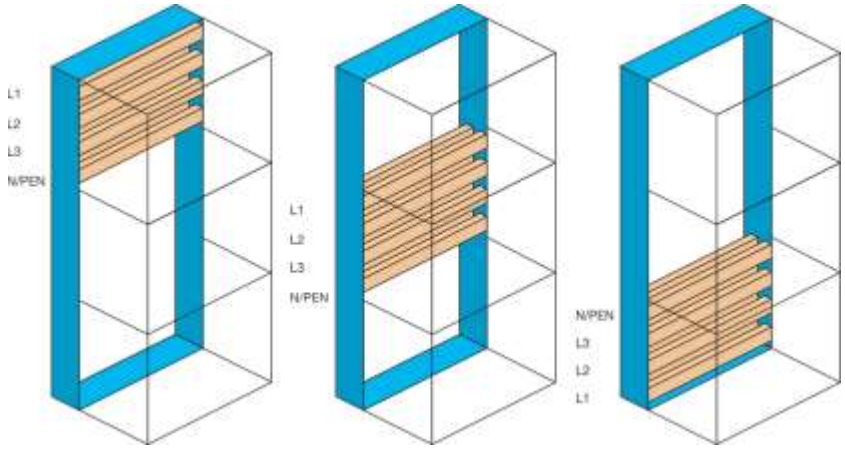
The easy connection (coupling) of the main busbars in the unimes H power distribution system offers several advantages:

- Easy and time-saving bar assembly
- Coupling possible without space loss on the side
- Short connection paths
- Reduction of power loss
- Reduction of the copper requirements
- Maintenance-free screw connections (for designs according to this manual)
- Subsequent replacement of individual enclosures in copper-plated enclosure rows possible

**Main busbar space**

The main busbars can be positioned at three different heights. You can position the main busbars at the bottom, in the middle or at the top. This facilitates the installation of up to 3 main busbar systems (H-SaS) in the enclosure. Two main busbar systems may be loaded simultaneously. The flexible H-SaS positioning in the enclosure makes it possible to change the position of the main busbar system without any space loss on the side (via a coupling enclosure (U-TK)). The short connection paths to the distribution busbars also make it possible to reduce the copper requirements.

### Phase positions of the H-SaS




**NOTICE**

Up to three main busbar systems can be installed at the same time, but only a maximum of two main busbar systems may be loaded at the same time.

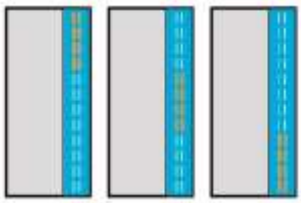
### System enclosures - Examples

Basic enclosure U-BS

Basic enclosure U-BSI

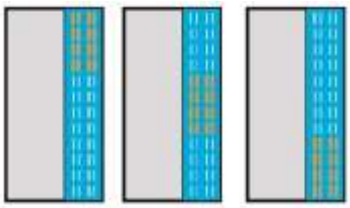
### Arrangement of the main busbars

The rated current $I_{nA}$ determines the necessary enclosure depth and arrangement of the main busbars. With rated currents of 2950 A and higher, enclosure depths of 800 mm with 4 Cu busbars per terminal are used for the main busbar system.



H-SaS positions for enclosure depth 600 mm
(enclosure side view)

Max. rated current $I_{nA}$:
Cu 2 x 30 x 10: 1250 A
Cu 2 x 40 x 10: 1600 A
Cu 2 x 60 x 10: 2000 A
Cu 2 x 80 x 10: 2950 A



H-SaS positions for enclosure depth 800 mm
(enclosure side view)

Max. rated current $I_{nA}$:
Cu 4 x 60 x 10: 3200 A
Cu 4 x 80 x 10: 4000 A

**NOTICE**

**Special version for enclosure depth of 800 mm**

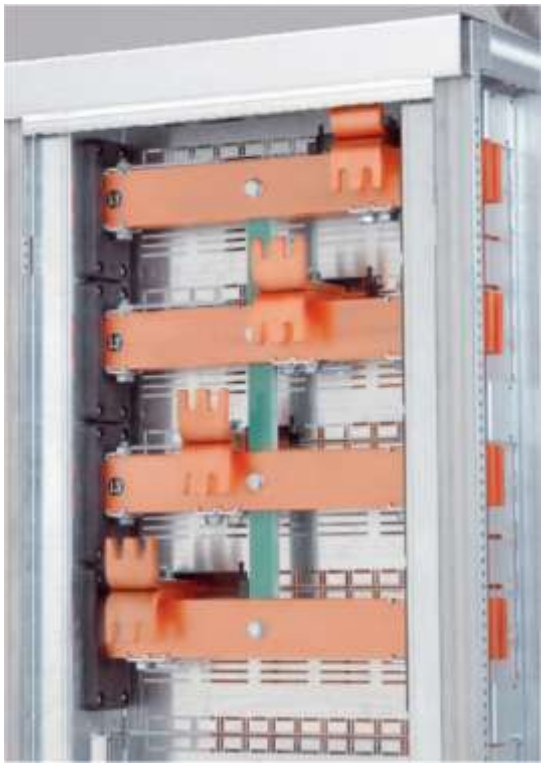
When installing 2 x nn x 10 busbar systems, the busbar system must be placed closer to the device compartment. The space in the area around the rear panel thus remains free.

**Special version for enclosure depth of 800 mm with pSLB**

➢ Follow the instructions in the relevant manual on passive arc fault protection for the correct implementation.

➢

**Main busbars without/with perforation(s) for fibreglass bars**

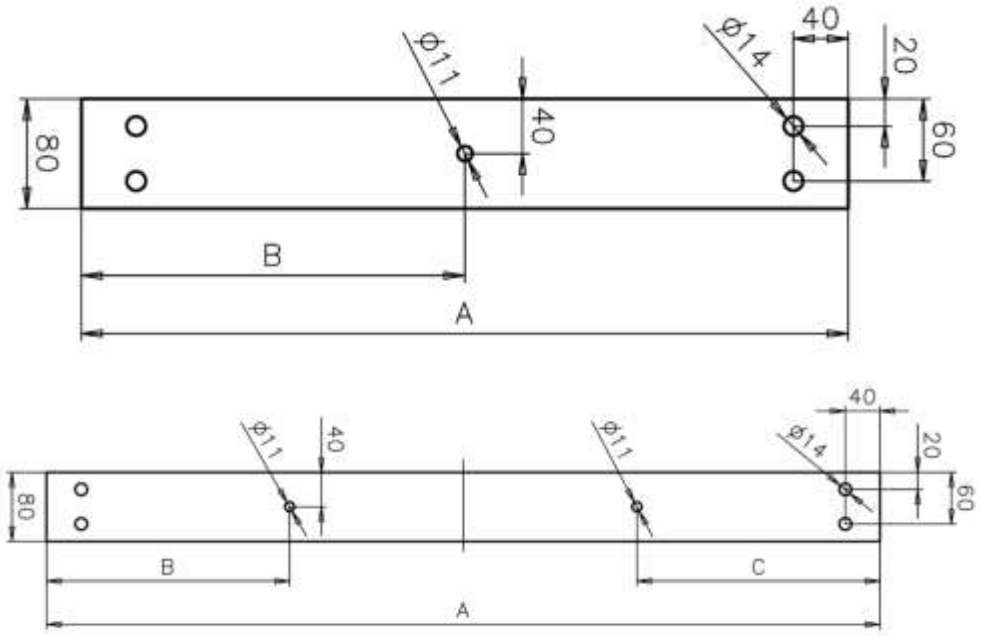


H-SaS reinforced with fibreglass bar (FG)

