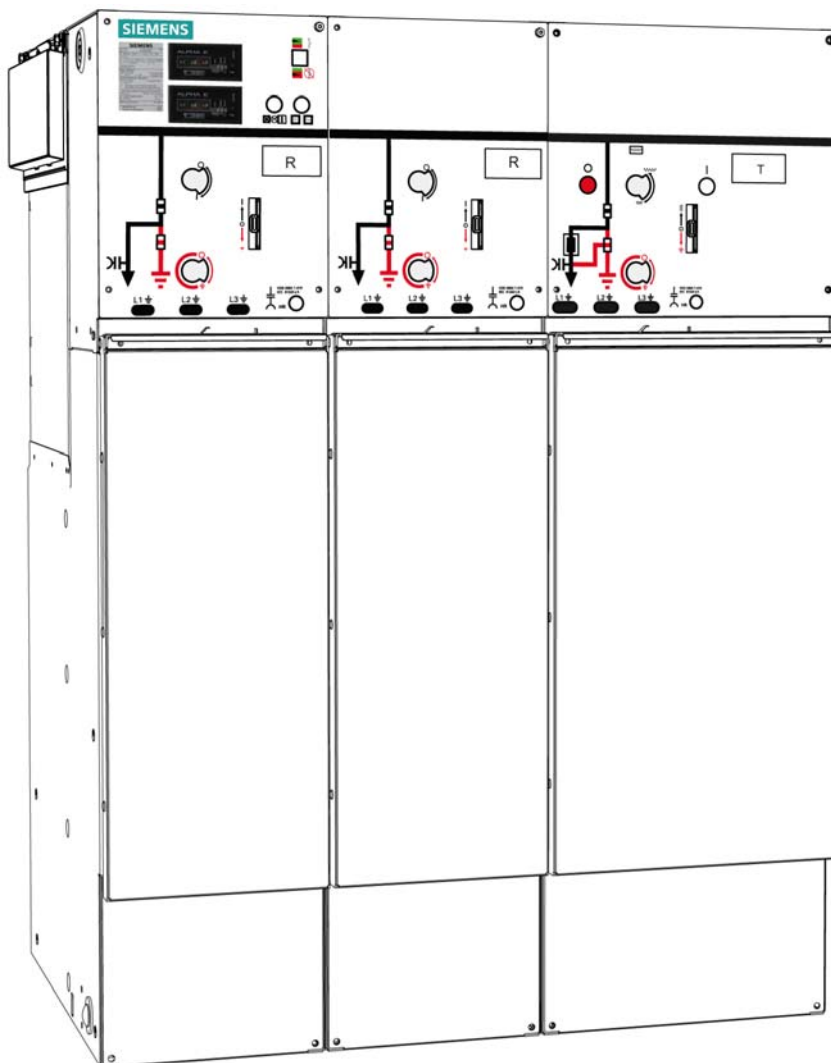




Medium-Voltage Switchgear

Type 8DJH

Up to 24 kV, gas-insulated



Medium-Voltage
Switchgear

INSTALLATION AND OPERATING INSTRUCTIONS

Order No.: 500-8384.9
Revision: 06
Issue: 10-08-2011

**Siemens AG
Energy Sector
Division Power Distribution**

**Since
1992**

Accreditation of the **Testing Department** according to **DIN EN ISO/IEC 17025** for the testing areas of high-voltage switching devices and switchgear, devices for electrical power engineering, and environmental simulation by DAkkS (German Accreditation Body) as **Testing Laboratory Medium Voltage, Frankfurt/Main, Germany**, DAkkS accreditation number: D-PL-11055-09, and as **PEHLA Testing Laboratory, Frankfurt/Main, Germany**, DAkkS accreditation number: D-PL-12072-01.

**Since
1995**

Application of a quality and environmental management system for the **Medium Voltage Division** according to **DIN EN ISO 9001** and **DIN EN ISO 14001**, quality and environmental management systems. Model for description of the quality assurance in design, development, production, installation and maintenance.
Certification of the quality and environmental management system by the certification and environmental experts of DNV (DNV Zertifizierung und Umweltgutachter GmbH)
DNV registration number: 92113-2011-AHSO-GER-TGA

**Since
2008**

Application of an industrial health and safety management system for the **Medium Voltage Division** according to **BS OHSAS 18001:2007**.
Certification of the industrial health and safety management system by the certification and environmental experts of DNV (DNV Zertifizierung und Umweltgutachter GmbH)
DNV registration number: 87028-2010-AHSO-GER-TGA

About these Instructions

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation or operation. For details about technical design and equipment like e.g. technical data, secondary equipment, circuit diagrams, please refer to the order documents. The switchgear is subject to continuous technical development within the scope of technical progress. If not stated otherwise on the individual pages of these instructions, we reserve the right to modify the specified values and drawings. All dimensions are given in mm. Should further

information be desired or should particular problems arise which are not covered sufficiently by these instructions, the matter should be referred to the competent Siemens department. The contents of this instruction manual shall not become part or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens.

The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

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Safety instructions

1 Signal terms and definitions

	DANGER!
	as used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken. ⇒ Observe the safety instructions.

	ATTENTION!
	as used in these instructions, this means that damage to property or environment can occur if the relevant precautionary measures are not taken. ⇒ Observe the safety instructions.

	NOTE!
	as used in these instructions, this points at facilitations of work, particularities for operation or possible maloperation. ⇒ Observe the notes.

- Symbols used**
- ⇒ Operation symbol: Identifies an operation. Asks the operator to perform an operation.
 - ✓ Result symbol: Identifies the result of an operation.

2 General instructions

Independently of the safety instructions given in these operating instructions, the local laws, ordinances, guidelines and standards for operation of electrical equipment as well as for labor, health and environmental protection apply.

	DANGER! Any kind of modification on the product or alteration of the product must be coordinated with the manufacturer in advance. Uncoordinated modifications or alterations can cause the expiration of warranty claims, cause danger to life, limb and other legally protected interests. The fulfillment of the type tests (according to IEC 62271-200) may not be guaranteed anymore. This applies especially though not exclusively to the following actions, e.g in the course of maintenance or repairs: ⇒ Original Siemens spare parts were not used. ⇒ Service engineers performing replacement were not trained and certified by Siemens. ⇒ Parts were fitted or adjusted incorrectly. ⇒ Settings were not made in accordance with Siemens specifications. ⇒ After installation and setting, no final check was performed by a service engineer approved by Siemens , including documentation of the test results. ⇒ Maintenance was not done according to the operating instructions of the Siemens products.
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Five Safety Rules of Electrical Engineering

The Five Safety Rules of Electrical Engineering must generally be observed during operation of the products and components described in these operating instructions:

- Isolate.
- Secure against reclosing.
- Verify safe isolation from supply.
- Earth and short-circuit.
- Cover or barrier adjacent live parts.

Hazardous materials

If hazardous materials are required to perform the work, the relevant safety data sheets and operating instructions must be observed.

Personal protective equipment (PPE)

For switchgear with proven internal arc classification according to IEC 62 271 Part 200, no protective equipment is required **for operating the switchgear**.

To work on switchgear where covers have to be removed, personal protective equipment has to be worn for protection against hot gases exhausting in case of internal arc.

To select the protective equipment, the national standards and specifications of the corresponding authorities and professional associations must absolutely be observed.

The protective equipment consists of:

- Protective clothing
- Gloves
- Helmet and face protection

3 Due application

The switchgear corresponds to the relevant laws, prescriptions and standards applicable at the time of delivery. If correctly used, they provide a high degree of safety by means of logical mechanical interlocks and shockproof metal enclosure of live parts.

	DANGER!
	The perfect and safe operation of this switchgear is conditional on: ⇒ Observance of operating and installation instructions. ⇒ Qualified personnel. ⇒ Proper transportation and correct storage of the switchgear. ⇒ Correct installation and commissioning. ⇒ Diligent operation and maintenance. ⇒ Observance of the instructions applicable at site for installation, operation and safety (e.g. DIN VDE 0101/0105).

4 Qualified personnel

Qualified personnel in accordance with these instructions are persons who are familiar with transport, installation, commissioning, maintenance and operation of the product and have appropriate qualifications for their work, e.g.:

- Training and instruction or authorization to switch on, switch off, earth and identify power circuits and equipment / systems as per the relevant safety standards.
- Training regarding the applicable specifications for the prevention of accidents and the care and use of appropriate safety equipment.
- Training in first aid and behavior in the event of possible accidents.

Description

5 Features

Typical uses	8DJH switchgear is used - even under severe ambient conditions - for power distribution in secondary distribution systems, such as • Industrial distribution systems • Consumer and transfer substations It is available for rated voltages up to 24 kV and rated currents of the feeders up to 630 A.
Technology	• Factory-assembled, type-tested, metal-enclosed switchgear for indoor installation • Individual panels and/or panel blocks can be freely combined to a switchgear assembly • Circuit-breaker panels with maintenance-free indoor vacuum circuit-breakers for rated voltages from 7.2 to 24 kV • Hermetically welded switchgear vessel, made of stainless steel, with welded-in bushings for electrical connections and mechanical components • Insulating gas SF₆ • Maintenance-free • Climate-independent • Three-position switch-disconnector with load-break and make-proof earthing function • Circuit-breaker with vacuum interrupters and integrated three-position disconnector with make-proof earthing function • Cable connection for bushings with outside cone • Installation and extension without gas work • Comprehensive special equipment or accessories • Ecological manufacture and recycling
Freely configurable block versions	Besides the standard panel blocks, the fully modular switchgear concept offers the possibility to combine freely configurable panel blocks. Up to four modules can be combined in one panel block. The position of the individual modules is free, except for the bus sectionalizer modules. The width and weight of the switchgear results from the addition of the configured individual panels.
Personal safety	• Safe-to-touch and hermetically sealed primary enclosure • HV HRC fuses and cable sealing ends are only accessible when outgoing feeders are earthed • Operation only possible when enclosure is closed • Logical mechanical interlocking • Capacitive voltage detecting system to verify safe isolation from supply and phase coincidence • Feeder earthing via make-proof earthing switches

Security of operation and availability

- Sealed primary enclosure
- Independent of environmental effects such as pollution, humidity and small animals
- Sealed for life: Welded switchgear vessel, welded-in bushings and operating mechanism
- Operating mechanism parts maintenance-free (IEC/EN 62 271-1/VDE 0671-1)
- Operating mechanisms of switching devices accessible outside the switchgear vessel
- Switchgear interlocking system with logical mechanical interlocks
- Mechanical position indicators integrated in the mimic diagram

6 Functional modules (selection)

Overview: Configurability of panel modules

	Panel modules	Panel width	Freely configurable arrangement in panel blocks	Stipulated arrangement in panel blocks
R	Ring-main feeder	310 mm	X	
T	Transformer feeder with switch-disconnector/fuse combination	430 mm	X	
L	Circuit-breaker feeder	430 mm	X	
K	Cable feeder (combinations of transformer and circuit-breaker feeder are possible via panel extensions)	310/430 mm		X
S	Bus sectionalizer module with three-position switch-disconnector	430 mm		X
H	Bus sectionalizer module with switch-disconnector/fuse combination	430 mm		X

Examples for panel modules

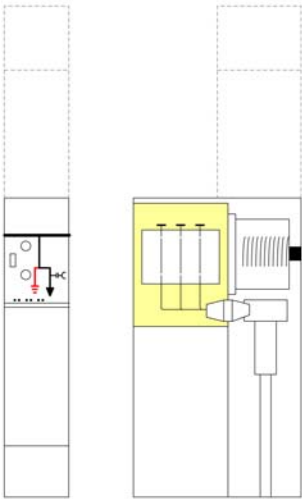


Fig. 1: Ring-main feeder type R

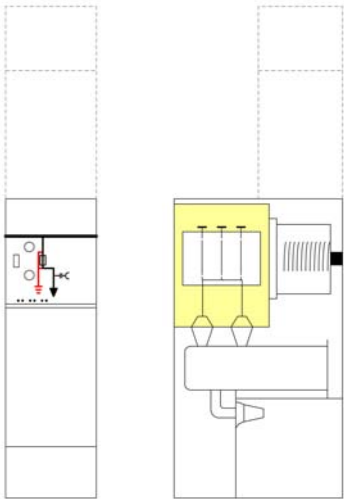


Fig. 2: Transformer feeder type T

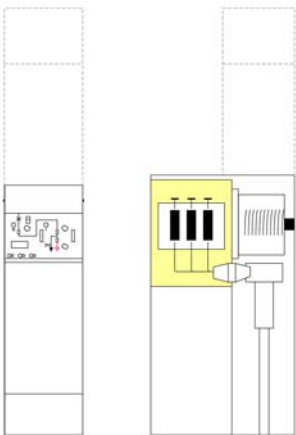


Fig. 3: Circuit-breaker feeder type L (430 mm)

**Overview: Panel modules
as individual panels**

	Panel modules as individual panels	Panel width
R	Ring-main feeder	310/500 mm
K	Cable feeder	310/430 mm
T	Transformer feeder	430 mm
L	Circuit-breaker feeder	430/500 mm
M	Metering panel	430/500/840
S	Bus sectionalizer module with three-position switch-disconnector	430/500/620 mm
H	Bus sectionalizer module with switch-disconnector/fuse combination	430 mm
V	Bus sectionalizer with circuit-breaker	500 mm
E	Busbar earthing panel	310/500 mm

7 Components

7.1 Three-position switch-disconnector

Features

- The three-position switch-disconnector is designed for rated voltages from 7.2 kV to 24 kV
- Switching functions as general-purpose switch-disconnector (class E3) according to IEC/EN 60 265-1 / VDE 0670-301, IEC/EN 62 271-102 / VDE 0671-102 and IEC/EN 62 271-105 / VDE 0671-105
- Designed as a three-position switch incorporating the functions of a switch-disconnector and a make-proof earthing switch with the switch positions: "CLOSED - OPEN - EARTHED"
- The function of a 2nd earthing switch is integrated in the switch-fuse combination

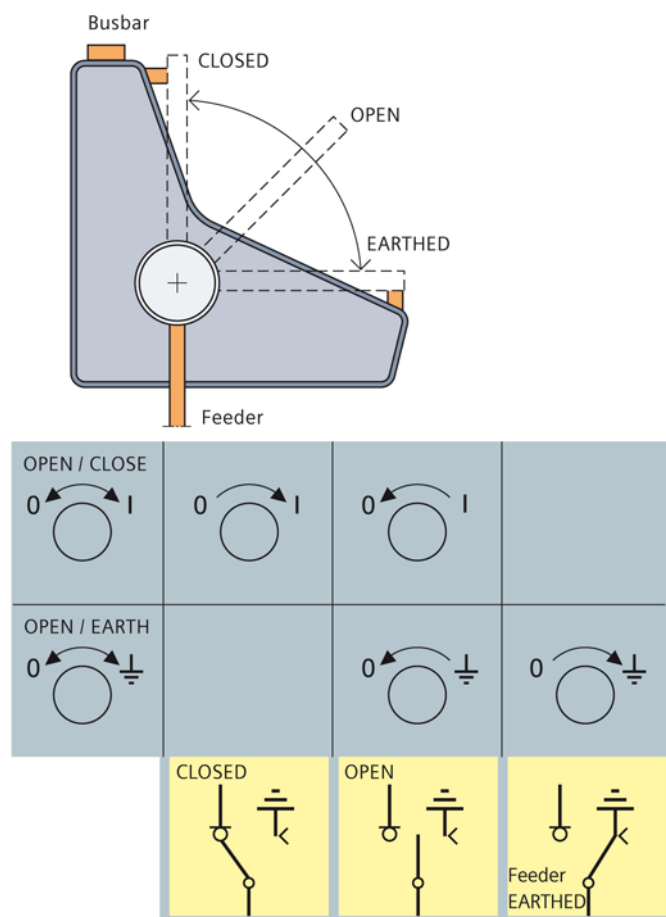


Fig. 4: Operation of three-position switch

- Mode of operation** The operating shaft forms one unit together with the three contact blades. Due to the arrangement of the fixed contacts (earth - busbar), it is not necessary to interlock the CLOSE and EARTHING functions.
- Closing operation** During the closing operation, the operating shaft with the moving contact blades changes from the "OPEN" to the "CLOSED" position.
- The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.
- Opening operation** During the opening operation, the arc is caused to rotate by the arc-suppression system, thus preventing the development of a fixed root. This very effective arc extinction provides short arcing times. The isolating distance in gas established after opening satisfies the conditions for isolating distances according to IEC/EN 60 265-1 / VDE 0671-102 and IEC/EN 62 271-1 / VDE 0671-1.
- Earthing operation** The "EARTHING" operation is implemented by the turning movement of the operating lever (rotation, if required) from the "OPEN" to the "EARTHED" position.

Operating mechanisms for the three-position switch

- Common features**
- Mechanical endurance of more than 1000 operating cycles
 - Manual operation with the help of a slip-on operating lever
 - Option: Motor operation of the disconnecting function
 - Control board with accordingly cut-out switching gate prevents the three-position switch-disconnector from being switched directly from the CLOSED via the OPEN to the EARTHED position.
 - Two separate actuating openings are provided for unambiguous selection of either the load-break or make-proof earthing functions.
 - Operation via rotary movement, operating direction according to IEC/EN 60 447 (VDN/ VDEW recommendation).

The switching movements are performed independently of the operating speed.

Features of spring-operated/stored-energy mechanism

During the charging process, the closing and opening springs are charged. This ensures that the switch-disconnector/fuse combination can switch off all types of faults reliably even during closing.

Closing and opening is done via pushbuttons after removing the operating lever, and is therefore identical with the operation of circuit-breaker operating mechanisms.

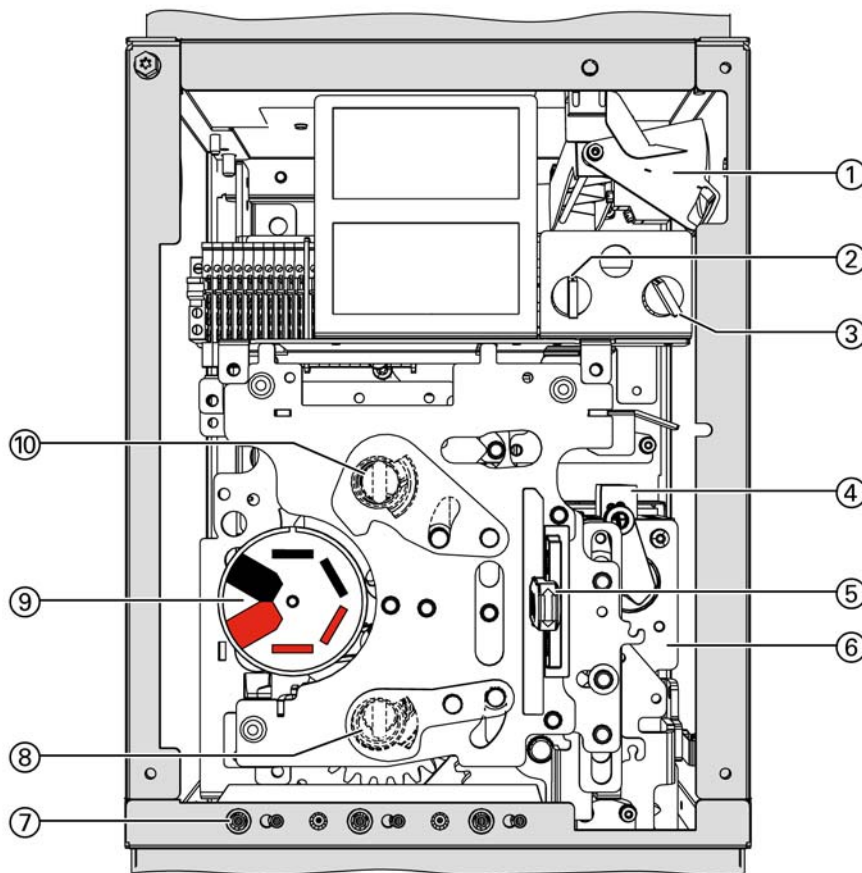
An energy store is available for tripping by means of an operating HV HRC fuse or via a shunt release (f-release).

After the HV HRC fuse has tripped, a red transverse bar appears on the "fuse tripped" indicator.

Manual operation for the EARTHING function with the help of a slip-on operating lever.

Assignment of operating mechanism type of three-position switch to panel types				
Panel type	R, S, L		T, H	
Function	Switch-disconnector (R, S)	Earthing switch	Switch-disconnector	Earthing switch
	Disconnecter (L)			
Type of operating mechanism	Spring-operated	Spring-operated	Stored-energy	Spring-operated
Operation	Manual	Manual	Manual	Manual
	Motor (option)		Motor (option)	

Design The three-position switch-disconnector is operated through a gas-tight welded bushing at the front of the switchgear vessel.



Ring-main feeder:

- ① Ready-for-service indicator
- ② Knob-operated switch for CLOSE/OPEN, motor operating mechanism (option)
- ③ Knob-operated switch for local-remote operation (option)
- ④ Auxiliary switch (option)
- ⑤ Control gate/locking device for three-position switch-disconnector
- ⑥ Motor operating mechanism (option)
- ⑦ Capacitive voltage detecting system
- ⑧ Manual operation of the rotary lever mechanism for the EARTHING function
- ⑨ Position indicator for three-position switch-disconnector
- ⑩ Manual operation of the rotary lever mechanism for the CLOSE function

Fig. 5: Front operating mechanism in ring-main feeder

Spring-operated mechanism

The spring-operated mechanism is used for the three-position switch-disconnector in ring-main panels (as ring-main switch). The switching movements are performed independently of the operating speed.

