System Manual
Passive arc fault protection

agardio.arc

:hager

Table of contents

1 About this System Manual

Part of the unimes H power distribution system

This System Manual on the agardio.arc passive arc fault protection system is an integral part of the unimes H power distribution system.

- Carefully read through this manual and the System Manual for the unimes H power distribution system before performing work on the enclosure system.
- Read and observe the Safety section in particular.
- The safety measures in the other sections must also be observed.

Introductory information

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

The symbols and abbreviations used are explained.

Chapter index

1.1 Subject of the System Manual

Target group

This System Manual is aimed at users of Hager's passive arc fault protection system (**pSLB**) agardio.arc:

Specifiers, manufacturers, operators and users of switchgear and controlgear assemblies according to DIN EN 61439-1/-2.

The System Manual also contains information regarding the basic principles of arc faults, as well as guidance on the intended use, design, function, mounting, installation, and maintenance of a passive arc fault protection system.

Objective

This manual describes the design, function and use of Hager's agardio.arc passive arc fault protection system.

The manual also contains information regarding efficient use, as well as guidance on the intended use, design, function, mounting and installation.

1.2 Observe related documents

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.

Operator

- System Manual for unimes H power distribution system
- Manuals on the basic enclosure types
- Instructions and documentation for the arc fault protection components

Planner

- unimes H power distribution system manual
- Hager catalogues for power distribution systems with technical information
- Component selection, lists, and production drawings from the “hagercad” planning software
- Guidelines for project planning and design of switchgear according to DIN EN 61439 (VDE 06600-600)
- Design verification

Panel builder/electrically skilled person/system manager

- System Manual for unimes H power distribution system
- Manuals on the basic enclosure types
- Instructions on arc fault protection components
- Component selection, lists and production drawings from the 'Hagercad' planning software
- Guidelines for project planning and design of switchgear according to DIN EN 61439 (VDE 0660-600)
- Record for routine verification (routine test report)
- Checklist for the conformity assessment procedure
- Design verification

Storing the documents

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

- ➢ Store the manuals and instructions enclosed with the components within easy reach at the location where the enclosure system is installed. Authorised personnel must have access to the manuals at all times.
- ➢ The operator is responsible for storing the documents safely.

Instructions on installation, maintenance, cleaning and disposal

- ➢ Observe the unimes H System Manual and manuals for the individual enclosure types for all maintenance, cleaning and repair work, as well as for disposal.

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

System Manual for agardio.arc passive arc fault protection system

Revision number	Date	Name	Document no.
V1.0	02/2022	A. Rigert H. Müller J. Berg	453-313-022

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1.4 Used symbols and trademarks

Structure of warning messages

⚠ Signal word
Type and source of the danger! **Consequences if the danger is ignored** ➢ Measures for averting the danger

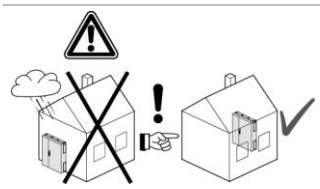
Danger levels in warning messages

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

2 Safety and standards

Read carefully

- Carefully read the safety information in the operating instructions for the unimes H power distribution system. The safety-related information should help you detect and avoid risks in due time. It is a prerequisite for safe installation and use of the enclosure system.
- Also observe the safety information in this section and in other sections of the System Manual for the agardio.arc arc fault protection system.

Chapter index

2.1 Intended use

Only limited personal protection without arc fault protection

Every year, arc faults cause significant personal injuries and system damage and lead to increased costs due to production shut-down.

The occurrence of arc faults can cause deadly accidents.

Provoked arc fault if there is no arc fault protection

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

Not even state-of-the-art switchgear systems can completely eliminate the risk of arc fault ignition. Within a very short time, an arc fault releases vast amounts of energy in the form of heat, pressure, flying parts and toxic gases.

Arc faults are often caused by errors when working on live systems and by non-compliance with the 5 safety rules, see page 12. They can also be caused by foreign bodies in the system, external environmental factors or animals intruding.

Protection criteria according to DIN EN 61439-2, Supplement 1

Arc fault class			Criterion no.	Description
A	B	C	1	Properly secured doors and covers do not open and provide a minimum protection level of IPX1
			2	No parts with a mass greater than 60 g are ejected, except for detached parts between the switchgear and indicators
			3	No holes on enclosure parts up to a height of 2 m due to arc burn-out
			4	No ignition of indicators
			5	Protective conductor circuit function for touchable enclosure parts present
			6	Arc fault remains in the defined area and does not spread
			7	Emergency operation of unaffected functional units possible

Personal protection, system protection

Thanks to its structural concept, Hager's passive arc fault protection offers personal and system protection up to a maximum of $I_{p\ arc}$ 85 kA, 500 V. The protection can be limited to switchgear or enclosure. System function protection is defined as a level of protection that allows the switchgear to be either fully or partially restarted.

unimes H phased concept according to DIN EN 61439-2, Supplement 1

unimes H switchgear classification

Arcing Class C

Protection objective: Personal protection and system function protection

- Proof of protection by arc fault tested zones
- Failure effect limited to point of origin
- Protection criteria 1 to 7

Arcing Class B

Protection objective: Personal protection and system protection

- Proof of protection by arc fault tested zones
- Failure effect limited to field
- Protection criteria 1 to 6

Arcing Class A

Protection objective: Personal protection

- Proof of protection by arc fault tested zones
- Failure effect limited to switchgear
- Protection criteria 1 to 5

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 61439-2.

The passive arc fault protection system can be installed in the following enclosure types:

- U-TE/U-TK
- U-LE/U-LK
- U-CW(I)/U-BS(I)
- U-FL
- U-MUN
- U-SV
- U-S(I)
- U-BS(I)
- U-T2 (Note: This option is not available in the Hagercad software)

Switchgear and controlgear assemblies that are fitted with Hager's agardio.arc passive arc fault protection system provides arc fault protection that meets the requirements of the currently valid standard.

Requirements for personal and system protection according to EN 61439-2, Supplement 1, 8.7

Hager's passive arc fault protection system meets the requirements for personal and system protection outlined in Standard EN 61439-2, Supplement 1, Section 8.7 (assessment of arc fault test) as an evaluation of the properties under arc fault conditions based on criteria 1 to 7.

- Criteria 1 to 5 define personal protection. The passive arc fault protection system meets criteria 1 to 5 for protection against serious personal injury.
- Personal and system protection are provided if criteria 1 to 6 are met. The passive arc fault protection system meets criteria 1 to 6 for protection against serious personal injury and for system protection (limiting the arc fault to the defined area where it occurred).
- Personal and system protection with limited operational capability are provided if criteria 1 to 7 are met. The passive arc fault protection system meets criteria 1 to 7 for protection against serious personal injury and for system protection with limited operational capability (emergency operation with the remainder of switchgear and controlgear assembly). Following troubleshooting and cleaning, the specifications according to criterion 7 are required for emergency operation:
  - insulation test with 1.5 times the value of the rated operational voltage for 1 minute,
  - minimum protection level of IPXXB for doors and covers of affected units,
  - all other units are fully functional and are essentially in the same condition as before the arc fault.
- Any use beyond the operating conditions described in EN 61439-2, Supplement 1, Section 8.7 requires a special risk assessment and specific measures based on this assessment.

Intended use also includes

- ➢ Reading and observing this manual along with any instructions provided with the components, the System Manual for the unimes H power distribution system and other unimes H manuals.
- ➢ Complying with the safety regulations.

Misuse

Any other or additional use as well as changes and modifications to the components of the arc fault protection system are considered to be misuse. Hager does not assume any liability for damages resulting from misuse.

Danger due to arc faults in the case of incorrect installation

If the functionality of the arc fault protection system is impaired due to incorrect installation, you can expect that the direction of the arc fault will never be deflected when an arc fault occurs and that the arc fault will lead to fatal consequences. Personal protection is not provided in this case.

Arc faults can be expected to cause fatal consequences at all times. They may result in serious injuries and even death.

- ➢ Observe the technical data, specifications and tolerance values specified in this manual.

2.2 Safety instructions for arc fault protection

Electrical hazards

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

Arc fault protective devices

Arc fault protective devices should be selected such that, when an arc fault occurs, they quickly initiate the suppression of the arc fault if:

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

Guaranteeing arc fault protection with specialist personnel

Only appropriately authorised and qualified specialist personnel may perform operations on the components of the arc fault protection system.

Taking arc fault protection into consideration during planning

Arc fault protection should be taken into account when planning the switchgear and controlgear assembly.

The arc fault protection system consists of the components described here.

Project planning of the arc fault protection system must be carried out by the manufacturer of the switchgear and controlgear assembly and take into account the specific application and user's requirement profile.

Minimum qualifications of specialist personnel: electrician/electrically skilled person with appropriate testing experience

- Only qualified electricians may select, assemble, install, operate, test, maintain, dismantle, and dispose of components of the arc fault protection system.
- The passive arc fault protection system may only be installed in a de-energised state.

Observe residual energies and static discharge

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.

2.3 Standards

Applicable standards

Ensure compliance with the following standards and regulations when designing and configuring a passive arc fault protection system:

- DIN EN IEC 61439-1/-2:2021 (VDE 0660-600-1/-2:2021): 'Low-voltage switchgear and controlgear assemblies - Part 1: General rules; Part 2: Switchgear and controlgear assemblies'
- DIN EN 61439-2, Supplement 1: 'Guide for testing under conditions of arcing due to internal fault' (corresponds to IEC/TR 61641:2019: 'Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault')
- DIN EN 0100-530:2018: 'Low-voltage electrical installations - Part 530: Selection and erection of electrical equipment - Switchgear and controlgear'
- DIN EN 0100-420:2019: 'Low-voltage electrical installations - Part 4-42: Protection for safety – Protection against thermal effects'
- Work Equipment Safety Regulation, June 2015

2.4 Structure of IEC TR 61641 standard

Arc fault classes

- **Arcing Class A – PSC**, guarantees personal protection under arcing conditions (criteria 1 to 5 and arc ignition protected zones where applicable).
- **Arcing Class B – PSC**, guarantees personal protection and switchgear protection under arcing conditions (criteria 1 to 6 and arc ignition protected zones where applicable).
- **Arcing Class C – PSC**, guarantees personal protection and switchgear protection under arcing conditions and allows limited operation (criteria 1 to 7 and arc ignition protected zones where applicable).
- **Arcing Class I – PSC**, which limits risk by means of arc ignition protected zones.

Arc fault degrees of protection

(i) Personal protection

(ii) Damage limited to one part of the switchgear and controlgear assembly

(iii) Switchgear and controlgear assembly suitable for limited operation

Two levels of personal protection

(I) Switchgear and controlgear assembly in areas only specialist personnel can access.

(II) Switchgear and controlgear assembly in areas ordinary persons are intended to access.

- Option of insulating all active conductors to make the complete switchgear and controlgear assembly an arc ignition protected zone.
- Arc fault protection of front, rear and sides as basic requirement.
- Minimum requirements for arc ignition protected zones.

Tests in technical report

The tests described in the technical report refer only to:

- closed, floor-standing or wall-mounted low-voltage switchgear and controlgear assemblies according to IEC/EN 61439-2 (power switchgear and controlgear assemblies – PSC).
- the condition that doors and cladding of the switchgear and controlgear assembly are closed and correctly secured.

Tests according to TR 61641

Tests according to TR 61641 do not take the following into account:

- other effects that can pose a risk such as toxic gases and loud noise,
- conditions arising during maintenance work such as open doors or similar,
- access to the cover and floor area of the switchgear and controlgear assembly.

3 About the passive arc fault protection

Important features

The most important features and functional design of the agardio.arc passive arc fault protection.

Chapter index

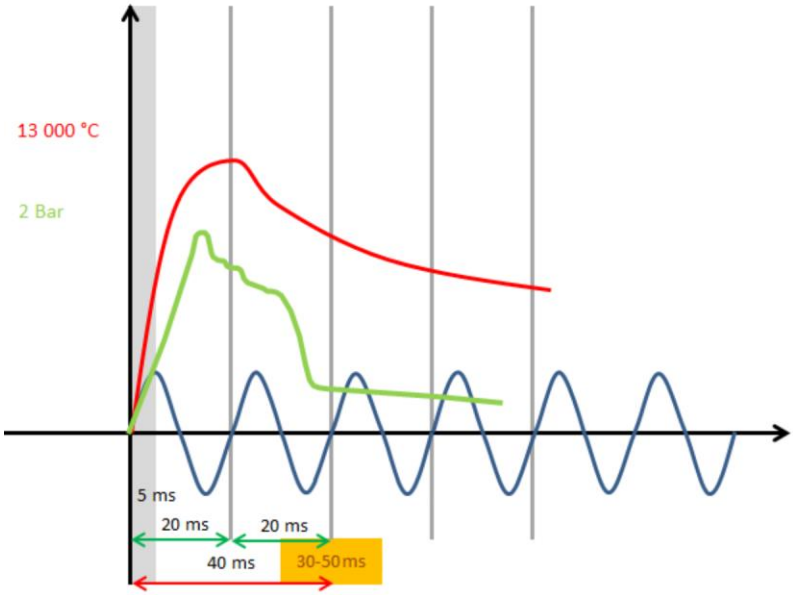
3.1 Causes of arc fault

Reasons arc faults occur

The main reason arc faults occur is human error, e.g., assembly errors, work on conducting parts, tools forgotten or non-compliance with maintenance and inspection requirements. Other reasons include operational faults (e.g., insulation faults, poor contacting, condensation), overvoltage, inadequate dimensioning or excessive packing density. Animals are also a potential risk, e.g. a rodent bite.

Fatal hazards and destruction after only 5 ms

An arc fault that occurs begins to wreak havoc after only about 5 ms (heat, blinding, shock waves, flying parts, poisoning due to gases or dusts).



Time sequence of an arc fault

	Temperature
	Pressure
30-50 ms	Switch-off by MCB

The arc fault reaches the maximum pressure and extremely high temperatures of over 10,000°C as early as the first 20 ms. Neither the shut-down time of a medium-voltage protective device (after 300 ms) nor the shut-down of the ACB alone (30-50 ms) can limit the extreme effects of an arc fault (danger to personnel and damage to equipment).

3.2 System description

Passive arc fault protection

The uncontrolled occurrence and propagation of arc faults in the switchgear should be taken into account during the planning phase in order to ensure the highest protection objective, i.e. personal protection.

The form of internal separation selected (Form 1, 2b and 4b) enables a level of system protection that prevents foreign bodies from penetrating the individual functional compartments and thus ideally prevents the occurrence of an arc fault entirely or at least reduces the probability of an arc fault.

If an arc fault nevertheless occurs within the switchgear, the components of the passive arc fault protection ensure that the destructive effects of the arc fault do not harm any personnel and are limited to the affected functional unit or switchgear part. The damage is therefore limited to the point of origin; adjacent functional units and compartments of the switchgear are not affected.

In contrast to active arc fault protection systems, for example, Hager's agardio.arc active arc fault protection system, the arc fault in passive arc fault protection leads to partial destruction of the switchgear or functional unit. The switchgear can only be put back into operation after it has been replaced or repaired.

Components of passive arc fault protection

The passive arc fault protection system is implemented based on a combination of multiple components and measures:

Arc fault protection task	Component/Measure
Reduce the probability of an arc fault occurring.	- Partitions as barriers against occurrence of an arc fault
Prevent the propagation of the arc fault to other switchgear parts.	- Partitions as barriers against propagation of an arc fault
After an arc fault occurs: Reduce the risks and damage caused by flying parts	- Mechanically reinforced enclosure components (e.g., reinforced hinges on doors or reinforced side panels) - Targeted pressure relief (e.g., cover plates with pressure vent flaps)
Controlled re-direction of the arc fault	- Arc fault is directed to pre-defined areas (e.g., by means of arc stoppers)

The various protection concepts and their components are described in detail in the following section.

3.3 Characteristic features

Characteristic features

The agardio.arc passive arc fault protection system is designed for the following parameters:

- Voltage U = 500 V AC
- Frequency 45 – 62 Hz
- $I_{p\,arc}$ 85 kA max. r.m.s
- T = 300 ms
- EN 61439-1/TR 61641
- Fulfilment of criteria 1-7 of EN 61439-2, Supplement 1; Section 8.7 regarding personal protection, system protection, system function protection
- Arcing Class ABC, black cretonne 150 g/m^2

3.4 Active arc fault protection system

Active arc fault protection system

The damage caused by an arc fault can be reduced significantly if it is quickly detected and extinguished systematically. This is possible by means of an active arc fault protection system, for example.

agardio.arc– Arc fault extinguished within 2-3 ms

The extinguishing time of an arc fault is usually between 2 ms and 3 ms with Hager's agardio.arc active arc fault protection system, including light and current detection as well as extinguishing of the arc fault via quenching devices. Furthermore, the entire switchgear can be switched off automatically after 30-50 ms by means of the air circuit breaker. The impact of arc faults on personnel and the switchgear itself are thus kept to a minimum. Hager's arc fault protection system thus ensures a high level of personal protection and availability of the switchgear.

Sample expansion with an active arc fault protection system

Increased project planning cost/complexity

An active arc fault protection system offers many advantages but is considerably more costly/complex to implement compared to a passive arc fault protection system. For example, the following are required:

- Additional electronic components to detect an arc fault
- Components to extinguish the arc fault
- Detection devices to control short-circuiting devices
- Uninterruptible power supply
- Air circuit breakers

Further information on Hager's active arc fault protection system is provided on the Hager website of your specific country.