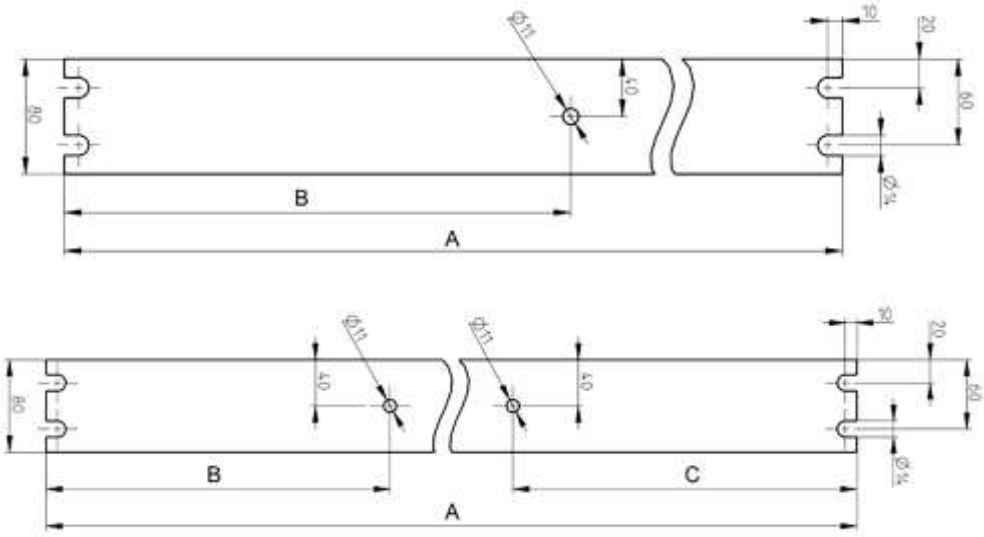
A distinction is made in the unimes H power distribution system between the different short-circuit resistances of the main busbars: without reinforcement from additional fibreglass bars or with reinforcement from additional fibreglass bars. Fibreglass bars (FG) are mounted to increase the short-circuit resistance of the main busbar system H-SaS.

There are different perforations for the fibreglass bars FG depending on the enclosure width, enclosure type and version (with/without cable compartment):

**Perforations for fibreglass bar for transport divider lugs U-TT/U-TTS (examples)**




**Perforations for fibreglass bars for compact transport divider U-TTK (examples)**




Examples of production drawings:
In this case, Cu 80x10 with fibreglass bar perforation(s) for transport divider lugs U-TT/U-TTS as well as for compact transport divider U-TTK

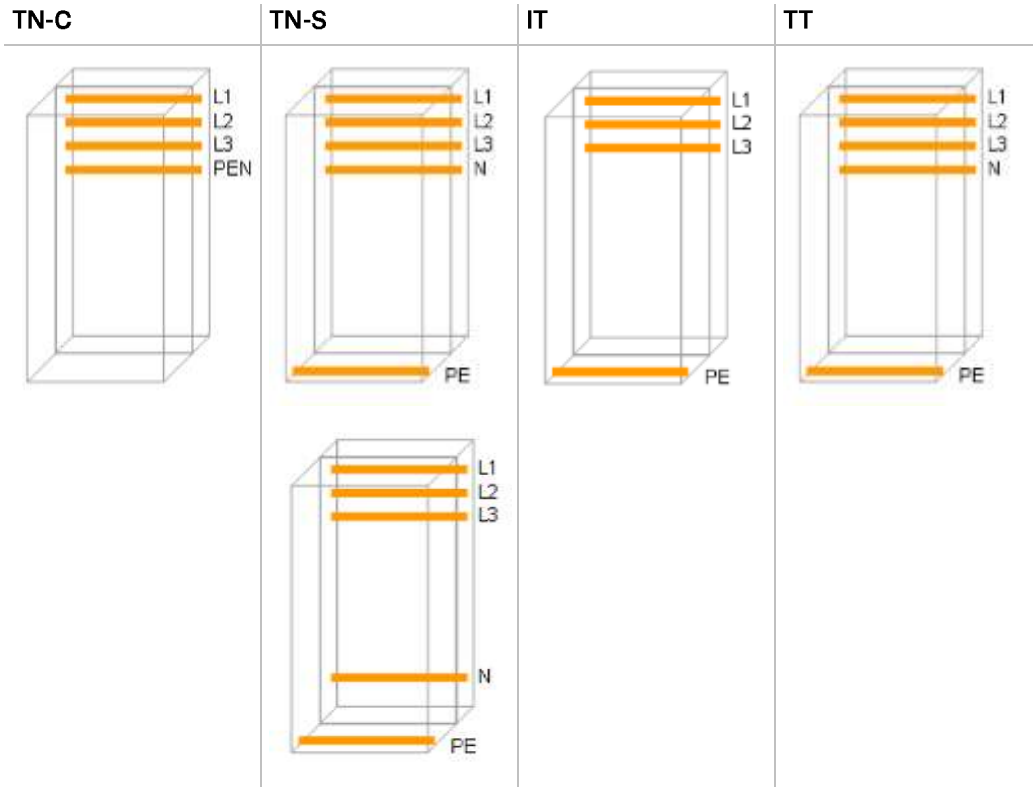
**A**: Length

**B**: Distance to the middle hole for the left/middle fibreglass bar

**C**: Distance to the middle hole for the right-hand fibreglass bar

The perforation(s) for reinforcement with fibreglass bar FG vary depending on the busbar type, enclosure width, enclosure type and version (with/without cable compartment). The panel builder can refer to the production drawings for the relevant dimensions.

➢ For more information, refer to the section "Internal fitting by the panel builder".




Overview of busbar system routing according to the type of low-voltage network/ type of earth connection

## 12.3 Spatial distribution data

### Installable devices in the device compartment

A wide range of devices can be installed in the type-tested unimes H power distribution system, thus enabling the easy implementation of switchgear and controlgear assembles in accordance with EN 61439-1/-2. Using the CE declaration of conformity of the original manufacturer, Hager, reduces the effort required to prepare the CE declaration of conformity.