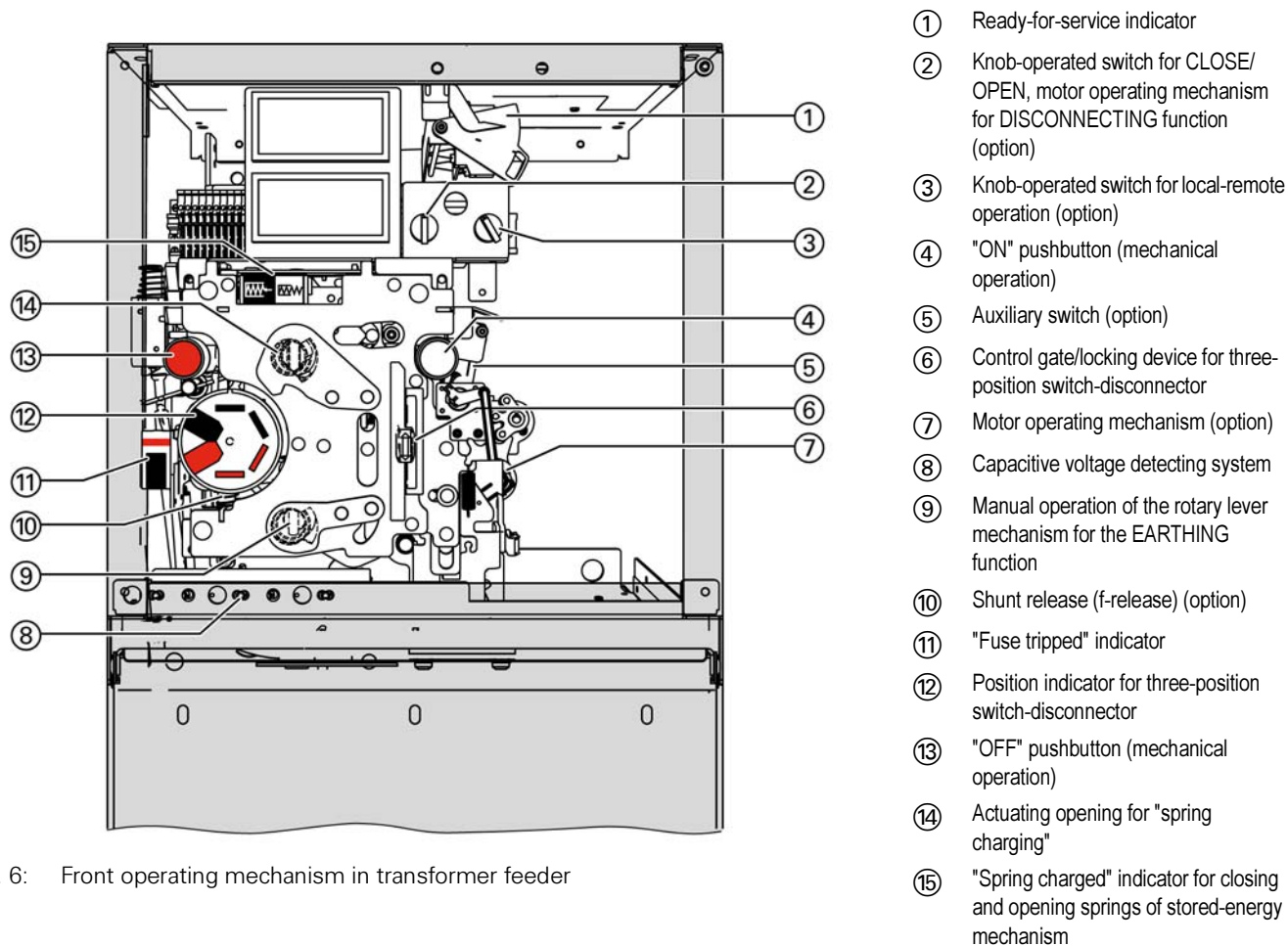


Fig. 6: Front operating mechanism in transformer feeder

**Mode of operation of
spring-operated/stored-
energy mechanism**

The spring-operated/stored energy mechanism is used for three-position switch-disconnectors in transformer panels (as transformer switch). First, the operating springs are charged with the "spring charged" operation. Then, closing and opening is done via separate pushbuttons. An energy store is available for the opening process when an HV HRC fuse or a shunt release (f-release) trips. No additional charging process is required for the energy store. This energy store is already charged by switching from the "spring not charged" position to the "spring charged" position. This pre-charged energy store ensures that the switch-disconnector/fuse combination can switch off all types of faults reliably even during closing. After the HV HRC fuse has tripped, a red transverse bar appears on the "fuse tripped" indicator.

Generally, the switchgear is equipped with an operating lever ejection system, which means that, after charging the springs, the operating lever is ejected, thus preventing it from being left inserted accidentally. On the customer's request, the operating lever ejection system can be omitted.

	ATTENTION!
	Risk of injury! When charging the spring, the operating lever is inserted in the actuating opening. If no operating lever ejection system is available, the operating lever rotates and can thereby injure the operator. ⇒ Remove operating lever before charging the spring.

Sequence	1	2	3	4
Operation		 Charging the springs		
Switch position	OPEN	OPEN	CLOSE	OPEN
Position indicator				
"Spring charged" indicator				
Closing spring	not charged	charged	not charged	not charged
Opening spring	not charged	charged	charged	not charged

Equipment

Mechanism operation

Operating levers for charging the springs of the switch-disconnector and the make-proof earthing switch. Coding of the operating levers is optionally possible.

Motor operating mechanism (optional)

Operation

- Local operation by momentary-contact rotary control switch (option)
- Remote operation (standard) applied to terminal

Operating voltages for motor operating mechanisms and tripping coils

- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC 50/60 Hz
- Power consumption: 80 W for AC and DC

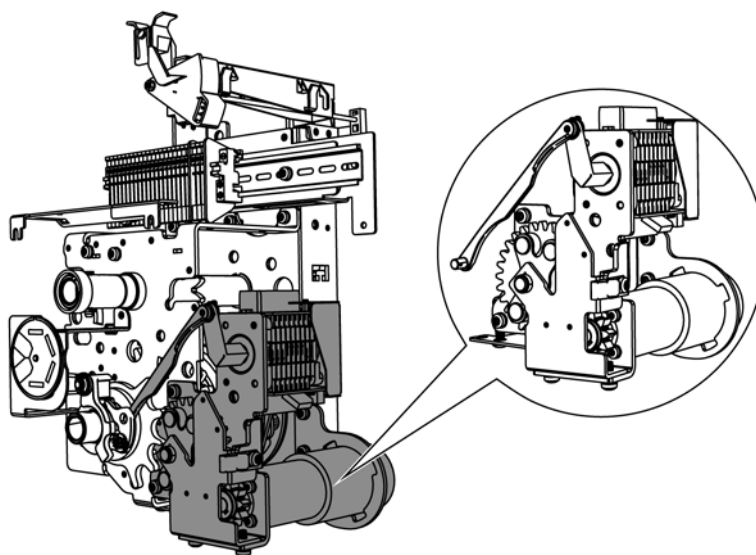


Fig. 7: Motor unit with auxiliary switch block

**Shunt release (f-release)
CLOSE/OPEN (optional)**

Spring-operated/stored-energy mechanisms can be equipped with a magnetic tripping coil (shunt release). Remote electrical tripping of the three-position switch-disconnector is possible via the magnet coil, e.g. transformer overtemperature tripping.

To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary switch which is mechanically coupled with the three-position switch-disconnector.

In transformer panels, continuity at the shunt release can only be tested when the operating lever is removed.

Auxiliary switch (optional)

The operating mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary switch for the position indication. A motor operating mechanism is equipped with an auxiliary switch as standard.

- For switch-disconnector function: CLOSED and OPEN: 1 NO + 1 NC + 2 changeover
- For earthing switch function: CLOSED and OPEN: 1 NO + 1 NC + 2 changeover

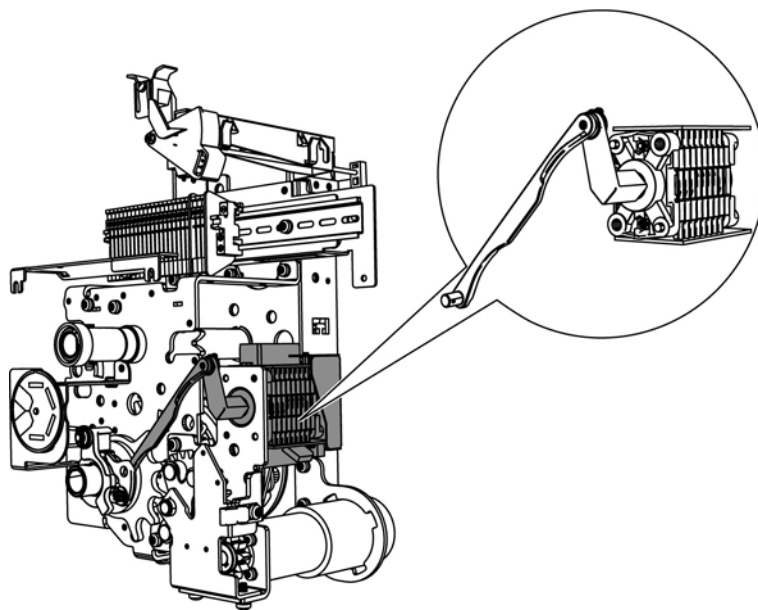


Fig. 8: Auxiliary switch in the operating mechanism of the three-position switch-disconnector, for example in the ring-main feeder

Wiring

Auxiliary switches, motor operating mechanisms or shunt releases are wired to terminal strips. The terminal strips are feeder-related and located over the operating mechanism assembly of the associated feeder. Customer-side cable routing is made from the side, if required from above to the terminal strip arranged at the operating mechanism assembly.

7.2 Vacuum circuit-breaker type 2

- Features**
- Vacuum circuit-breaker for rated voltages from 7.2 kV to 24 kV
 - According to IEC/EN 62 271-100 / VDE 0671-100
 - Climate-independent vacuum interrupter poles in the gas-filled switchgear vessel
 - Application in hermetically welded switchgear vessel in conformity with the system
 - Operating mechanism located outside the switchgear vessel in the front operating mechanism box
 - Maintenance-free according to IEC/EN 62 271-1 / VDE 0671-1

Operating mechanism functions The closing and opening springs are charged by means of the operating lever supplied, or by the motor (option), until the latching of the closing/opening spring is indicated ("spring charged" indicator). Then, the vacuum circuit-breaker can be closed manually or electrically (option).

Operating mechanism for circuit-breaker feeder The operating mechanism assigned to a circuit-breaker feeder consists of the following components:

- Operating mechanism for circuit-breaker
- Operating mechanism for three-position disconnecter
- Motor operating mechanism (optional)
- Position indicators
- Pushbuttons for CLOSING and OPENING the circuit-breaker
- Mechanical operations counter (optional)
- Interlocking between circuit-breaker and disconnecter
- "Spring charged" indicator

Assignment of operating mechanism type to panel types			
Panel type	L, V		
Function	Circuit-breaker	Three-position disconnecter	
		Disconnecter	Earthing switch
Type	Stored-energy	Spring-operated	Spring-operated
Operation	Manual/motor	Manual/motor	Manual

The vacuum circuit-breaker consists of a vacuum interrupter unit with integrated three-position disconnecter located in the switchgear vessel, and the associated operating mechanisms.

The vacuum circuit-breaker is a circuit-breaker without automatic reclosing.

For further data, see Page 44, "Technical data".

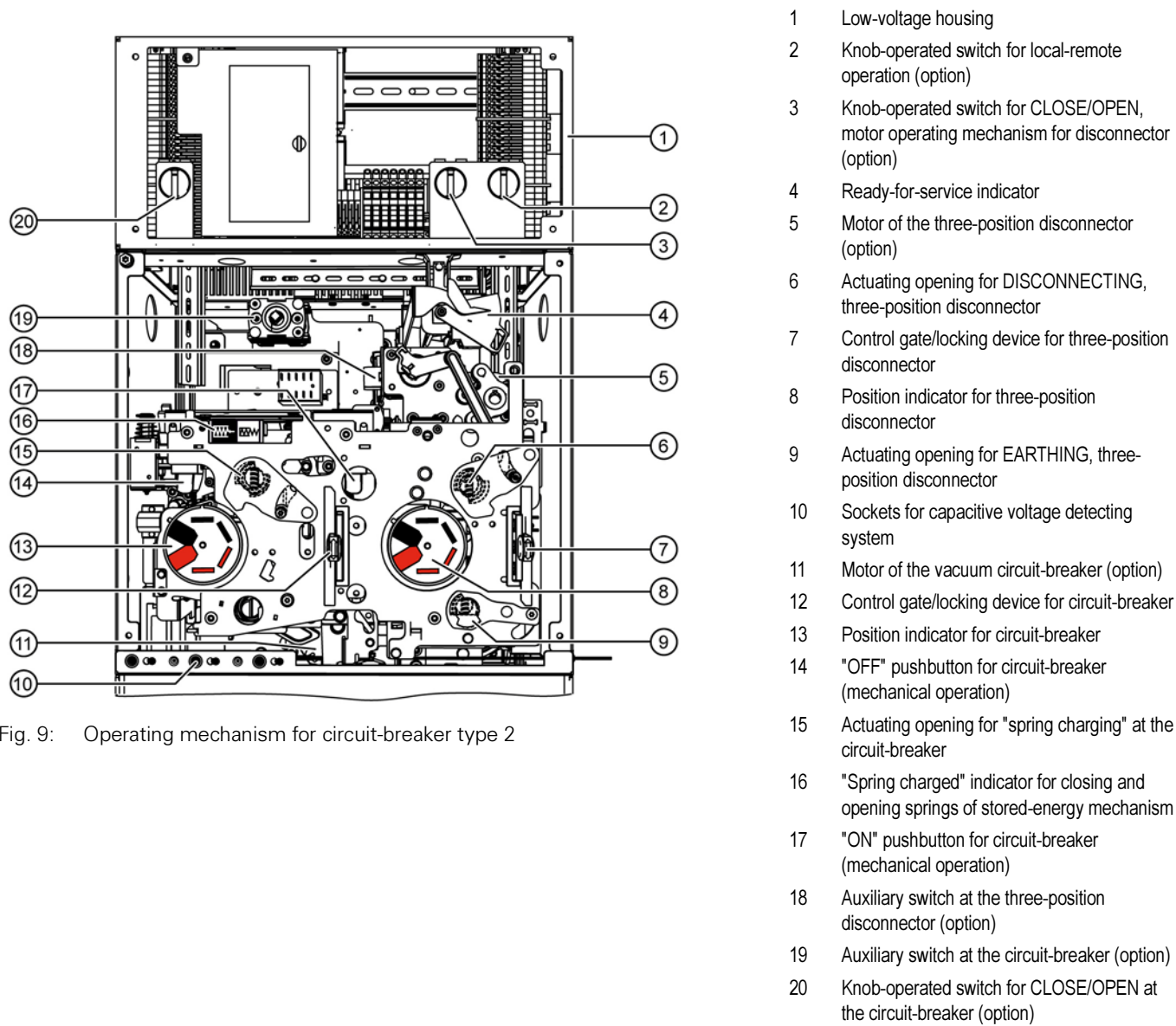


Fig. 9: Operating mechanism for circuit-breaker type 2

In individual panels, the rating plate is located top-left on the front cover, in blocks it is only provided on the left-hand panel.

Sequence	1	2	3	4
Operation		 Charging the springs		
Switch position	OPEN	OPEN	CLOSED	OPEN
Position indicator				
"Spring charged" indicator				
Closing spring	not charged	charged	not charged	not charged
Opening spring	not charged	charged	charged	not charged

Secondary equipment of the vacuum circuit-breaker type 2

Secondary components	The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application.
Motor operating mechanism (option)	Operating voltages for motor operating mechanisms (disconnecter) • 24, 48, 60, 110, 220 V DC • 110 and 230 V AC 50/60 Hz Motor rating for disconnecter operating mechanism at • 24 V to 220 V DC: maximum 80 W • 110 V and 230 V AC: maximum 80 W Motor rating for circuit-breaker operating mechanism at • 24 V to 220 V DC: maximum 80 W • 110 V and 230 V AC: maximum 80 W
Closing solenoid (option)	• For electrical closing (coil voltage is coupled with motor voltage)
Shunt release (option)	• Magnet coil • Magnet coil with energy store • Tripping by protection relay or electrical actuation
C.t.-operated release (option)	• For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, SEG WIC; other designs on request • Used if external auxiliary voltage is missing, tripping via protection relay
Low-energy magnetic release (option)	• For tripping pulse 0.02 Ws, tripping via transformer monitor (IKI-30)
Undervoltage release (option)	• Comprising: - Energy store and unlatching mechanism - Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops • Connection to voltage transformers possible
Circuit-breaker tripping signal (option)	• For electrical signaling (as pulse ≥ 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection) • Via auxiliary switch
Varistor module	• Integrated in the releases for voltages > 60 V DC
Auxiliary switch (option)	• For circuit-breaker: 6NO + 6NC, free contacts thereof 2NO + 2NC + 2 changeover, depending on equipped releases • For disconnecter: 6NO + 6NC, free contacts thereof 2NO + 2NC + 2 changeover
Position switch (option)	• For "closing/opening spring charged" indication
Interlock between circuit-breaker and disconnecter	• Operating mechanism with mechanical interlocking • Mutual interrogation between circuit-breaker and three-position disconnecter • During operation of the three-position disconnecter from CLOSED to OPEN and from EARTHED to OPEN, the vacuum circuit-breaker cannot be closed • When the vacuum circuit-breaker is closed, the three-position disconnecter is interlocked
Gas pressure monitoring (option)	• Free contact: 1S + 1Ö

7.3 Vacuum circuit-breaker type 1.1

- Features**
- Vacuum circuit-breaker for rated voltages from 7.2 kV to 24 kV
 - According to IEC/EN 62 271-100 / VDE 0671-100
 - Climate-independent vacuum interrupter poles in the gas-filled switchgear vessel
 - Application in hermetically welded switchgear vessel in conformity with the system
 - Operating mechanism located outside the switchgear vessel in the front operating mechanism box
 - Maintenance-free according to IEC/EN 62 271-1 / VDE 0671-1

Operating mechanism functions

The closing spring is charged by means of the operating lever or the hand crank supplied, or by the motor (option), until the latching of the closing spring is indicated ("spring charged" indicator).)Then, the vacuum circuit-breaker can be closed manually or electrically (option).

In operating mechanisms provided for automatic reclosing (ARE), the closing spring can be recharged by hand, or automatically in case of motor operating mechanism. This enables an immediate auto-reclosing.

- Operating mechanism for circuit-breaker feeder**
- The operating mechanism assigned to a circuit-breaker feeder consists of the following components:
- Operating mechanism for circuit-breaker
 - Operating mechanism for three-position disconnecter
 - Motor operating mechanism (optional)
 - Position indicators
 - Pushbuttons for CLOSING and OPENING the circuit-breaker
 - Mechanical operations counter
 - Interlocking between circuit-breaker and disconnecter
 - "Spring charged" indicator

Assignment of operating mechanism type to panel types			
Panel type	L, V		
Function	Circuit-breaker	Three-position disconnecter	
		Disconnecter	Earthing switch
Type	Stored-energy	Spring-operated	Spring-operated
Operation	Manual/motor	Manual/motor	Manual

The vacuum circuit-breaker consists of a vacuum interrupter unit with integrated three-position disconnecter located in the switchgear vessel, and the associated operating mechanisms.

The vacuum circuit-breaker is a circuit-breaker for automatic reclosing.

For further data, see Page 44, "Technical data".

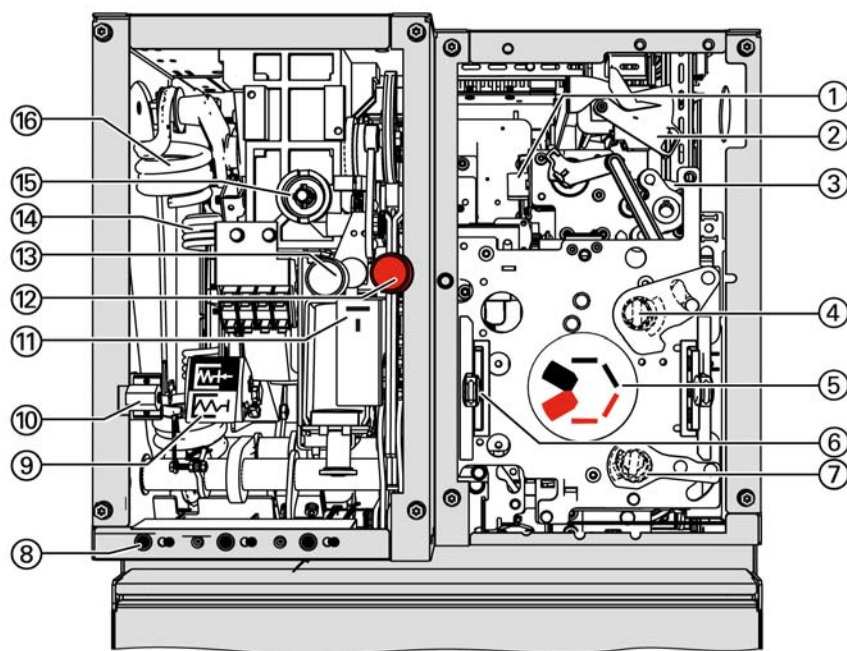


Fig. 10: Operating mechanism for circuit-breaker type 1.1

- ① Auxiliary switch at the three-position disconnector (option)
- ② Ready-for-service indicator
- ③ Motor of the three-position disconnector (option)
- ④ Actuating opening for DISCONNECTING, three-position disconnector
- ⑤ Position indicator for three-position disconnector
- ⑥ Control gate/locking device for three-position disconnector
- ⑦ Actuating opening for EARTHING, three-position disconnector
- ⑧ Socket of capacitive voltage detecting system
- ⑨ Indicator for the circuit-breaker closing spring (not charged / charged)
- ⑩ Operations counter
- ⑪ Position indicator for circuit-breaker
- ⑫ "OFF" pushbutton for circuit-breaker (mechanical operation)
- ⑬ "ON" pushbutton for circuit-breaker (mechanical operation)
- ⑭ Opening spring
- ⑮ Actuating opening for "spring charging" at the circuit-breaker
- ⑯ Closing spring

In individual panels, the rating plate is located top-left on the front cover, in blocks it is only provided on the left-hand panel.

Secondary equipment of the vacuum circuit-breaker type 1.1

Secondary components

The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application.