4 Protection concepts

Protection concepts

The various protection concepts of the passive arc fault protection system with important information on mounting the individual components.

NOTE

- The unimes H enclosures and enclosure combinations shown are examples for the possible protection concepts.

Chapter index

4.1 Conceptual design

What is the objective?

- Arc fault protection for low-voltage switchgear and controlgear assemblies.

What protection is sought?

The tests in the technical report refer to:

- closed, floor-standing or wall-mounted low-voltage switchgear and controlgear assemblies according to DIN IEC 61439-2 'Power switchgear and controlgear assemblies (PSC ASSEMBLIES)'

What is not considered?

Not all the dangerous effects of an arc fault on personnel are taken into account for these test procedures. For example, testing is not carried out under conditions that occur during maintenance work.

The following cases or effects are not taken into account for this technical report:

- open doors or cladding of switching enclosure combination
- doors or cladding that are not properly secured
- access to the cover area or floor area of the switchgear and controlgear assembly
- other effects that can pose a risk such as toxic gases and loud noise

Design

With the help of Hager's passive arc fault protection system, a protection objective of up to arcing Class C with a rated short-time withstand current of max. $I_{p\,arc}$ 85 kA is achievable depending on the enclosure shell, enclosure front and correct components in the interior fittings. The following grades are possible with this solution:

- Limited to switchgear up to 50 kA arcing Class A
- Limited to switchgear up to 85 kA arcing Class A
- Limited to enclosure up to 50 kA arcing Class B/C
- Limited to enclosure up to 85 kA arcing Class B/C

Required arc fault protection components

Irrespective of the required protection class and always required in the case of a pSLB:

- Rear panel with reinforced holding brackets
- Doors with additional hinges
- Enclosure covers
- Adjustment covers
- Arc stoppers
- Rear panel protection
- Side panel protection
- Reinforced side panel

Additional arc fault protection components in the interior fittings

Protection class	Components in the interior fittings								
	Cover plate with pressure vent flaps	Pressure relief cover plate flaps	Rear partition holder plate	Arc stoppers	Rear panel protection	Side panel protection of main busbar (H-SaS)	Enclosure divider	FSTK spare space cover	Rear panel protection on retaining plate, integrated cable compartment
Limited to switchgear Class A, up to 50 kA	Yes*	Yes*	Yes**	Yes**	Yes**	Yes**	Yes**	-	-
Limited to switchgear Class A, up to 85 kA	-	Yes	Yes**	Yes**	Yes**	Yes**	Yes**	-	-
Limited to enclosure Class B/C, up to 50 kA	Yes*	Yes*	Yes	Yes	Yes	Yes	Yes	Yes	-
Limited to enclosure Class B/C, up to 85 kA	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*) Optionally with cover plate with pressure vent flaps or pressure relief cover plate flaps
**) At the end of the switchgear

The following summary applies in general: The higher the protection class and the desired rated short-time withstand current $I_{p\,arc}$, the more components are required for the solution.

4.2 Enclosure shell protection concept

Enclosure shell

When an arc fault occurs, a shock wave develops affecting all of the external walls of the enclosure. The system is designed in such a way that multiple elements of the enclosure shell are reinforced to ensure that parts of the enclosure do not become loose and thus injure personnel.

The following components are part of the enclosure shell:

- Holding bracket for rear panel
- Reinforced side panel
- Cover plate
- Cover plate flaps

The components are described in detail in the "Design and function" section.

4.3 Enclosure front protection concept

Enclosure front

The use of an arc fault protection system affects the possible design options for the enclosure front and front installation level. As a result, this limits potential expansion and affects the rated short-time withstand current $I_{p\,arc}$.

General limitations

The following limitations apply to the enclosure front when a pSLB is used:

- module front not possible for enclosure U-FL
- double doors not possible in HF (behind front) front level

Other elements

The enclosure front area also includes the following elements:

- Reinforced solid doors
- Reinforced module doors
- Adjustment covers

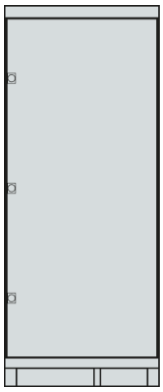
The components are described in detail in the 'Design and function' "Design and function" section.

4.3.1 Enclosure fronts

Enclosure fronts - Overview

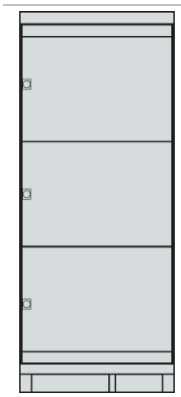
The following tables show the possible installation levels and potential versions for the different enclosure types.

U-TE/U-TK



HF

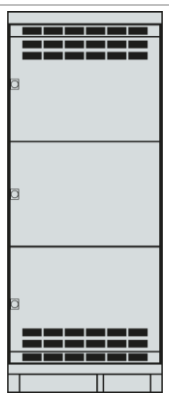
- Solid door without ventilation
- Max. $I_{p\ arc}$ 85 kA



HF

- Module doors without ventilation
- Max. $I_{p\ arc}$ 85 kA*

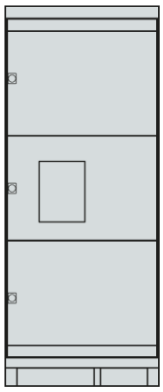
*with swivelled and fixed extended touch protection (Form 4b)



HF

- Module doors with ventilation
- Max. $I_{p\ arc}$ 50 kA*

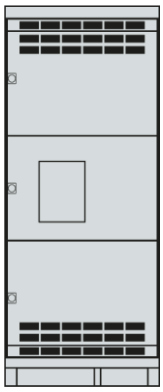
*with swivelled and fixed extended touch protection (Form 4b)



FE1

- Module doors without ventilation
- Max. $I_{p\ arc}$ 85 kA*

*with swivelled and fixed extended touch protection (Form 4b)

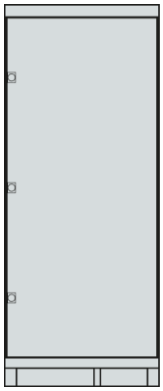


FE1

- Module doors with ventilation
- Max. $I_{p\ arc}$ 50 kA*

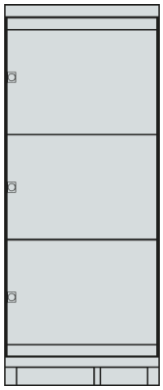
*with swivelled and fixed extended touch protection (Form 4b)

U-LE/U-LK



HF

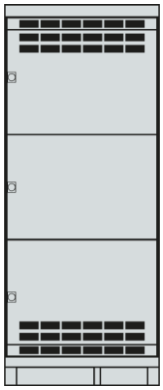
- Solid door without ventilation
- Max. $I_{p\ arc}$ 85 kA



HF

- Module doors without ventilation
- Max. $I_{p\ arc}$ 85 kA*

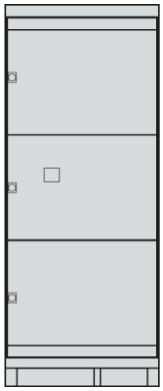
*with control compartment (Form 4b)



HF

- Module doors with ventilation
- Max. $I_{p\ arc}$ 50 kA*

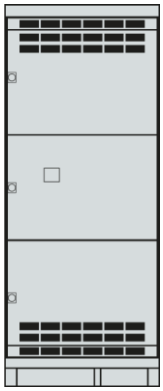
*with control compartment (Form 4b)



FE1

- Module doors without ventilation
- Max. $I_{p\ arc}$ 85 kA*

*with control compartment (Form 4b)



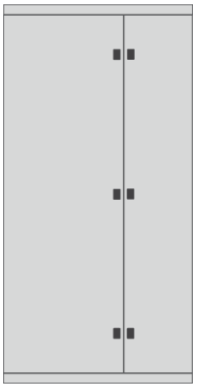
FE1

- Module doors with ventilation
- Max. $I_{p\ arc}$ 50 kA*

*with control compartment (Form 4b)

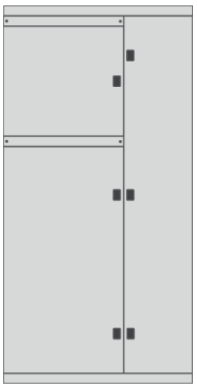
U-CW(I)

The U-CWI cable compartment always has a solid door.



HF

- Solid door without ventilation
- Max. $I_{p\,arc}$ 85 kA
- Full extension



HF

- Module doors without ventilation
- Max. $I_{p\,arc}$ 85 kA
- Partial extension

HF

- Module doors with ventilation
- Max. $I_{p\,arc}$ 50 kA
- Partial extension

FE1

- Module fronts without ventilation
- Max. $I_{p\,arc}$ 85 kA
- Full extension

FE1

- Module fronts with ventilation
- Max. $I_{p\,arc}$ 50 kA
- Full extension

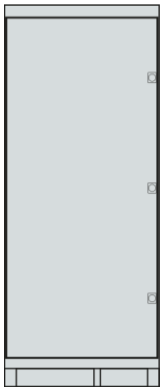
FE1

- Module door and module fronts without ventilation
- Max. $I_{p\,arc}$ 85 kA
- Partial extension

FE1

- Module door and module fronts with ventilation
- Max. $I_{p\,arc}$ 50 kA
- Partial extension

U-FL



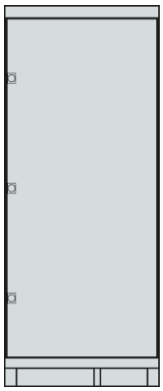
HF

- Solid door without ventilation
- Max. $I_{p\ arc}$ 85 kA

FE1

There is no option for a pSLB in the case of FE1

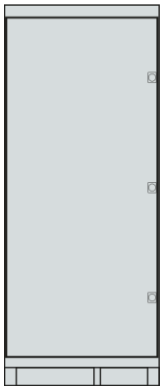
U-MUN



HF

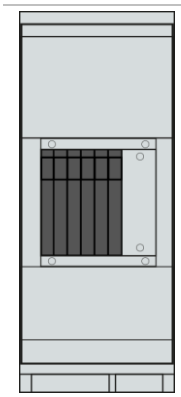
- Solid door without ventilation
- Max. $I_{p\ arc}$ 85 kA

U-SV



HF

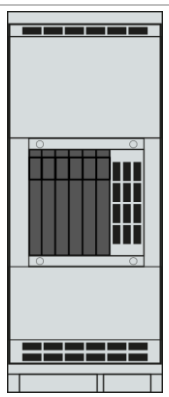
- Solid door without ventilation
- Max. $I_{p\ arc}$ 85 kA



FE1

- Module doors without ventilation
- Max. $I_{p\ arc}$ 85 kA*

*with control compartment (Form 4b)



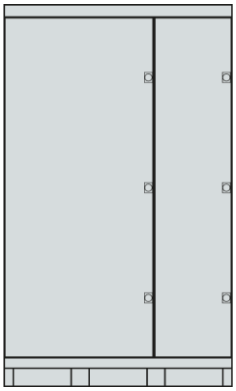
FE1

- Module doors with ventilation
- Max. $I_{p\ arc}$ 50 kA*

*with control compartment (Form 4b)

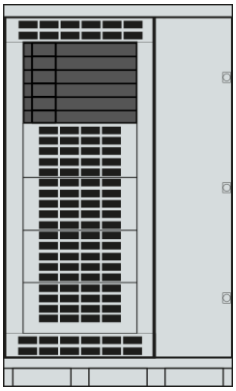
U-S(I)

The U-SI cable compartment always has a solid door.



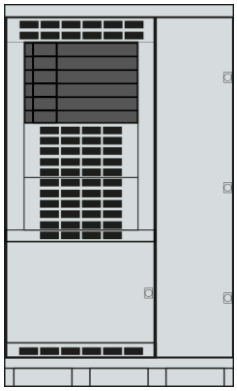
HF

- Solid door without ventilation
- Max. $I_{p\,arc}$ 85 kA
- Full extension



FE1

- Module front with ventilation
- Max. $I_{p\,arc}$ 50 kA
- Full extension



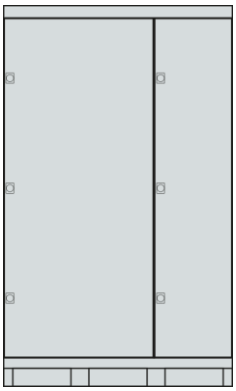
FE1

- Module front with ventilation
- Max. $I_{p\,arc}$ 50 kA*
- Partial extension

*with control compartment (Form 4b)

U-BS(I)

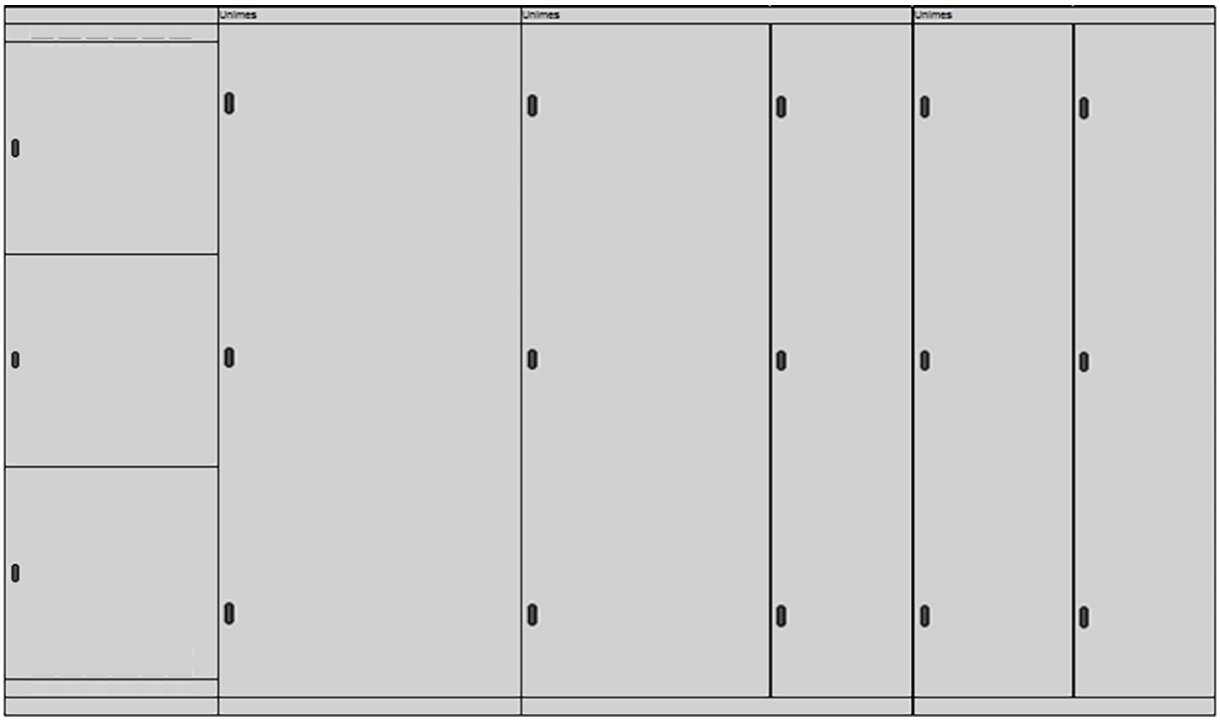
The U-BSI cable compartment always has a solid door.