The devices to be installed determine the type of enclosure and the space required when designing the system. With a wide selection of available enclosure dimensions, the power distribution system provides the matching enclosure width. The structure of the device compartment is customised to the device type.

| | |
|---|---|
| **Devices** | depending on enclosure type,<br>enclosure type and enclosure dimensions are selected depending on the devices to be installed |
| **Device installation/ Electrical connections** | Depending on the enclosure type: |
| Fixed system: FFF, FFD (Fixed connection -F) | U-PWE, U-PWK, U-TE, U-TK, U-T2, U-LE, U-LK, U-CW(I), U-FL, U-MUN, U-BS(I) |
| Removable system: WFF, WFD (Removable connection -R) | U-CW(I), U-S(I), U-SV, U-BS(I) |
| Withdrawable system to plug in: WWD (Withdrawable connection -W) | U-CW(I), U-BS(I) |
| Withdrawable system: WWW (Withdrawable connection -W) | U-PWE, U-PWK, U-TE, U-TK, U-T2, U-CW(I) |
| **Accessories** | Depending on the enclosure type and devices |
| **Installation position** | Vertical/horizontal depending on the enclosure type |
| **Installation level** | Depending on the enclosure type: FE1, FE2, behind front HF |
| **Device outlet** | Depending on the enclosure type: bottom, top, combined, left, right |
| **Protection type (without equipment)** | Depending on the enclosure type: IP 20 - IP 40/IP 41 |

The installable devices and the special features to be taken into consideration are described in the manuals for the individual enclosure types.

- ➢ Observe the manuals for the individual enclosure types.

## Terminal compartment data

| | |
|---|---|
| **Position of cable connection compartment** | Depending on the enclosure type: top, bottom, left, right |
| **Enclosures with integrated cable compartment (KRI)** | U-BSI, U-SI, U-CWI |
| **Connection direction** | Enclosure roof or enclosure base, cable compartment |
| **Position of outgoing N/PEN conductor** | - Horizontal device installation: at the rear<br>- Vertical device installation: top or bottom |
| **Position of outgoing PE conductor** | - Horizontal device installation for enclosures with integrated cable compartment: at the rear or front<br>- Vertical device installation for enclosures with integrated cable compartment: at the front at the top or bottom |

## Multifunctional compartment data: Control compartment/univers N expansion kit

| | |
|---|---|
| **Enclosure types with optional control compartment** | U-S(I) partial extension, U-SV, U-FL, U-BS(I), U-CW(I) partial extension, U-PWE, U-PWK, U-LE, U-LK |
| **Enclosure types with optional univers N expansion kit** | U-S(I) partial extension, U-SV, U-FL, U-BS(I), U-CW(I) partial extension, U-PWE, U-PWK, U-LE, U-LK |
| **Position of multifunctional compartment** | Depending on the enclosure type: top, bottom |

## 12.4 Distribution busbars

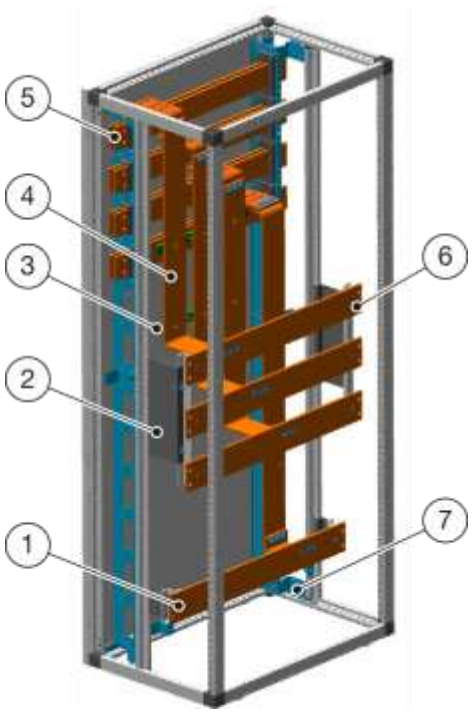
➢ The distribution busbars of the individual enclosure types and the field connection to the main busbar system H-SaS are described in detail in the respective manual for the individual enclosure types.

**Processing time optimised by production drawings**

Hager provides the panel builder with enclosure type-specific assembly drawings and individual component drawings for producing the individual copper parts.

- On receipt of the Cu production drawings, the panel builder can produce the individual Cu parts before the switching enclosures are delivered.
- This optimises the processing time.

**Components of distribution busbar system F-SaS**




| | |
|---|---|
| 1 | N conductor/PEN conductor (in cable connection compartment at bottom)<br>- screwed onto insulation carrier 1-pole LVZIT1<br>- this LVZIT1 is mounted on pre-assembled holding bracket N |
| 2 | Holding bracket insulation carrier U-HFL, pre-assembled<br>- for mounting insulation carrier LVZITFL |
| 3 | Fibreglass bars FG (2 x) to support the field connection (for field connection to the H-SaS at top or bottom) |
| 4 | Field connection (H-SaS field connection at top here) |
| 5 | Main busbar system H-SaS |
| 6 | Distribution busbars L1, L2, L3 (L1 here) mounted on insulation carrier LVZITFL |
| 7 | PE attachment kit pre-assembled (mounted in cable connection compartment at bottom here) |

**Connection technology of the field connection**

- Connections with standard screws
- Connection to the main busbar system without drilling
- Terminated connection brackets ensure short connection paths
- Connections with simple Cu bends possible
- Short construction times thanks to the production/assembly drawings of the connections

## 12.4.1 Post insulators

### Post insulators for field connections

Post insulators U-SI410 are assembled to the short-circuit-proof busbars of the field connections.

The post insulators are secured onto holding brackets for insulators U-HBFI.. or with holding plates U-HPL.

U-TE: Number of insulators U-SI410

| | **ACB 3-pole** | | **ACB 3-pole+N** | | | **ACB 4-pole** | |
|---|---|---|---|---|---|---|---|
| | H-SaS position | | | | | | |
| $I_{nA}$ [A] | top/ bottom | middle ZU/ZO * | top/bottom 450/600 ** | | middle ZU/ZO * | top/ bottom | middle |
| 800 | 6 | 9/10 | 8 | 7 | 10/12 | 7 | 12 |
| 1250 | 6 | 9/10 | 11 | 7 | 12 | 7 | 12 |
| 1600 | 9 | 12/13 | 11 | 9 | 15 | 11 | 16 |
| 2000 | 9 | 12/13 | 11 | | 16 | 11 | 16 |
| 2500 | 6 | 9 | 7 | | 12 | 7 | 12 |
| 3200 | 6 | 9 | 7 | | 12 | 7 | 12 |
| 4000 | 3 | - | 4 | | - | 4 | - |

* ZU = Feed bottom, ZO = Feed top

** For enclosure width [mm]

### U-TK: Number of insulators U-SI410

| | **ACB 3-pole** | | | **ACB 3-pole+N** | | | **ACB 4-pole** | | |
|---|---|---|---|---|---|---|---|---|---|
| | H-SaS position | | | | | | | | |
| $I_{nA}$ [A] | top and bottom | top and middle | middle and bottom | top and bottom | top and middle | middle and bottom | top and bottom | top and middle | middle and bottom |
| 800 | 6 | 10 | 9 | 6 | 11 | 9 | 6 | 11 | 11 |
| 1250 | 6 | 10 | 9 | 6 | 11 | 9 | 6 | 11 | 11 |
| 1600 | 6 | 10 | 9 | 6 | 11 | 9 | 6 | 11 | 11 |
| 2000 | 6 | 10 | 9 | 6 | 11 | 11 | 6 | 11 | 11 |
| 2500 | 6 | 10 | 9 | 6 | 11 | 11 | 6 | 11 | 11 |
| 3200 | 6 | 10 | 9 | 6 | 11 | 11 | 6 | 11 | 11 |
| 4000 | - | - | - | - | - | - | - | - | - |