Motor operating mechanism (option)

Operating voltages for motor operating mechanisms (disconnecter)

- 24, 48, 60, 110, 220 V DC
- AC 50/60 Hz, 110 and 230 V

Motor rating for disconnector operating mechanism at

- 24 V to 220 V DC: maximum 80 W
- 110 V and 230 V AC: maximum 80 W

Motor rating for circuit-breaker operating mechanism at

- 24 V to 220 V DC: maximum 350 W
- 110 V and 230 V AC: maximum 400 VA

Closing solenoid (option)

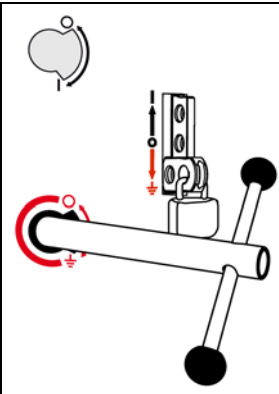
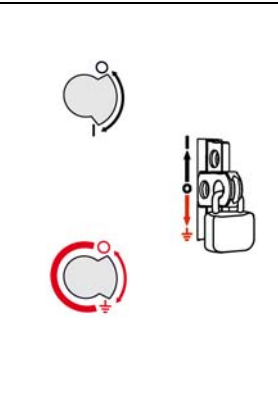
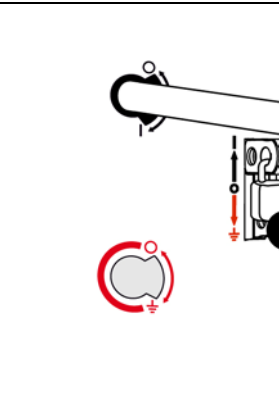
- For electrical closing

Shunt release (option)

- Magnet coil
- Magnet coil with energy store
- Tripping by protection relay or electrical actuation

C.t.-operated release (option)	• For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, SEG WIC; other designs on request • Used if external auxiliary voltage is missing, tripping via protection relay
Undervoltage release	• Comprising: - Energy store and unlatching mechanism - Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops • Connection to voltage transformers possible
Anti-pumping (mechanical and electrical)	• Standard • Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing, and remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.
Circuit-breaker tripping signal (option)	• For electrical signaling (as pulse ≥ 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection) • Via limit switch and cutout switch • Via auxiliary switch
Varistor module	• Integrated in the releases for voltages > 60 V DC
Auxiliary switch (option)	• 6 NO + 6 NC, free contacts thereof 2 NO + 2 NC + 2 changeover • Option: 12 NO + 12 NC, free contacts thereof 7 NO + 4 NC + 2 changeover
Interlock between circuit-breaker and disconnecter	• Operating mechanism with mechanical interlocking • Mutual interrogation between circuit-breaker and three-position switch • During operation of the three-position disconnecter from CLOSED to OPEN and from EARTHED to OPEN, the vacuum circuit-breaker cannot be closed. • When the vacuum circuit-breaker is closed, the three-position disconnecter is interlocked
Gas pressure monitoring (option)	• Free contact: 1NO + 1NC
7.4 Interlocks	
Mechanical interlock	• The switching gate prevents switching straight from "CLOSED" to "EARTHED" or from "EARTHED" to "CLOSED", as the operating lever must be re-inserted in the "OPEN" position. • The cable compartment cover (HV HRC fuse compartment cover) can only be removed if the transformer feeder is earthed and the operating lever is removed. The three-position switch-disconnector can only be switched from the "EARTHED" position to another position if the cable compartment cover (HV HRC fuse compartment cover) is fitted. • Interlocks between the circuit-breaker and the three-position disconnecter - Circuit-breaker in OPEN position: The three-position disconnecter can be closed and opened. The circuit-breaker is locked out. - Circuit-breaker in CLOSED position: The three-position disconnecter cannot be operated. • The cable compartment covers can only be removed when the associated feeder is earthed.

- A closing lock-out (option) in the ring-main or circuit-breaker feeder prevents the three-position disconnecter / switch-disconnector from being switched to the "CLOSED" position if the cable compartment cover is removed.
- A de-earthing lock-out in the transformer panel (standard), the ring-main panel or the circuit-breaker panel (option) prevents the three-position disconnecter / switch-disconnector from being switched from "EARTHED" to "OPEN" if the cable compartment cover is removed.
- With stored-energy and circuit-breaker operating mechanisms, closing and opening is not possible if the operating lever is inserted.
- The locking device (option) of the switching gate can be padlocked in all three switch positions. The locking device can be padlocked so that **no closing** or **no opening** or **no earthing** is possible. The padlock can also be fitted in such a way that none of the three switching operations can be performed.

				
Padlock	Down	Center	Up	
Actuating opening	Earthing switch	-	Disconnector/switch-disconnector	Circuit-breaker/transformer switch
Possible switching operations	Only EARTHING and DE-EARTHING possible	No switching operations possible Precondition: Spring energy store not charged	- Only CLOSING and OPENING possible - Only possible if the circuit-breaker is open	- Charging the spring

Electrical interlock If the operating lever for the three-position switch is inserted, the motor operating mechanism cannot be operated from remote or locally anymore.

7.5 Cable compartment covers

- The cable compartment covers can only be removed when the associated feeder is earthed.

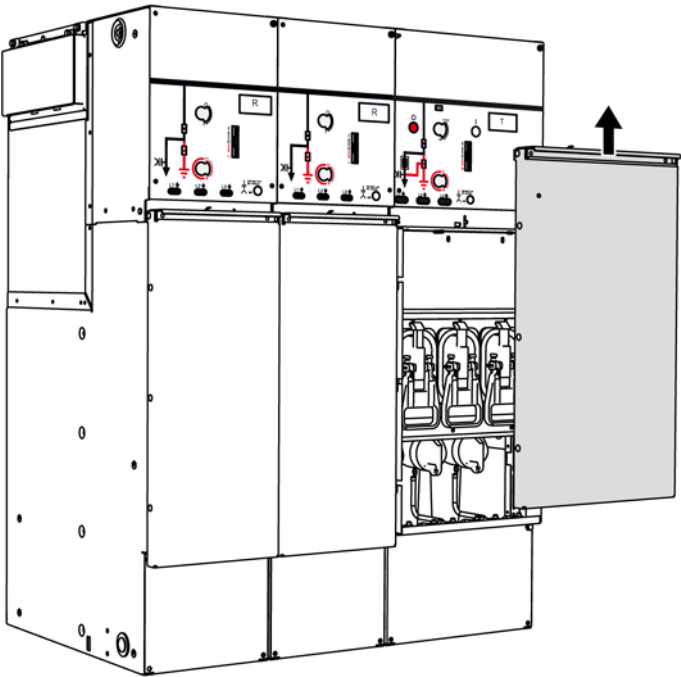


Fig. 11: Removing the cable compartment cover at the transformer panel

	ATTENTION! In switchgear panels without switching devices, the cable compartment covers are screwed on. Do absolutely observe the Five Safety Rules of Electrical Engineering. ⇒ Isolate. ⇒ Secure against reclosing. ⇒ Verify safe isolation from supply. ⇒ Earth and short-circuit. ⇒ Cover or barrier adjacent live parts.
---	--

7.6 HV HRC fuse assembly

- Features**
- HV HRC fuse-links according to DIN 43 625 (main dimensions) with striker in "medium" version according to IEC/EN 60 282-1
 - as short-circuit protection before transformers,
 - with selectivity to upstream and downstream connected equipment,
 - 1-pole insulated
 - Requirements according to IEC 62 271-105 / VDE 067-105 fulfilled by combination of HV HRC fuses with the three-position switch-disconnector
 - Thermal striker tripping when the corresponding HV HRC fuse-link is used
 - Climate-independent and maintenance-free, with fuse boxes made of cast resin
 - Arrangement of fuse assembly below the switchgear vessel

- Fuse assembly connected to the three-position switch-disconnector via welded-in bushings and connecting bars
- Fuses can only be replaced if feeder is earthed
- Option: "Tripped indication" of the HV HRC fuse of the transformer switch for remote electrical indication with 1NO contact
 - The switchgear operates perfectly in a range between the rated filling level of 150 kPa and the minimum functional level of 130 kPa.
 - **If the gas pressure falls below 130 kPa, the switchgear must not be operated anymore.** The ready-for-service indicator changes from the green area to the red area ("Not ready for service")
 - When the ready-for-service indicator changes from the green to the red area or vice versa, the signaling switch is tripped.

Signaling switch in manual/motor operating mechanism

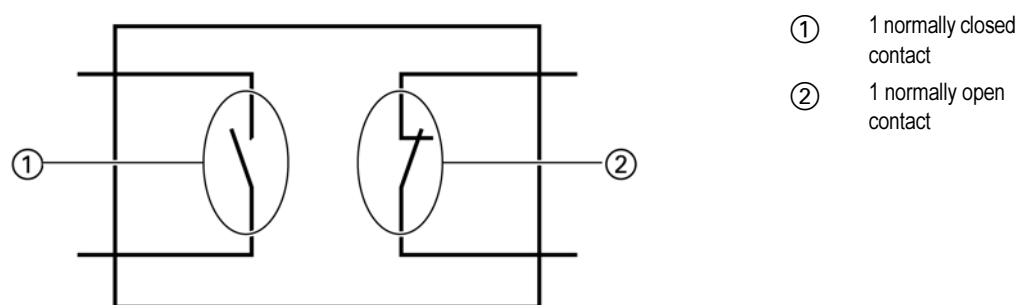


Fig. 12: Ready-for-service indicator changes to green area: NC contact opens and NO contact closes

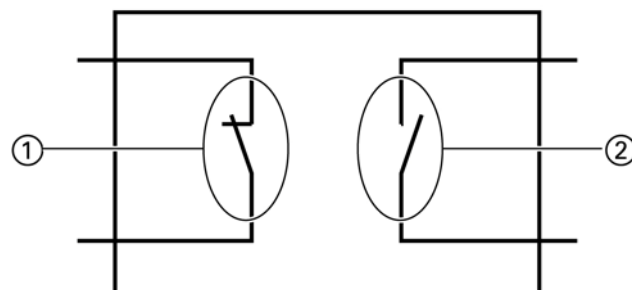


Fig. 13: Ready-for-service indicator changes to red area: NC contact closes and NO contact opens

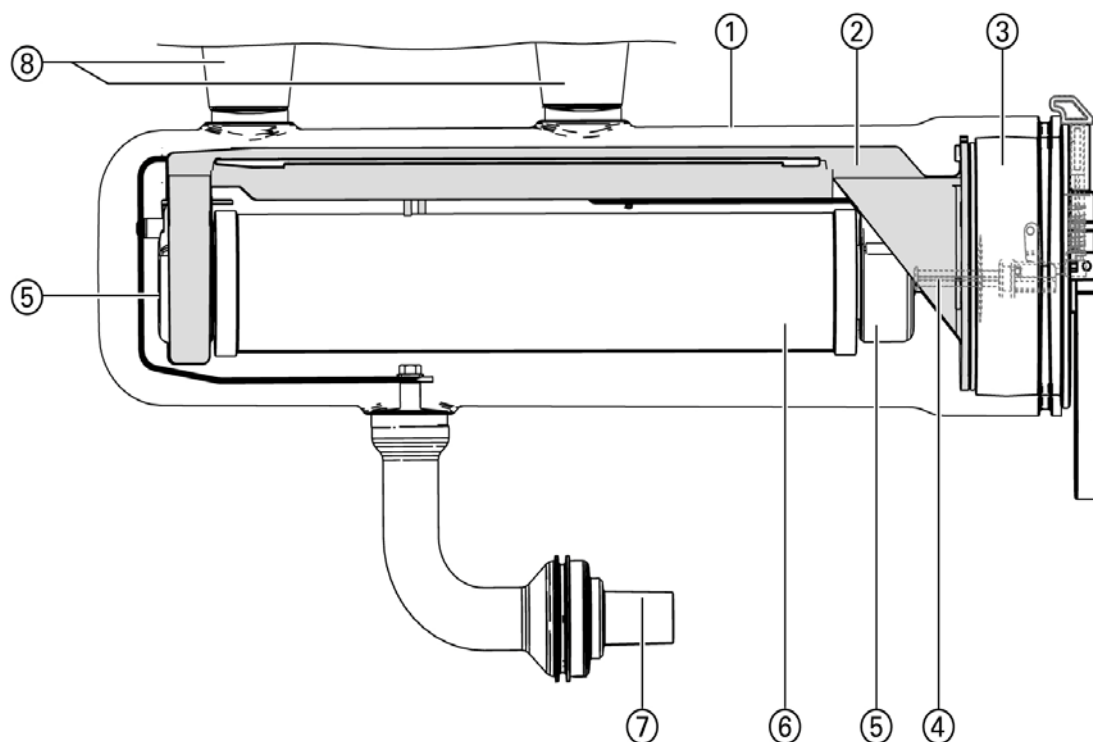


Fig. 14: HV HRC fuse assembly

- | | | | |
|---|---|---|------------------------------------|
| ① | Fuse box | ⑤ | Locking cap with control electrode |
| ② | Fuse slide | ⑥ | HV HRC fuse |
| ③ | Sealing cover with seal | ⑦ | Cable connection (bushing) |
| ④ | Tripping pin for redirection at the spring-operated/stored-energy mechanism | ⑧ | Fuse bushing |

Possible cable connections for the HV HRC fuse assembly

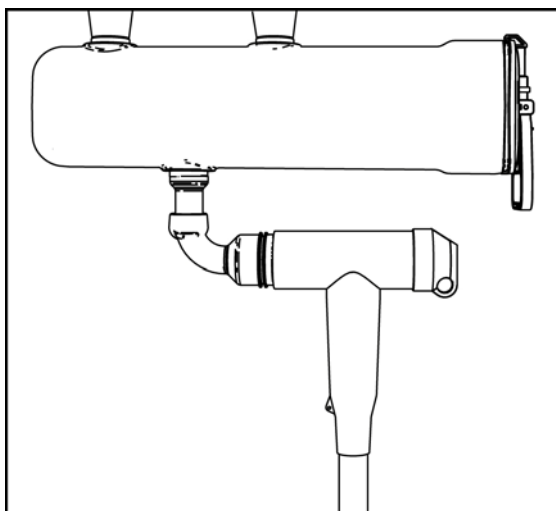


Fig. 15: Fuse assembly with bushing according to DIN 50181 type C for connection of T-plugs or elbow plugs for cable routing downwards (T-plug shown)

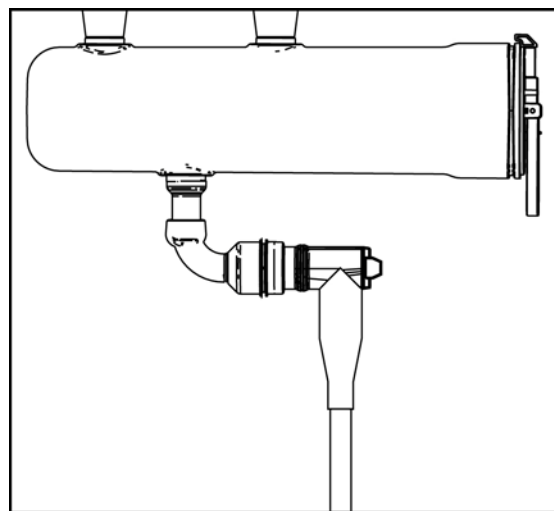


Fig. 16: Fuse assembly with bushing according to DIN 50181 type A for connection of elbow plugs for cable routing downwards

Possible cable connections for the HV HRC fuse assembly

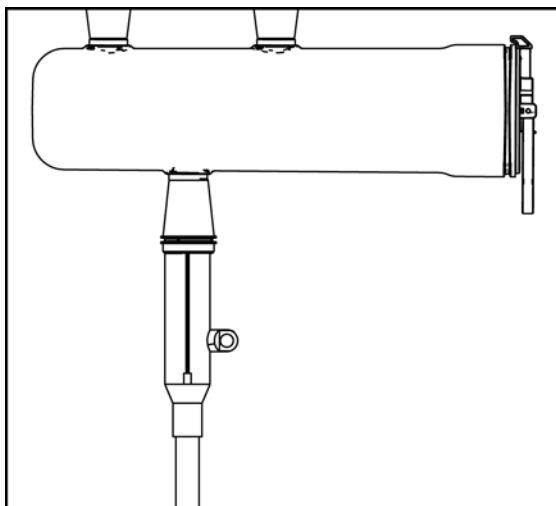


Fig. 17: Fuse assembly with bushing according to DIN 50181 type A for connection of straight cable plugs for cable routing downwards

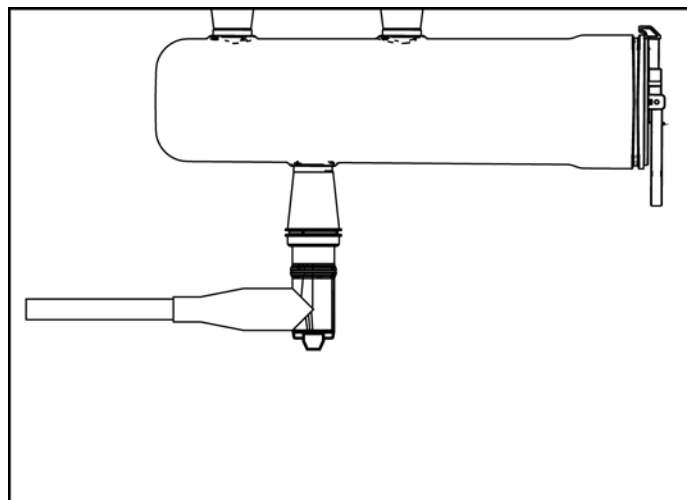


Fig. 18: Fuse assembly with bushing according to DIN 50181 type A for connection of elbow plugs for cable routing to the rear

Mode of operation

In the event that an HV HRC fuse-link has tripped, the switch is tripped via an articulation which is integrated into the cover of the fuse box.

In the event that fuse tripping fails, e.g. if the fault current is less than $I_{\min}$, or if the fuse has been inserted incorrectly, the fuse box is protected by thermal protection. The overpressure generated by overheating trips the switch via a diaphragm in the cover of the fuse box and via the articulation. This breaks the current before the fuse box incurs irreparable damage. This thermal protection works independently of the type and design of the HV HRC fuse used. Like the fuse itself, it is maintenance-free and independent of any outside climatic effects.

Schematic sketches for fuse tripping

Fuse-link in service condition



Fuse tripped by striker



Fuse tripped by overpressure, e.g. if fault current is less than $I_{\min}$ and if HV HRC fuse has been inserted incorrectly

Furthermore, the specified HV HRC fuses release the striker depending on the temperature and trip the switch-disconnector as early as in the fuse overload range. Impermissible heating of the fuse box can be avoided in this way.

7.7 Cable connection

	ATTENTION!
	For perfect installation of the cable plugs, the following must be observed: ⇒ Mount the cable plugs according to the manufacturer's instructions. ⇒ If the manufacturer has not made any stipulations, the bolted joints must be tightened with max. 50 Nm.

Cable connections with bolted contact for ring-main and circuit-breaker feeders

Features

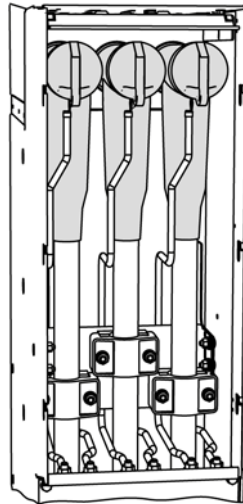


Fig. 19: Cable connection for ring-main and circuit-breaker feeders (example Euromold K400 TB)

- For bushings according to EN 50 181/DIN EN 50 181 (interface type C with bolted contact M16)
- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cable with adapter systems
- Access to the cable compartment only if the feeder has been disconnected and earthed
- As screened (semi-conductive) version independent of the site altitude
- Connection of cable elbow plugs or cable T-plugs with bolted contact M16 for 630 A, paper-insulated mass-impregnated cables via customary adapters, power cables as thermoplastic-insulated single-core cables with the corresponding plugs and adapters mentioned above

Options

- Mounted cable clamps on cable bracket (e.g. C profiles or similar)
- Surge protection devices of the same make in connection with the respective cable T-plugs

Surge arresters

- Pluggable on cable T-plug, cable elbow plug
- Installation of certain configurations with surge arresters possible via deep cable compartment cover
- Surge arresters recommended if, at the same time, the cable system is directly connected to the overhead line, or the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear

Surge limiters

- Pluggable on cable T-plug
- Surge limiters recommended when motors are connected

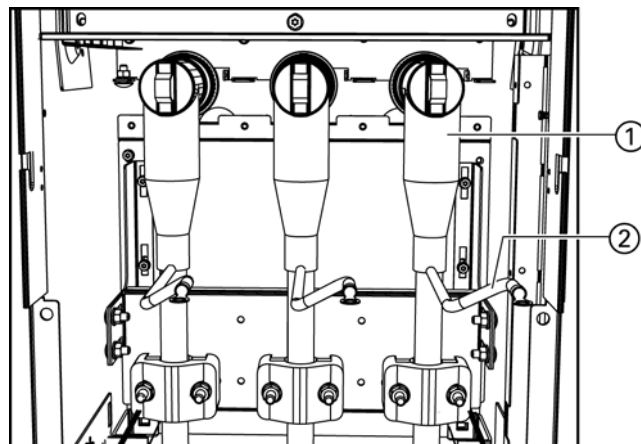
Conventional cable connections for ring-main feeders and circuit-breaker feeders

Conventional cable sealing ends can be equipped with elbow adapters, e.g. RICS (Tyco Electronics Raychem).