HF

- Solid door without ventilation
- Max. $I_{p\,arc}$ 85 kA

4.3.2 Behind front (HF) front installation level



U-TE U-FL U-SI U-VLI/U-CWI

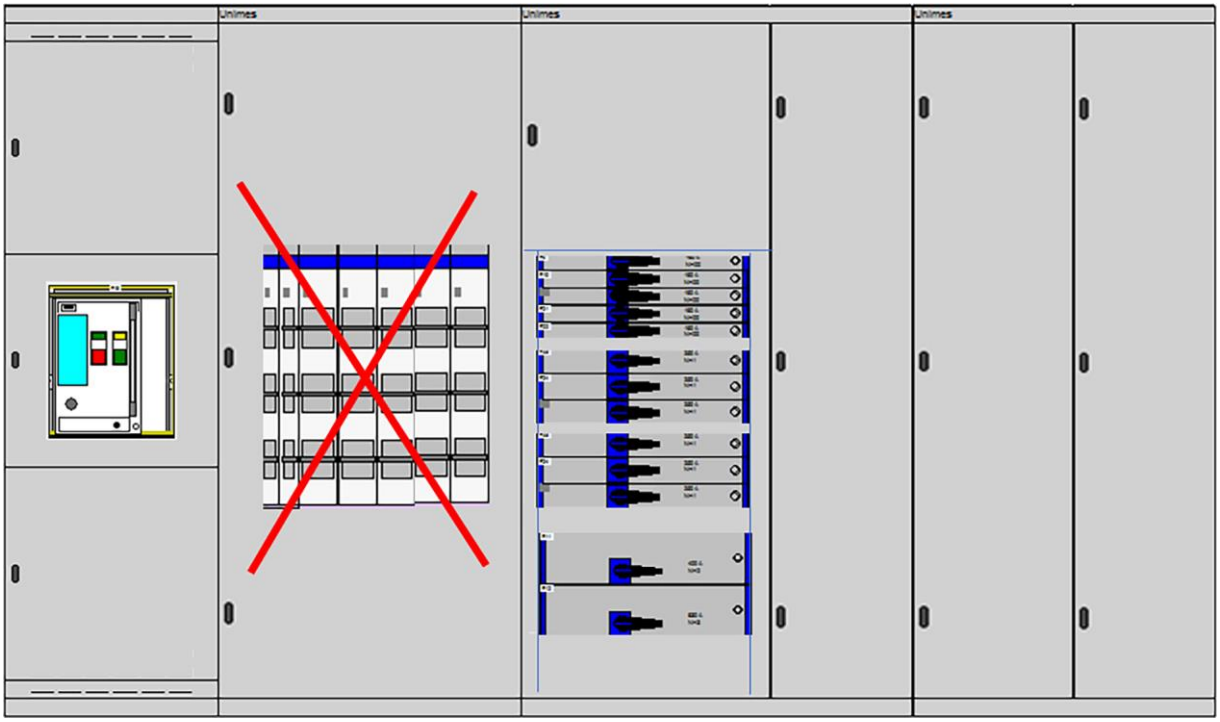
Possible version

- HF version up to max. $I_{p\,arc}$ 85 kA, 500 V
- Module doors with Form 4b in the case of U-TE, U-TK, U-LE, U-LK
- Module door for control compartment for a minimum of Form 2b
- Solid doors 450 mm to 1000 mm Form 1 without front convection
- Module door or solid door with convection possible for a minimum of Form 2b

Not possible

- Module front for U-FL
- Double doors

4.3.3 Front installation level 1 (FE1) without ventilation slits



U-TE U-FL U-SI U-VLI/U-CWI

Possible versions

- FE1 up to max. $I_{p\,arc}$ 85 kA, 500 V
- Module doors with Form 4b cut-out for U-TE, U-TK up to max. $I_{p\,arc}$ 85 kA
- Module doors with Form 4b cut-out for U-LE, U-LK
- Module door for control compartment for a minimum of Form 2b
- Module front with Form 4b for U-VL(I)/U-CW(I) with rotary drive up to max. $I_{p\,arc}$ 85 kA
- Module front with Form 4b for U-SV, U-S(I) up to max. $I_{p\,arc}$ 85 kA

Not possible

- Module front for U-FL

4.3.4 Front installation level 1 (FE1) with ventilation slits

U-TE U-FL U-SI U-VLI/U-CWI

Possible versions

- Version FE1 up to max. $I_{p\,arc}$ 50 kA, 500 V
- Module doors Form 4b incl. ventilation for U-TE, U-TK, U-LK up to max. $I_{p\,arc}$ 50 kA
- Module front Form 4b incl. ventilation for U-VL(I)/U-CWI with rotary drive up to max. $I_{p\,arc}$ 50 kA
- Module front Form 4b incl. ventilation for U-SV, U-S(I) up to max. $I_{p\,arc}$ 50 kA
- Ventilation covers for Form 4b up to max. $I_{p\,arc}$ 50 kA for U-TE, U-TK, U-LE, U-LK

Not possible

- Module front for U-FL

4.4 Protection concept for interior fittings

Interior fittings

The following pages show the position of the components in the interior fittings depending on the desired arcing class as well as the desired $I_{p\,arc}$.

- Limited to switchgear up to max. $I_{p\,arc}$ 50 kA/85 kA, arcing Class A
- Limited to enclosure up to max. $I_{p\,arc}$ 50 kA, arcing Class B/C
- Limited to enclosure up to max. $I_{p\,arc}$ 85 kA, arcing Class B/C

4.4.1 Limited to switchgear up to 50 kA/85 kA, arcing Class A

To achieve arcing Class A, limited to switchgear up to max. $I_{p\,arc}$ 85 kA, additional protective parts must be installed:

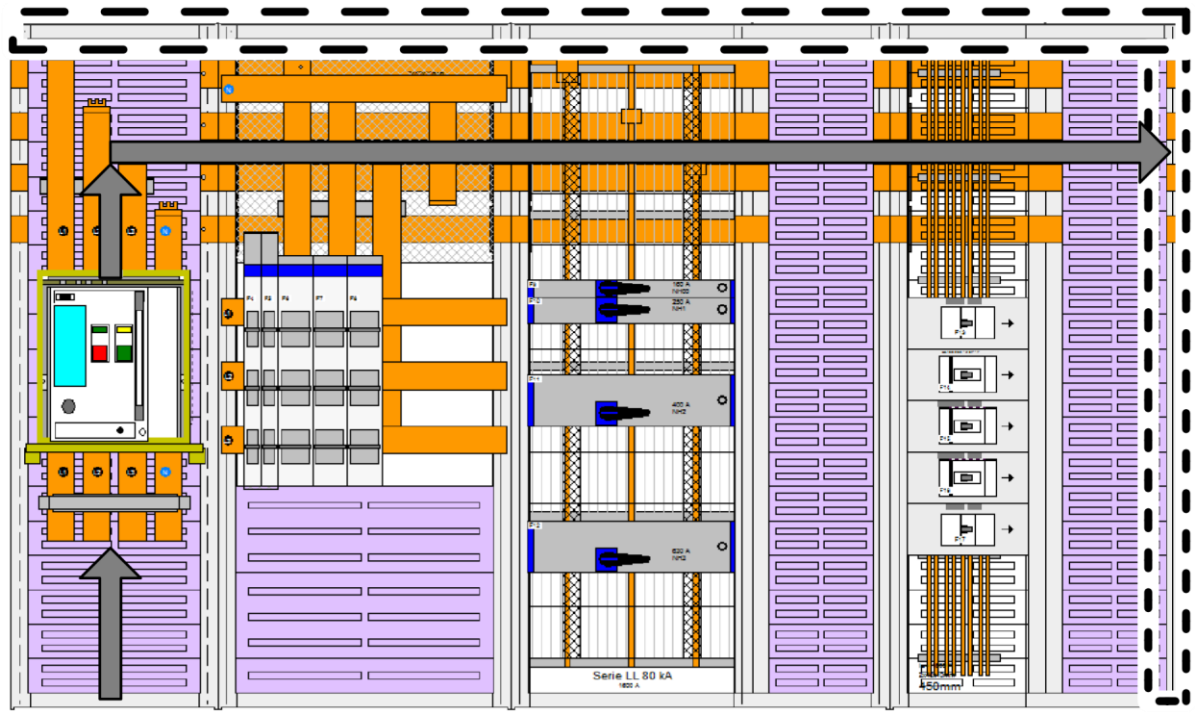
- Side panel protection
- Enclosure divider

Key

Protection area		Protection components
	**Cover plate**	- Cover plate with pressure vent flaps (up to 50 kA) or - Pressure relief cover plate flaps (up to 85 kA)
	**End of switchgear**	- Rear partition holder plate - Arc stoppers - Rear panel protection **Additional components (up to 85 kA)** - Side panel protection of H-SaS (up to 85 kA) - Enclosure divider (up to 85 kA)

-

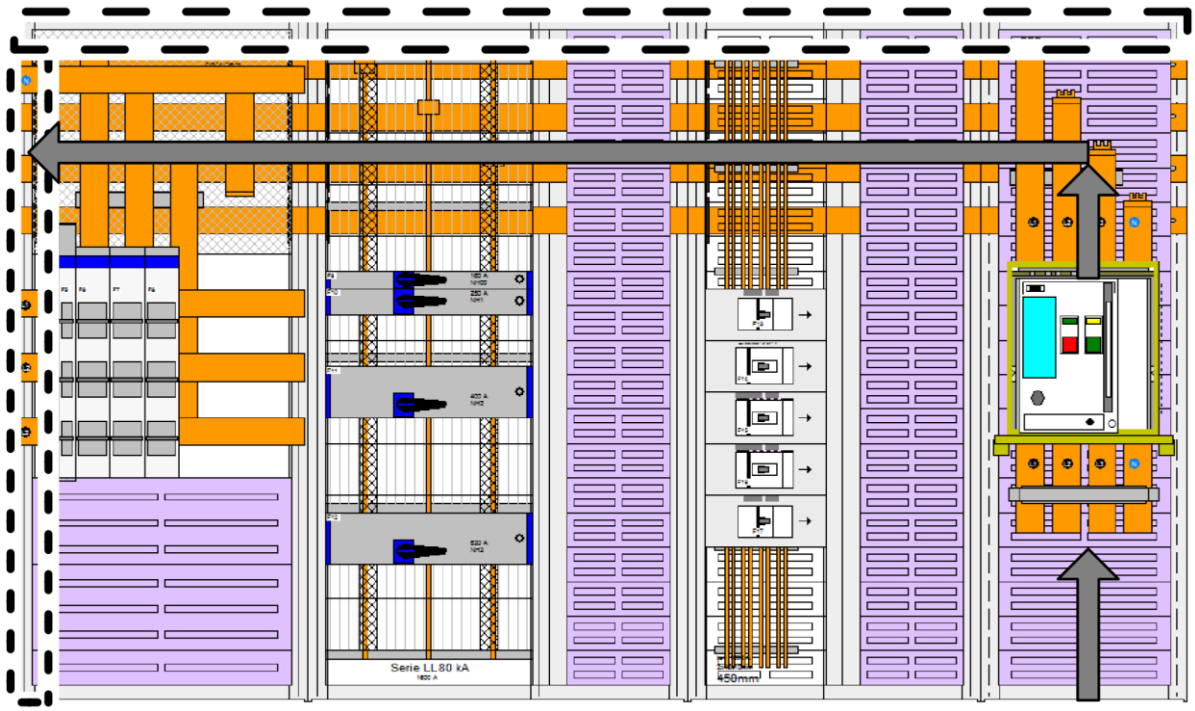
Single incoming unit on left, arcing Class A, max. $I_{p\ arc}$ 85 kA



U-TE	U-FL	U-S(I)	U-VL(I)/U-CW(I)

Component	**Position(s)**
Cover plate with pressure vent flaps	Up to 50 kA: Top
Pressure relief cover plate flaps	Up to 85 kA: Top
Rear partition holder plate	On the right at the end of the switchgear
Arc stoppers	On the right at the end of the switchgear
Rear panel protection	On the right at the end of the switchgear
Side panel protection of H-SaS	Up to 85 kA: on right, at the end of the switchgear
Enclosure divider	Up to 85 kA: on right, at the end of the switchgear

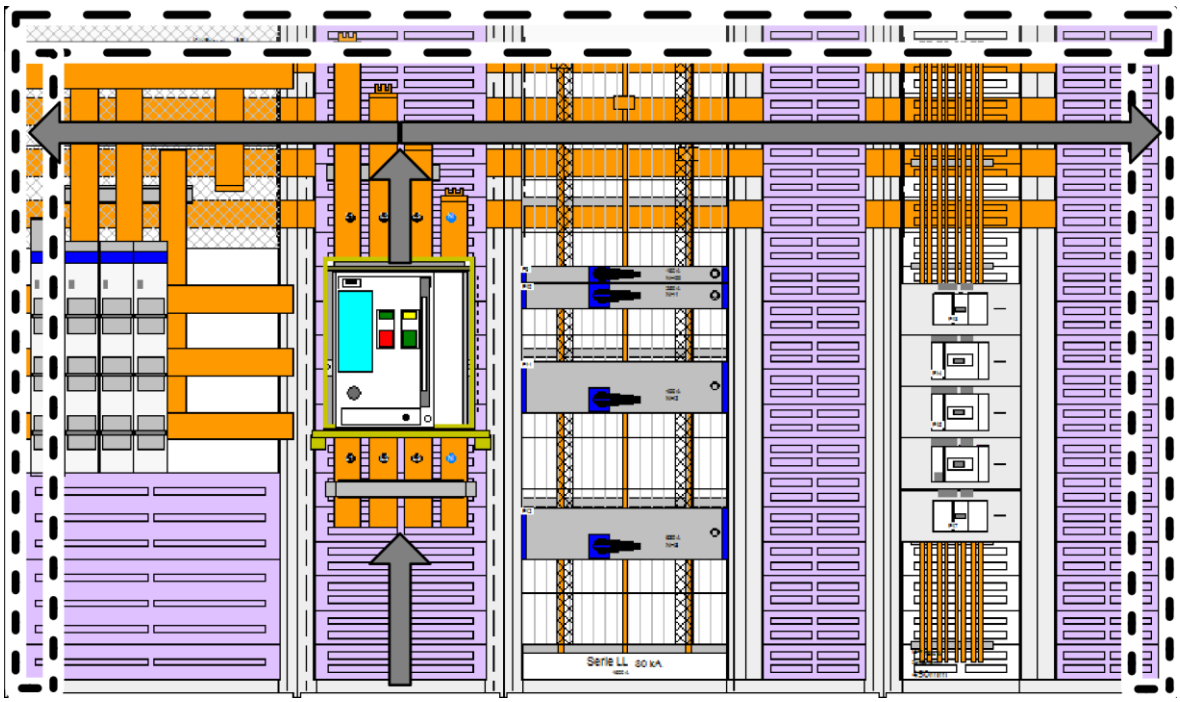
Single incoming unit on right, arcing Class A, max. $I_{p\,arc}$ 85 kA



U-FL	U-S(I)	U-VL(I)/U-CW(I)	U-TE

Component	Position(s)
Cover plate with pressure vent flaps	Up to 50 kA: Top
Pressure relief cover plate flaps	Up to 85 kA: Top
Rear partition holder plate	On the left at the end of the switchgear
Arc stoppers	On the left at the end of the switchgear
Rear panel protection	On the left at the end of the switchgear
Side panel protection of H-SaS	Up to 85 kA: on left, at the end of the switchgear
Enclosure divider	Up to 85 kA: on left, at the end of the switchgear

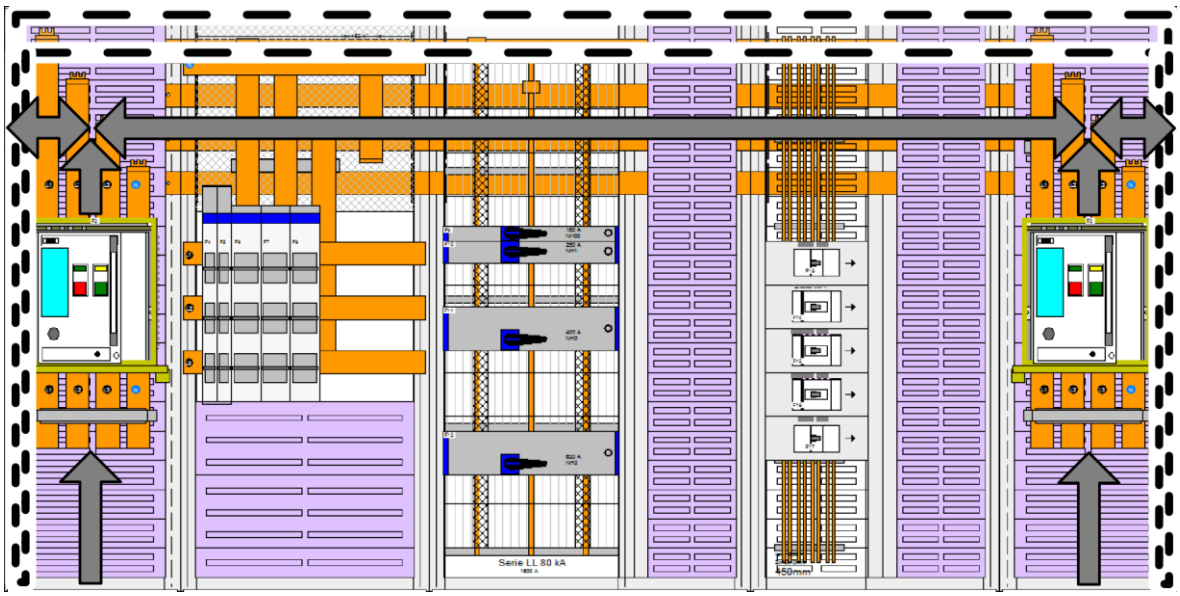
Single incoming unit in middle, arcing Class A, max. $I_{p\ arc}$ 85 kA



U-FL	U-TE	U-S(l)	U-VL(l)/U-CW(l)

Component	**Position(s)**
Cover plate with pressure vent flaps	Up to 50 kA: Top
Pressure relief cover plate flaps	Up to 85 kA: Top
Rear partition holder plate	Left and right at the end of the switchgear
Arc stoppers	Left and right at the end of the switchgear
Rear panel protection	Left and right at the end of the switchgear
Side panel protection of H-SaS	Up to 85 kA: on left and right, at the end of the switchgear
Enclosure divider	Up to 85 kA: on left and right, at the end of the switchgear

Double incoming unit on left + right, arcing Class A, max. $I_{p\ arc}$ 85 kA



U-TE	U-FL	U-S(I)	U-VL(I)/U-CW(I)	U-TE

Component	Position(s)
Cover plate with pressure vent flaps	Up to 50 kA: Top
Pressure relief cover plate flaps	Up to 85 kA: Top
Rear partition holder plate	Left and right at the end of the switchgear
Arc stoppers	Left and right at the end of the switchgear
Rear panel protection	Left and right at the end of the switchgear
Side panel protection of H-SaS	Up to 85 kA: on left and right, at the end of the switchgear
Enclosure divider	Up to 85 kA: on left and right, at the end of the switchgear