## 12.5 Characteristics of the switchgear and controlgear assembly for connecting to the mains

### Characteristics for the SK for connecting to the electrical system

**Rated values for voltages**

| | | |
|---|---|---|
| Rated voltage $U_n$ | [V AC] | ≤ 690 |
| Rated operational voltage $U_e$ | [V AC] | ≤ 690 |
| Rated insulation voltage $U_i$ | [V AC] | 1000 |
| Rated impulse withstand voltage $U_{imp}$<br>► minimum clearances | [kV] | 12 ► 14 mm |

**Rated values for currents**

| | | |
|---|---|---|
| Rated current (per incoming enclosure) $I_{nA}$ | [A] | ≤ 4000 |
| Rated current $I_{nA}$ | [A] | |
| - 1x M-BB system | | |
| - Enclosure depth 600 mm | | ≤ 2950 |
| - Enclosure depth 800 mm | | ≤ 4000 |
| - 2x M-BB systems | | |
| - Enclosure depth 600 mm | | ≤ 2x 2600 |
| - Enclosure depth 800 mm | | ≤ 2x 3800 |
| Rated peak withstand current $I_{pk}$ | [kA] | ≤ 268 |
| Rated short-time withstand current $I_{cw}$(1 s) | [kA] | ≤ 120 |
| Rated conditional short-circuit current $I_{cc}$ | [kA] | ≤ 125 |
| Rated frequency $f_n$<br>*(45 - 62 Hz) | [Hz] | 50* |

## 12.6 N/PEN conductor on N/PEN support in the integrated cable compartment

| | | |
|---|---|---|
| Usage | | N/PEN bar support can only be used in enclosures with an integrated cable compartment (U-CWI, U-SI, U-BSI) |
| Cable compartment widths | [mm] | 400/600 |
| Enclosure height | [mm] | 2000/2200 |
| Enclosure depth | [mm] | 600/800 |
| Conductor | | N / PEN |
| Number of terminals | | 1-pole or 2-pole |
| Touch protection | | Optional for N conductor, sliding |
| Installation in the cable compartment | | Left rear |
| Field connection | | Fastening angle of H-SaS to N/PEN conductor in the cable compartment in the unimes H system |
| Material | | Flat copper Cu-ETP R240 |
| Form of internal separation | | 1, 2b |

### Electrical data

| **Rated current** | [A] | **400** | **800** | **1000** | **1250** | **1600** | **2000** |
|---|---|---|---|---|---|---|---|
| Busbar cross section | [mm] | 30 x 10 | 40 x 10 | 50 x 10 | 30 x 10 | 40 x 10 | 50x10 |
| Number of copper busbars | | 1 | | | 2 | | |
| Installation position | | Vertical | | | | | |
| Maximum permissible distance between supports | [mm] | 500 (predefined, see Installation manual) | | | | | |
| Terminal conductor distance | [mm] | 22 ► suitable for M12 (clearance 12 mm) | | | | | |
| Rated operational voltage | [V AC] | ≤ 690 | | | | | |
| Network types | | TN-S/TN-C/TN-C-S/TT/IT | | | | | |
| Connection cross sections | [mm²] | 50, 70, 120, 240, 2 x 185, 2 x 240 | | | | | |

## 12.7 N/PE/PEN on insulators in the integrated cable compartment

| | | |
|---|---|---|
| Usage | | - Assembly on 4 N/PE mounting plates with an insulator (DE)<br>- In enclosures with an integrated cable compartment<br>- In enclosures without an integrated cable compartment<br>- In separate enclosure U-BS |
| Enclosure height | [mm] | 2000/2200 |
| Enclosure depth | [mm] | 600/800 |
| Conductor | | N / PE / PEN |
| Number of terminals | | 1-pole |
| Installation in the cable compartment | | Vertical, rear left |
| Field connection | | Fastening angle of H-SaS to N/PE/PEN conductor in the cable compartment |
| Material | | Flat copper Cu-ETP R240 |
| Field connection position to H-SaS | | Top, middle, bottom |
| Form of internal separation | | 1 |

### Electrical data

| **Rated current** | **[A]** | **1250** | **1600** | **2000** |
|---|---|---|---|---|
| Busbar cross section | [mm] | 60 x 10 | 80 x 10 | 100 x 10 |
| Number of copper busbars | | 1 | | |
| Installation position | | Vertical | | |
| Maximum permissible distance between supports | [mm] | 600 | | |
| Rated operational voltage | [V AC] | ≤ 690 | | |
| Network types | | TN-S/TN-C/TN-C-S/TT/IT | | |
| Connection cross sections | [mm²] | 50, 70, 120, 240, 2 x 185, 2 x 240 | | |

# 12.8 Continuous current and current heat losses of Cu conductors H-SaS

**Continuous current and current heat losses of Cu conductors: without reinforcement***

| **Cu ETP-R240**<br>(e-Cu57 F25) (per terminal) for H-SaS support U-FSTK | | $I_n$ [A] | $I_{pk}$ [kA]<br>Without reinforcement | $I_{cw}$ (1 s) [kA]<br>Without reinforcement |
|---|---|---|---|---|
|  | **2 x 30 x10**<br>- 1 x U-FSTK-30-xx | 1250 | 133 | 60 |
| | **2 x 40 x10**<br>- 1 x U-FSTK-30-xx | 1600 | 145 | 65 |
|  | 2 x 60 x 10<br>- 1 x U-FSTK-60-xx | 2000 | 188 | 85 |
|  | 2 x 80 x10<br>- 1 x U-FSTK-80-xx | 2950 | 188 | 85 |
|  | **4 x 60 x10**<br>- 2 x U-FSTK-60-xx | 3200 | 188 | 85 |
|  | **4 x 80 x10**<br>- 2 x U-FSTK-80-xx | 4000 | 188 | 85 |

*) Continuous currents and current heat losses for bare current busbars with rectangular cross section in indoor installations at air temperature 35°C and busbar temperature > 65°C.

- Dimensional stability of the bar support material: At least 125°C.
- Assessment basis: EN 61439
- Maximum centre-to-centre distance between supports: 660 mm

## Continuous current and current heat losses of Cu conductors: with reinforcement*

| **Cu ETP-R240**<br>(e-Cu57 F25) (per terminal) for H-SaS support U-FSTK | | **$I_n$ [A]** | **$I_{pk}$ [kA]**<br>With reinforcement | **$I_{cw}$ (1 s) [kA]**<br>With reinforcement |
|---|---|---|---|---|
|  | 2 x 60 x 10<br>- 1 x U-FSTK-60-xx | 2000 | 220 | 100 |
|  | 2 x 80 x10<br>- 1 x U-FSTK-80-xx | 2950 | 220 | 100 |
|  | **4 x 60 x10**<br>- 2 x U-FSTK-60-xx | 3200 | 268 | 120 |
|  | **4 x 80 x10**<br>- 2 x U-FSTK-80-xx | 4000 | 268 | 120 |

*) Continuous currents and current heat losses for bare current busbars with rectangular cross section in indoor installations at air temperature 35°C and busbar temperature > 65°C.