- Possibilities of connection**
- Cable testing e.g. with measuring bolt, make nkt cables, type PAK 630, see Page 209, "Cable testing"
 - Conventional sealing end: As customer supply

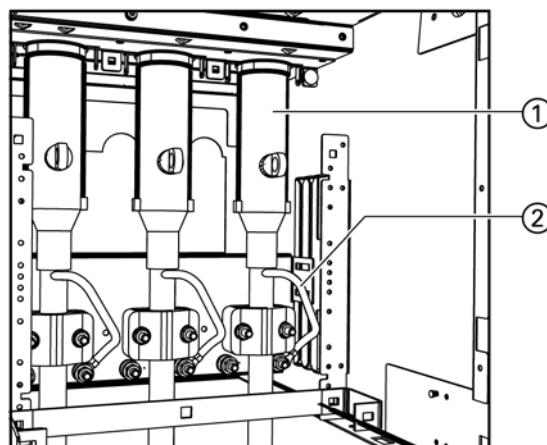
- Options**
- Mounted cable clamps on cable bracket (e.g. C profiles or similar)

Cable connections with plug-in contact for transformer feeders



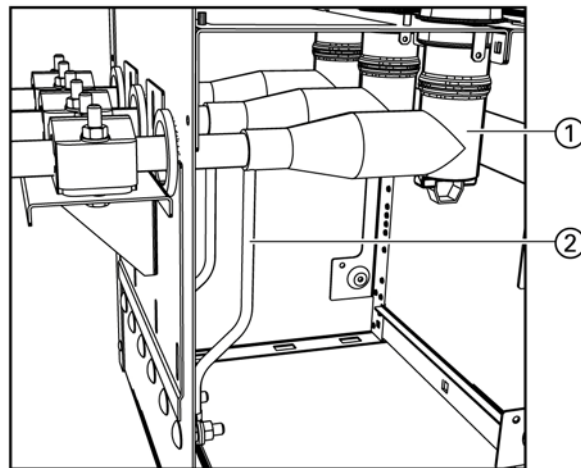
- ① Elbow cable plug, e.g. Euromold K158
- ② Earthing

Fig. 20: Cable connection for transformer feeder: Interface type A (250 A) - Cable feeder to the front



- ① Straight cable plug, e.g. Euromold K152
- ② Earthing

Fig. 21: Cable connection for transformer feeder: Interface type A (250 A) - Cable feeder downwards



- ① Elbow cable plug, e.g. Euromold K158
- ② Earthing

Fig. 22: Cable connection for transformer feeder: Interface type A (250 A) - Cable feeder to the rear

Cable connections with bolted contact for transformer feeders

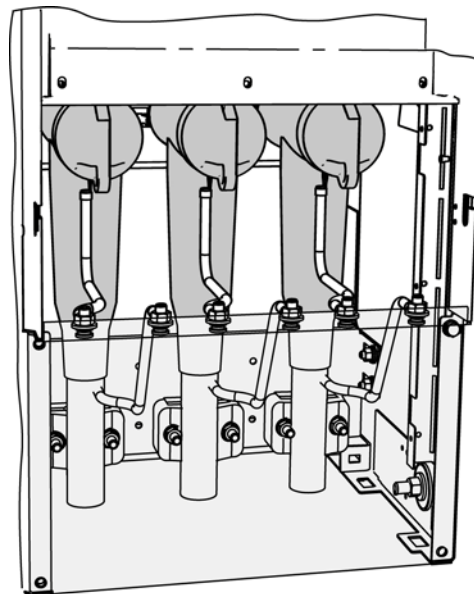


Fig. 23: Cable connection for transformer feeder: Interface type C (630 A): E.g. Euromold K400 TB (black), nkt AB 24-630 and ASA 24-5 (gray)

- Features**
- As plug-in contacts according to EN 50 181/DIN EN 50 181 interface type A for cable elbow plugs or straight cable plugs
 - For bushings according to EN 50 181/DIN EN 50 181 interface type C with bolted contact M16

Cable sealing ends The transformer cables are connected with cable plugs.

- Option**
- Mounted cable clamps on cable bracket
 - Bolted contact (M16)

Selection table for plug systems**Plug systems**

Manufacturer	Plug type for ring-main feeders	Plug type for transformer feeders
Euromold	(K) 400 TB (S)	(K) 158 LR
	(K) 400 LB	(K) 151 SR
	- - -	AGW (L) 10 (20); AGG (L) 10 (20)
nkt cables	CB 24-630	CE 24-250
	AB 24-630	EASW 10/250
	-	EASW 20/250
Südkabel (ABB)	SEHDT 13 (23)	SEHDG 11.1 (21.1)
	SEHDT 13.1 (23.1)	SEW 12 (24)
Prysmian Kabel (Pirelli)	FMCTs(m)-400	FMCE(m)-250
Tyco-Electronics/Raychem	RICS 51 ...	RSES; RSSS
Further plug types on request		

7.8 Aligning and extending the switchgear

- Features**
- Busbar extension possible on all individual panels and panel blocks (ordering option)
 - Plug-in unit consisting of contact coupling and screened silicone coupling
 - Insensitive to pollution and condensation
 - Switchgear installation, extension or panel replacement is possible without **gas work**
 - Busbar connections to metering panels are possible

Design Every switchgear block and every individual panel is optionally available with busbar extension on the right, on the left or on both sides. This offers a high flexibility for the creation of switchgear configurations whose functional units are lined up in any order. Local installation and lining up is done **without gas work**.

Lining up takes place as follows:

- By the busbar couplings on the medium-voltage side. Tolerances between adjacent panels are compensated by spherical fixed contacts and the movable contact coupling with degrees of freedom in all axis directions.
- By safe dielectric sealing with screened silicone couplings that are externally earthed and adjustable to tolerances. These silicone couplings are pressed on with a defined pressure when the panels are interconnected.
- On free busbar ends, screened dummy plugs are inserted, each of which is pressed on through a metal cover. A common protective cover with a warning is fixed over all three covers.
- By centering bolts for easier switchgear installation and fixing of adjacent panels.
- By bolted panel joints with defined stops for the distances between adjacent panels and the associated pressure of contact pieces and silicone couplings.

Switchgear installation, extension or replacement of one or more functional units requires a lateral wall distance ≥ 200 mm.

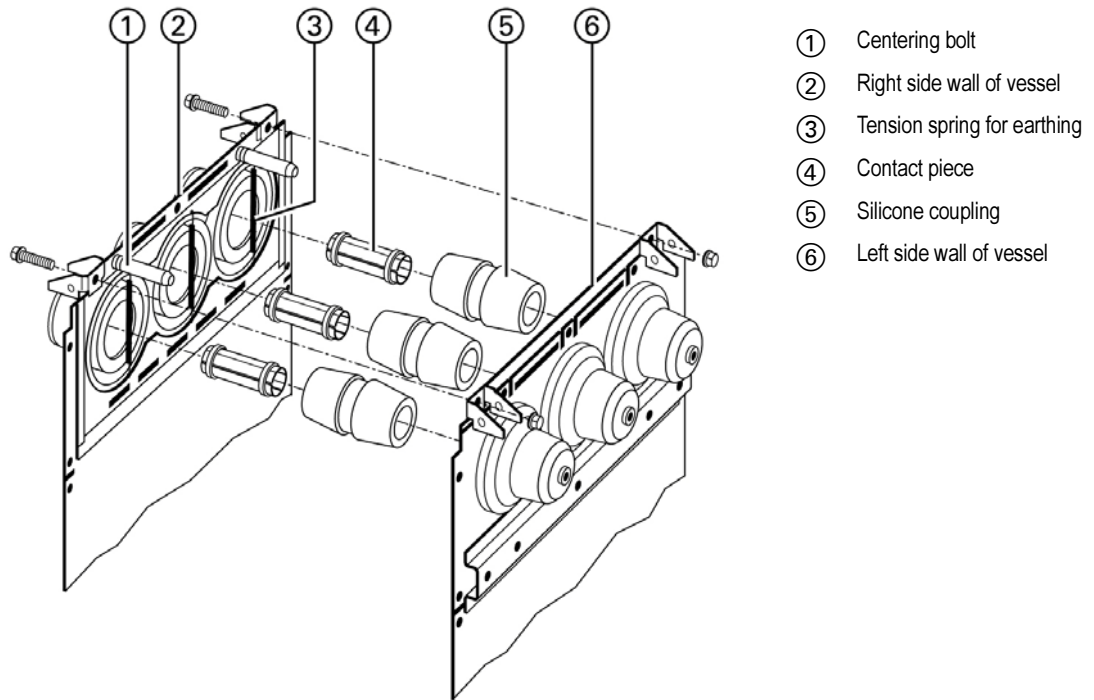


Fig. 24: Lining up via busbar coupling

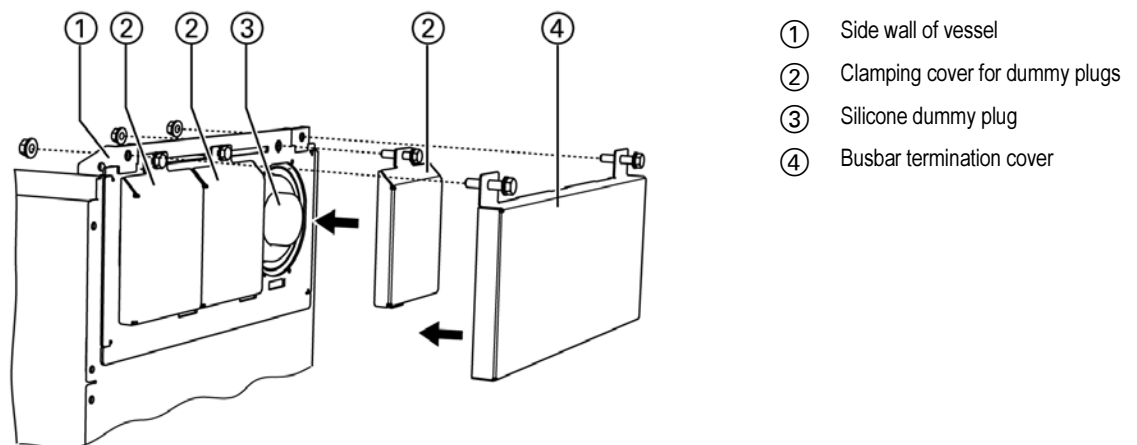


Fig. 25: Switchgear end wall with dummy plug

7.9 Current and voltage transformers

Current and voltage transformers

Current transformers

- According to IEC 60 044-1/ VDE 0414-44-1

Voltage transformers

- According to IEC 60 044-2 / VDE 0414-44-2

Technical data

The technical data of the current and voltage transformers are given in the associated order documents.

7.10 Protection and control equipment

Protection and control equipment is equipped according to the customer's specifications. The devices are normally installed in the low-voltage compartment and/or in the low-voltage niche. For details please refer to the relevant circuit documentation.

7.11 Voltage detecting systems

For voltage detection according to IEC 61243-5/VDE 0682-415 with:

- HR system (standard)
- LRM system (option)
- VOIS+, VOIS R+ (option)
- Integrated voltage detecting system CAPDIS-S1 +/-S2+(option)
- WEGA 1.2/2.2 (option)

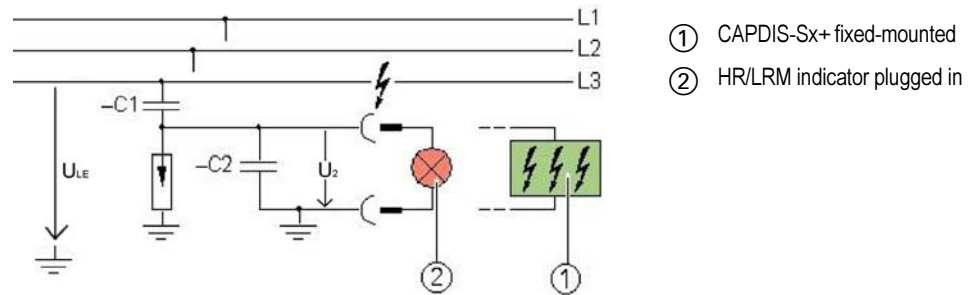
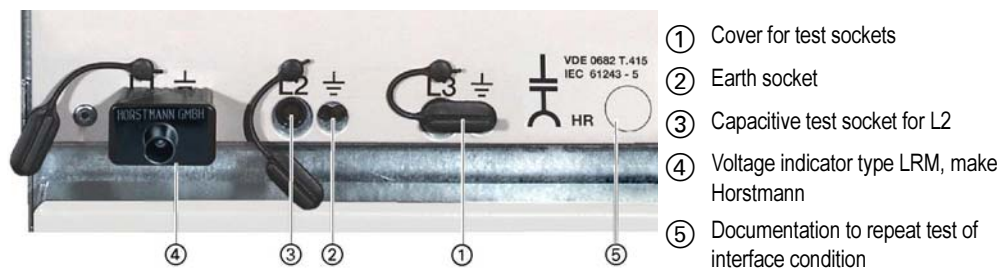


Fig. 26: Voltage detecting system via capacitive voltage divider (principle)

- -C1: Capacity integrated into bushing
- -C2: Capacity of the connection leads and the voltage indicator to earth
- $U_{LE} = U_N / \sqrt{3}$ during rated operation in the three-phase system
- $U_2 = U_A$ = Voltage at the capacitive interface of the switchgear or at the voltage indicator

Features of HR/LRM system



- With voltage indicator
 - HR system (standard)
 - LRM system (option)
 - LRM system (option), integrated type VOIS+
 - LRM system (option), integrated type CAPDIS-S1+
 - LRM system (option), integrated type CAPDIS-S2+
- Verification of safe isolation from supply phase by phase through insertion in each socket pair
- Voltage indicator flashes if high voltage is present
- Indicator suitable for continuous operation
- Safe-to-touch
- Measuring system and voltage indicator can be tested

Features of VOIS+, VOIS R+

- Integrated display, without auxiliary power
- With indications "A1" to "A3" (see VOIS and CAPDIS indications)
- Maintenance-free, repeat test required
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 67, temperature range -25 °C to +55°C
- With integrated signaling relays (only VOIS R+)
- "M1": Operating voltage present at one phase L1, L2 or L3 as a minimum
- "M2": Operating voltage not present at L1, L2 and L3



Fig. 27: VOIS+: Cover closed

Common features of CAPDIS-Sx+

- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 54, temperature range -25 °C to +55 °C
- With capacitance circuit

Features of CAPDIS-S1+

- Without auxiliary power
- With indication "A1" to "A5"
- Without ready-for-service monitoring
- Without signaling relay (thus without auxiliary contacts)

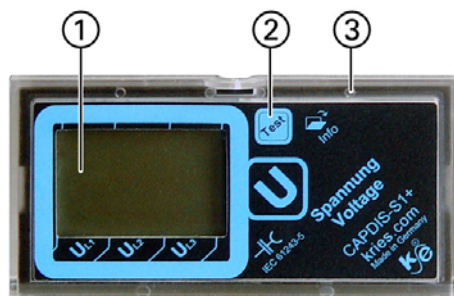


Fig. 28: CAPDIS-S1+: Cover closed



Fig. 29: CAPDIS-S1+: Cover open

- ① LC display
- ② "Display Test" button
- ③ Cover
- ④ Test socket L2

- ⑤ Earth socket
- ⑥ Test socket L3
- ⑦ Test socket L1
- ⑧ Short instruction

Features of CAPDIS-S2+

- With indication "A0" to "A6"
- Only by pressing the "Device Test" pushbutton: "ERROR" indication (A6), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (external auxiliary power required)
- With integrated signaling relay for signals "M1" to "M4" (auxiliary power required):
 - "M1": Voltage present at phases L1, L2, L3
 - "M2": Voltage not present at L1, L2 and L3 (= active zero indication)
 - "M3": Earth fault or voltage failure, e.g. in one phase
 - "M4": External auxiliary power missing (with operating voltage present or not)

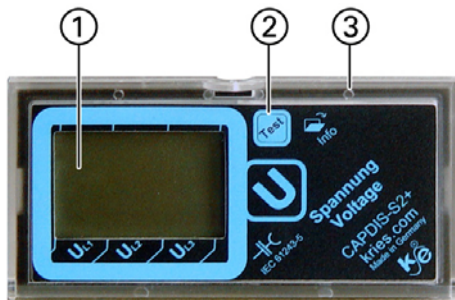


Fig. 30: CAPDIS-S2+: Cover closed



Fig. 31: CAPDIS-S2+: Cover open

- | | |
|-------------------------|---------------------|
| ① LC display | ⑤ Earth socket |
| ② "Display Test" button | ⑥ Test socket L3 |
| ③ Cover | ⑦ Test socket L1 |
| ④ Test socket L2 | ⑧ Short instruction |

WEGA 1.2

- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication "A1" to "A5" (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- Without integrated signaling relay
- Without auxiliary power

WEGA 2.2

- Voltage detecting system according to IEC 61243-5 or VDE 0682-415
- With indication "A0" to "A6" (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay
- Auxiliary power required for signaling relay



Fig. 32: WEGA 1.2



Fig. 33: WEGA 2.2

**Indications VOIS, VOIS R+,
CAPDIS -S1+/-S2+**

Indication	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+			
	L1	L2	L3	L1	L2	L3	L1	L2	L3	
A0							000			Operating voltage not present (CAPDIS-S2+)
A1	⚡ ⚡ ⚡			⚡ ⚡ ⚡			⚡ ⚡ ⚡			Operating voltage present
A2										- Operating voltage not present - Auxiliary power not present (CAPDIS-S2+)
A3		⚡ ⚡			⚡ ⚡			⚡ ⚡		Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4				⚡ ⚡ ⚡			⚡ ⚡ ⚡			Voltage (not operating voltage) present
A5				⚡ ⚡ ⚡			⚡ ⚡ ⚡			Indication: "Display Test" passed
A6							⚡ ⚡ ⚡ ERROR			Indication: "ERROR" e.g. in case of missing auxiliary voltage (CAPDIS-S2+, error indication M4)

**Indications
WEGA 1.2, WEGA 2.2**

Indication	WEGA 1.2			WEGA 2.2			
	L1	L2	L3	L1	L2	L3	
A0				⚡ ⚡ ⚡			For WEGA 2.2: Operating voltage not present, auxiliary power present, LCD illuminated
A1	⚡ ⚡ ⚡			⚡ ⚡ ⚡			- Operating voltage present - For WEGA 2.2: Auxiliary power present, LCD illuminated
A2							- Operating voltage not present - For WEGA 2.2: Auxiliary power not present, LCD not illuminated
A3		⚡ ⚡		⚡ ⚡ ⚡			- Failure in phase L1, operating voltage at L2 and L3 - For WEGA 2.2: Auxiliary power present, LCD illuminated
A4	⚡ ⚡ ⚡			⚡ ⚡ ⚡			- Voltage present, current monitoring of coupling section below limit value - For WEGA 2.2: Auxiliary power present, LCD illuminated
A5	⚡ ⚡ ⚡			⚡ ⚡ ⚡			- Indication: "Display Test" passed - For WEGA 2.2: Auxiliary power present, LCD illuminated
A6				⚡ ⚡ ⚡			For WEGA 2.2: LCD for missing auxiliary voltage is not illuminated

7.12 Ready-for-service indicator

	DANGER!
	Mortal danger, and damage to the switchgear if the switch-disconnector is operated without the switchgear being ready for service! ⇒ Operate the switch-disconnector only if the indicator shows service readiness of the switchgear. ⇒ If the switchgear is not ready for service, isolate the switchgear in the opposite substation, and inform the Siemens representative.

The switchgear is filled with insulating gas at a relative pressure. The ready-for-service indicator at the switchgear front shows through the red/green indication if the gas density is in order.

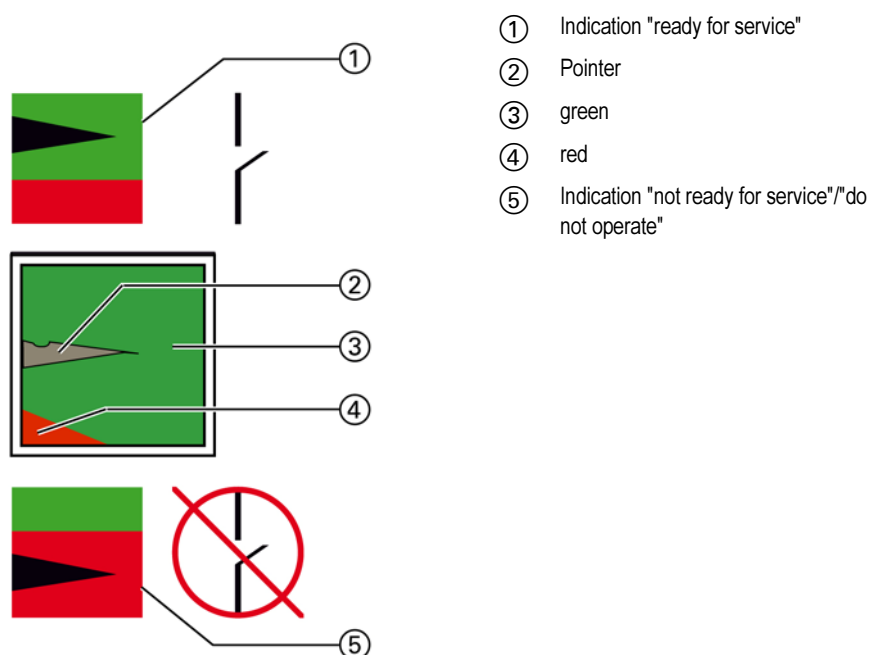
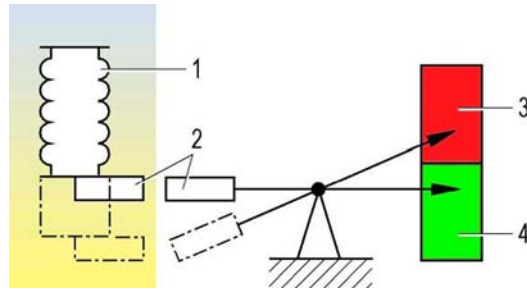


Fig. 34: Ready-for-service indicator

Features

- Self-monitoring, easy to read
- Independent of temperature and external pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Alarm switch "1S + 1Ö" for remote electrical indication

Mode of operation



Principle of gas monitoring with ready-for-service indicator

- ① Measurement box in filled stainless-steel vessel
- ② Magnetic coupling
- ③ Red indication: not ready for service/do not operate
- ④ Green indication: ready for service

For the ready-for-service indicator, a gas-tight measurement box is installed inside the switchgear vessel.

A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an armature outside the switchgear vessel through the non-magnetizable switchgear vessel. This armature moves the ready-for-service indicator of the switchgear.