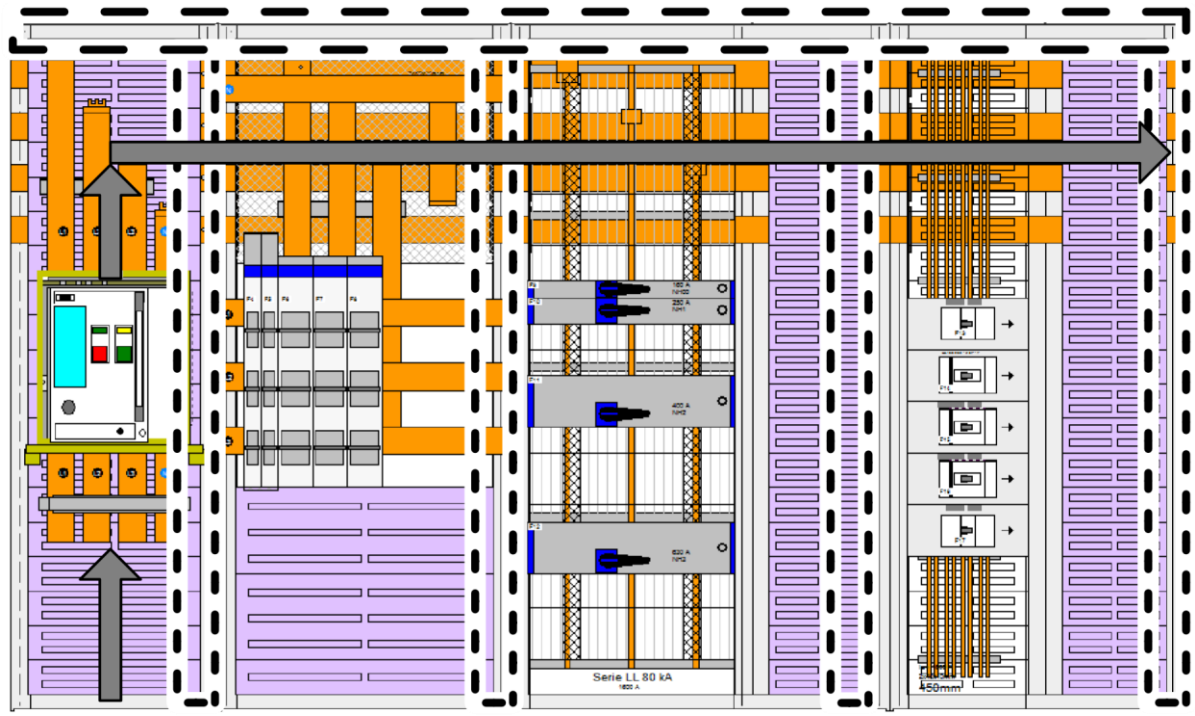
4.4.2 Limited to enclosure up to 50 kA arcing Class B/C

Key for diagrams below

The following components are provided for switchgear up to max. $I_{p\,arc}$ 50 kA and arcing Class B/C.

Protection area		Protection components
	**Cover plate**	- Cover plate with pressure vent flaps or - Pressure relief cover plate flaps
	**End of switchgear**	- Rear partition holder plate - Arc stoppers - Rear panel protection - Side panel protection of H-SaS (optionally at the start or end of switchgear) - Enclosure divider - FSTK spare space cover

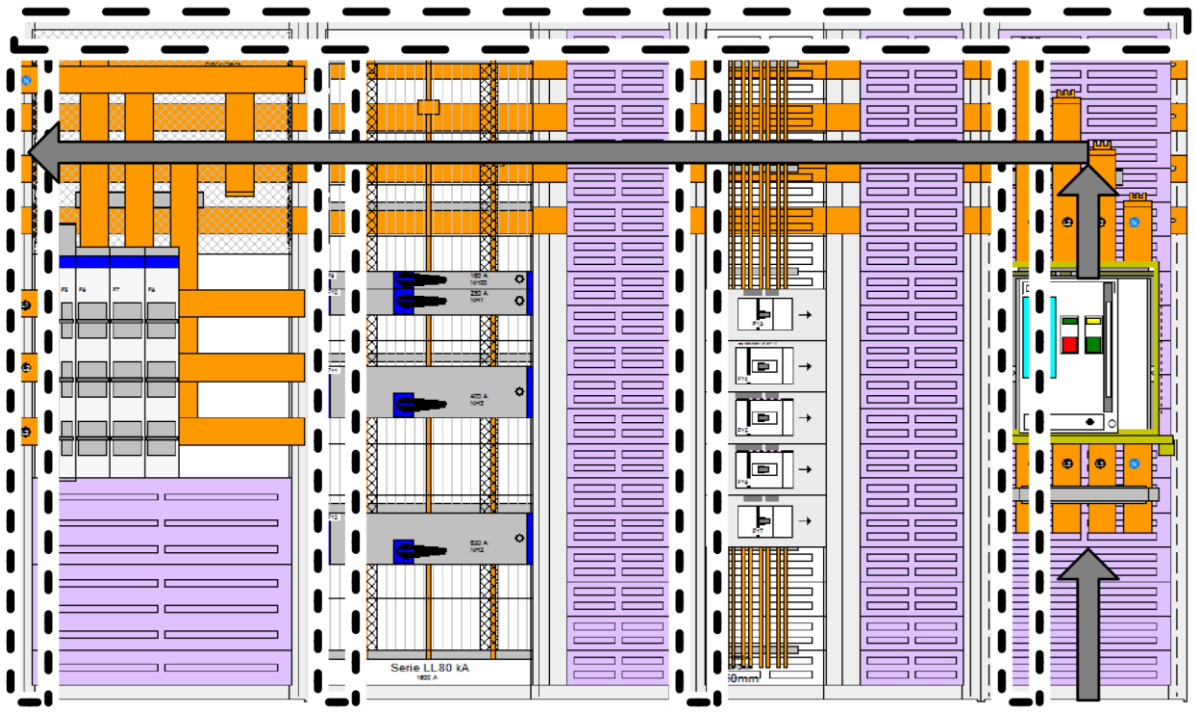
Single incoming unit on left, arcing Class B/C, max. $I_{p\ arc}$ 50 kA



U-TE | U-FL | U-S(I) | U-VL(I)/U-CW(I)

Component	Position(s)
Cover plate with pressure vent flaps or Pressure relief cover plate flaps	Top
Rear partition holder plate	On right in every enclosure
Arc stoppers	On right in every enclosure
Rear panel protection	On right in every enclosure
Side panel protection of H-SaS	Optional: on right, at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	On right in every enclosure

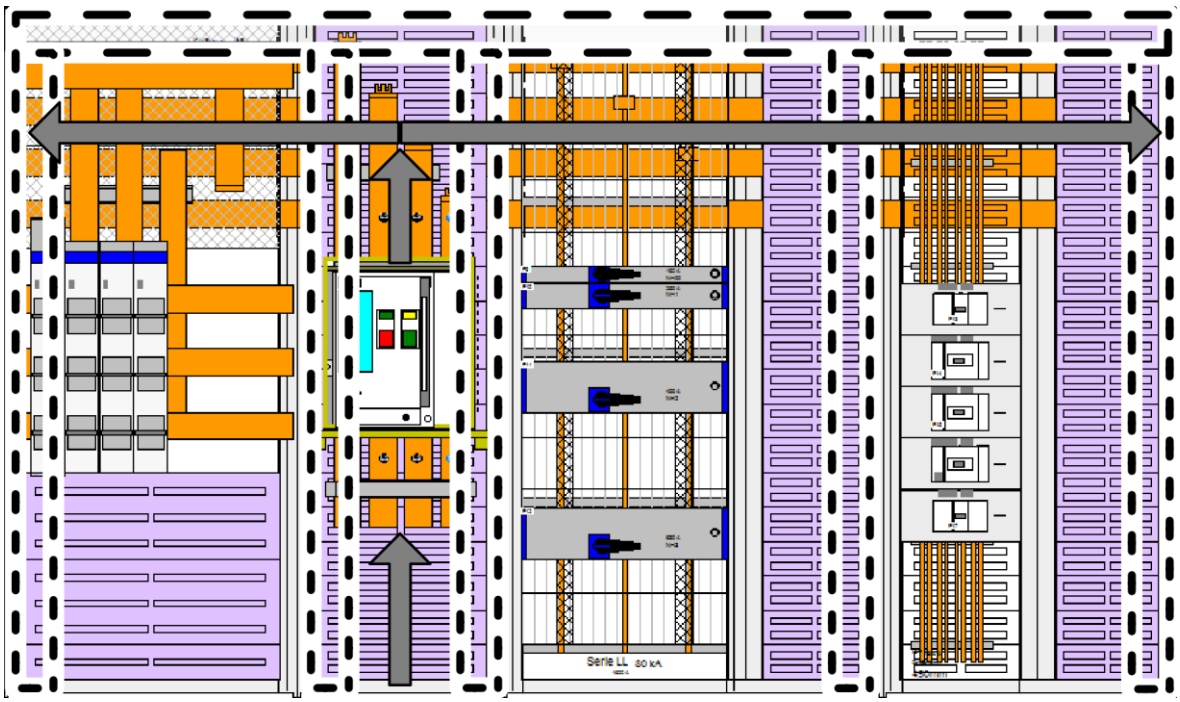
Single incoming unit on right, arcing Class B/C, max. $I_{p\ arc}$ 50 kA



U-FL | U-S(l) | U-VL(l)/U-CW(l) | U-TE

Component	Position(s)
Cover plate with pressure vent flaps or Pressure relief cover plate flaps	Top
Rear partition holder plate	On left in every enclosure
Arc stoppers	On left in every enclosure
Rear panel protection	On left in every enclosure
Side panel protection of H-SaS	Optional: on left, at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	On left in every enclosure

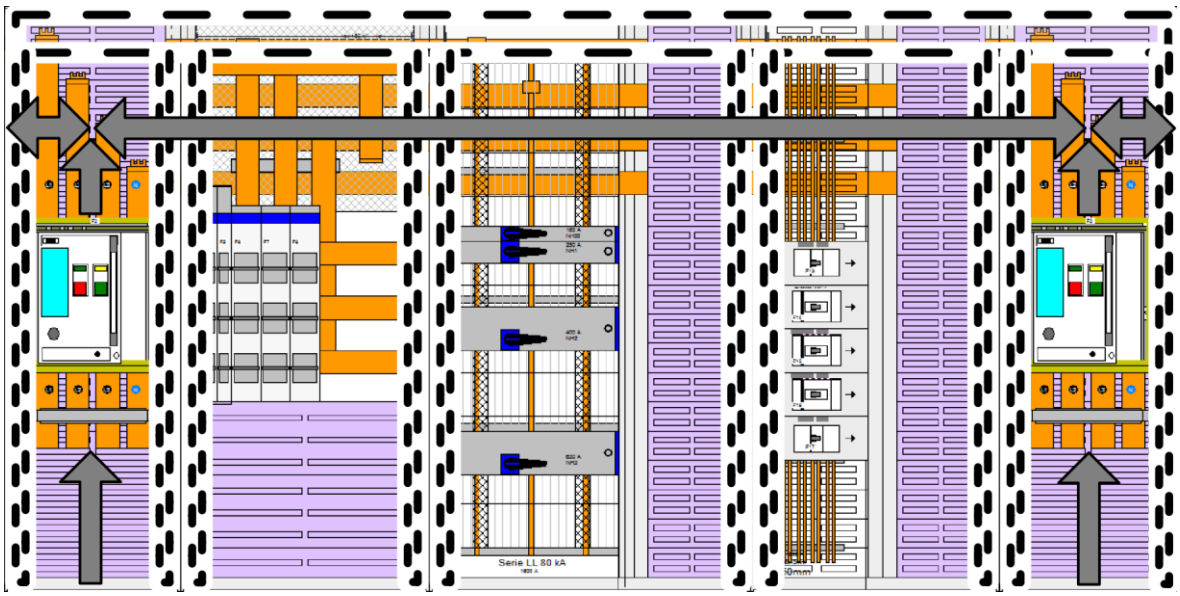
Single incoming unit in middle, arcing Class B/C, max. $I_{p\,arc}$ 50 kA



U-FL	U-TE	U-S(I)	U-VL(I)/U-CW(I)

Component	**Position(s)**
Cover plate with pressure vent flaps or Pressure relief cover plate flaps	Top
Rear partition holder plate	Left in every enclosure + right at the end of the switchgear
Arc stoppers	Left in every enclosure + right at the end of the switchgear
Rear panel protection	Left in every enclosure + right at the end of the switchgear
Side panel protection of H-SaS	Optional: on left and right at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left in every enclosure + right at the end of the switchgear

Double incoming unit on left + right, arcing Class B/C, max. $I_{p\,arc}$ 50 kA



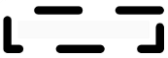
U-TE	U-FL	U-S(I)	U-VL(I)/U-CW(I)	U-TE

Component	Position(s)
Cover plate with pressure vent flaps or Pressure relief cover plate flaps	Top
Rear partition holder plate	Left and right in every enclosure
Arc stoppers	Left and right in every enclosure
Rear panel protection	Left and right in every enclosure
Side panel protection of H-SaS	Optional: on left and right at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left and right in every enclosure

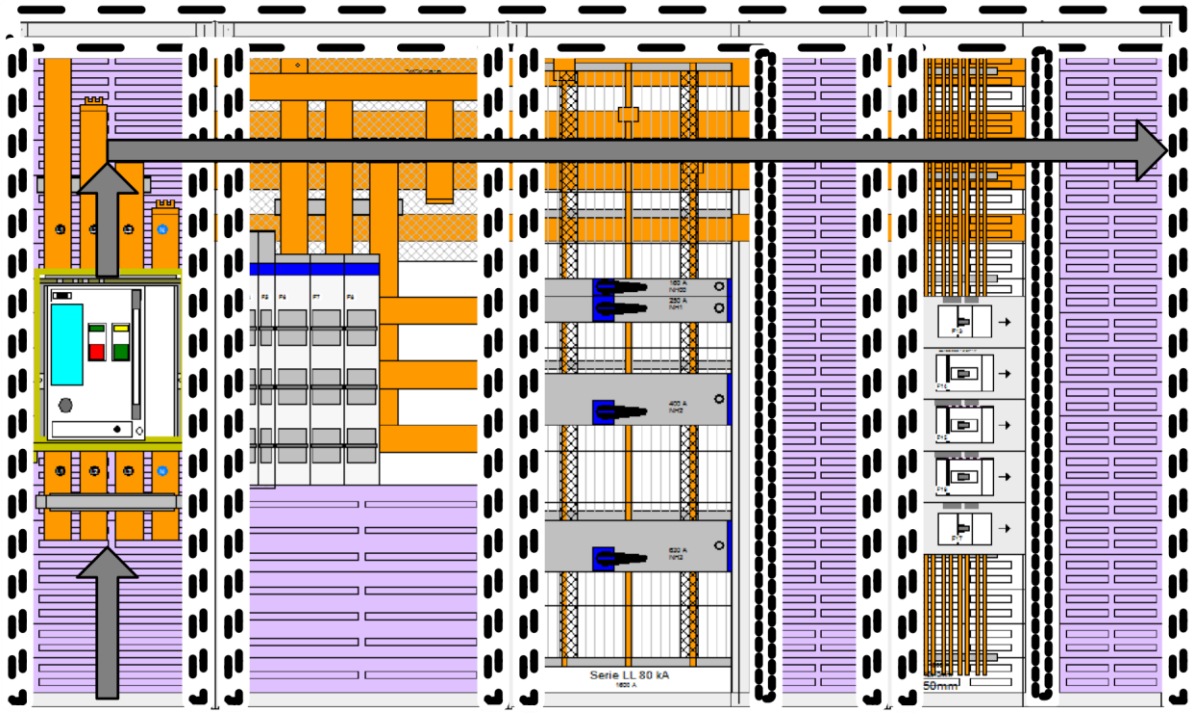
4.4.3 Limited to enclosure up to 85 kA arcing Class B/C

Key for diagrams below

The following components are provided for switchgear up to max. $I_{p\,arc}$ 85 kA and arcing Class B/C.