- Dimensional stability of the bar support material: At least 125°C.
- Assessment basis: EN 61439
- Reinforcement: Fibreglass bar 1x (2 Cu busbars) or 2 x (4 Cu busbars) per terminal
- Maximum centre-to-centre distance between supports: 660 mm or max. 330 mm distance to fibreglass bars with reinforcement

## 12.9 Reduction factors

### Current reduction at an increased ambient temperature

- Reduced heat dissipation (lower temperature difference)
- Average values of switchgear and low-voltage switchgear

**Ambient temperature/reduction factor**

| 35°C | 40°C | 45°C | 50°C | 55°C |
|---|---|---|---|---|
| 1 | 0.95 | 0.9 | 0.85 | 0.8 |

### Current reduction for altitudes > 2000 m above sea level

- Reduced heat dissipation (lower temperature difference)
- Average values of switchgear and low-voltage switchgear

**Altitude above sea level/reduction factor**

| 2000 m | 3000 m | 4000 m | 5000 m |
|---|---|---|---|
| 1 | 0.95 | 0.9 | 0.85 |

### Current reduction with an increased IP protection type

- Reduced heat dissipation (lower temperature difference)
- Average values of switchgear and low-voltage switchgear

### Rated diversity factor downstream of main circuits

| Number of main circuits | Rated diversity factor | |
|---|---|---|
| | EN 614391/2 | (EN 61439-3) |
| 1 | 1 | 1 |
| 2 and 3 | 0.9 | 0.8 |
| 4 and 4 | 0.8 | 0.7 |
| 6 to 9 | 0.7 | 0.6 |
| 10 and more | 0.6 | 0.5 |

# 13 Appendix

## Abbreviations

| Abbreviation | Description |
|---|---|
| **ACB** | **A**ir **C**ircuit **B**reaker |
| **AGR** | Type designation of the overcurrent relay, integrated into the ACB tempower2 |
| **ALR** | Position signalling switch |
| **aSLB** | Active arc fault protection system |
| **cos ϕ** | Phase shift |
| **CT** | **C**urrent **T**ransformer |
| **D** | **D**rawable, (a plug connection that can be released without the use of tools), see glossary for explanation |
| **DBO** | Low voltage switchgear and control gear assemblies in accordance with DIN EN 61439-1/-3 (Distribution Board intended to be Operated by ordinary persons) |
| **DBO-SG** | Switchgear that can be operated by ordinary persons: Distributor / distribution board |
| **EFM** | **E**lectric **F**use **M**onitoring |
| **EIB** | European Installation Bus |
| **EMC** | Electromagnetic compatibility |
| **-F** | **F**ixed mounting, see glossary |
| **FE** | Functional earth |
| **FE1** | Front installation level FE1: Installation in fixed front (door) |
| **FE2** | Front installation level FE2: Installation in a front consisting of cover plates (produced by the switchgear manufacturer) |
| **F-BB** | Field busbar system, distribution busbar system |
| **(GF)** | **G**round **F**ault on the OCR |
| **GF** | Fibre glass bar in the M-BB |
| **gG** | Fuse operating class: Full range protection, standard type for general use |
| **Sz.** | Size |
| **h3+ MCCB** | moulded-case circuit breakers of the h3+ series |
| **HF** | Installation level HF: Behind front / installation behind door |
| **M-BB** | Main busbar system |
| **HW** | Hollow wall |
| **IK** | Resistance to impacts, protection type |
| **IP** | IP degree of protection (**I**ngress **P**rotection) |
| **LBS** | Switch disconnector (LBS = **L**oad **B**reak **S**witch) |
| **LL bar** | Power switch fuse |
| **(LL HRC bar)** | Short for: ‘Switch disconnector with fuses in bar design’ |
| **LS** | Circuit breaker |
| **LT** | Long-term delay, protective function see also short-term delay (ST) |
| **MA** | Installation manual |

| Abbreviation | Description |
|---|---|
| **MCCB** | Moulded-case circuit breaker<br>**M**oulded-**C**ase **C**ircuit **B**reaker |
| **MU** | Module Unit [mm] |
| **MHT** | magnetic tripping mechanism integrated into the ACB |
| **ModBus** | Communication protocol |
| **N** | Neutral conductor |
| **HRC** | High-voltage high-power... |
| **HRC-S** | Low voltage high power fuse |
| **NP** | N-phase protection on OCR |
| **NT** | Neutral conductor disconnector |
| **OCR** | **O**ver**C**urrent **R**elay |
| **PE** | **P**rotective **E**arth |
| **PLE** | Space unit |
| **PSC** | Power switchgear and controlgear assembly in accordance with 61439-1/-2 |
| **PSC-SK** | SK, can only be operated by a qualified electrician / electrically instructed person (under the supervision of a qualified electrician), cannot be operated by ordinary persons |
| **pSLB** | Passive arc fault protection system |
| **PZ...** | Pozidrive® (screwdriver type) ... (Size) |
| **-R** | **Plug-in connection, plug-in input, screwed output**<br>**R**emovable |
| **RDF** | **R**ated **D**iversity **F**actor,<br>see glossary for explanation |
| **Roc** | RAL of choice |
| **SAB** | Switchgear manufacturer, switchgear manufacturing |
| **BB** | Busbar system |
| **SHT** | **Sh**unt **T**rip Device |
| **Silas/LT** | HRC fuse switch disconnector LT |
| **SK** | Switchgear and controlgear assembly |
| **SK I / SK II** | Protection class I / II |
| **SLS** | Selective circuit breaker |
| **ST** | Short-term delay, protective function<br>See also long-term delay (LT) |
| **SVB** | Special distribution assembly, special distribution assembler |
| **TA** | Partial extension |
| **TP2** | Terasaki ACB tempower2 |
| **TP2-MA** | ACB tempower2 with motor drive AR2 |
| **TP2-SHT** | **Sh**unt **T**rip Device;<br>can be connected to ACB tempower2 |
| **TP2-UVT** | **U**nder**V**oltage **T**rip,<br>can be connected to ACB tempower2 |
| **TP2-TF** | Door flange for ACB tempower2 |
| **TSK** | Type-tested low voltage switchgear and controlgear assembly |
| **U-** | System enclosure unimes H |
| **U-LE** | unimes H system enclosure for incoming and outgoing units, with LBS switch disconnector |
| **U-LK** | unimes H system enclosure: Coupling enclosure with cross couplings, with LBS switch disconnector |

| Abbreviation | Description |
|---|---|
| **U-T2** | unimes H system enclosure: Double incoming / outgoing or coupling enclosure with the option of installing a double incoming unit, with ACB switch disconnector |
| **U-TE** | unimes H system enclosure for incoming and outgoing units, with ACB switch disconnector |
| **U-TK** | unimes H system enclosure: Coupling enclosure with cross couplings, with ACB switch disconnector |
| **U-TT** | Transport divider (copper tabs with screw connections) |
| **U-TTK** | Compact transport divider |
| **univers N SK** | univers N low voltage switchgear and control gear assembly |
| **UVT** | **U**nder**V**oltage **T**rip |
| **VA** | Full extension |
| **VDE** | Verband der Elektrotechnik, Elektronik und Informationstechnik e. V. [Association for Electric Technology, Electronics and IT] |
| **VS** | Distribution enclosure |
| **-W** | **W**ithdrawable connection, see glossary for explanation |
| **WS** | Wall-mounted enclosure |