While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, changes in the relative gas pressure resulting from temperature and external pressure variations are not. The gas in the measurement box has the same temperature as that in the switchgear.

The temperature effect is compensated via the same pressure change in both gas volumes.

7.13 Short-circuit/earth-fault indicators

All ring-main feeders can be **optionally** equipped with a 3-phase short-circuit or earth-fault indicator.

Features

- Indication on the switchgear front or in the door of the low-voltage compartment
- Factory-assembled including sensor mounted on ring-main cable bushing
- Short-circuit pickup values: See table
- Reset manually or automatically after a preset time, depending on the type
- Optical signals when a pre-selected pickup value is exceeded
- Option: Remote electrical indication via passing contact (changeover contact) or via maintained contact (D) connected to terminals (rear side of device).

Selection of short-circuit/earth-fault indicators



Fig. 35: Short-circuit indicator ALPHA E, make Horstmann



Fig. 36: Short-circuit indicator SIGMA, make Horstmann



Fig. 37: Short-circuit indicator IKI-20, make Kries

Selection of short-circuit and earth-fault indicators (further types on request)							
Indicator type	Reset		Remote reset:	Automatically after return of auxiliary voltage/primary current	Pickup values	Pickup values	Remote indication as
	manually	automatically after	A: By auxiliary voltage B: Via NO contact (floating)		Short-circuit current I _k (A) Standard, other values on request	Earth-fault current I _E (A) Standard, other values on request	x = Number of relays W: Passing contact D: Maintained contact
Short-circuit indicator (make Horstmann)							
ALPHA M	x	-	-	-	400, 600, 800, 1000	-	x = 1, W, D
ALPHA E		2 h or 4 h	A (12-60V AC/DC)				
Opto F 3.0 ¹⁾	x	1, 2, 4 or 8 h	B (1NO)	-	400, 600, 800, 1000	-	x = 1, W, D
SIGMA	x	1, 2, 4 or 8 h	B (1NO)	-	400, 600, 800, 1000 or self-adjustment	-	x = 1, W, D
SIGMA ACDC ²⁾				Auxiliary voltage			
Earth-fault/short-circuit indicator (make Horstmann)							
Opto F+E 3.0 ¹⁾	x	1, 2, 4 or 8 h	B (1NO)	-	400, 600, 800, 1000	40, 80, 120, 160	x = 2, W, D
SIGMA F+E	x	1, 2, 4 or 8 h	B (1NO)	-	400, 600, 800, 1000 or self-adjustment	20*, 40, 60, 80, 100, 120, 160 *) not with all measuring sensors	x = 2, W, D
SIGMA F+E ACDC ²⁾				Auxiliary voltage			
ComPass A ³⁾	x	2, 4 or 8 h	-	Auxiliary voltage	-	25, 50, 75, 100	x = 4 (freely programmable); RS485, MODBUS
Earth-fault indicator (make Horstmann)							
EARTH ZERO	x	2, 4 or 8 h	-	Auxiliary voltage	-	25, 50, 75, 100	x = 1, W, D
Combined short-circuit/earth-fault indicator (make Kries Energietechnik)							
IKI-20Bx	Yes	2 h, 4 h	B (1NO)	Primary current	400, 600, 800, 1000, 2000	40, 80, 100, 150	x = 1, 2 or 3, W, D
IKI-20Tx				Auxiliary voltage			
IKI-20Ux				Primary current			
IKI-20U2a				Primary current			
IKI-20PULS				Auxiliary voltage		Pulse detection	x = 2, W, D
Earth-fault indicator (make Kries Energietechnik)							
IKI-10light-Px		2 h, 4 h	B (1NO)	Auxiliary voltage	-	20, 40, 60, 80	x = 2, W, D

¹⁾ Power supply for LED indication via built-in long-time lithium cell, alternatively 12–110 V DC or 24–60 V AC

²⁾ External auxiliary voltage required (12-60 V DC or 110-230 V AC)

³⁾ External auxiliary voltage required (24-230 V AC or DC)

7.14 Accessories

Standard accessories (selection)

- Operating and installation instructions
- Operating lever for disconnect, switch-disconnector and circuit-breaker

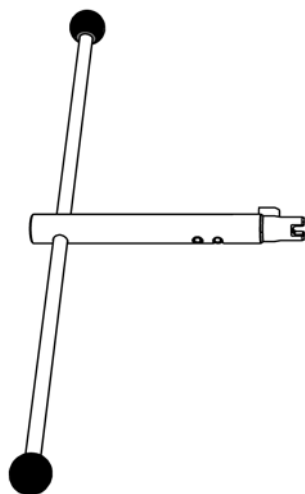


Fig. 38: Standard operating lever

Standard: Single-lever operation with black handle and coding as universal lever.

Alternative 1: One operating lever with red handle for earthing and de-earthing, and one operating lever with black handle for load breaking.

Alternative 2: Single-lever operation via anti-reflex lever with and without coding

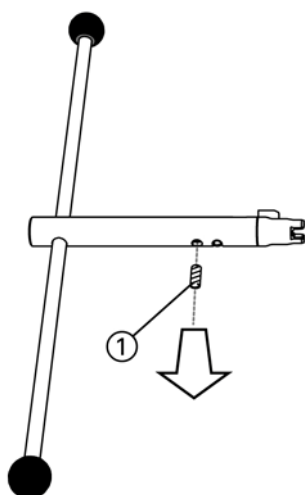


Fig. 39: Readjustment of the standard operating lever to an anti-reflex lever

① Setscrew

Remove setscrew as shown in the illustration to get an anti-reflex lever.

- Double-bit key (option)

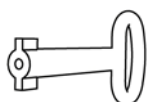


Fig. 40: Double-bit key with 3 mm diameter for low-voltage door

- Other accessories** According to the order documents/purchase order (selection):
- HV HRC fuse-links
 - Cable plugs / adapter systems
 - Surge arresters / limiters
 - Test fuses for mechanical simulation of the striker of HV HRC fuse-links in transformer feeders / contactor panels with extension tube



- LRM voltage indicators
- Test units to check the capacitive interface and the voltage indicators
- Unit for the function test of the plug-in indicator



- Phase comparison test units (e.g. make Pfisterer type EPV, KRIES type CAP-Phase, make Horstmann type ORION 3.0)

Phase comparison test unit make Pfisterer, type EPV	Phase comparison test unit make Kries, type CAP-Phase	Phase comparison test unit make Horstmann, type ORION 3.0
As combined test unit (HR and LRM) for - Voltage detection - Phase comparison - Interface testing at the switchgear - Integrated self-test	As combined test unit (HR and LRM) for - Voltage detection - Repeat test - Phase comparison - Phase sequence test - Self-test - The unit does not require a battery.	As combined test unit for - Phase comparison - Interface testing at the switchgear - Voltage detection for LRM systems - Integrated self-test - Indication via LED and acoustic alarm

7.15 Low-voltage compartment (option)

Features

Overall height

- Design options: 200, 400, 600 or 900 mm

Optionally available cover:

- Installation possible on the switchgear per feeder; customer-specific equipment; separate wiring duct on the switchgear beside the low-voltage compartment

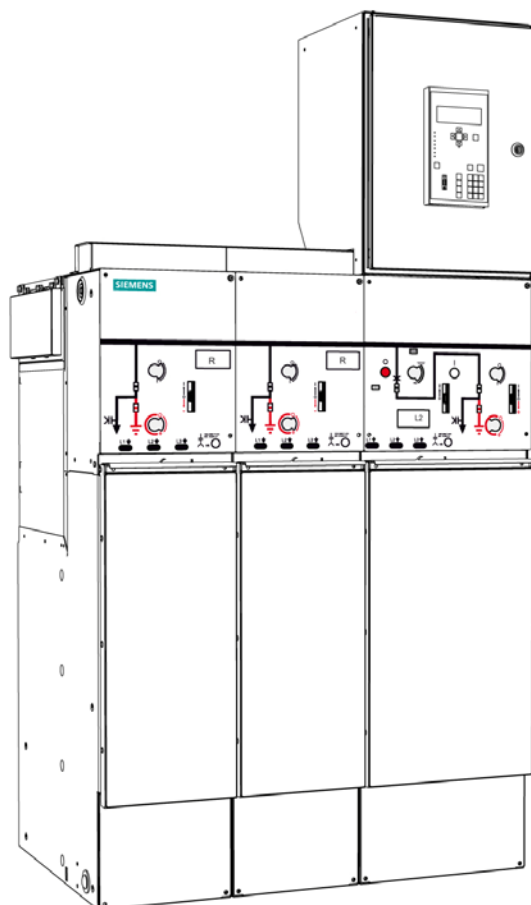
Example of switchgear with low-voltage equipment

Fig. 41: Example of switchgear with low-voltage compartment

Shipping and transport data

If the switchgear is delivered with low-voltage compartment, please observe the different transport dimensions and weights as well as the relocation of the center of gravity.

8 Technical data

8.1 General technical data

General electrical data

Rated insulation level		Rated voltage U _r	kV	7.2	12	15	17.5	24	
		Rated short-duration power-frequency withstand voltage U _d							
		- phase-to-phase, phase-to-earth, open contact gap	kV	20	28/42*	36	38	50	
		- across isolating distance	kV	23	32/48*	39	45	60	
		Rated lightning impulse withstand voltage U _p							
		- phase-to-phase, phase-to-earth, open contact gap	kV	60	75	95	95	125	
		- across isolating distance	kV	70	85	110	110	145	
Rated frequency f _r			Hz	50/60					
Rated normal current I _r **		for ring-main feeders	A	400 or 630					
		for busbar	A	630					
		for circuit-breaker feeders		250 or 630					
		for transformer feeders	A	200 ¹⁾					
50 Hz	Rated short-time withstand current I _k	for switchgear with t _k = 1 s	up to kA	25				20	
		for switchgear with t _k = 3 s (design option)	up to kA	20					
	Rated peak withstand current I _p		up to kA	63				50	
	Rated short-circuit making current I _{ma}	for ring-main feeders	up to kA	63				50	
		for circuit-breaker feeders	up to kA	63				50	
		for transformer feeders	kA	25					
	60 Hz	Rated short-time withstand current I _k	for switchgear with t _k = 1 s	up to kA	21				20
			for switchgear with t _k = 3 s (design option)	up to kA	21				20
Rated peak withstand current I _p		up to kA	55				52		
Rated short-circuit making current I _{ma}		for ring-main feeders	up to kA	55				52	
		for circuit-breaker feeders	up to kA	55				52	
		for transformer feeders	kA	26					
Filling pressure (pressure values at 20 °C)		Rated filling level p _{re} (absolute)	kPa	150					
		Minimum functional level p _{me} (absolute)	kPa	130					
Ambient air temperature T		without secondary equipment	°C	-25/-40 ^{*)} up to +55/+70 [*]					
		with secondary equipment	°C	-5/-40 ²⁾ up to +55/+70 ^{*)}					
		for storage/transport including secondary systems	°C	-40 to +70					
Degree of protection		for gas-filled switchgear vessel		IP 65					
		for switchgear enclosure		IP2X/IP3X ^{*)}					
		for low-voltage compartment		IP3X/IP4X ^{*)}					

* Design option

** The rated normal currents apply to ambient air temperatures of max. 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62271-1 / VDE 0671-1)

¹⁾ Depending on HV HRC fuse-link

²⁾ Depending on the secondary equipment used

8.2 Three-position switch-disconnector

Three-position switch-disconnector

Three-position switch-disconnector

Switching capacity for general-purpose switches according to IEC / EN 60265-1 / VDE 0670-301										
Rated voltage U _r					kV	7.2	12	15	17.5	24
Test duty 1	Rated mainly active load breaking current	100 operations	I ₁		A	630				
		20 operations	0.05 I ₁		A	31.5				
Test duty 2a	Rated closed-loop breaking current		I _{2a}		A	630				
Test duty 3	Rated no-load transformer breaking current		I ₃		A	40				
Test duty 4a	Rated cable-charging breaking current		I _{4a} (I _c or I ₆)		A	68				
Test duty 4b	Rated line-charging breaking current		I _{4b}		A	68				
Test duty 5	Rated short circuit making current		I _{ma}	50 Hz	up to kA	63				50
				60 Hz	up to kA	55				52
Test duty 6a	Rated earth-fault breaking current		I _{6a} (I _e)		A	200				
Test duty 6b	Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions		I _{6b} (√3 · I _{CL})		A	115				
-	Cable-charging breaking current under earth-fault conditions with superimposed load current		I _L + √3 · I _{CL}		A	630 + 115				
Number of mechanical operating cycles / Classification					n	1,000 / M1				
Number of electrical operating cycles / Classification					n	100 / E3				

Switching capacity for make-proof earthing switch according to IEC/EN 62271-102 / VDE 0671-102							
Rated voltage U _r			7.2	12	15	17.5	24
Rated short-circuit making current I _{ma}	50 Hz	up to kA	63				50
	60 Hz	up to kA	55				52
Number of mechanical operating cycles		n	1000				
Number of short-circuit making operations / Classification		n	5 / E2				

Switch-disconnector/fuse combination

Switching capacity for switch-disconnector/fuse combination according to IEC 62271-105 / VDE 0671-105							
Rated voltage U _r			7.2	12	15	17.5	24
Rated normal current		A	200 ¹⁾				
Rated transfer current	I _{transfer}	A	1500		1300		
Maximum transformer rating		kVA	1000	1250	1600	1600	2000
¹⁾ Depending on HV HRC fuse-link							

Switching capacity for make-proof earthing switch, with HV HRC fuses on feeder side							
Rated voltage U _r			7.2	12	15	17.5	24
Rated short-circuit making current I _{ma}	50 Hz	kA	5				
	60 Hz		5.2				
Rated short-time withstand current	I _k with t _k = 1 s	kA	2				

Motor operating mechanism

The rated current of the motor protection equipment is shown in the following table:

Rated supply voltage V	Recommended rated current for the protection equipment A
DC 24	4
DC 48	2
DC 60	1.6
DC/AC 110	1.0
DC 120/125	1.0
DC 220	0.5
AC 230	0.5
Control voltage (including releases) is generally protected with 8A.	

8.3 Three-position disconnecter**Three-position disconnecter**

Switching capacity and classification of three-position disconnecters and earthing switches according to IEC/EN 62 271-102 / VDE 0671-102.

For disconnecter

Rated voltage U_r	kV	7.2	12	15	17.5	24
Rated normal current I_r	A	250, 630				
Number of mechanical operating cycles / Classification	n	1000 / M0				

For make-proof earthing switch

Rated voltage U _r	kV	7.2	12	15	17.5	24
Rated short-circuit making current I _{ma}	A	63 ¹⁾				50
Number of short-circuit making operations / Classification	n	5 / E2				
¹⁾ 52.5 kA at 60 Hz						

8.4 Vacuum circuit-breaker

Switching capacity and classification of switching devices

Vacuum circuit-breaker with switching capacity according to IEC/EN 62271-100 / VDE 0671-100.

Type 1.1 with three-position disconnector									
Rated voltage U_r				kV	7.2	12	15	17.5	24
Rated normal current of feeders I_r				A	630				
50 Hz	Rated short-time withstand current I_k	for switchgear with $t_k = 1$ s	$I_k (t_k)$	up to kA	25				20
		for switchgear with $t_k = 3$ s	$I_k (t_k)$	up to kA	20				
	Rated peak withstand current I_p			up to kA	63		50		
	Rated short-circuit breaking current I_{sc}			up to kA	25		20		
	Rated short-circuit making current I_{ma}			up to kA	63		50		
	60 Hz	Rated short-time withstand current I_k	for switchgear with $t_k = 1$ s	$I_k (t_k)$	up to kA	21			
for switchgear with $t_k = 3$ s			$I_k (t_k)$	up to kA	21				20
Rated peak withstand current I_p			up to kA	55		52			
Rated short-circuit breaking current I_{sc}			up to kA	21		20			
Rated short-circuit making current I_{ma}			up to kA	55		52			
Number of mechanical operating cycles, disconnector				1,000					
Number of mechanical operating cycles, earthing switch				1,000					
Number of mechanical operating cycles, circuit-breaker				10,000					
Classification of circuit-breaker				M2, E2, C2					
Classification of disconnector				M0					
Classification of make-proof earthing switch				E2					
Rated operating sequence				O-0.3s-CO-3min-CO					
				O-0.3s-CO-15s-CO on request					
Number of short-circuit breaking operations				n	25 or 50				

Type 2 with three-position disconnector									
Rated voltage U_r				kV	7.2	12	15	17.5	24
Rated normal current of feeders I_r				A	630				
50 Hz	Rated short-time withstand current I_k	for switchgear with $t_k = 1$ s	$I_k (t_h)$	up to kA	20				
		for switchgear with $t_k = 3$ s	$I_k (t_h)$	up to kA	20				
	Rated peak withstand current I_p			up to kA	50				
	Rated short-circuit breaking current I_{sc}			up to kA	20 *				
	Rated short-circuit making current I_{ma}			up to kA	50				
	60 Hz	Rated short-time withstand current I_k	for switchgear with $t_k = 1$ s	$I_k (t_h)$	up to kA	21			20
for switchgear with $t_k = 3$ s			$I_k (t_h)$	up to kA	21			20	
Rated peak withstand current I_p			up to kA	55			52		
Rated short-circuit breaking current I_{sc}			up to kA	21			20		
Rated short-circuit making current I_{ma}			up to kA	55			52		
Number of mechanical operating cycles, disconnector					1,000				

Type 2 with three-position disconnecter		
Number of mechanical operating cycles, earthing switch		1,000
Number of mechanical operating cycles, circuit-breaker		2,000
Classification of circuit-breaker		M1, E2, C1
Classification of disconnecter		M0
Classification for make-proof earthing switch		E2
Rated operating sequence		O-3min-CO-3min-CO
Number of short-circuit breaking operations	n	6 or 20

Operating times, contacts

Operating times	Component		Type 1.1	Type 2	Unit
Closing time	Closing solenoid	(Y9)	< 75	< 30	ms
Opening time	1st shunt release	(Y1)	< 65	< 35	ms
	2st shunt release	(Y3)	--	< 35	ms
	Additional release 3AX 1101	(Y2)	< 50	--	ms
	Additional release 3AX 11		< 65	< 50	ms
	(C.t.-operated release,	(Y4), (Y6)			
	undervoltage release)	(Y7)			
Low-energy release	(Y6)	--	< 50	ms	
Arcing time			< 15	< 15	ms
Break time	1st shunt release	(Y1)	< 80	< 50	ms
	2st shunt release	(Y3)		< 50	
	Additional release 3AX 1101	(Y2)	< 65	--	ms
	Additional release 3AX 11		< 65	< 50	ms
	(C.t.-operated release,	(Y4), (Y6)			ms
	Undervoltage release)	(Y7)			ms
	Low-energy release	(Y6)			--
Charging time (motor)			< 15	< 15	s
Dead time			0.3	180	s
Close-open contact time	1st shunt release	(Y1)	< 80	< 65	ms
	2st shunt release	(Y3)	--	< 65	
	Additional release 3AX 1101	(Y2)	< 60	--	ms
	Additional release 3AX 11		< 60	< 65	ms
	(C.t.-operated release,	(Y4), (Y6)			ms
	Undervoltage release)	(Y7)			ms
	Low-energy release	(Y6)			--
Minimum command duration					
CLOSE	Closing solenoid	(Y9)	45	40	ms
OPEN	Shunt release	(Y1), (Y3)	< 40	< 40	ms
	Additional release 3AX 1101	(Y2)	< 20	--	ms
	Additional release 3AX 11		< 20	< 20	ms
	(C.t.-operated release,	(Y4), (Y6)			ms
	Undervoltage release)	(Y7)			ms
	Low-energy release	(Y6)			--

Closing time The interval of time between the initiation (command) of the closing operation and the instant when the contacts touch in all poles.

Opening time The interval of time between the initiation (command) of the opening operation and the instant when the contacts separate in all poles.

Arcing time The interval of time from the first initiation of an arc and the instant of final arc extinction in all poles.

Break time The interval of time between the initiation (command) of the opening operation and the instant of final arc extinction in the last-pole-to-clear (=opening time and arcing time).

Close-open contact time The interval of time - in a make-break operating cycle - between the instant when the contacts touch in the first pole in the closing process, and the instant when the contacts separate in all poles in the subsequent opening process.

Motor operating mechanism For DC operation, the maximum power consumption is approx. 350 W. For AC operation, the maximum power consumption is approx. 400 V A

The rated current of the motor protection equipment is shown in the following table:

Rated supply voltage	Recommended rated current for the protection equipment*
	Type 1.1
V	A
DC 24	8
DC 48	6
DC 60	4
DC/AC 110 50/60 Hz	2
DC 220/AC 230 50/60 Hz	1.6

*) M.c.b. with C-characteristic

The supply voltage may deviate from the rated supply voltage specified in the table by -15% to +10% .

The breaking capacity of the auxiliary switch 3SV92 is shown on the following table:

Breaking capacity	Operating voltage [V]	Normal current [A]	
AC 40 to 60 Hz	up to 230	10	
DC		Resistive load	Inductive load
	24	10	10
	48	10	9
	60	9	7
	110	5	4
	220	2.5	2

Closing solenoid (Y9) The closing solenoid closes the circuit-breaker. After completion of a closing operation, the closing solenoid is de-energized internally. It is available for AC or DC voltage. Power consumption: 140 W or 140 VA.

Shunt release Shunt releases are used for automatic or deliberate tripping of circuit-breakers. They are designed for connection to external voltage (DC or AC voltage). They can also be connected to a voltage transformer for deliberate tripping.

Shunt releases based on two principles (**Y1**, **Y2**) can be used:

- With the **shunt release (Y1)** the circuit-breaker is opened electrically. Power consumption: 140 W or 140 VA.
- With the **shunt release (Y2)** the electrical opening command is transferred magnetically and thus, the circuit-breaker is opened. Power consumption: 70 W or 50 VA.

Undervoltage release

Undervoltage releases are tripped automatically through an electromagnet or deliberately. The deliberate tripping of the undervoltage release generally takes place via a NC contact in the tripping circuit or via a NO contact by short-circuiting the magnet coil. With this type of tripping, the short-circuit current is limited by the built-in resistors. Power consumption: 20 W or 20 VA.