Protection area		Protection components
	**Cover plate**	- Pressure relief cover plate flaps
	**End of switchgear**	- Rear partition holder plate - Arc stoppers - Rear panel protection - Side panel protection of H-SaS - Enclosure divider - FSTK spare space cover
	**Rear panel**	- Rear panel protection (mounted on retaining plate with integrated cable compartment)

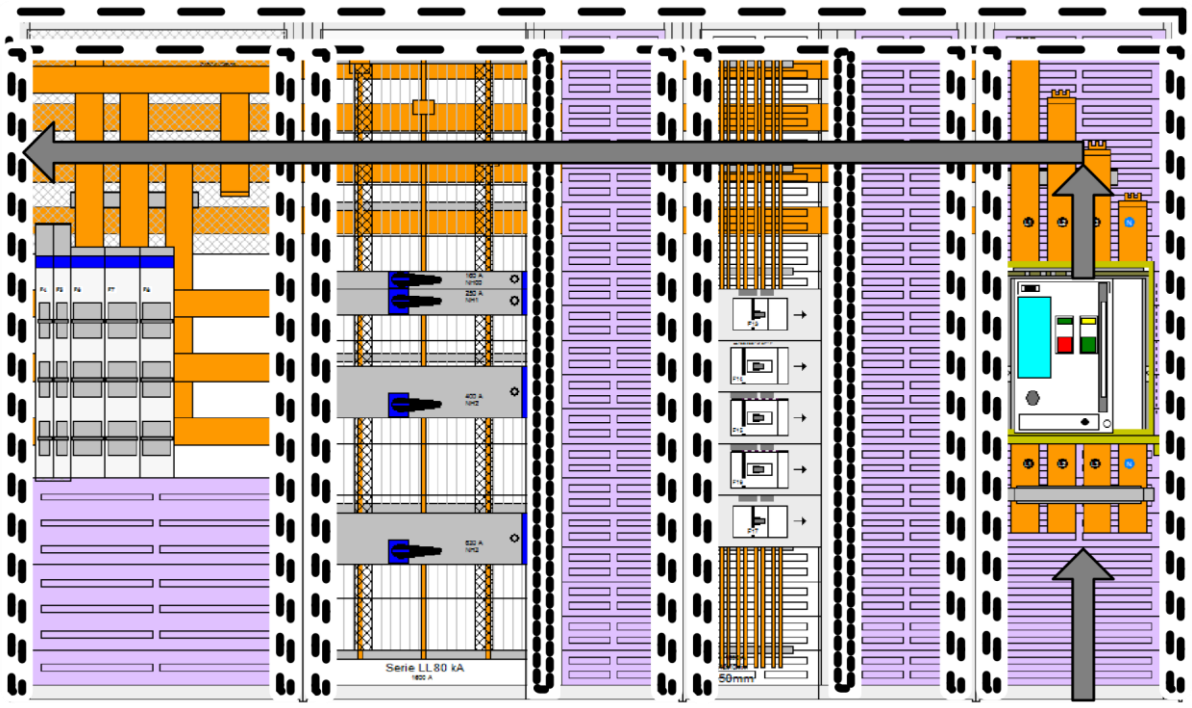
Single incoming unit on left, arcing Class B/C, max. $I_{p\ arc}$ 85 kA



U-TE | U-FL | U-S(I) | U-VL(I)/U-CW(I)

Component	Position(s)
Pressure relief cover plate flaps	Top
Rear partition holder plate	Left and right in every enclosure
Arc stoppers	Left and right in every enclosure
Rear panel protection	Left and right in every enclosure
Side panel protection of H-SaS	On the right at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left and right in every enclosure
Rear panel protection (mounted on retaining plate with integrated cable compartment)	Middle of the enclosure (with integrated cable compartment)

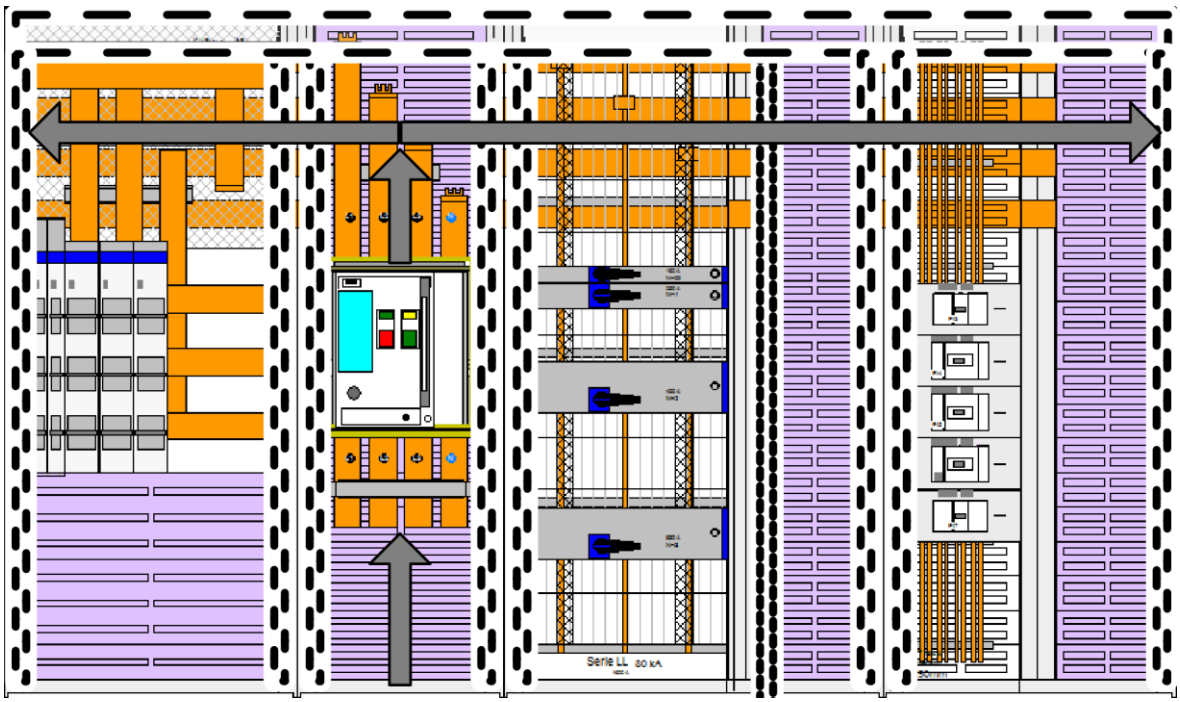
Single incoming unit on right, arcing Class B/C, max. $I_{p\ arc}$ 85 kA



U-FL | U-S(I) | U-VL(I)/U-CW(I) | U-TE

Component	Position(s)
Pressure relief cover plate flaps	Top
Rear partition holder plate	Left and right in every enclosure
Arc stoppers	Left and right in every enclosure
Rear panel protection	Left and right in every enclosure
Side panel protection of H-SaS	On the left at the end of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left and right in every enclosure
Rear panel protection (mounted on retaining plate with integrated cable compartment)	Middle of the enclosure (with integrated cable compartment)

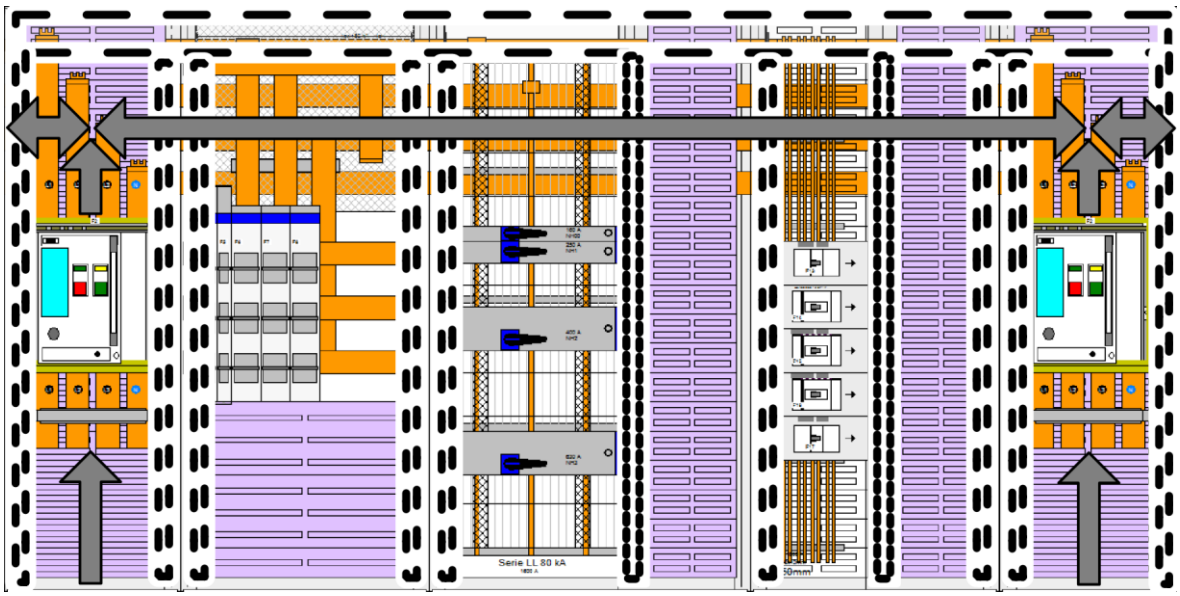
Single incoming unit in middle, arcing Class B/C, max. $I_{p\,arc}$ 85 kA



U-FL	U-TE	U-S(I)	U-VL(I)/U-CW(I)

Component	**Position(s)**
Pressure relief cover plate flaps	Top
Rear partition holder plate	Left and right in every enclosure
Arc stoppers	Left and right in every enclosure
Rear panel protection	Left and right in every enclosure
Side panel protection of H-SaS	Left and right at the ends of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left and right in every enclosure
Rear panel protection (mounted on retaining plate with integrated cable compartment)	Middle of the enclosure (with integrated cable compartment)

Double incoming unit on left + right, arcing Class B/C, max. $I_{p\,arc}$ 85 kA



U-TE	U-FL	U-S(I)	U-VL(I)/U-CW(I)	U-TE

Component	Position(s)
Pressure relief cover plate flaps	Top
Rear partition holder plate	Left and right in every enclosure
Arc stoppers	Left and right in every enclosure
Rear panel protection	Left and right in every enclosure
Side panel protection of H-SaS	Left and right at the ends of the switchgear
Enclosure divider	Between all enclosures in the switchgear
FSTK spare space cover	Left and right in every enclosure
Rear panel protection (mounted on retaining plate with integrated cable compartment)	Middle of the enclosure (with integrated cable compartment)

4.5 Special solutions for U-TE/U-TK

U-TE/U-TK with main busbar in the middle

A different partition concept applies to enclosures U-TE/U-TK with the main busbar in the middle so that the busbar does not collide with the partition plate and arc stoppers.

As a solution, only the special 'rear partition holder plate' U-RWSHASASMI3PN is installed instead of two parts 'rear partition' U-RWSCHHA and 'rear panel protection'. This solution provides the same functions and no arc stoppers or rear panel protection need to be installed.

The number of rear partition holder plates U-RWSHASASMI3PN to be installed is based on the project planning rules for 'main busbar in middle', 'limited to switchgear' or 'limited to enclosure' and the maximum $I_{p\,arc}$.

U-RWSHASASMI3PN

U-TE/U-TK width 450 mm, 3P+N

A different partition concept applies to enclosures U-TE/U-TK with width of 450 mm and 3P+N so that the busbar does not collide with the partition plate and arc stoppers.

As a solution, only the special 'rear partition holder plate' U-RWSHASASMI3PN is installed instead of two parts 'rear partition holder plate' U-RWSCHHA and 'rear panel protection'. This solution provides the same functions and no arc stoppers or rear panel protection need to be installed.

The number of rear partition holder plates to be installed U-RWSHASASMI3PN is based on the project planning rules for 'limited to switchgear' or 'limited to enclosure' and the maximum $I_{p\,arc}$.

U-RWSHASASMI3PN

5 Design and function

Passive arc fault protection components and their function

Chapter index

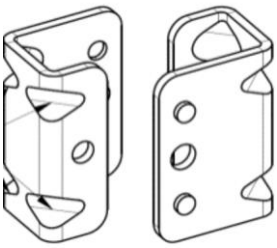
5.1 Enclosure shell components

5.1.1 Holding bracket for rear panel

Holding bracket for rear panel

Rear panel secured with 8 x fixing angle

Do not use universal hinges



Special fixing angles

In principle, standard rear panels can be used but the universal hinges are too weak to withstand the pressure of an arc fault.

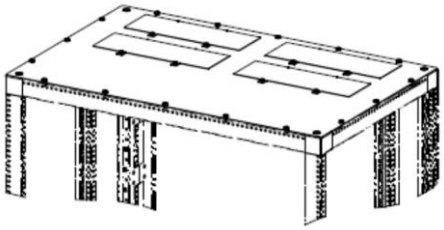
- Each rear panel must be secured **with 8 special fixing angles**.

Versions

Different versions are available for the different enclosure dimensions. The references can be found in the Appendix, see page 78.

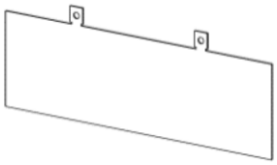
5.1.2 Cover plate and cover plate flaps

Cover plate with pressure vent flaps up to max. $I_{p\,arc}$ 50 kA



Cover plates with pressure vent flaps

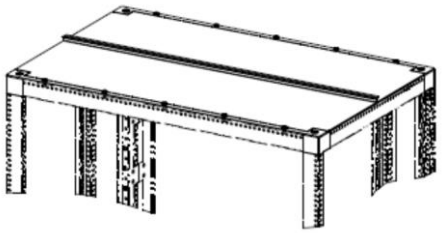
Cover plate



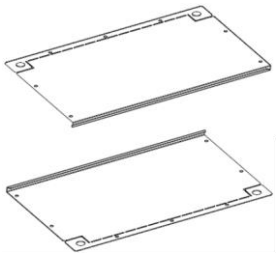
Pressure vent flap (spare flap for cover plate)

- Cover plates with pressure vent flaps are suitable for cable entry from above.
- Application in arc fault protection up to max. $I_{p\,arc}$ 50 kA

Pressure relief cover plate flaps up to max. $I_{p\,arc}$ 85 kA



Pressure relief cover plate flaps, mounted



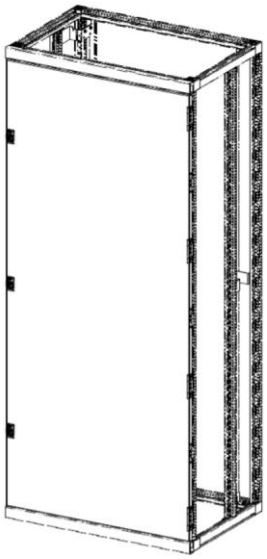
Pressure relief cover plate flaps

- The pressure relief cover plate flaps open upwards in the event of a shock wave, thereby reducing the pressure inside the enclosure. They are therefore not suitable for cable entry from above due to the possibility of this movement.
- Application in arc fault protection up to max. $I_{p\,arc}$ 85 kA

5.2 Enclosure front components

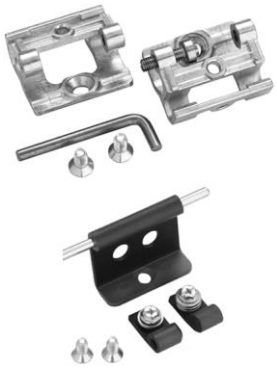
5.2.1 Solid door and module door hinges

Solid door and module door hinges



7 hinges for solid door

Solid door with 7 hinges and 3 locks



Hinge sets for 120°/180°

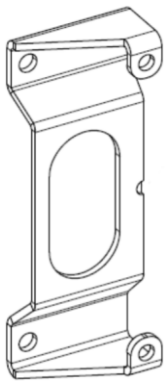
Standard solid doors and modular doors can be used with the passive arc fault protection system, but the standard locks with rod guides are not sufficiently stable to withstand the pressure of an arc fault. The following adjustments are therefore necessary:

- Solid doors must be secured with either 7 x 120° hinges or 4 x 180°.
- Each module door must be secured with 2 hinges (120° or 180°).

5.2.2 Solid door and module door locking

Solid door and module door locking

Only use 60 x 35 mm key plates



Reinforced closing angle (individual part)

Note the following for the locks:

- Only 60 x 35 mm key plates can be used both for module doors and solid doors.
- A reinforced closing angle must be mounted on the support for each lock.
- Each solid door must be fitted **with 3 locks**.
- One lock is sufficient for module doors.
- Hager has already pre-assembled hinges and key plates.

5.2.3 Adjustment covers

Adjustment covers

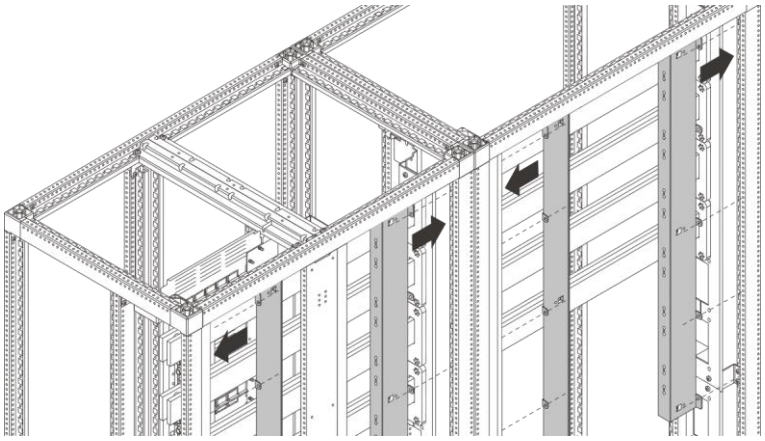
Covers are also required in enclosures without arc fault protection and are used to adjust the height of module doors.

Only closed enclosure covers may be used in enclosures with passive arc fault protection and max. $I_{p\,arc}$ 85kA.

5.3 Components in the interior fittings

5.3.1 Rear partition holder plates

Application area



Rear partition holder plates, assembly

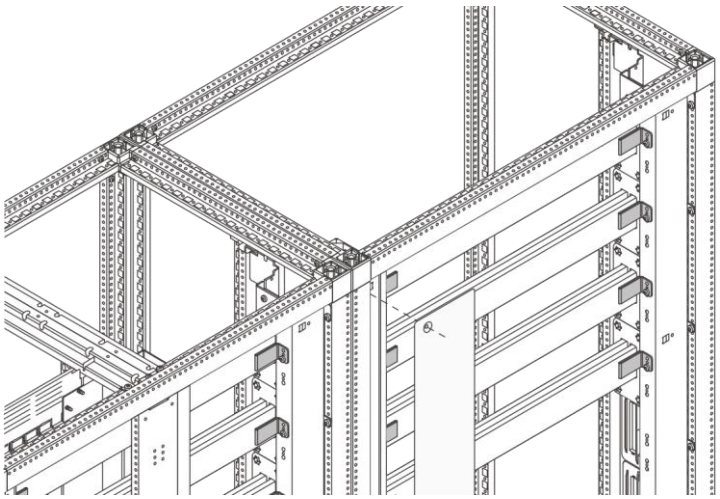
Rear partition holder plate as individual part

A rear partition holder plate prevents an arc fault from spreading from one switchgear part to another.