## Type of earth connection

| Abbreviation | Description |
|---|---|
| T | Earth (from French **t**erre) |
| I | Insulated (from French **i**solé) |
| IT | No direct connection between active conductors and earthed parts; the bodies of the electrical system are earthed (from French **i**solé **t**erre) |
| C | Combined (from French **c**ombiné) |
| S | Separated (from French **s**éparé) |
| TN | TN network (from French **t**erre **n**eutre) |
| TT | TT network: The star point of the transformer and the bodies of the equipment are directly earthed. The protective earth is thus not in contact with the neutral conductor (from French **t**erre **t**erre) |
| TN-C | Protective earth (PE) and neutral conductor (N) are consolidated in one conductor, the PEN conductor, in the entire system (from French **t**erre **n**eutre **c**ombiné). |
| TN-C-S | In the distribution network, the protective earth (PE) and the neutral conductor (N) are combined (PEN conductor) and separated in the consumer system (from French **t**erre **n**eutre **c**ombiné **s**éparé) |
| TN-S | Protective earth and neutral conductor are routed separately throughout the entire system (from French **t**erre **n**eutre **s**éparé) |

## Important formula characters first mentioned in EN 61439-1

| Abbreviation | Description | Standard section EN 61439-1 |
|---|---|---|
| **CTI** | Comparative tracking index | 3.6.16 |
| **ELV** | Low voltage | 3.7.11 |
| **EMC** | Electromagnetic compatibility | 3.8.13 |
| **$f_n$** | Rated frequency | 3.8.12 |
| **$I_c$** | Short-circuit current | 3.8.6 |
| **$I_{cc}$** | Conditional short-circuit current | 3.8.10.4 |
| **$I_{cp}$** | Prospective short-circuit current | 3.8.7 |
| **$I_{cw}$** | Rated short-time current | 3.8.9.3 |
| **$I_n$** | Rated current | 3.8.10.1 |
| **$I_{nA}$** | Rated current of a switchgear and controlgear assembly | 5.3.1 |
| **$I_{nc}$** | Rated current of a circuit | 5.3.2 |
| **$I_{pk}$** | Rated peak withstand current | 3.8.10.2 |
| **N** | Neutral conductor | 3.7.5 |
| **PE** | Protective conductor | 3.7.4 |
| **PEN** | PE/N conductor, PEN conductor | 3.7.6 |
| **RDF** | Rated diversity factor | 3.8.11 |
| **SCPD** | Short-circuit protection device | 3.1.11 |
| **SPD** | Surge protection device | 3.6.12 |
| **$U_e$** | Rated operational voltage | 3.8.9.2 |
| **$U_i$** | Rated insulation voltage | 3.8.9.3 |
| **$U_{imp}$** | Rated impulse withstand voltage<br>rated peak withstand current | 3.8.9.4 |
| **$U_n$** | Rated voltage | 3.8.9.1 |

### NOTE

According to the Low Voltage directive and the EMC directive, EN 61439-1 does not confer a presumption of conformity without another part of the standard being applied. To achieve a presumption of conformity for switchgear and controlgear assemblies, at least EN 61439-1 and EN 61439-2 (Parts 1 and 2 of the standard EN 61439) must be applied.

# 14 Glossary

## A

### ACB

Air circuit breaker (ACB). Compared to compact circuit breakers (MCCB = Moulded-Case Circuit Breaker), air circuit breakers have a larger volume and are designed for higher rated currents. A circuit breaker is a mechanical switchgear unit that can switch on, route, and switch off currents in the circuit under operating conditions. Under defined exceptional conditions such as a short-circuit, a circuit breaker can also switch on, switch off, and route currents for a predetermined time. The ACB is designed to keep the main contacts closed for as long as possible.

In the low-voltage range, an ACB is used wherever high cut-off currents are to be expected and yet selectivity must still be guaranteed (e.g., near the transformer).

Use of the air circuit breaker (ACB) primarily as a

- circuit breaker in areas with general protection function
- Circuit breaker for electrical machines

Air circuit breakers (ACB) are available in two designs:

- Fixed mounting: Basic switch without chassis
- Withdrawable connection: Switch with chassis

The chassis (enclosure) is permanently installed in the power distributor. The switch is moved in / out with the aid of a crank.

### Arc faults

Arc that occurs as a fault. It does not occur during normal operation. It occurs due to a fault. Arc faults can cause serious personal injuries. In addition, arc faults can limit or make it impossible to continue operating the power consumers. A passive arc fault protection system is used to ensure personal safety, while an active arc fault protection system is used not only to ensure personal safety but also to maintain the functionality of a system.

### Arcing fault

Arc fault. Arc that occurs as a fault.

### Arcs

Arcing occurs as an electrical gas discharge with high current between two electrodes. An arc moves at a speed of 100 m/s. It produces an electrically conductive plasma between two conductors whose temperature can reach up to 20,000°C. The high temperature results in explosive pressure increases. An arc fault occurs as a non-operational fault and entails significant hazards for people and for the continued operation of the system.

### Auxiliary power circuit

Auxiliary power circuits are used for monitoring, measuring, signalling and/or controlling the functions within a main power circuit. This includes all conductive parts of an electrical circuit within the switching equipment combination that are not part of the main circuit. This also includes the auxiliary circuits of the switchgear.

# B

## Basic protection

Protection against direct contact with active parts. Basic protection is an integral part of the protection measures against electric shock and serves to prevent direct contact with hazardous active parts. Fault protection as protection against indirect contact with active parts is also an integral part of the personal protection against electric shock.

Basic protection can be achieved through

- design measures within the switchgear and controlgear assembly serving as protective measures:
  - Insulating materials and insulation of hazardous active parts
  - Covers and enclosures
- through additional measures during installation, for example, the installation at a location that can only be accessed by authorised personnel.

## Busbar compartment

Main busbar compartment. The busbar compartment contains the main busbars with connections to the distribution busbars.

## Busbar couplings

Busbar couplings switch connections between busbars that (normally) belong to separate circuits.

## Busbar support SST / F-BB support

Also F-BB support, field busbar support, SST busbar support, field distribution busbar support, distribution busbar. The distribution busbars are positioned in the F-BB support.

## Busbar system (SaS)

High-voltage busbar systems are key components of a power distribution system. They determine the short-circuit resistance and thus the operational safety of a low-voltage switchgear and controlgear assembly. The busbar systems of the unimes H power distribution system can be designed with standard Cu busbars. The drill-free connection technology reduces workloads and thus saves time and costs.