Circuit-breaker tripping signal

When the circuit-breaker is tripped by a release (e.g. by protection tripping) there is a signal through the NO contact -S6. If the circuit-breaker is tripped deliberately with the mechanical pushbutton, this signal is suppressed by the NC contact -S7.

C.t.-operated release (Y6)

The following c.t.-operated releases are available:

- The c.t.-operated release **3AX1102** consists of an energy store, an unlatching mechanism and an electromagnetic system. Rated tripping current: 0.5 A/1 A
- The c.t.-operated release **3AX1104** (low-energy release) is adequate for a tripping pulse of ≤ 0.1 Ws in connection with adequate protection systems. It is used if auxiliary voltage is missing, tripping via protection relay.

Low-energy magnetic release (for type 2)

For tripping pulse 0.02 Ws, tripping via transformer monitor (IKI-30).

Varistor module

Integrated in the releases.

8.5 Classification of 8DJH switchgear according to IEC/EN 62 271-200

8DJH is classified according to IEC/EN 62 271-200 / VDE 0671-200.

Design and construction

Partition class	PM (metallic partition)	
Loss of service continuity category for functions/modules	- with HV HRC fuses (T, H)	LSC 2A
	- without HV HRC fuses (R, L, ...)	LSC 2B
Accessibility to compartments (enclosure)		
Busbar compartment		Non-accessible
Switching device compartment		Non-accessible
Low-voltage compartment (option)		Tool-based
Cable compartment for functions/modules	- with HV HRC fuses (T, H)	Interlock-controlled
	- without HV HRC fuses (R, L, ...)	Interlock-controlled
	- only cable feeder (K)	Tool-based
	- metering panels (air-insulated) (M)	Tool-based

Internal arc classification IAC (option)

Designation of the internal arc classification IAC		
IAC class for		
- wall-standing arrangement	IAC A FL up to 21 kA, 1 s	
- free-standing arrangement	IAC A FLR up to 21 kA, 1 s	
	- F	Front
	- L	Lateral
	- R	Rear

8.6 Standards and guidelines

The medium-voltage switchgear type 8DJH for indoor installation complies with the following prescriptions and standards:

		IEC/EN standard	VDE standard
Switchgear		62 271-1	0670-1000
		62 271-200	0671-200
Switching devices	Circuit-breakers	62 271-100	0671-100
	Disconnectors/earthing switches	62 271-102	0671-102
	Switch-disconnectors	60 265-1	0670-301
	Switch-disconnector/fuse combination	62 271-105	0671-105
Voltage detecting systems		61 243-5	0682-415
Surge arresters		60 099	0675
Degree of protection		60 529	0470-1
Instrument transformers	Current transformers	60 044-1	0414-1
	Voltage transformers	60 044-2	0414-2
SF₆		60 376	0373-1
Installation and earthing		61 936-1 / HD 637 -S1	0101
Environmental conditions		60 721-3-3	DIN EN 60 721-3-3

Type approval according to German X-ray regulations (RöV)

The vacuum interrupters fitted in the vacuum circuit-breakers are type-approved in accordance with the X-ray regulations of the Federal Republic of Germany. They conform to the requirements of the X-ray regulations of January 8, 1987 (Federal Law Gazette I 1987, Page 114) in the new edition of April 30, 2003 (Federal Law Gazette I 2003, No. 17) up to the value of the rated voltage stipulated in accordance with IEC/DIN VDE.

Electromagnetic compatibility - EMC

The a.m. standards as well as the "EMC Guide for Switchgear"* are applied during design, manufacture and erection of the switchgear. Installation, connection and maintenance have to be performed in accordance with the stipulations of the operating instructions. For operation, the legal stipulations applicable at the place of installation have to be observed additionally. In this way, the switchgear assemblies of this type series fulfill the basic protection requirements of the EMC guide.

The switchgear operator / owner must keep the technical documents supplied with the switchgear throughout the entire service life, and keep them up-to-date in case of modifications of the switchgear.

* (Dr. Bernd Jäkel, Ansgar Müller; Medium-Voltage Systems - EMV Guide for Switchgear; A&D ATS SR/PTD M SP)

Protection against solid foreign objects, electric shock and water

The panels of 8DJH fulfill the following degrees of protection according to IEC 62 271-200, IEC 60 529 and DIN VDE 0671-200:

- IP2X standard for parts under high voltage in switchgear panels with HV HRC fuses
- IP3X option for switchgear enclosure of operating front and side walls with locking device
- IP65 for parts under high voltage in switchgear panels without HV HRC fuses, or without air-insulated metering panels

Transport regulations

According to "Annex 1 of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) dated September 30th, 1957" Siemens gas-insulated medium-voltage switchgear does not belong to the category of dangerous goods regarding transportation, and is exempted from special transport regulations according to ADR, Clause 1.1.3.1 b.

8.7 Switchgear versions - Dimensions and weights

The transport weight results from the switchgear weight per transport unit and the packing weight. The packing weight results from the transport dimensions and the type of transport.

Packing weights

Maximum width of switchgear unit [mm]	Packing weight for Europe, approx. [kg]	Packing weight for overseas, approx. [kg]
850	30	90
1200	40	120
1550	50	150
1800	60	180
2000	75	225

Switchgear weights

The weight of the switchgear unit results from the sum of the weights per functional unit. Depending on the design and the degree to which it is equipped (e.g. current transformers, motor operating mechanism, low-voltage compartment), different values will result. The table shows mean values.

Panel type	Width [mm]	Gross weight for a switchgear height of			LV compartment 600 mm
		1200 mm	1400 mm	1700 mm	
		approx. [kg]	approx. [kg]	approx. [kg]	
R	310	100	110	120	40
R(500)	500	140	150	170	60
K	310	100	110	120	40
K(E)	430	130	140	160	50
T	430	135	145	160	50
L	430	130	140	155	50
L (type 1.1) without 4MT3	500	210	220	240	60
L (type 2)	500	160	170	190	60
M(BC/BB/CB)	840	-	370	400	70
M(CC)	840	-	270	300	70
M(500) incl. 3x4MT3	500	230	240	260	60
S	430	130	140	160	50
S(500)	500	150	160	180	60
S(620)	620	200	220	240	2x40
H	430	135	145	160	50
V	500	240	250	270	60
E	310	100	110	120	40
E(500)	500	140	150	170	60

Panel block	Width [mm]	Gross weight for a switchgear height (without low-voltage compartment) of		
		1200 mm	1400 mm	1700 mm
		approx. [kg]	approx. [kg]	approx. [kg]
KT, TK	740	230	250	280
K(E)T	860	240	260	290
KL*, LK	740	230	250	280
K(E)L*	860	250	270	300
RK, KR	620	200	220	240
RT, TR	740	230	250	280
RL*, LR	740	230	250	280
TT	860	270	290	320
RR	620	200	220	240

LL*	860	260	280	310
RS	740	230	250	280
RH	740	230	250	280
RRT	1050	330	360	400
RRL*	1050	320	350	390
RTR	1050	330	360	400
RLR	1050	320	350	390
RRR	930	300	330	360
TTT	1290	410	440	490
LLL*	1290	400	430	480
RRS	1050	320	350	390
RRH	1050	330	360	400
RRRT	1360	430	470	520
RRRL*	1360	430	470	520
RRRR	1240	400	440	480
TRRT	1480	470	510	560
LRRL	1480	460	500	550
TTTT	1720	540	580	640
LLLL*	1720	520	560	620
RRRS	1360	420	460	510
RRRH	1360	430	470	520

* Applies to design with circuit-breaker type 2

8.8 Tightening torques

If not stated otherwise, the following tightening torques apply to 8DJH switchgear:

Joint: material/material	Thread	Tightening torque
Metal joints:		
sheet-steel/sheet-steel	M6 (self-cutting)	12 Nm
e. g.: front plates, top plates, etc.	M8	30 Nm
Earthing busbar:		
sheet-steel/copper	M8	21 Nm
copper/copper	M8	21 Nm
sheet-steel/copper	M10	30 Nm
Current conductor joint:		
copper/copper	M8	21 Nm
copper/copper	M10	30 Nm
Switchgear earthing:		
sheet-steel/cable lug	M12	50 Nm*
Cable shield earthing	M10	30 Nm*
The tightening torque at the cable lug joint depends on : - material of cable lug - instructions of sealing end manufacturer - instructions of cable manufacturer	M16 (all other cable panels)	max. 50 Nm (all other cable panels)

8.9 Gas leakage rate

Gas leakage rate The gas leakage rate is < 0.1% per year (referred to the absolute gas pressure).

8.10 Dielectric strength and site altitude

Dielectric strength

- The dielectric strength is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 62271-1 / VDE 0671-1.
- The rated values are referred to sea level and to normal atmospheric conditions (101.3 hPa, 20 °C, 11g/m³ humidity according to IEC 60071 and VDE 0111).
- The dielectric strength decreases with increasing altitude. For site altitudes above 1000 m (above sea level) the standards do not provide any guidelines for the insulation rating, but leave this to the scope of special agreements.

All parts housed inside the switchgear vessel which are subjected to high voltage are SF₆-insulated against the earthed enclosure.

Site altitude

The gas insulation at a relative gas pressure of 50 kPa (= 500 hPa) permits switchgear installation at any desired altitude above sea level without the dielectric strength being adversely affected. This also applies to the cable connection when using screened cable T-plugs or cable elbow plugs.

A decrease (reduction) of the dielectric strength with increasing site altitude must only be considered for panels with HV HRC fuses as well as for air-insulated metering panels and a site altitude of 1000 m above sea level. A higher insulation level must be selected, which results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor K_a .

Rated voltage (r.m.s. value)	[kV]	7.2	12	15	17.5	24
Rated short-duration power-frequency withstand voltage (r.m.s. value)						
- Across isolating distances	[kV]	23	32	39	45	60
- Between phases and to earth		20	28	36	38	50
Rated lightning impulse withstand voltage (peak value)						
- Across isolating distances	[kV]	70	85	105	110	145
- Between phases and to earth		60	75	95	95	125

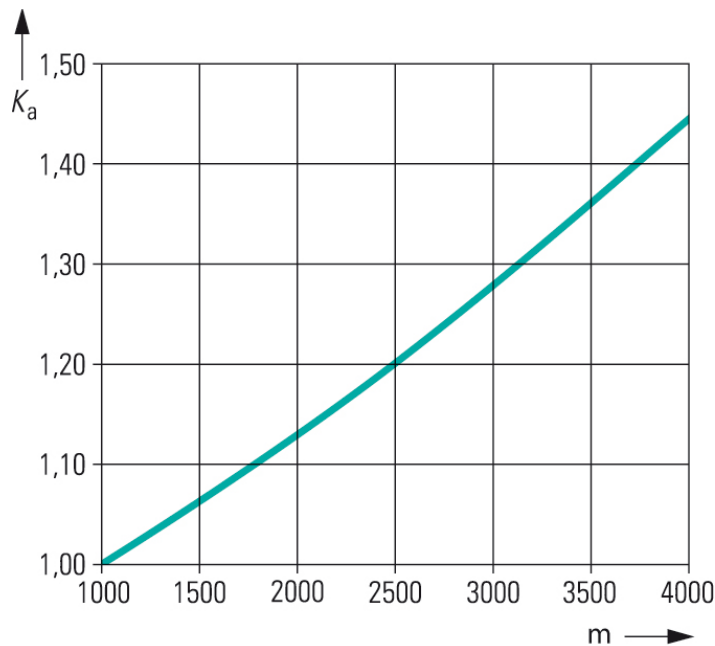


Fig. 42: Correction factor K_a as a function of the site altitude in m above sea level

Example**Rated short-duration power-frequency withstand voltage to be selected for site altitudes > 1000 m**

≥ Rated short-duration power-frequency withstand voltage up to ≤ 1000 m * K_a

Rated lightning impulse withstand voltage to be selected for site altitudes > 1000 m

≥ Rated lightning impulse withstand voltage up to ≤ 1000 m * K_a

Example

3000 m site altitude above sea level

17.5 kV switchgear rated voltage

95.0 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand voltage to be selected

95 kV * 1.28 = 122 kV

Result

According to the above table, a switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV is to be selected.

8.11 Selection of HV HRC fuse-links**Allocation of HV HRC fuses and transformers**

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with HV HRC fuse-links and tested in accordance with IEC 62 271-105.

The transformer protection table below shows HV HRC fuse-links recommended for transformer protection. Furthermore, the switchgear also permits fuse protection of transformers up to ratings of 2000 kVA. Please contact us for such applications.

The **protection table** applies to:

- Maximum ambient air temperature in the switchgear room of 40°C according to IEC 62 271-1 considering the influence of the switchgear enclosure
- Requirements according to IEC 62271-105
- Protection of distribution transformers according to IEC 60787
- Rated power of transformer (no overload operation)

The specified HV HRC fuses make SIBA are type-tested partial range fuses according to IEC 60 282-1. The dimensions correspond to DIN 43625. The HV HRC fuses have a thermal protection in form of a temperature-limiting striker tripping operating in case of defective HV HRC fuse-links or high overload currents.

Please contact us if you want to use HV HRC fuses from other manufacturers.

Basis for selection of HV HRC fuse-links:

- IEC 60282-1
- IEC 62271-105
- IEC 60787
- Recommendations and data sheets of fuse manufacturers
- Permissible power loss in the switchgear enclosure at an ambient air temperature of 40° C

Transformer protection table: Recommendation for the allocation of HV HRC fuse-links make SIBA and transformers

Transformer				HV HRC fuse			
U [kV]	S _N [kVA]	u _K [%]	I _L [A]	I _s [A]	U _s [kV]	e [mm]	Order no.
3.3-3.6	20	4	3.5	6.3	3-7.2	292	30 098 13.6,3
				10	3-7.2	292	30 098 13.10
	30	4	5.25	10	3-7.2	292	30 098 13.10
				16	3-7.2	292	30 098 13.16
	50	4	8.75	16	3-7.2	292	30 098 13.16
				20	3-7.2	292	30 098 13.20
	75	4	13.1	20	3-7.2	292	30 098 13.20
				25	3-7.2	292	30 098 13.25
	100	4	17.5	31.5	3-7.2	292	30 098 13.31,5
				40	3-7.2	292	30 098 13.40
	125	4	21.87	31.5	3-7.2	292	30 098 13.31,5
				40	3-7.2	292	30 098 13.40
	160	4	28	40	3-7.2	292	30 098 13.40
				50	3-7.2	292	30 098 13.50
4.16-4.8	20	4	2.78	6.3	3-7.2	292	30 098 13.6,3
				10	3-7.2	292	30 098 13.10
	30	4	4.16	10	3-7.2	292	30 098 13.10
				16	3-7.2	292	30 098 13.16
	50	4	6.93	16	3-7.2	292	30 098 13.16
				20	3-7.2	292	30 098 13.20
	75	4	10.4	16	3-7.2	292	30 098 13.16
				20	3-7.2	292	30 098 13.20
	100	4	13.87	20	3-7.2	292	30 098 13.20
				25	3-7.2	292	30 098 13.25
	125	4	17.35	25	3-7.2	292	30 098 13.25
				31.5	3-7.2	292	30 098 13.31,5
	160	4	22.2	31.5	3-7.2	292	30 098 13.31,5
				40	3-7.2	292	30 098 13.40
5.0-5.5	20	4	2.3	6.3	3-7.2	292	30 098 13.6,3
				10	3-7.2	292	30 098 13.10
	30	4	3.4	6.3	3-7.2	292	30 098 13.6,3
				10	3-7.2	292	30 098 13.10
	50	4	5.7	10	3-7.2	292	30 098 13.10
				16	3-7.2	292	30 098 13.16
	75	4	8.6	16	3-7.2	292	30 098 13.16
				20	3-7.2	292	30 098 13.20
	100	4	11.5	16	3-7.2	292	30 098 13.16
				20	3-7.2	292	30 098 13.20
	125	4	14.4	20	3-7.2	292	30 098 13.20
				25	3-7.2	292	30 098 13.25
	160	4	18.4	31.5	3-7.2	292	30 098 13.31,5
				40	3-7.2	292	30 098 13.40
	200	4	23	40	3-7.2	292	30 098 13.40
				50	3-7.2	292	30 098 13.50
	250	4	28.8	40	3-7.2	292	30 098 13.40
				50	3-7.2	292	30 098 13.50
	315	4	36.3	50	3-7.2	292	30 098 13.50
				63	3-7.2	292	30 099 13.63
	400	4	46.1	63	3-7.2	292	30 099 13.63
				80	3-7.2	292	30 099 13.80

Transformer				HV HRC fuse			
U [kV]	S _N [kVA]	u _K [%]	I ₁ [A]	I _s [A]	U _s [kV]	e [mm]	Order no.
6-7.2	20	4	1.9	6.3	6-12	292	30 004 13.6,3
				6.3	3-7.2	292	30 098 13.6,3
				6.3	6-12	442	30 101 13.6,3
	30	4	2.8	6.3	6-12	292	30 004 13.6,3
				6.3	3-7.2	292	30 098 13.6,3
				6.3	6-12	442	30 101 13.6,3
	50	4	4.8	10	3-7.2	292	30 098 13.10
				10	6-12	292	30 004 13.10
				10	6-12	442	30 101 13.10
				16	3-7.2	292	30 098 13.16
				16	6-12	292	30 004 13.16
				16	6-12	442	30 101 13.16
				16	6-12	442	30 101 13.16
	75	4	7.2	16	3-7.2	292	30 098 13.16
				16	6-12	292	30 004 13.16
				16	6-12	442	30 101 13.16
	100	4	9.6	16	3-7.2	292	30 098 13.16
				16	6-12	292	30 004 13.16
				16	6-12	442	30 101 13.16
				20	3-7.2	292	30 098 13.20
				20	6-12	292	30 004 13.20
				20	6-12	442	30 101 13.20
	125	4	12	20	3-7.2	292	30 098 13.20
				20	6-12	292	30 004 13.20
				20	6-12	442	30 101 13.20
				25	3-7.2	292	30 098 13.25
				25	6-12	292	30 004 13.25
				25	6-12	442	30 101 13.25
	160	4	15.4	31.5	3-7.2	292	30 098 13.31,5
				31.5	6-12	292	30 004 13.31,5
				31.5	6-12	442	30 101 13.31,5
	200	4	19.2	31.5	3-7.2	292	30 098 13.31,5
				31.5	6-12	292	30 004 13.31,5
				31.5	6-12	442	30 101 13.31,5
				40	3-7.2	292	30 098 13.40
				40	6-12	292	30 004 13.40
				40	6-12	442	30 101 13.40
	250	4	24	40	3-7.2	292	30 098 13.40
				40	6-12	292	30 004 13.40
				40	6-12	442	30 101 13.40
				50	3-7.2	292	30 098 13.50
				50	6-12	292	30 004 13.50
				50	6-12	442	30 101 13.50
				63	6-12	292	30 012 43.63
	315	4	30.3	50	3-7.2	292	30 098 13.50
				50	6-12	292	30 004 13.50
				50	6-12	442	30 101 13.50
				63	6-12	292	30 012 43.63
	400	4	38.4	63	6-12	292	30 012 43.63
				80	6-12	292	30 012 43.80
				80	6-12	442	30 102 43.80
				63	3-7.2	292	30 099 13.63
				63	6-12	292	30 012 13.63
				63	6-12	442	30 102 13.63
	500	4	48	80	6-12	292	30 012 43.80
				80	6-12	442	30 102 43.80
				80	3-7.2	292	30 099 13.80
				80	6-12	292	30 012 13.80
				80	6-12	442	30 102 13.80
				100	6-12	292	30 012 43.100

Transformer				HV HRC fuse			
U [kV]	S _N [kVA]	u _K [%]	I ₁ [A]	I _s [A]	U _s [kV]	e [mm]	Order no.
6-7.2	500	4	48	100	6-12	442	30 102 43.100
				100	6-12	442	30 102 43.100
	630	4	61	125	6-12	442	30 103 43.125
				125	6-12	292	30 020 43.125
10-12	50	4	2.9	10	6-12	292	30 004 13.10
				10	6-12	442	30 101 13.10
				10	10-17.5	292	30 255 13.10
				10	10-17.5	442	30 231 13.10
				10	10-24	442	30 006 13.10
	75	4	4.3	10	6-12	292	30 004 13.10
				10	6-12	442	30 101 13.10
				10	10-17.5	292	30 255 13.10
				10	10-17.5	442	30 231 13.10
				10	10-24	442	30 006 13.10
	100	4	5.8	16	6-12	292	30 004 13.16
				16	6-12	442	30 101 13.16
				16	10-17.5	292	30 255 13.16
				16	10-17.5	442	30 231 13.16
				16	10-24	442	30 006 13.16
	125	4	7.2	16	6-12	292	30 004 13.16
				16	6-12	442	30 101 13.16
				16	10-17.5	292	30 255 13.16
				16	10-17.5	442	30 231 13.16
				16	10-24	442	30 006 13.16
	160	4	9.3	20	6-12	292	30 004 13.20
				20	6-12	442	30 101 13.20
				20	10-17.5	292	30 221 13.20
				20	10-17.5	442	30 231 13.20
				20	10-24	442	30 006 13.20
	200	4	11.5	25	6-12	292	30 004 13.25
				25	6-12	442	30 101 13.25
				25	10-17.5	292	30 221 13.25
				25	10-17.5	442	30 231 13.25
				25	10-24	442	30 006 13.25
	250	4	14.5	25	6-12	292	30 004 13.25
				25	6-12	442	30 101 13.25
				25	10-17.5	292	30 221 13.25
				25	10-17.5	442	30 231 13.25
				25	10-24	442	30 006 13.25
				31.5	6-12	292	30 004 13.31,5
				31.5	6-12	442	30 101 13.31,5
				31.5	10-17.5	292	30 221 13.31,5
				31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
	315	4	18.3	31.5	6-12	292	30 004 13.31,5
				31.5	6-12	442	30 101 13.31,5
				31.5	10-17.5	292	30 221 13.31,5
				31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
				40	6-12	292	30 004 13.40
				40	6-12	442	30 101 13.40
				40	10-17.5	292	30 221 13.40
				40	10-17.5	442	30 231 13.40
				40	10-24	442	30 006 13.40
	400	4	23.1	40	6-12	292	30 004 13.40
				40	6-12	442	30 101 13.40
				40	10-17.5	292	30 221 13.40
				40	10-17.5	442	30 231 13.40
				40	10-24	442	30 006 13.40