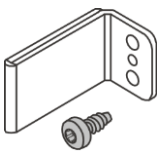
Every partition is screwed onto the enclosure profile between the retaining plate of the busbars and rear panel using 4 screws. This version is intended for use on the right or left (rotate 180°). The number of partitions required varies depending on the type of incoming unit, position of the main busbar or required protection class.

5.3.2 Arc stoppers

Application area



Arc stoppers are bolted to the rear partition holder plate at the height of the busbars.

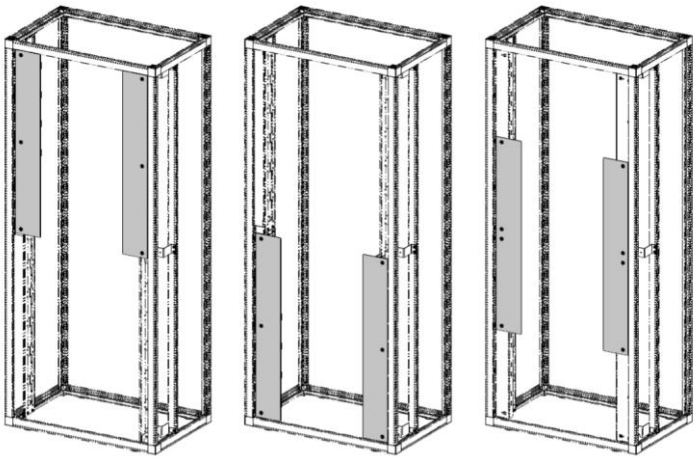


Arc stopper with attachment

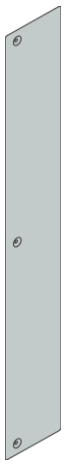
Arc stoppers are mounted on the rear partition holder plate on the connection side at the height of the main busbar. If an arc fault occurs, it should stop in the area of the arc stoppers. The arc stoppers are thereby 'consumed' by the arc fault with the result that the arc fault is held in this area until an upstream protective device switches off the voltage supply. Ideally, this prevents the arc fault from spreading within the switchgear.

5.3.3 Rear panel protection

Application area



Rear panel protection, mounted



U-RWSOU for top/bottom mounting position

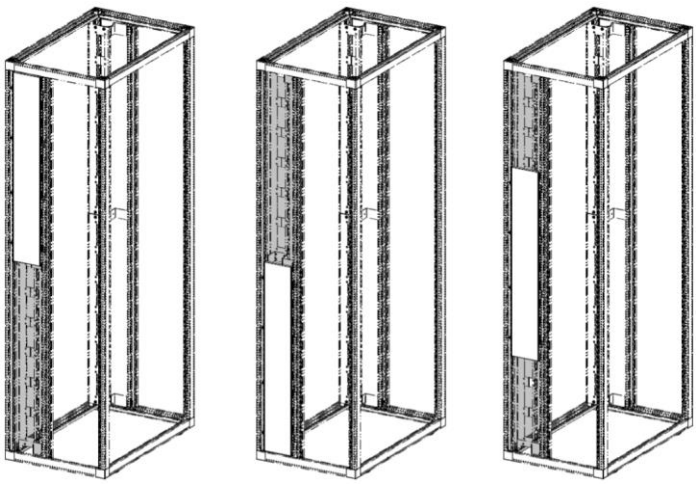
U-RWSM for middle mounting position

The rear panel protection acts as a protective shield for the rear panel in the area of the arc stoppers. Because the arc fault is delayed at the arc stoppers, without this protection, it could burn holes in the rear panel of the enclosure. In addition, the rear panel protection prevents the arc fault from penetrating further to the rear panel.

The number and design of the rear panel protection depends on the type of incoming unit, the main busbar position and the required protection class.

5.3.4 Side panel protection

Application area



Side panel protection mounted at different positions

Side panel protection

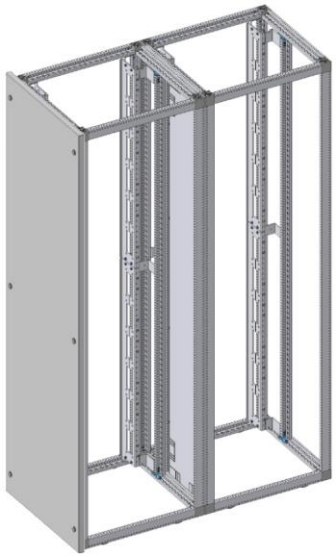
Just like the rear panel, the side panel must also be protected from the consequences of a hot arc fault in the immediate vicinity. Because the arc fault moves along the busbar system, the position of the side panel protection is based on the position of the main busbar in the enclosure. This protection prevents holes in the side panel of the enclosure. If two main busbars are installed in the enclosure, the entire side panel is thus closed.

The side panel protection is mounted on the two side panels at the height of the main busbar.

Designed for	Use of side panel protection
Max. $I_{p\ arc}$ 50 kA, Class A	Recommended
Max. $I_{p\ arc}$ 50 kA, Class B/C	Recommended
Max. $I_{p\ arc}$ 85 kA	Essential

5.3.5 Enclosure divider

Application area



Left: Side panel with enclosure divider
Middle: Enclosure divider between the enclosures

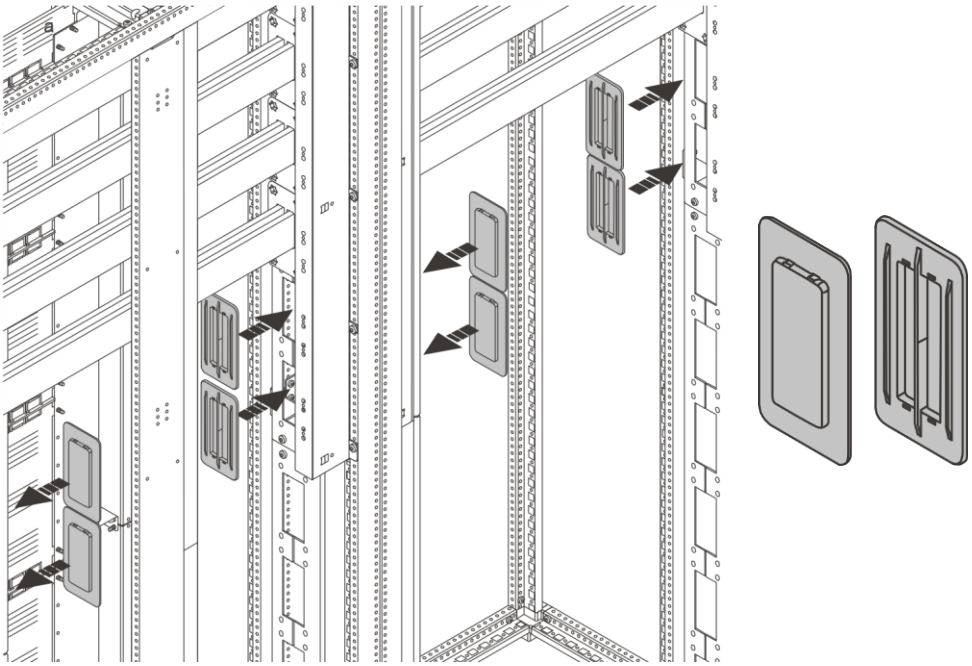
Enclosure divider

The enclosure divider protects the side panel in the device field and must be installed at the last enclosure (facing away from the source) in every switchgear between the enclosure and the side panel

To achieve arcing Class B/C, enclosure dividers are also mounted between all enclosures. Even where the requirement is 'limited to enclosure', there must be at least one enclosure divider between two adjacent enclosures. For this purpose, an enclosure divider is installed on all enclosures on the same enclosure side (left or right).

5.3.6 FSTK spare space cover

Application area



Covers are installed without additional assembly material by clicking in

FSTK spare space cover (front/rear)

In order to hold back the arc fault in the field of origin and to prevent it from migrating to other areas, unused openings in the retaining plates are sealed by means of FSTK spare place covers.

The covers must be installed from protection class 'arcing Class B/C' (limited to enclosure up to 50 kA). The number and position of the covers depends on the position of the main busbar and is described in detail in section "FSTK spare space cover".

6 Assembly

Chapter index

6.1 Assembly information

Assembly information

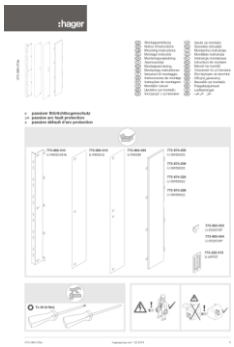
The following sequence is recommended when mounting the components of the arc fault protection system:

1	Check if enclosure divider(s) are installed
2	Rear partition holder plate
3	Fit FSTK spare space covers
4	Screw the arc stoppers together (alternatively screw them to the rear partition holder plate beforehand)
5	Mount rear panel protection
6	Install side panel protection
7	Secure the side panels
8	Mount the cover plate flaps if there is a cable entry from above.
9	Adjust copper angles (only for U-TE/U-TK/U-FL) enclosures

Retrofitting of the passive arc fault protection may be possible if the enclosure is accessible from the rear (pay attention to enclosure divider!).

NOTE

- The arc stoppers must always be mounted before the rear panel protection. The rear partition holder plates are no longer accessible after this.



- Follow the Hager installation manual on passive arc fault protection when mounting the individual components.

6.2 Enclosure shell

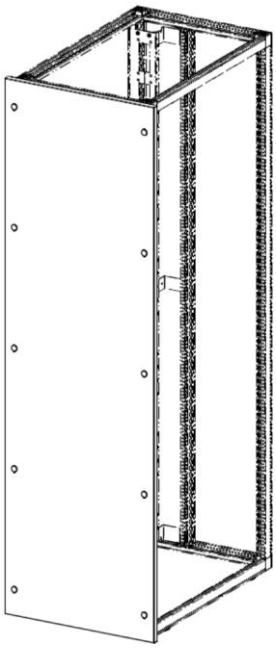
6.2.1 Reinforced rear panel

Assembly

The standard rear panel can be used. However, the rear panel must be secured with reinforced holding brackets. Hager has already pre-assembled these brackets.

6.2.2 Reinforced side panels

Position and number



Reinforced side panels are mounted on the left and right in switchgear with arc fault protection.

Assembly

The side panels are first hung at the top of the enclosure frame.

After inserting the opened screw cover caps into the enclosure wall, each side panel is bolted to the enclosure frame with 10 screws. Finally, the cover caps are closed.

6.2.3 Cover plate and cover plate flaps

Mounting cover plate with pressure vent flaps up to max. $I_{p\,arc}$ 50 kA

The cover plate is bolted onto the enclosure frame from above using the screws supplied. If necessary, openings are made in the cover plate for cable routing.

Mounting pressure relief cover plate flaps up to max. $I_{p\,arc}$ 85 kA

The pressure relief cover plate flaps are bolted onto the enclosure frame from above. **Comment:** The cable **cannot** be routed upwards in this case.

6.3 Enclosure front

6.3.1 Adjustment covers, enclosure covers and doors

Mounting adjustment covers

Already pre-assembled by Hager.

Mounting enclosure covers

Already pre-assembled by Hager.

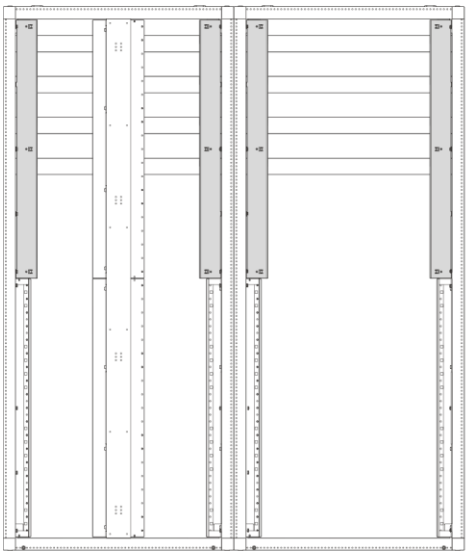
Mounting doors

Hager has already pre-assembled hinges and key plates.

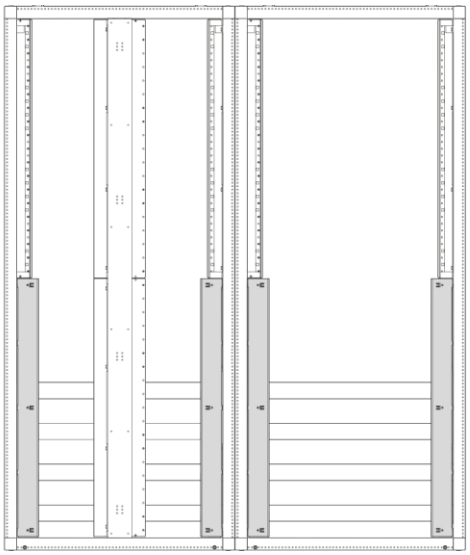
6.4 Interior fittings

6.4.1 Rear partition holder plate

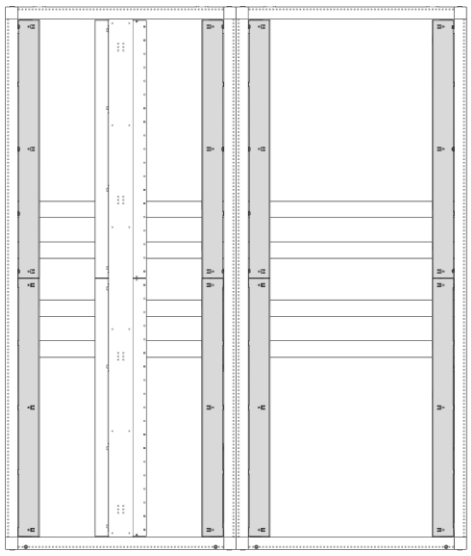
Position and number



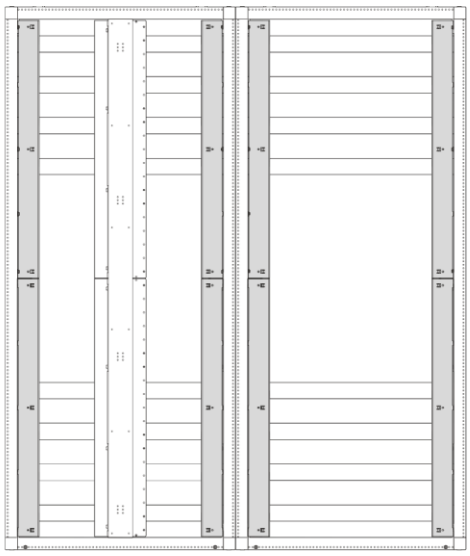
Rear partition holder plates if **main busbar at top**



Rear partition holder plates if **main busbar at bottom**



Rear partition holder plates if **main busbar in middle**



Rear partition holder plates if **two main busbars at top and bottom**

- Partitions are attached to the enclosure profile with 5 screws at the same height as the main busbar. By rotating through 180°, the element can be used both left and right.
- If the main busbar is located in the middle of the enclosure, or if two main busbars are installed in the enclosure, the partitions are fitted at the top and bottom.
- The partition positions specified above apply to both 3-pole and 4-pole main busbars.

Up to max. $I_{p\ arc}$ 50 kA	**From $I_{p\ arc}$ 50 kA**
Incoming unit on one side: - Partitions are only mounted so that they are facing away from the source Incoming unit on left and right: - Partitions are mounted on both sides	Irrespective of incoming unit: - Partitions are mounted on both sides

NOTE

In the following cases, 4 rear partition holder plates of type U-RWSHASASMI3PN are always mounted (top and bottom). No arc stoppers can be mounted there due to the geometry:

- Enclosure U-TE/U-TK with main busbar in the middle
- Enclosure U-TE/U-TK with a width of 450 mm and fitted with 3P+N

Details about these solutions are provided in section "Special solutions for U-TE/U-TK"

Assembly

➢ Align the top or bottom of the partition so that it is flush with the top or bottom edge of the corresponding retaining plate.
➢ After mounting the first screw:

- check the alignment: The end of the partition must be level with the end of the retaining plate,
- the hooks must be retracted.

➢ Then fit the remaining screws.

Versions

Different versions are available for the different enclosure dimensions. The references can be found in the Appendix, see page 78.