A distinction is made between:

- the main busbar system (H-SaS)
- the distribution busbar system = field distribution busbar system (F-SaS)

The busbar system also includes

- the busbar supports (H-SaS supports), type U-FSTK.. and, depending on the short-circuit current capability, additional fibreglass bar fastenings as reinforcements to ensure the tested short-circuit resistance
- the field busbar supports (F-SaS supports), e.g.:
  - type U-SST in the U-S(l) slimline horizontal HRC outgoing enclosure,
  - LVZSB, LVZIT, LVZ00IT or U-SST-5 for vertigroup size 0-3 in the U-FL fuseline HRC outgoing enclosure.
- Accessories for fastening, reinforcement bracket and partition.

## C

### Cable compartment

Terminal compartment. The connection points of the outer conductors/cables (interfaces) are located in the cable compartment. Some enclosure types of the unimes H power distribution system are provided as versions with an integrated cable compartment to the left or right of the device compartment.

### Circuit breaker

Switchgear for switching operating and short-circuit currents. In terms of design, a distinction is drawn between

- air circuit breakers (ACB) and
- moulded case circuit breakers (MCCB)

### Clearance

Shortest air distance between two conductive parts.

### Compartment

An enclosed sub-section or enclosed field. There are exceptions for enclosing openings that are necessary for connecting, controlling or ventilating.

### Coupling switch

Circuit breaker for busbar coupling.

### Creepage distance

Shortest distance between two conductive parts along the surface of a solid insulation material.

## D

### Degree of pollution

The degree of pollution defines the ambient conditions of a switching device. If the switching device is installed in an enclosure, the ambient conditions within the enclosure apply. The four defined degrees of pollution are used to assess the clearances and creepage distances. The degree of pollution 3 is defined as conductive pollution or dry, non-conductive pollution, which is expected to become conductive due to condensation.

### Derating

Load reduction / power reduction that occurs such as a high ambient temperature

### Device compartment

Area with electrical devices.

### Disconnected position

Disconnected position of a withdrawable part. In the disconnected position, separation sections disconnect the main power circuit and the auxiliary circuit from the supply. However, the withdrawable part remains connected to the switchgear and controlgear assembly throughout.

The separation section of a withdrawable part is the clearance between the open contacts. The clearance meets the safety requirements defined for the disconnector.

### Disconnector

Switchgear for the production of separating sections.

### Distribution busbar system (F-SaS)

Field distribution busbar system (F-SaS). Distribution busbars establish the connection between busbars of the main busbar system and the installed devices. The distribution busbar system F-SaS includes the busbar supports (F-SaS supports) and fastening and partition accessories in a field.

## E

### Earthing connection

The earthing connection includes all inactive conducting parts, such as casings, support rails, DIN rail, etc., which do not create a protective earthing connection between the protective earth of the incoming unit and the protective earth of the outgoing circuits. These inactive conducting parts must be earthed separately or connected to the protective earth according to the construction type. The contact resistance of this earthing connection (last construction part and protective earth of the incoming unit) must not exceed 0.1 ohms.

### EN 61439

The EN 61439 standard series replaced the EN 60439 standard series. The EN 61439 standard series has the goal of harmonising the rules and requirements for low-voltage switching equipment combinations.

The valid part of the EN 61439 standard series is always the applicable part of the standard, e.g. EN 61439-2 for energy switching equipment combinations (PSC switching equipment combinations) together with Part 1 of the standard (EN 61439-1).

### Connection between European standard and International standard

| European standard | International standard | German standard | Classification VDE specifications |
|---|---|---|---|
| EN 61439<br>(all parts) | IEC 61439<br>(all parts) | DIN EN 61439<br>(VDE 0660-600)<br>(all parts) | VDE 0660-600<br>(all parts) |

### Parts of EN 61439 standard

| Part of European standard | Content |
|---|---|
| EN 61439-1 | Low-voltage switchgear and controlgear assemblies -<br>Part 1: General rules |
| EN 61439-2 | Low-voltage switchgear and controlgear assemblies -<br>Part 2: Power switchgear and controlgear assemblies (PSC) |
| EN 61439-3 | Low-voltage switchgear and controlgear assemblies -<br>Part 3: Distribution board for operation by ordinary persons (DBO) |
| EN 61439-4 | Low-voltage switchgear and controlgear assemblies -<br>Part 4: Particular requirements for assemblies for construction sites (ACS) |
| EN 61439-5 | Low-voltage switchgear and controlgear assemblies -<br>Part 5: Assemblies for power distribution in public networks |
| EN 61439-6 | Low-voltage switchgear and controlgear assemblies -<br>Part 6: Busbar trunking systems (busways) |
| EN 61439-7 | Low-voltage switchgear and controlgear assemblies -<br>Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electrical vehicles charging stations |

**Supplements for parts of the EN 61439 standard**

| Part of European standard | Content |
|---|---|
| EN 61439-1 Supplement 1 | General rules: Guidance to specifying assemblies |
| EN 61439-1 Supplement 2 | General rules: A method of temperature-rise verification of low-voltage switchgear and controlgear assemblies by calculation |
| EN 61439-2 Supplement 1 | Power switchgear and controlgear assemblies: Guide for testing under conditions of arcing due to internal fault |

# F

## Fault protection

Protection against indirect contact with active parts. Fault protection is an integral part of the protection measures against electric shock. Basic protection as protection against direct contact with active parts is also an integral part of the personal protection against electric shock.

Fault protection serves to protect against the effects of faults

- inside the switchgear and controlgear assembly,
- in an external circuit that is supplied by the switchgear and controlgear assembly.

Protective measures for fault protection, according to EN 61439-1, EN 61439-1 supplementary sheet 1 and EN 61439-2, include at least one of the following protective measures:

- Protection by meeting the requirements for the protective earth and protective earthing circuit. The requirements ensure that the power supply is automatically switched off.
- Protection though protective separation. In the event of a fault, there is no path for the current flow.
- Protection through protective insulation.

## F-BB supports

see busbar supports SST / F-BB supports.

## Field

A field is a unit of a switchgear and controlgear assembly that is located between two vertical boundary levels.

## Functional unit

As part of a switchgear and controlgear assembly, a functional unit is used to fulfil the same function. The functional unit contains all the electrical and mechanical components, including switchgear that fulfils the same function.

Conductors that are connected to a functional unit but are located outside the compartment or the area protected by the housing is not considered a part of the functional unit. An enclosed field or space is also referred to as a compartment. The compartment can have openings used for connection, control or ventilation purposes.

# H

### Hazard zone

According to DIN VDE 0105-100, the hazard zone is an area around live parts in which the required insulation level is not ensured. When entering this area, there is the risk of electric current passing through the human body and/or arcing. All work performed in the hazard zone must satisfy the conditions for work under voltage.

# I

### Incoming unit

Usually, the incoming unit is intended as a functional unit for the supply of electrical power to the switchgear and controlgear assembly.

### Insert (fixed part)

An insert is an assembly consisting of operating equipment. This operating equipment is assembled on a common carrying structure and wired for fixed mounting.

Unlike detachable parts, an insert must not be removed from the switchgear and controlgear assembly in its entirety and replaced if the connected electrical circuit is live.