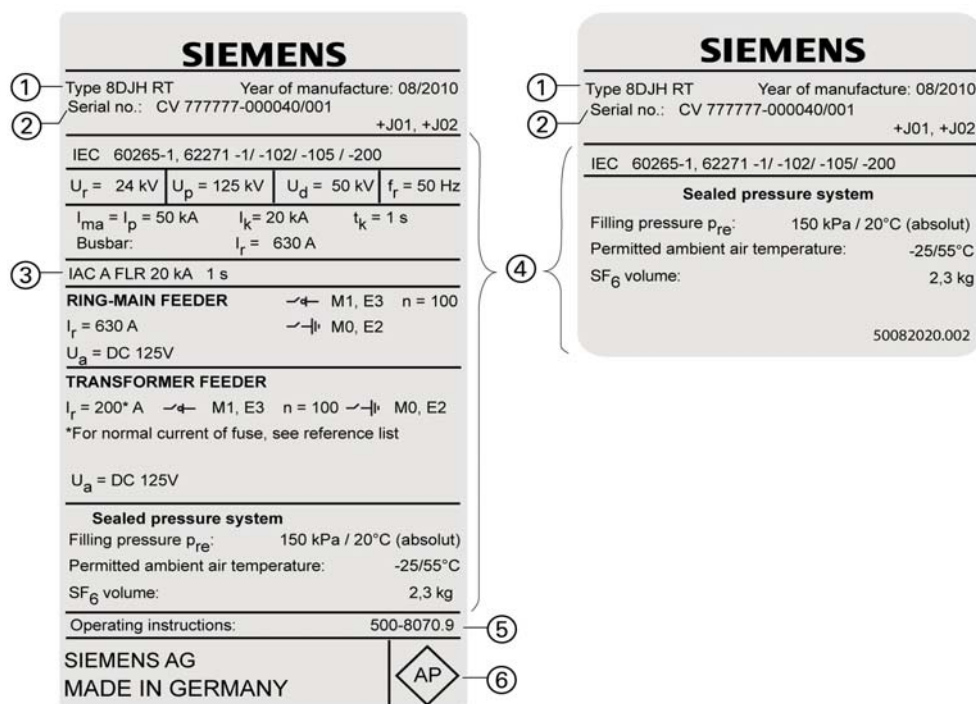
Transformer				HV HRC fuse			
U [kV]	S _N [kVA]	u _K [%]	I ₁ [A]	I _s [A]	U _s [kV]	e [mm]	Order no.
10-12	400	4	23.1	50	6-12	292	30 004 13.50
				50	6-12	442	30 101 13.50
				50	10-17.5	292	30 221 13.50
				50	10-17.5	442	30 232 13.50
				50	10-24	442	30 014 13.50
				50	10-24	442	30 014 13.50
	500	4	29	50	6-12	292	30 004 13.50
				50	6-12	442	30 101 13.50
				50	10-17.5	292	30 221 13.50
				50	10-17.5	442	30 232 13.50
				50	10-24	442	30 014 13.50
				50	10-24	442	30 014 13.50
	630	4	36.4	63	6-12	292	30 012 43.63
				80	10-24	442	30 014 43.80
				63	6-12	292	30 012 13.63
				63	6-12	442	30 102 13.63
				63	10-17.5	442	30 232 13.63
				80	6-12	292	30 012 43.80
	800	5-6	46.2	80	6-12	442	30 102 43.80
				63	6-12	292	30 012 13.63
				80	6-12	292	30 012 43.80
	1000	5-6	58	100	6-12	442	30 102 43.100
	1250	5-6	72.2	125	6-12	442	30 103 43.125
13.8	50	4	2.1	6.3	10-17.5	442	30 231 13.6,3
				6.3	10-24	442	30 006 13.6,3
	75	4	3.2	6.3	10-17.5	442	30 231 13.6,3
				10	10-17.5	442	30 231 13.10
	100	4	4.2	10	10-24	442	30 006 13.10
				10	10-17.5	442	30 231 13.10
				16	10-17.5	442	30 231 13.16
	125	4	5.3	16	10-24	442	30 006 13.16
				10	10-17.5	442	30 231 13.10
				16	10-17.5	442	30 231 13.16
	160	4	6.7	16	10-24	442	30 006 13.16
				16	10-17.5	442	30 231 13.16
	200	4	8.4	16	10-17.5	442	30 231 13.16
				20	10-17.5	442	30 231 13.20
				20	10-24	442	30 006 13.20
	250	4	10.5	20	10-17.5	442	30 231 13.20
				25	10-17.5	442	30 231 13.25
				25	10-24	442	30 006 13.25
	315	4	13.2	25	10-17.5	442	30 231 13.25
				31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
	400	4	16.8	31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
	500	4	21	40	10-17.5	442	30 231 13.40
				40	10-24	442	30 006 13.40
	630	4	26.4	50	10-17.5	442	30 232 13.50
				50	10-24	442	30 014 13.50
	800	5-6	33.5	63	10-24	442	30 014 43.63
	1000	5-6	41.9	80	10-24	442	30 014 43.80
15-17.5	50	4	1.9	6.3	10-17.5	442	30 231 13.6,3
				6.3	10-24	442	30 006 13.6,3
	75	4	2.9	6.3	10-17.5	442	30 231 13.6,3
	100	4	3.9	10	10-17.5	442	30 231 13.10
	125	4	4.8	16	10-17.5	442	30 231 13.16
				16	10-24	442	30 006 13.16

Transformer				HV HRC fuse			
U [kV]	S _N [kVA]	u _K [%]	I ₁ [A]	I _s [A]	U _s [kV]	e [mm]	Order no.
15-17.5	160	4	6.2	16	10-17.5	442	30 231 13.16
	200	4	7.7	20	10-17.5	442	30 231 13.20
				20	10-24	442	30 006 13.20
	250	4	9.7	25	10-17.5	442	30 231 13.25
				25	10-24	442	30 006 13.25
	315	4	12.2	31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
	400	4	15.5	31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
	500	4	19.3	31.5	10-17.5	442	30 231 13.31,5
				31.5	10-24	442	30 006 13.31,5
				40	10-17.5	442	30 231 13.40
				40	10-24	442	30 006 13.40
	630	4	24.3	40	10-17.5	442	30 231 13.40
				40	10-24	442	30 006 13.40
				50	10-17.5	442	30 232 13.50
				50	10-24	442	30 014 13.50
	800	5-6	30.9	63	10-24	442	30 014 43.63
	1000	5-6	38.5	80	10-24	442	30 014 43.80
	1250	5-6	48.2	100	10-24	442	30 022 43.100
20-24	50	4	1.5	6.3	10-24	442	30 006 13.6,3
	75	4	2.2	6.3	10-24	442	30 006 13.6,3
	100	4	2.9	6.3	10-24	442	30 006 13.6,3
	125	4	3.6	10	10-24	442	30 006 13.10
	160	4	4.7	10	10-24	442	30 006 13.10
	200	4	5.8	16	10-24	442	30 006 13.16
	250	4	7.3	16	10-24	442	30 006 13.16
	315	4	9.2	16	10-24	442	30 006 13.16
				20	10-24	442	30 006 13.20
	400	4	11.6	20	10-24	442	30 006 13.20
				25	10-24	442	30 006 13.25
	500	4	14.5	25	10-24	442	30 006 13.25
				31.5	10-24	442	30 006 13.31,5
	630	4	18.2	31.5	10-24	442	30 006 13.31,5
				40	10-24	442	30 006 13.40
	800	5-6	23.1	31.5	10-24	442	30 006 13.31,5
				40	10-24	442	30 006 13.40
	1000	5-6	29	50	10-24	442	30 014 13.50
				63	10-24	442	30 014 43.63
	1250	5-6	36	80	10-24	442	30 014 43.80
	1600	5-6	46.5	100	10-24	442	30 022 43.100
	2000	5-6	57.8				On request
U	Rated system voltage						
S _N	Rated power						
u _K	Relative impedance voltage						
I ₁	Rated current						
I _s	Rated current of fuse						
U _s	Rated voltage of fuse						
e	Reference dimension						

**NOTE!**

- For switchgear with rated voltages up to 12 kV, a fuse slide for HV HRC fuse-links with dimension 292 mm is normally provided.
- 7.2 kV fuse-links with dimension 192 mm as well as 24 kV fuse-links with dimension 292 mm are not permissible.

8.12 Rating plates



Rating plate at the front (example)

Rating plate inside the operating mechanism box (example)

- | | |
|---|---|
| ① Switchgear type and year of manufacture | ④ Technical data |
| ② Serial number | ⑤ Number of operating instructions |
| ③ Internal arc classification (option) | ⑥ Test mark for the performed acceptance test (German: Abnahme-Prüfung) (pressure test) of the vessel |

9 Switchgear maintenance

Maintenance 8DJH switchgear is maintenance-free. Inspection/testing of the secondary equipment such as the capacitive voltage detecting system is done within the scope of national standards or customer-specific regulations.

Checking the dew point The dew point needs **no** checking throughout the entire service life.

Checking the gas quality The gas quality needs **no** checking throughout the entire service life.

Replacement of components Due to the fact that all parts of this switchgear have been optimized to last the normal service life, it is not possible to recommend particular spare parts.

Information required for spare part orders of single components and devices:

- Type and serial number of the switchgear (see rating plates)
- Description/identification of the device or component on the basis of a sketch/photo or a circuit diagram.

10 End of service life

SF₆ gas

	NOTE!
	The equipment contains the fluorized greenhouse gas SF₆ registered by the Kyoto Protocol with a global warming potential (GWP) of 22 200. SF₆ has to be reclaimed and must not be released into the atmosphere. ⇒ For use and handling of SF₆, IEC 62271-303 has to be observed: High-voltage switchgear and controlgear - Part 303 Use and handling of sulphur hexafluoride (SF₆).

Before recycling the materials, evacuate the SF₆ gas professionally and prepare it for further use.

Recycling The switchgear is an environmentally compatible product.

The components of the switchgear can be recycled in an environmentally compatible way by dismantling into sorted scrap and residual mixed scrap.

After evacuating the SF₆ gas, the switchgear mainly consists of the following materials:

- Steel (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (conductor bars)
- Silver (contacts)
- Cast-resin based on epoxy resin (bushings and post insulators)
- Plastic materials (switching devices and fuse tripping)
- Silicone rubber

The switchgear can be recycled in ecological manner in compliance with existing legislation.

Auxiliary devices such as short-circuit indicators have to be recycled as electronic scrap.

Batteries have to be recycled professionally.

As delivered by Siemens, the switchgear does not contain hazardous materials as per the Hazardous Material Regulations applicable in the Federal Republic of Germany. For operation in other countries, the locally applicable laws and regulations must be followed.

For further information please contact your regional Siemens representative.

Installation

11 Preparing installation

11.1 Packing

The transport units can be packed as follows:

- On pallets, covered with PE protective foil
- In a seaworthy crate (switchgear is sealed with desiccant bags in PE foil)
- Other packings in special cases (e.g. latticed crate, cardboard cover for air freight)

	ATTENTION!
	Packing and consumable materials of the switchgear must be disposed of in an environmentally compatible way or recycled. ⇒ Observe the local regulations for disposal and environmental protection.

Transport unit

On the customer's request, transport units may consist either of:

- Individual switchpanels
- or
- Panel blocks with up to four functions
- and accessories

11.2 Completeness and transport damage

Checking for completeness

- ⇒ Check whether the delivery is complete and correct using the delivery notes and packing lists.
- ⇒ Compare the serial numbers of the switchgear on the delivery note with those on the packing and the rating plates.
- ⇒ Check whether the accessories included in the subframe are complete.

Transport damages

- ⇒ Temporarily open the packing in a weatherproof place to detect hidden damages. Do not remove the PE foil until reaching the final mounting position in order to keep the switchgear as clean as possible.
- ⇒ Check the switchgear for transport damages.
- ⇒ Check the gas density (see Page 171, "Final tests after installation", Checking the "Ready-for-service indicator").
- ⇒ Refit the packing as far as possible and useful.
- ⇒ Determine and document detected defects and transport damages immediately, e.g. on freight documents.
- ⇒ As far as possible, document larger defects and transport damages photographically.
- ⇒ Repair or have the transport damages repaired.

11.3 Intermediate storage

	DANGER! Risk of injury and damage to the stored goods if the storage space is overloaded. ⇒ Observe the load-bearing capacity of the floor. ⇒ Do not stack the transport units. ⇒ Do not overload lighter components by stacking.
	ATTENTION! Fire risk. The transport unit is packed in flammable materials. ⇒ No smoking. ⇒ Keep fire extinguishers in a weatherproof place. ⇒ Mark the location of the fire extinguisher.
	ATTENTION! Supplied desiccant bags lose their effectiveness if they are not stored in the undamaged original packings. ⇒ Do not damage or remove packing of desiccant bags. ⇒ Do not unpack desiccant bags before use.

If the comprehensive accessories, the delivered switchgear or parts thereof have to be stored before installation, a suitable storage room or place has to be selected and prepared.

Intermediate storage of the transport units:

- In original packing as far as possible
- Switchgear with secondary system: Observe the permissible storage temperature from -25° C to +70° C in accordance with the installed secondary devices.
- Switchgear without secondary system: Observe the permissible storage temperature from -40° C to +70° C.
- In a weatherproof place
- Protected against damage
- If packed in seaworthy crates, the switchgear can be stored for a maximum of 6 months (desiccant bags)
- Store transport units in such a way that they can be taken out later in the correct order for installation.

Switchgear storage in closed rooms

As a rule, the switchgear should be stored in a closed room. The storage room must have the following characteristics:

- Floor with adequate load-bearing capacity (weights as per delivery note)
- Even floor to enable stable storage
- Well-ventilated and free of dust as far as possible
- Dry and protected against humidity and vermin (e.g. insects, mice, rats)
- Check humidity in the packings every 4 weeks (condensation)
- Do not unpack small parts to avoid corrosion and loss.

Outdoor storage of switchgear packed in seaworthy crates

If the switchgear or parts thereof are delivered in seaworthy crates, these can be stored up to 6 months in other rooms or outdoors. The storage place must have the following characteristics:

- Floor with adequate load-bearing capacity (weights as per delivery note)
- Protected against humidity (rain water, flooding, melting water from snow and ice), pollution, vermin (rats, mice, termites, etc.) and unauthorized access
- Place all crates on planks and square timber for protection against floor humidity.
- After 6 months of storage, have the desiccant agent regenerated professionally. To do this, ask for expert personnel via your regional Siemens representative.

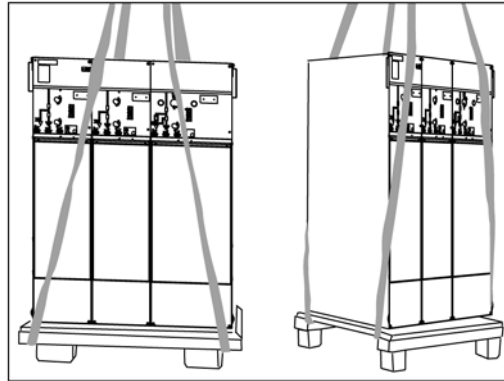
11.4 Unloading and transport to the place of installation

	ATTENTION!
	Non-observance of the following instructions can endanger people or damage the transport units while unloading. ⇒ Make sure that nobody is standing in the swinging area of lifted switchgear. ⇒ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the switchpanel walls under load. ⇒ Observe the dimensions and weights of the transport unit (delivery note). ⇒ Observe even weight distribution and the high center of gravity of the switchgear. ⇒ Please ensure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity. ⇒ Do not climb onto the roof of the switchpanels. ⇒ If the low-voltage compartment is removed, do not step on the mounting plates of the low-voltage compartments. ⇒ Observe the instructions on the packing. ⇒ Unload the transport units in packed condition and leave packed for as long as possible. ⇒ Do not damage the PE protective foil.

- ⇒ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the switchpanel walls under load.
- ⇒ Sling the ropes around the ends of the wooden pallets.
- ⇒ Move the switchgear on their wooden pallets as far as possible.
- ⇒ Unload the transport units and set them down as close to the switchgear building as possible in order to avoid unnecessary ways.
- ⇒ Move the transport units into the building, if possible on their wooden pallets. Only remove packing where absolutely necessary in order to keep the switchgear as clean as possible.
- ⇒ Remove foil only in the building, right before assembling the transport units, and temporarily to check for transport damages.
- ⇒ Set the transport units down in the correct sequence directly in front of the place of installation (leave a clearance for installation).

Unloading and transport in original packing

⇒ Transport the switchgear by means of a crane or a fork-lift truck.



Removing the wooden pallets

The transport units are screwed on the wooden pallets with transport angles or directly in the switchgear subframe.

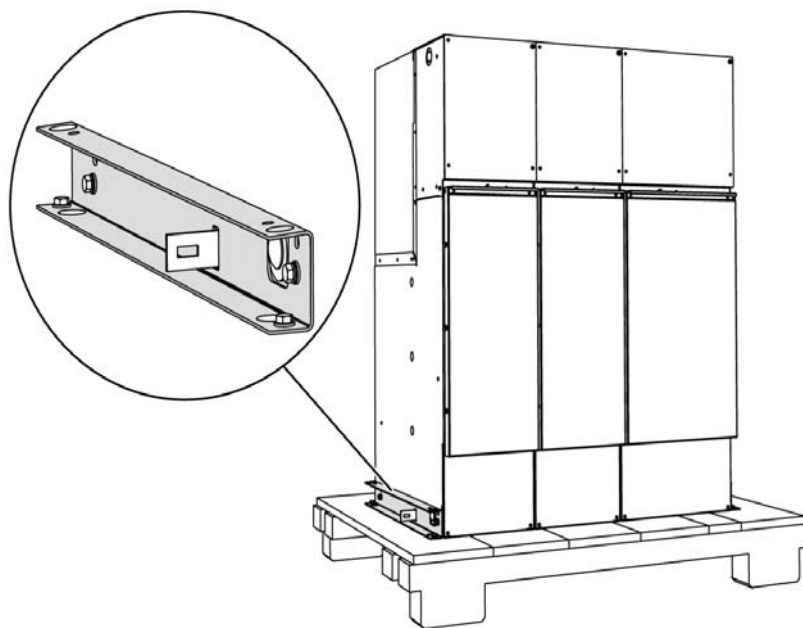


Fig. 43: Transport unit fixed on wooden pallet with transport angle (view from the left)

- ⇒ Remove the PE foil; if required, remove seaworthy or latticed crate before.
- ⇒ If necessary, remove the front cable compartment cover from the subframe of the switchgear.
- ⇒ Remove the fixing screws from the transport angles / pallet and keep them for re-use.
- ⇒ Remove transport angles.

If the switchgear cannot be lifted directly from the wooden pallet onto its mounting position, please proceed as follows:

- ⇒ Lower the transport units by means of the lateral transport angles onto roller pads (reinforced rollers) or tubes.
- ⇒ Lift the switchgear at the side edges with roller crowbars and slowly lower it onto the mounting position.

Please do always observe the following for both sides of the transport unit:

⇒ Screw the fixing bolts again into the holes provided for this purpose.

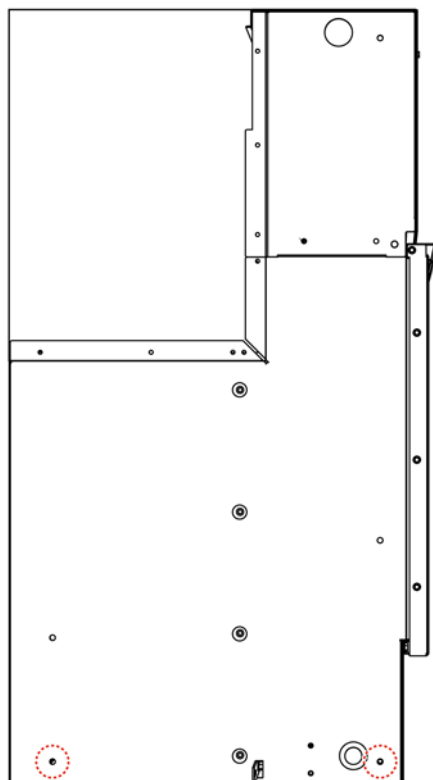


Fig. 44: Points for fixing bolts (view from the left)

Switchgear transport with crane eyes

⇒ The crane eyes are pre-assembled at the factory.

For deliveries without LV compartment and pressure absorber:

⇒ To crane the transport unit, fix the crane eyes at the clamping plate bracket with one bolt-and-washer assembly M8 x 20 each.

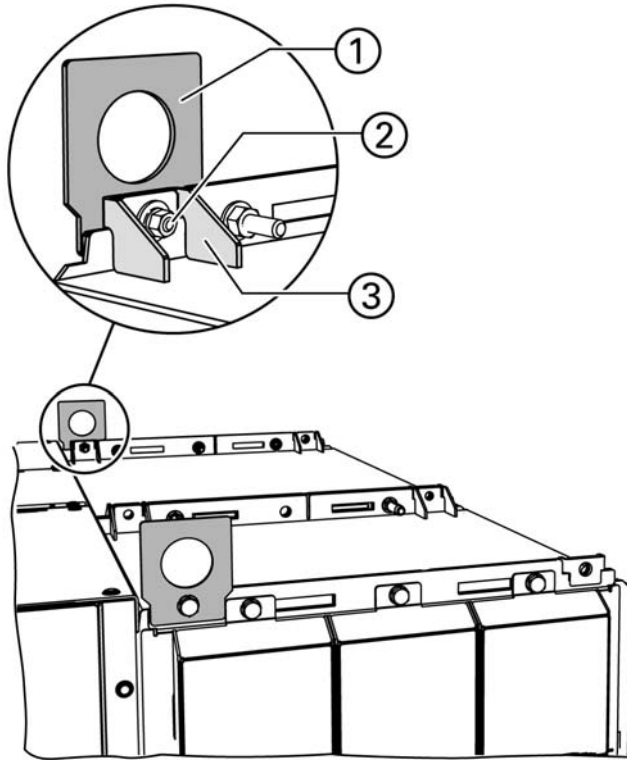


Fig. 45: Fixing the crane eyes for deliveries without LV compartment (zoomed detail shows rear view of crane eye)

- ① Crane eye
- ② Bolt M8 x 20
- ③ Clamping plate bracket

For deliveries with LV compartment and/or pressure absorber:

⇒ To crane the transport unit, fix the crane eyes at the clamping plate with two bolt-and-washer assemblies M8 x 20 each.