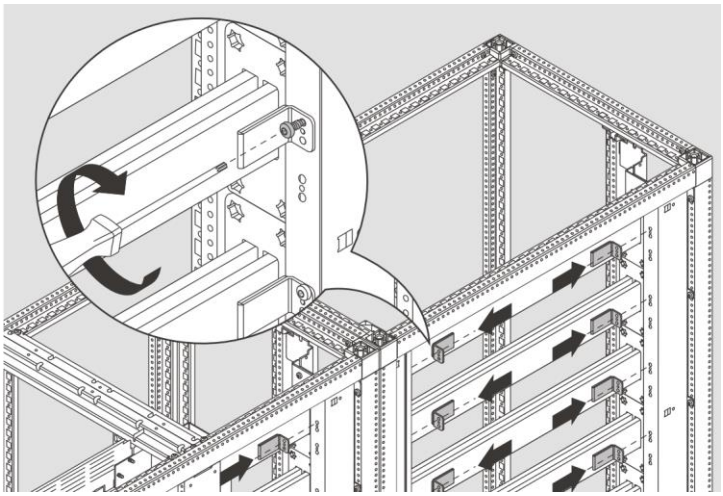
6.4.2 Arc stoppers

Position and number

Arc stopper assembly kits (incl. fixing material) are available for 3- or 4-pole systems in accordance with the main busbar. By turning 180°, they can be used both right and left. They are secured onto the rear partition holder plates.

If mounted above the enclosure middle: align the arc stoppers with the top edge of the main busbar.

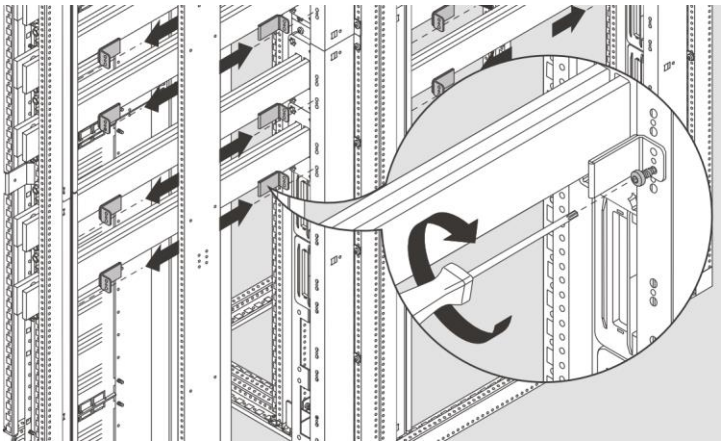
If mounted below the enclosure middle: align the arc stoppers with the bottom edge of the main busbar.



In the **top** section of the enclosure:

Top edge of arc stopper = Top edge of busbar

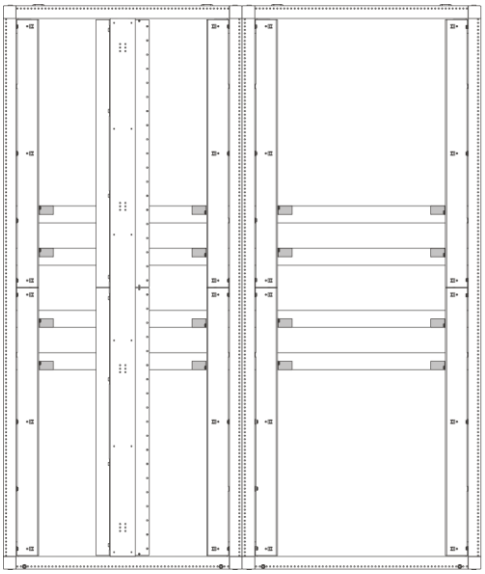
Enclosure middle



In the **bottom** section of the enclosure:

Bottom edge of arc stopper = Bottom edge of busbar

Position of arc stoppers where main busbar is in the middle



The top edge of the arc stopper is flush with the top edge of the busbar in the top half of the enclosure

The bottom edge of the arc stopper is flush with the bottom edge of the busbar in the bottom half of the enclosure

Assembly

The arc stoppers are secured onto the rear partition holder plate with one screw in each case. The arc stoppers can also be pre-assembled outside the enclosure on the rear partition holder plates before the rear partition holder plates are inserted.

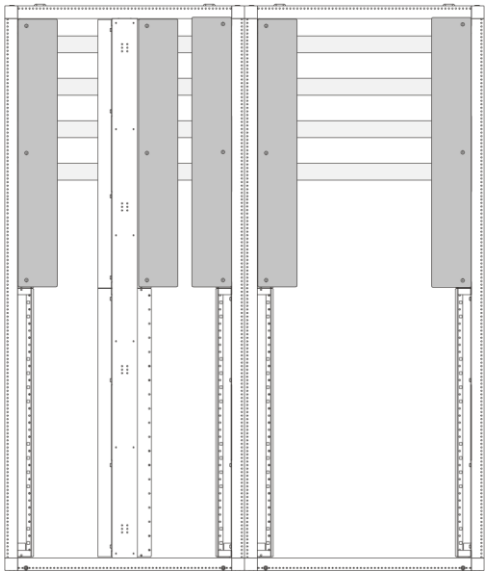
6.4.3 Rear panel protection

Versions

There are two versions depending on the installation position of the main busbar (H-SaS).

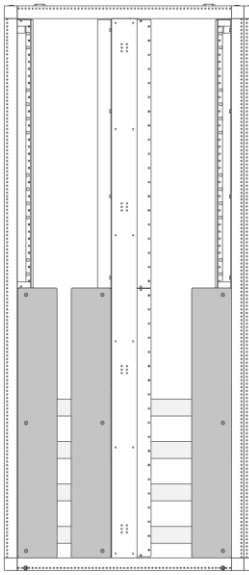
Rear panel protection version	Position of main busbar
U-RWSOU	- top - bottom - on two main busbar positions
U-RWSM	Main busbar in the middle

Position and number for main busbar at top/bottom

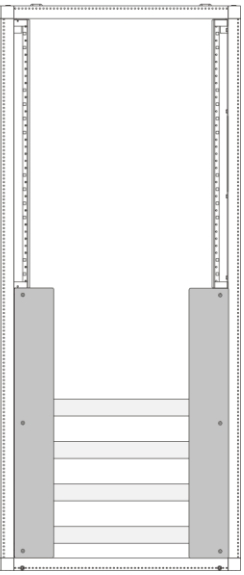


Rear panel protection for H-SaS at top (with integrated cable compartment)

Rear panel protection for H-SaS at top

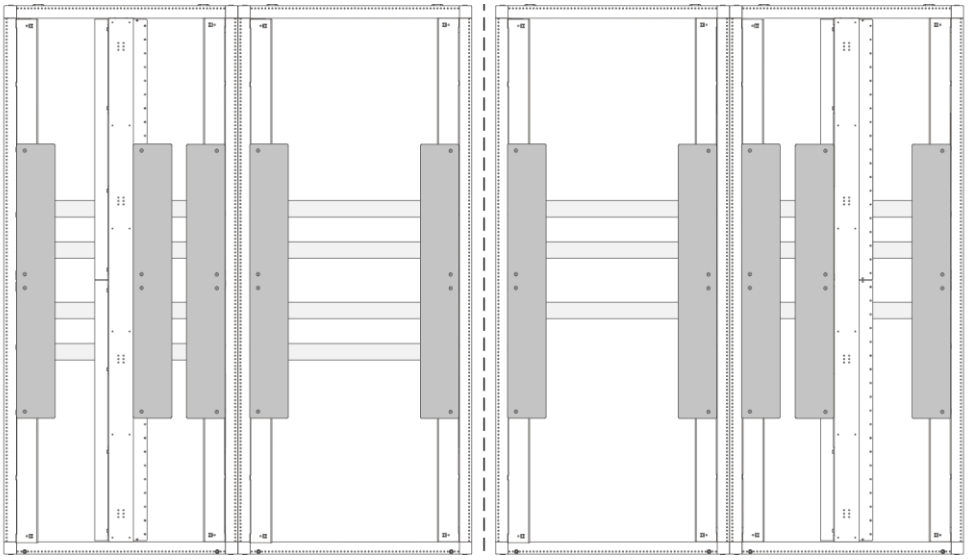


Rear panel protection for H-SaS at bottom (with integrated cable compartment)



Rear panel protection for H-SaS at bottom

Position and number for H-SaS in middle



Rear panel protection for 4-pole H-SaS in middle (with integrated cable compartment)

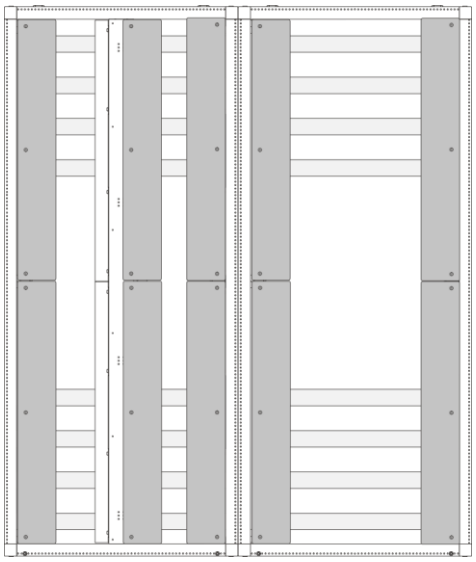
Rear panel protection for 4-pole H-SaS in middle

Rear panel protection for 3-pole H-SaS in middle (with integrated cable compartment)

Rear panel protection for 3-pole H-SaS in middle

The rear panel protection U-RWSM is fastened to the rear partition holder plates with 4 screws or, in the case of the integrated cable compartment (KRI), directly to the enclosure frame.

Position and number for 2 x H-SaS



Rear panel protection for 2 x H-SaS (with integrated cable compartment)

Rear panel protection for 2 x H-SaS

Assembly

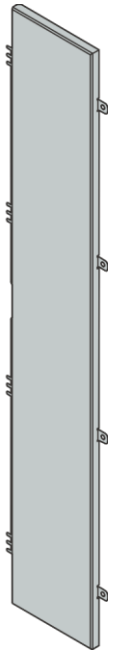
The rear panel protection is screwed onto the mounted rear partition holder plates using the 3 screws supplied. By turning 180°, it can be used both right and left.

If the main busbar is located in the middle, rear panel protection U-RWSM is required instead of rear panel protection U-RWSOU. It is secured with 4 screws.

The rear panel protection is mounted on the enclosure profile in the vertical centre of the enclosure in enclosures with an integrated cable compartment (KRI).

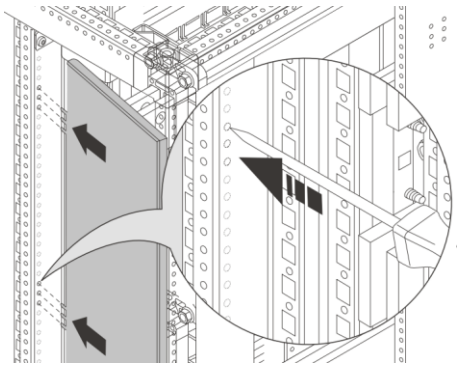
6.4.4 Side panel protection of the H-SaS

Position and number

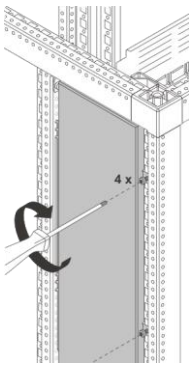


The side panel protection is fitted at the height of the main busbar facing away from the source. The entire side panel must be locked if there are two main busbars.

Assembly



When mounting, holes are first opened in the enclosure profile using a punch and hammer.



The side panel protection can then be inserted into the side of the enclosure rack. It is fastened with 4 screws on the opposite side.

Versions

Different versions are available for the different enclosure dimensions. The references can be found in the Appendix, see page 78.

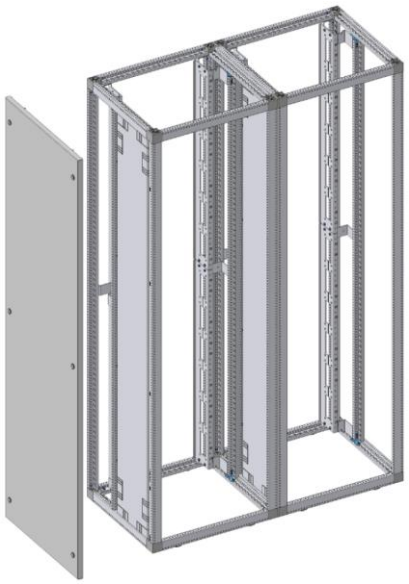
6.4.5 Enclosure divider

Position and number

The enclosure dividers are mounted between the enclosures depending on the required protection class and the rated short-time withstand current $I_{p\ arc}$. The number and position can be seen in the "Protection concept for interior fittings" section.

Assembly

The enclosure divider is mounted between the enclosure rack and additional depth support.



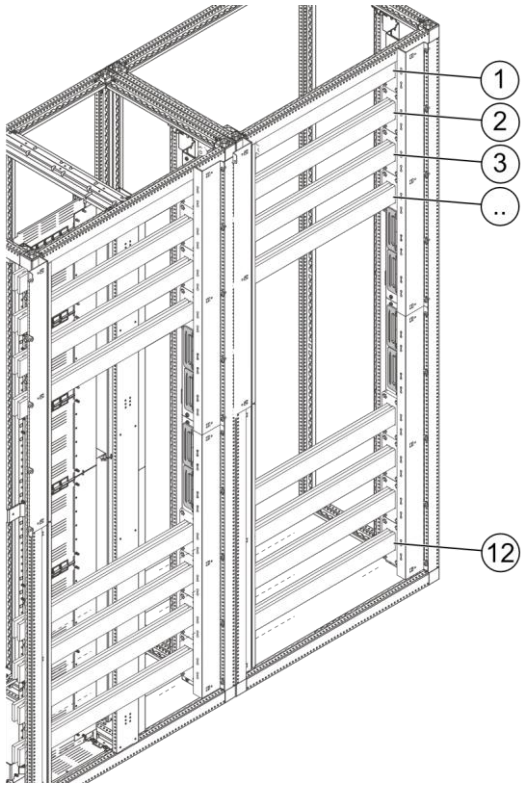
Enclosure divider assembly with 8 screws

6.4.6 FSTK spare space cover

Position and number

Some of the openings in the retaining plates that are not used for copper busbars are closed using the FSTK spare space covers from a rated short-time withstand current of $I_{p\,arc}$ of 50 kA. The number and position of covers depend on the position of the busbars and is specified in the following tables.

The covers must be installed on the left-hand and right-hand side of the enclosure. The openings in the vertical centre of the enclosure must also be sealed with them in enclosures with an integrated cable compartment (KRI).

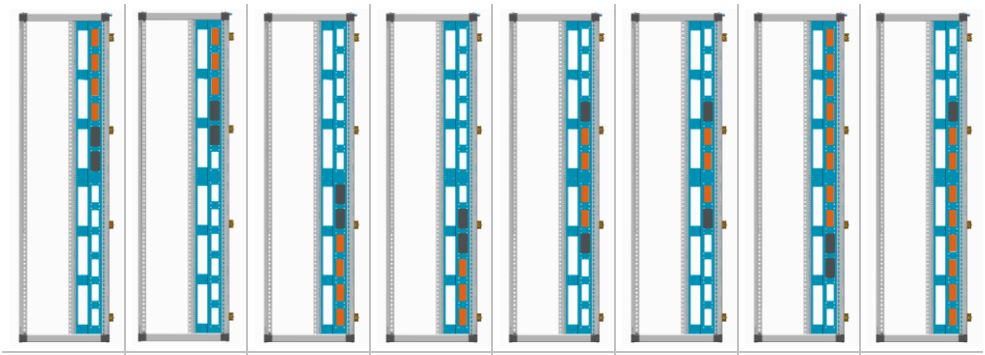


Example for two 4-pole H-SaS: Openings 5 to 8 are locked.

The positions of the FSTK covers are specified in the following tables depending on the position of the main busbar.

Position 1 is the highest installation position, position 12 the lowest.

Position and number for one main busbar per enclosure



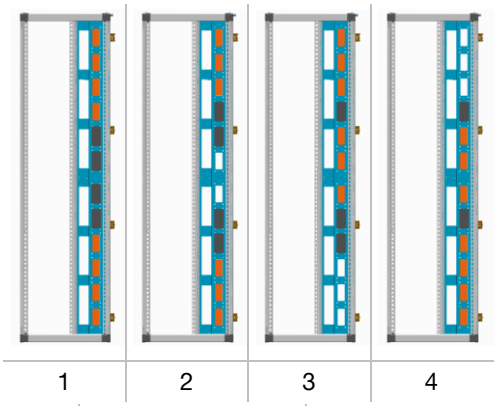
View from the side

Busbar system

FSTK spare space cover

Fig.	H-SaS position	Openings sealed by FSTK spare space cover
1	4-pole, top	5 and 6
2	3-pole, top	4 and 5
3	4-pole, bottom	7 and 8
4	3-pole, bottom	8 and 9
5	4-pole, middle	4 and 9
6	3-pole, middle	4 and 8
7	8-pole, top	9 and 10
8	8-pole, bottom	4

Position and number for two main busbars per enclosure



View from the side

Busbar system

FSTK spare space cover

Fig.	Position of first H-SaS	Position of second H-SaS	Openings sealed by FSTK spare space cover
1	4-pole, top	4-pole, bottom	5, 6, 7, 8
2	3-pole, top	3-pole, bottom	4, 5 and 8, 9
3	3-pole, top	3-pole, middle (5-7)	4 and 8, 9
4	3-pole, middle (5-7)	4-pole, bottom	4 and 8

Assembly

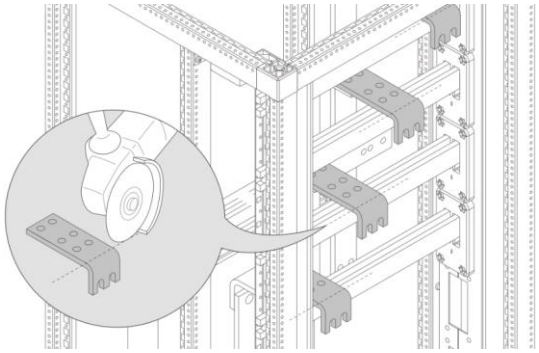
Mounted without tools by clicking into the retaining plates.