### Internal separation

Form of internal separation. The form of internal separation inside the switchgear and controlgear assembly is a division of the physical separation through covers or partition walls, insulation of active parts or the integrated enclosure of devices. The manufacturer and user agree the form of internal separation and higher protection types. The internal separation makes it possible to meet the following conditions between functional units, separate compartments or enclosed protected spaces:

- Protection against contact with hazardous parts: at least protection type IXXB, the protection type IP 2X covers the protection type IP XXB.
- Protection against solid foreign objects entering the system: at least protection type IP2X.

The different forms of separation according to EN 61439-1/-2 are:

- Form 1,
- Form 2a and Form 2b,
- Form 3a and Form 2b,
- Form 4a and Form 4b.

### IP degree of protection

The IP degree of protection is important for ensuring protection against electric shock. The IP degree of protection applies to casings, covers and enclosures. The IP degree of protection is specified with two code numbers and optionally an additional letter.

- The first code number (0-6) indicates the protection against solid foreign objects from entering the system and the protection against contact with hazardous parts.
- The second code number (0-8) indicates the protection against water from entering the system.
- The additional letter (A-D) indicates the protection against contact with hazardous parts.

## M

### Main busbar

Also main bus bar. A distribution busbar or multiple distribution busbars can be connected to a main busbar. Alternative or additional incoming units or outgoing units can be connected to the main busbar.

### Main busbar system (M-BB)

Multi-pole busbar system that is routed in the enclosure of a switchgear and controlgear assembly. The main busbars of the enclosures of the power distribution system unimes H are connected via transport divider plates U-TT (U-TTS as a set) or the compact transport divider U-TTK. Distribution busbars can be connected to the main busbars. Alternative or additional incoming units or outgoing units can be connected to the main busbar.

### Main power circuit

Main current track, power circuit. The main current circuit of a switching equipment combination includes all conductive parts of an electrical circuit in a switching equipment combination that are used for transporting electrical energy.

The main circuit is used for generating, distributing or switching of electrical power to electrical consumers.

## O

### Operating position

The operating position is a position of a part that can be removed from the switchgear and controlgear assembly, in which the removable part is fully connected for the intended function.

A removable part can be removed from the switchgear and controlgear assembly in its entirety under voltage and replaced. Here, a removable part is a group of equipment assembled and wired on a common support structure.

### Operator

The responsible operator of an electrical system as an owner, leaseholder or lessee. The term working proprietor or proprietor [Betriebsinhaber] is used in Switzerland.

## P

### Protective earthing connection

The protective earthing connection includes all active parts that are used to establish the connection between the protective earth of the incoming unit and the protective earth of the outgoing circuits. It must be ensured that this connection is not interrupted when the casings are removed (e.g. for maintenance work). The requirements of the protective earth’s short-circuit resistance must be observed for the protective earthing connection.

## R

### Rated diversity factor RDF

The rated diversity factor (RDF), as the characteristic properties of the switchgear and controlgear assembly, is particularly important for the safe operation of switchgear and controlgear assembly. The rated diversity factor is the share of the respective rated currents that any possible combination of outgoing current circuits can simultaneously and permanently carry without the switchgear and

controlgear assembly overloading. An essential prerequisite here is that the load of the incoming unit must not exceed the rated current of the incoming unit.

### Removable part

A removable part is an assembly consisting of operating equipment. This operating equipment is assembled and wired on a common carrying structure.

Unlike inserts, a detachable part may be removed from the switchgear and controlgear assembly in its entirety and replaced if the connected electrical circuit is live.

## S

### Service index (SI)

The service index is an indicator of the availability of a switchgear with consideration of the life cycle.

The service index distinguishes between the degree of availability:

- 1: Availability not necessary / uncritical
- 2: Availability partially required
- 3: Availability essential

The service index also distinguishes between the different life cycles:

- 1st number in service index: Operation
- 2nd number in service index: Maintenance
- 3rd number in service index: Modification / conversion / extension

### Sub-section

Unit of a switchgear and controlgear assembly within a field that is located between two horizontal or vertical boundary levels.

### Switchgear and controlgear assembly

As a low-voltage switchgear and controlgear assembly, it distributes and controls electrical energy for all load types according to EN 61439-2. Intended for industrial, commercial and similar applications, which are not intended to be operated by ordinary persons.

### Switchgear and controlgear assembly

Range of components, according to the definition of the original manufacturer, that can be installed for different switchgear and controlgear assemblies in compliance with the manuals of the original manufacturer. The unimes H power distribution system is a type-tested switchgear and controlgear assembly for switchgear and controlgear assemblies according to EN 614391/2.

## T

### Terminal compartment

Cable compartment. The connection points of the outer conductors/cables (interfaces) are in the terminal compartment.

### Test position

At the test position of a withdrawable part, the main power circuit is separated at the feeder side and meeting the requirements of a separation section is not necessary. The separation section of a withdrawable part is the air distance between the open contacts, which meet the safety requirements defined for the switch disconnector.

- At the test position, the auxiliary circuit is connected in such a way that the integrated devices can be tested.
- At the test position, the withdrawable part is connected mechanically with the switchgear and controlgear assembly.

### Transport unit

Complete switchgear and controlgear assembly or a part of a switchgear and controlgear assembly, which is not dismantled further or disassembled for transport.

### Trigger

Used for protective tripping (opening of a) circuit breaker that is not initiated by the operation of the associated control device.

### Type of electrical connection of functional units

The user can specify the electrical connection of functional units within the switchgear combination. A three-digit code identifies the type of electrical connection of the functional unit:

- 1st letter: Feeding the main circuit to the functional unit
- 2nd letter: Outlet of the main power circuit from the functional unit
- 3rd letter: Connection of auxiliary power circuits

The following letters stand for the relevant type of connection:

- F: For fixed connections,
- D: For releasable connections,
- W: For guided connections.

A functional unit with the code allocation FFD has, for example, fixed feed connections, fixed outlet connections and releasable auxiliary circuits.

## V

### Vicinity zone

The vicinity zone for non-electrotechnical work is a limited area that is connected to the hazard zone. The outer boundary of the vicinity zone DV is defined up to 1 kV of mains voltage (effective value) in DIN VDE 0105-100 at a distance of 1.0 metres. This safety distance is the distance in the air from the unprotected live parts. The safety distance applies to all construction work and non-electrotechnical work, such as

- scaffolding,
- work with lifting equipment or construction machines,
- assembly work,
- paint and touch-up work,
- moving other devices and construction equipment,
- transport work.

If protection is ensured through distance and supervision is also ensured, the work must be performed by electrically skilled personnel or electrotechnically instructed personnel or under corresponding supervision and the defined distances must be observed. The outer boundary of the safety distance for special

work is defined up to 1 kV of mains voltage (effective value) in DIN VDE 0105-100 at a distance of 0.5 metres. This safety distance is the distance in the air from the unprotected live parts. The safety distance under supervision applies to special work, such as:

- moving ladders,
- paint and touch-up work,
- hoisting or lowering tools or material.

## W

### Withdrawable part

On power switchgear and controlgear assemblies, a withdrawable part is a removable part that can be moved from operating position to a disconnected position or a test position. It remains mechanically connected to the switchgear and controlgear assembly.

A removable part can be removed from the switchgear and controlgear assembly in its entirety under voltage and replaced. Here, a removable part is a group of equipment assembled and wired on a common support structure.

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