6.4.7 Adjusting copper angles U-TE, U-TK and U-FL

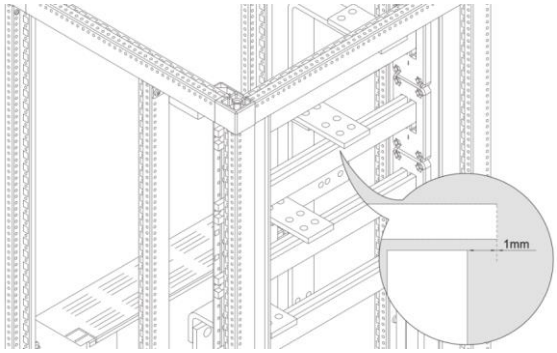
Adjusting copper angles

The U-TE, U-TK and U-FL enclosures are fitted with copper angles that are fitted so that they are overhanging towards the rear panel.

The angles must be cut 1 mm above the bars of the main busbar as shown below.



Separate copper angles



Distance of 1 mm above the bars

7 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

7.1 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.

7.2 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.

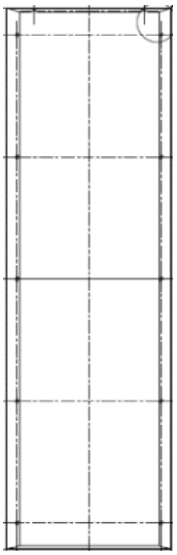
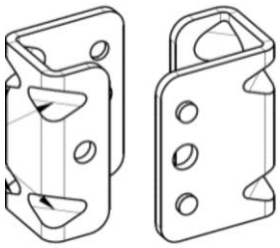
Recommended recurring tests

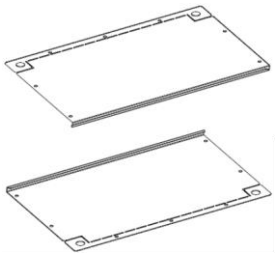
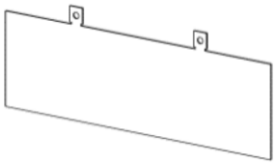
System/equipment	Test interval	Type of test	Tester
Electrical systems and stationary operating equipment	4 years 5 years in Switzerland	For perfect working order	Electrically skilled person
Electrical systems and stationary operating equipment in operating sites, special kinds of rooms and installations according to DIN VDE 100 group 700	1 year	For perfect working order	Electrically skilled person
Protection devices, such as - Air circuit breakers/ACB - Disconnector - Moulded case circuit breakers/MCCB - Load break switches - NH fuse switches	1 year Recommendation	- External visual inspection - Switching operation/functional test	Electrically skilled person

8 Appendix

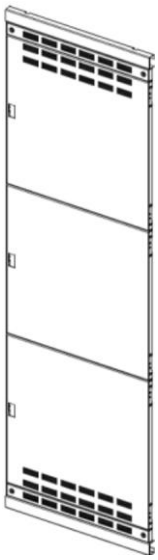
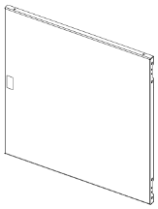
8.1 Overview of product range

Enclosure shell

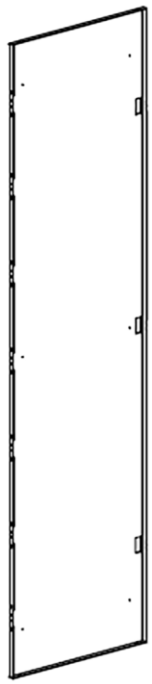
Component	Description	H x W [mm]	Reference
Reinforced side panel (10 fast. points), IP40 	- RAL 7035 - Includes fixing material	2000 x 600 2200 x 600 2000 x 800 2200 x 800	U-SWV2060 U-SWV2260 U-SWV2080 U-SWV2280
	- RAL of choice - Includes fixing material	2000 x 600 2200 x 600 2000 x 800 2200 x 800	U-SWV2060A U-SWV2260A U-SWV2080A U-SWV2280A
Rear panel holding bracket 	- For single-part or two-part rear panels (2 sets required for two-part rear panel) - Mounted at the rear on enclosure frame		U-HWRWV8
Cover plate with pressure vent flaps 	- For venting in the event of a pressure build-up caused by an arc fault - Up to max. $I_{p\,arc}$ 50 kA - Incl. flaps - Includes fixing material - For enclosure widths of 400 to 1350 mm and depths of 600/800 mm	400 x 600 450 x 600 600 x 600 700 x 600 800 x 600 850 x 600 1000 x 600 1100 x 600 1200 x 600 1300 x 600 1350 x 600 400 x 800 450 x 800 600 x 800 700 x 800 800 x 800 850 x 800 1000 x 800 1100 x 800 1200 x 800 1300 x 800 1350 x 800	U-DBDK4060 U-DBDK4560 U-DBDK6060 U-DBDK7060 U-DBDK8060 U-DBDK8560 U-DBDK10060 U-DBDK11060 U-DBDK12060 U-DBDK13060 U-DBDK13560 U-DBDK4080 U-DBDK4580 U-DBDK6080 U-DBDK7080 U-DBDK8080 U-DBDK8580 U-DBDK10080 U-DBDK11080 U-DBDK12080 U-DBDK13080 U-DBDK13580

Component	Description	H x W [mm]	Reference
Pressure relief cover plate flaps 	- For venting in the event of a pressure build-up caused by an arc fault - Up to max. $I_{p\,arc}$ 85 kA - Includes fixing material	400 x 600 450 x 600 600 x 600 700 x 600 800 x 600 850 x 600 1000 x 600 1100 x 600 1200 x 600 1300 x 600 1350 x 600	U-DBDEK4060 U-DBDEK4560 U-DBDEK6060 U-DBDEK7060 U-DBDEK8060 U-DBDEK8560 U-DBDEK10060 U-DBDEK11060 U-DBDEK12060 U-DBDEK13060 U-DBDEK13560
Spare flap for cover plate 	- Mounted on U-DBDK...		U-DK

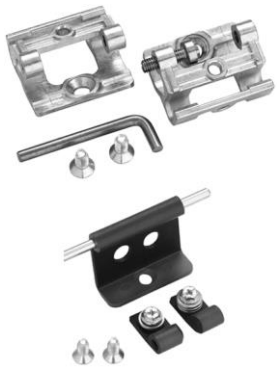
Enclosure front - Module doors

Component	Description	W x H [mm]	Reference
powerline module door front 	- 3 module doors each for 12 MU incl. enclosure covers and adjustment covers - Without locking system - Door opening adaptable to left or right - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-MFKS4520A)	450 x 2000 600 x 2000 800 x 2000 450 x 2200 600 x 2200 800 x 2200	U-MFKS4520 U-MFKS6020 U-MFKS8020 U-MFKS4522 U-MFKS6022 U-MFKS8022
Module door IP30 	- 1-door - Without locking system - Door opening adaptable to left or right - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., M-MT4512A)	450 x 600 600 x 600 700 x 600 800 x 600 850 x 600 1000 x 600	U-MT4512 U-MT6012 U-MT7012 U-MT8012 U-MT8512 U-MT10012
Adjustment cover (Max. $I_{p\ arc}$ 85 kA) 	- For height adjustment of module doors without ventilation slits - 50 or 100 mm in height - Without ventilation slits - Includes fixing material - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., M-AB4505A)	450 x 50 600 x 50 700 x 50 800 x 50 850 x 50 1000 x 50 1100 x 50 1200 x 50 1300 x 50 450 x 100 600 x 100 700 x 100 800 x 100 850 x 100 1000 x 100 1100 x 100 1200 x 100 1300 x 100	M-AB4505 M-AB6005 M-AB7005 M-AB8005 M-AB8505 M-AB10005 M-AB11005 M-AB12005 M-AB13005 M-AB4510 M-AB6010 M-AB7010 M-AB8010 M-AB8510 M-AB10010 M-AB11010 M-AB12010 M-AB13010

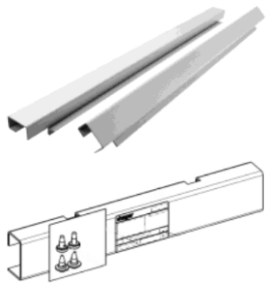
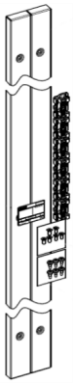
Enclosure front - Individual doors

Component	Description	W x H [mm]	Reference
Individual door with triple lock 	- Door for triple lock pSLB 120°/180° - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-ET3V4020A)		
	- Enclosure height 2000 mm	2000 x 400 2000 x 450 2000 x 600 2000 x 700 2000 x 800 2000 x 850 2000 x 1000	U-ET3V4020 U-ET3V4520 U-ET3V6020 U-ET3V7020 U-ET3V8020 U-ET3V8520 U-ET3V10020
	- Enclosure height 2200 mm	2200 x 400 2200 x 450 2200 x 600 2200 x 700 2200 x 800 2200 x 850 2200 x 1000	U-ET3V4022 U-ET3V4522 U-ET3V6022 U-ET3V7022 U-ET3V8022 U-ET3V8522 U-ET3V10022

Enclosure front - Accessories

Component	Description	Dimension	Reference
Hinge set 	- Per pSLB individual door		
	- 120° opening left	7 pcs.	M-SCHL7
	- 120° opening right	7 pcs.	M-SCHR7
	- 180° opening left/right	4 pcs.	M-SCH180OV
Key plates 	- 60 x 35 mm for module door and pSLB individual door		
	- Square arbor	6 pcs. 7 pcs. 8 pcs.	MES-4k6K MES-4k7K MES-4k8K
	- Triangular arbor	7 pcs. 8 pcs.	MES-3k7K MES-3k8K
	- Arbor and double bit	3 pcs. 5 pcs.	MES-DB3K MES-DB5K
	- Arbor and double bit incl. key catch	3 pcs.	MES-DBS3K
	- With round arbor and slot	⦰ 13 mm	MES-RDSK

Enclosure front - Enclosure covers

Component	Description	Dimension	Reference
Enclosure covers 50 mm, IP 40 	- Includes fixing material - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., M-SBD40A)	Enclosure width [mm]	
		400	M-SBD40
		450	M-SBD45
		600	M-SBD60
		700	M-SBD70
		800	M-SBD80
		850	M-SBD85
		1000	M-SBD100
		1100	M-SBD110
		1200	M-SBD120
		1300	M-SBD130
		1400	M-SBD140
Enclosure cover (vertical) 	- Partial extension or full extension - Enclosure heights 2000 and 2200 mm - 23 MU, 27 MU, 34 MU or 38 MU - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-SBV23A)	2000/23 MU	U-SBV23
		2000/34 MU	U-SBV34
		2200/27 MU	U-SBV27
		2200/38 MU	U-SBV38
Adjustment covers with convection 	- Up to max. $I_{p\,arc}$ 50 kA - Includes fixing material - Cover height from 50 to 300 mm - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-ABKS50A)	Cover height [mm]	
		50 mm	U-ABKS50
		75 mm	U-ABKS70
		100 mm	U-ABKS100
		150 mm	U-ABKS150
		200 mm	U-ABKS200
		300 mm	U-ABKS300
Adjustment covers without convection 	- Up to max. $I_{p\,arc}$ 85 kA - Includes fixing material - Cover height from 50 to 300 mm - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-AB50A)	Cover height [mm]	
		50 mm	U-AB50
		75 mm	U-AB70
		100 mm	U-AB100
		150 mm	U-AB150
		200 mm	U-AB200
		300 mm	U-AB300
For U-CW(I): Adjustment covers with convection IP3x 	- Up to max. $I_{p\,arc}$ 50 kA - Includes fixing material - Cover height from 50 to 300 mm - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-ABCK50A)	Cover height [mm]	
		50 mm	U-ABCK50
		75 mm	U-ABCK70
		100 mm	U-ABCK100
		150 mm	U-ABCK150
		200 mm	U-ABCK200
		300 mm	U-ABCK300
For U-CW(I): Adjustment covers without convection IP4x 	- Up to max. $I_{p\,arc}$ 85 kA - Includes fixing material - Cover height from 50 to 300 mm - RAL 7035 - RAL of choice available: Add the letter A to the reference for this purpose (e.g., U-ABCG50A)	Cover height [mm]	
		50 mm	U-ABCG50
		75 mm	U-ABCG70
		100 mm	U-ABCG100
		150 mm	U-ABCG150
		200 mm	U-ABCG200
		300 mm	U-ABCG300

Interior fittings

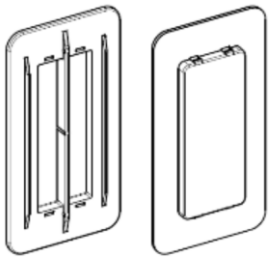
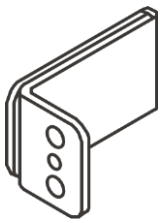
Components	Description	Dimension	Reference

Rear partition holder plates
 
	- Partition between retaining plate and rear panel
	- Mounted on the enclosure frame or suspended from the retaining plate
	- Galvanised steel plate
	- Includes fixing material
	Note
	- Not in the case of:
	  - U-TE/U-TK H-SaS in middle
	  - U-TE/U-TK width 450 mm, 3P+N
			U-RWSCHHA

Rear partition holder plate for U-TE/U-TK 	- Partition between retaining plate and rear panel	Width x depth x height [mm]	
	- For H-SaS in middle	600 x 600 x 2000 800 x 600 x 2000 800 x 800 x 2000 600 x 600 x 2200 800 x 600 x 2200 800 x 800 x 2200	U-RWSHASASMI3PN
	- For width 450 mm, 3P+N	450 x 600 x 2000 450 x 700 x 2200	U-RWSHASASMI3PN

pSLB rear panel protection
 
	- Mounted on rear partition holder plate
	- Galvanised steel plate
	- Incl. fixing material (set per enclosure half or H-SaS, maximum of 2 sets possible)
	Note
	- Not in the case of:
	  - U-TE/U-TK H-SaS in middle
	  - U-TE/U-TK width 450 mm, 3P+N		

	- H-SaS top or bottom		U-RWSOU
	- H-SaS middle		U-RWSM
H-SaS side panel protection 	- Mounted on enclosure profile and additional depth support - Galvanised steel plate - Includes fixing material	D x H [mm]	
		600 x 2000	U-SWS6020
		800 x 2000	U-SWS8020
		600 x 2200	U-SWS6022
		800 x 2200	U-SWS8022

Components	Description	Dimension	Reference
Enclosure divider 	- Mounted per enclosure and enclosure end - Hot-dip galvanised - Includes fixing material	D x H [mm]	
	- For standard version	400 x 2000 400 x 2200	U-STW4020 U-STW4022
	- For vertical version (U-SV and U-FL)	400 x 2000 400 x 2200	U-STWV4020 U-STWV4022
FSTK spare space cover 	- To cover unused FSTK mounting positions - For clicking in - Prevents the arc fault from spreading in the H-SaS area - Set with 8 pieces		U-APFST
Arc stoppers 	- Galvanised steel plate - Mounted on rear partition holder plate (arc stoppers per partition, 3-pole or 4-pole H-SaS) - Includes fixing material	3P H-SaS 4P H-SaS	U-ES3ST3P U-ES3ST4P

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
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
MCCB	Moulded-case circuit breaker **M**oulded-**C**ase **C**ircuit **B**reaker
MU	Module Unit [mm]

Abbreviation	Description
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
PZ...	Pozidrive® (screwdriver type) ... (Size)
-R	**Plug-in connection, plug-in input, screwed output** **R**emovable
RDF	**R**ated **D**iversity **F**actor, 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 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; can be connected to ACB tempower2
TP2-UVT	**U**nder**V**oltage **T**rip, 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
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

Abbreviation	Description
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 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.

9 Glossary

A

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.

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 system

Solid conductor for connecting several electrical circuits that are independent of each other. The conductor only has a low impedance. The busbars are at least supported by special busbar supports U- FSTK.. to control the high mechanical forces during a short circuit.

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(I) 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.

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.

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.

Device compartment

Area with electrical devices.

Distribution busbar

The distribution busbar is a busbar in a field (therefore also referred to as field distribution busbar or distribution board busbar). The distribution busbar is connected to the main busbar. The distribution busbar supplies the outgoing units. Conductors connected between a functional unit and a busbar are not part of the distribution busbar.

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.

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.

Field

A field is a unit of a switchgear and controlgear assembly that is located between two vertical boundary levels.

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 preformed in the hazard zone must satisfy the conditions for work under voltage.

I

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 (H-SaS)

Multi-pole busbar system that is routed inside the enclosure of a switchgear and controlgear assembly. The main busbars of the enclosures of the unimes H power distribution system are connected via transport divider lugs 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.

O

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

As the characteristic property of the switchgear and controlgear assembly, the rated diversity factor (RDF) is particularly important for the safe operation of a 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.

S

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

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 61439-1/-2.

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.

T

Terminal compartment

Cable compartment. The connection points of the outer conductors/cables (interfaces) are in the terminal compartment.

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.

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.

10 Index

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