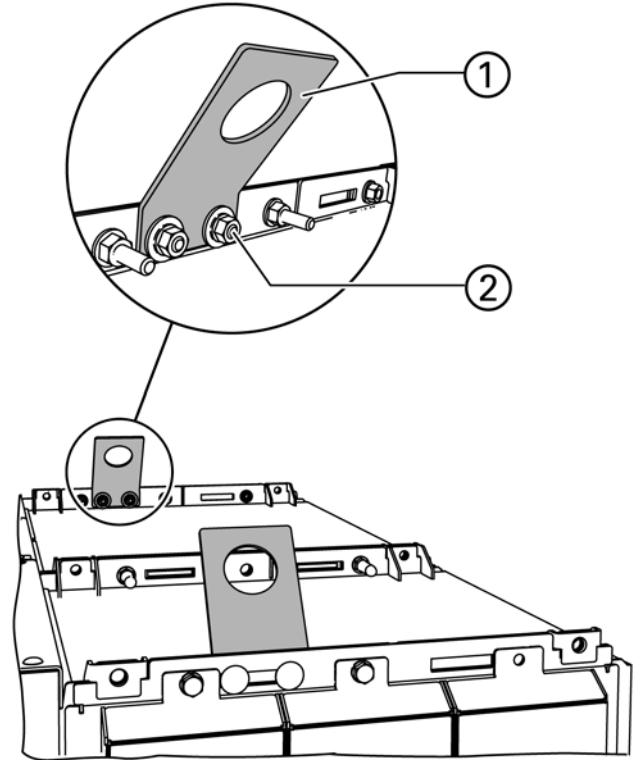


Fig. 46: Fixing the crane eyes for deliveries with LV compartment (zoomed detail shows rear view of crane eye)

- ⇒ Attach lifting equipment or rod.
- ⇒ Transport the switchgear.
- ⇒ When the switchgear is in its definitive position, remove the eyes again.
- ⇒ Please observe the following: To assemble panel groups, the crane eyes must be removed.

	ATTENTION!
	Danger due to swinging switchgear. The center of gravity is not always located under the fixing point. ⇒ Lift the switchgear slowly. ⇒ Keep the safety distances. ⇒ Do not transport more than a maximum width of 2.00 m and a maximum height of 2.30 m in a block.

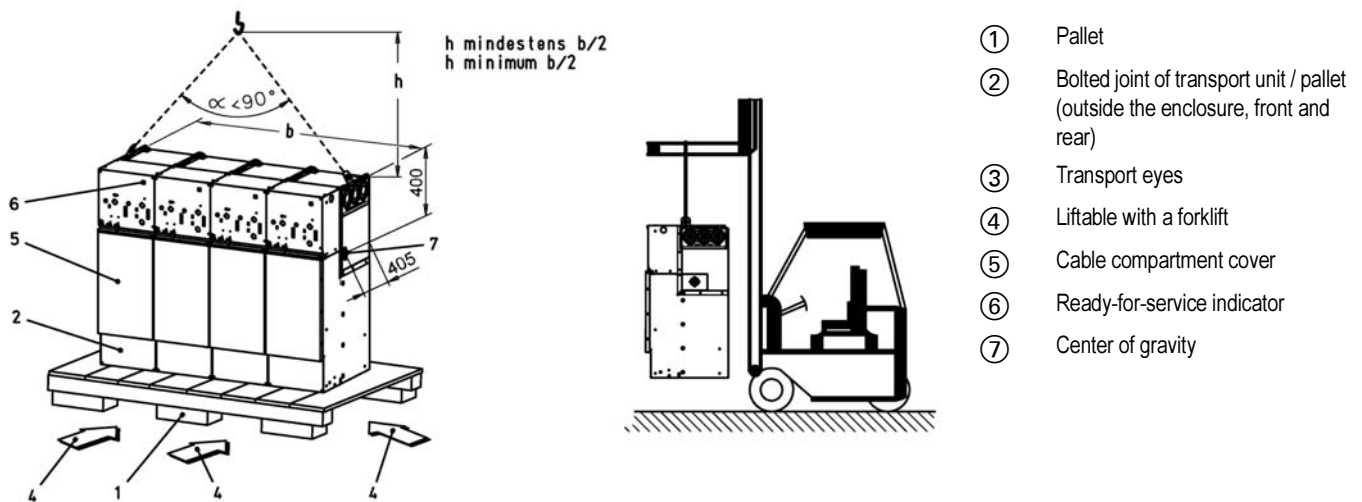


Fig. 47: Switchgear transport with crane or fork-lift truck (h at least w/2)

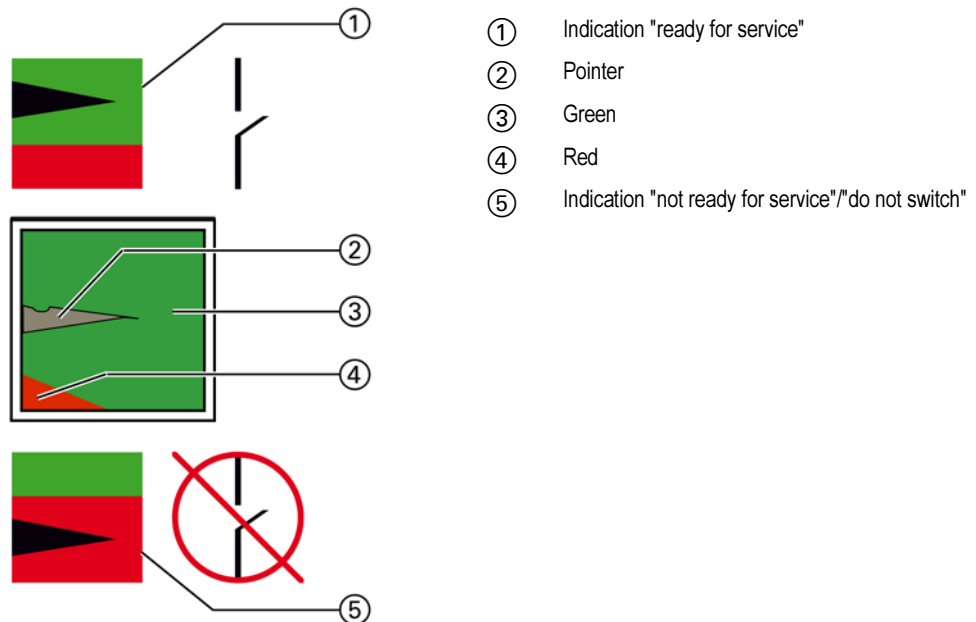
- ⇒ Lift or lower just slowly, as the switchgear will swing into the center of gravity when it is lifted.
- ⇒ While lifting, observe parts laid inside such as e.g. cable-type transformers, connecting cables.

11.5 Checking the ready-for-service indicator

Checking the ready-for-service indicator

The switchgear is filled with insulating gas at a relative pressure. Before starting installation, please verify that the gas filling of the switchgear is sufficient by means of the ready-for-service indicator.

- ⇒ Read the ready-for-service indicator.



If the pointer is in the green area, the gas density is in order. If the pointer is in the red area:

- ⇒ Check the auxiliary switch of the ready-for-service indicator.

Checking the auxiliary switch

The auxiliary switch of the ready-for-service indicator can latch tight in the red area due to extreme shocks during transport.

- ⇒ Remove the front plate of the switchgear. Push the roller lever of the auxiliary switch carefully towards the switch.
- ✓ The auxiliary switch must return automatically so that the pointer of the ready-for-service indicator is in the green area again. If not, please stop installation and contact the Siemens representative.

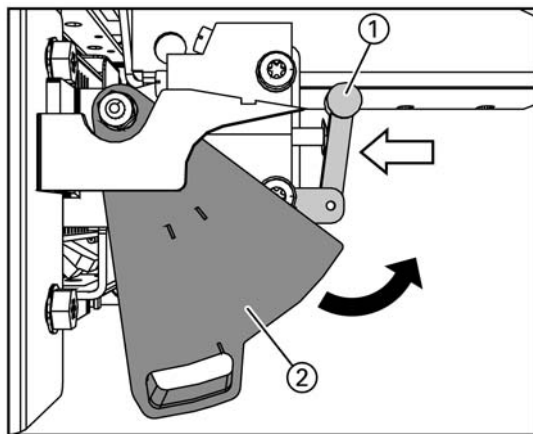


Fig. 48: Roller lever ① at the auxiliary switch ② of the ready-for-service indicator

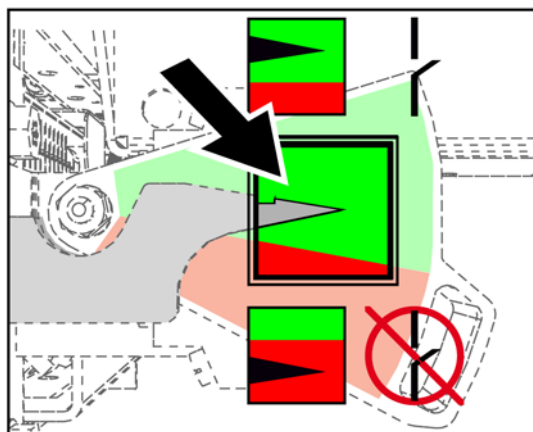


Fig. 49: Pointer position after operation of the plastic part at the auxiliary switch

11.6 Preparing the foundation

Please observe the following items when preparing the foundation:

- A suitable foundation can be a false floor, a double floor or a reinforced-concrete foundation. The reinforced-concrete floor must be equipped with foundation rails for supporting the panels.
- As for design and construction of the foundation, the relevant standards DIN 43 661 "Fundamentschienen in Innenanlagen der Elektrotechnik" (Foundation rails in electrical indoor installations) and DIN 18 202 "Maßtoleranzen im Hochbau" (Blatt 3) (Measuring tolerances in structural engineering (Sheet 3)) apply.
- The dimensions of the floor opening and the fixing points of the switchgear frame are given in the switchgear documentation.
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate them with shims.

Stipulations for evenness and straightness

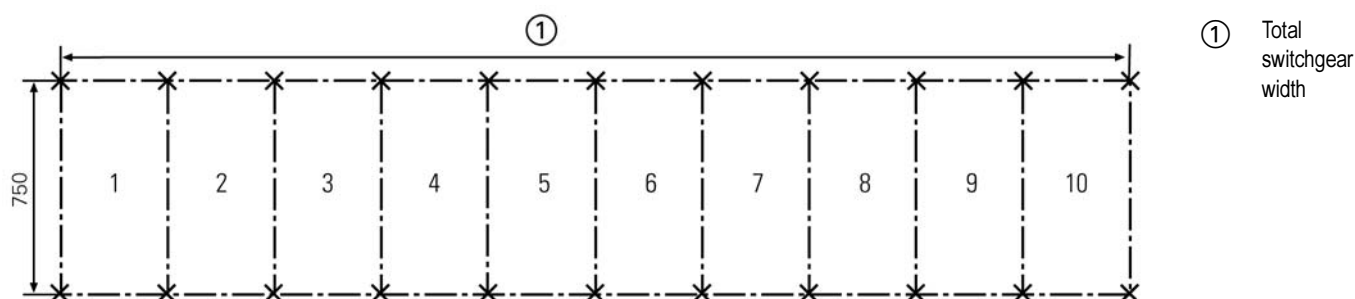


Fig. 50: Measuring sheet for the foundation. Evenness/straightness tolerance according to DIN 43661: 1 mm per 1 m length, 2 mm for the total length.

11.7 Comments on electromagnetic compatibility

To achieve appropriate electromagnetic compatibility (EMC), some basic requirements must be observed while erecting the switchgear. This applies especially to the installation and connection of external cables and wires.

Basic measures for ensuring EMC are already taken during design and assembly of the switchgear panels. Among other things, these measures include:

- the low-voltage compartment is an integral part of the panel, which means that the protection and control devices with the internal wiring are metal-enclosed;
- reliable earth connections of the frame parts via toothed contact washers or locking washers;
- inside the panel, wires are laid in metal ducts;
- spatial separation of sensitive signal wires from wires with high interference voltage levels;
- limitation of switching overvoltages of inductive loads (e.g. relay or contactor coils, motors) by means of protective circuits with diode, varistor or RC element;
- within the LV compartment, the secondary devices are mounted in defined zones;
- shortest possible connection between corresponding modules in subracks;
- consideration of the magnetic leakage fields of conductor bars and cables;
- protection of subracks and wiring backplanes against interference by perforated shielding plates;
- large surface bonding between all modules and devices as well as bonding to the earthing conductor of the switchgear assembly.

These measures basically enable proper operation of the switchgear itself. The planner or operator of the switchgear must decide whether additional measures are required depending on the electromagnetic environment where the switchgear is installed. Such measures must be implemented by the installation company in charge.

In an environment with heavy electromagnetic interference it may be necessary to use shielded cables and wires for the external connections in order to avoid interferences in the low-voltage compartment and thus, undesired influences on the electronic protection and control or other automation devices.

Cable shields must be electrically bonded to be able to carry high frequencies, and contacted concentrically at the cable ends.

The shields of cables and wires are connected and earthed in the low-voltage compartment.

Connect the shields to earth potential - with high electrical conductivity and all around as far as possible. Protect the contact surfaces from corrosion in case of humidity (regular condensation).

When laying cables into the switchgear assembly, separate the control, signaling and data cables and other lines with different signal and voltage levels by laying them on separate racks or riser cable routes.

Corresponding to the different shield designs, there is a number of methods to perform connection. The planning department or site management determines which of the methods will be used, taking EMC requirements into account. The preceding points should always be taken into account.

The shield is connected to cables or wires with clamps contacting all around. If low demands are placed on EMC, it is also possible to connect the shield directly to earth potential (combine or twist the shield wires) or via short cable connections. Use cable lugs or wire-end ferrules at the connecting points.

Always keep the connecting leads of the shields as short as possible (< 10 cm).

If shields are used as protective earth conductors at the same time, the connected plastic-insulated lead must be marked green/yellow over its entire length. Non-insulated connections are inadmissible.

12 Switchgear installation

12.1 Tools/auxiliary means

- Standard tools, such as a torque wrench
- Compensation shims with a thickness of 0.5 – 1.0 mm for floor unevenness
- Soft, lint-free cloths

	DANGER!
	For protection of personnel and environment:
	⇒ Read the instructions for use of cleaning agents carefully. ⇒ Observe the warnings (e.g. inflammable!, corrosive!, etc.)

Cleaning agents	ARAL, type 4005 or equivalent grease	For cleaning the front covers or silicone parts
	HAKU 1025-920	Contains carbon hydrogen!
	Household cleaner	For cleaning electrostatically stressed insulation (e.g. epoxy resin)
Cleaning aids	Lint-free cleaning paper	For applying and wiping off liquid cleaning agent (single use)
	Brush	
	Cleaning rag	
	Vacuum cleaner	

12.2 Installing the switchgear

- Preparations** You may only start installing the switchgear when
- all transport damages have been repaired
 - the gas filling of the switchgear vessels has been checked
 - the accessories and the required material are complete
 - the base frame has been levelled (1 mm/m), see DIN 43661

Precondition: Operating mechanism in "EARTHED" position.

	ATTENTION!
	Please observe the following for room planning and switchgear installation: ⇒ Dimensions of floor openings according to the dimension drawing in the switchgear documentation. ⇒ Direction of pressure relief according to the height of the cable basement in accordance with the cable bending radius. ⇒ Relief rooms according to the dimension drawing in the switchgear documentation.

Room planning

- Switchgear installation** There are two installation possibilities:
- Wall-standing arrangement
 - Option: Free-standing arrangement
- Switchgear dimensions** Switchgear dimensions (see Page 52, "Switchgear versions - Dimensions and weights")
- Pressure relief** In the standard design, the pressure is relieved downwards. For further information, see Page 82, "Pressure relief options".
- Room dimensions** See the dimension drawings below. For the internal arc classification according to IEC/ EN 62271-200 / VDE 0671-200, the room height of accessible switchgear rooms results from the switchgear height of +600 mm (± 100 mm).
- Door dimensions** The door dimensions depend on
- the number of panels in one transport unit
 - the switchgear design with or without low-voltage compartment
- Switchgear fixing**
- For floor openings and fixing points of the switchgear, see Page 75, "Floor openings and fixing points".
 - Foundations:
 - Steel girder construction
 - Reinforced-concrete floor
- Panel dimensions** For binding switchgear dimensions, please refer to the order documentation (dimension drawing, front view).
- Weights** For data, see Page 52, "Switchgear versions - Dimensions and weights".
- Fixing options**
- ⇒ The switchgear must be fixed to the foundation so as to guarantee sufficient pressure resistance. The panels can be fastened to the foundation in the following ways:
 - Bolted to foundation rails.
 - Welded to foundation rails.
 - Screwed into the concrete using size 10 dowels if there are no foundation rails available.

We recommend to fasten the switchgear with at least 4 bolts size M8 in each panel.

- ⇒ The base pieces of the panel frames contain cutouts for fastening the switchgear (see dimension drawing).

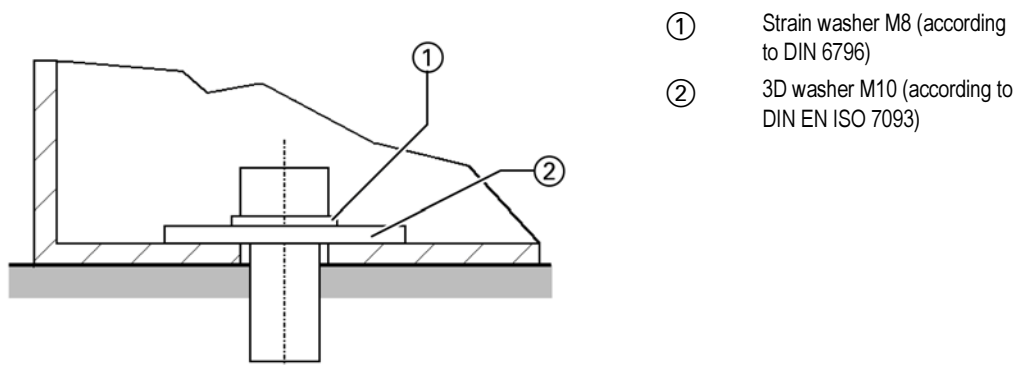


Fig. 51: Switchgear fastening to the foundation

Fastening the switchgear to the foundation

Fasten each panel to the foundation as follows:

- ⇒ For direct fastening to the concrete, drill holes in the foundation and insert size 10 dowels.
- ⇒ Place shims in the spaces between the panel frame and the foundation in the area of the fastening cutouts, so that the switchgear is not distorted when it is bolted on, and the seam does not cover any air-filled gaps when the switchgear is welded on.
- ⇒ Bolt or weld the switchgear to the foundation.
- ⇒ Remove any dirt, as extreme cleanliness is required during installation.
- ⇒ Paint welding seams to protect them against corrosion.

Floor openings and fixing points

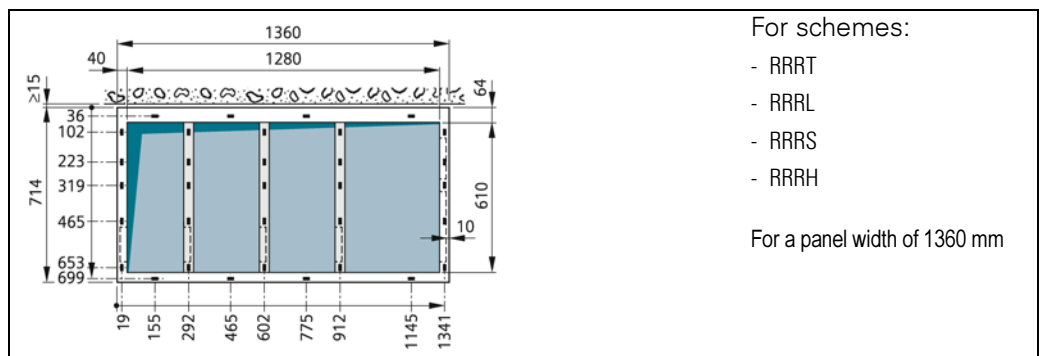
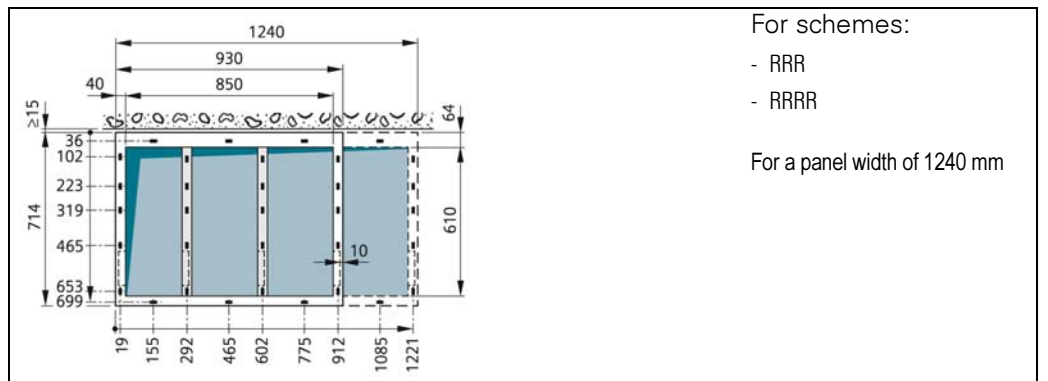
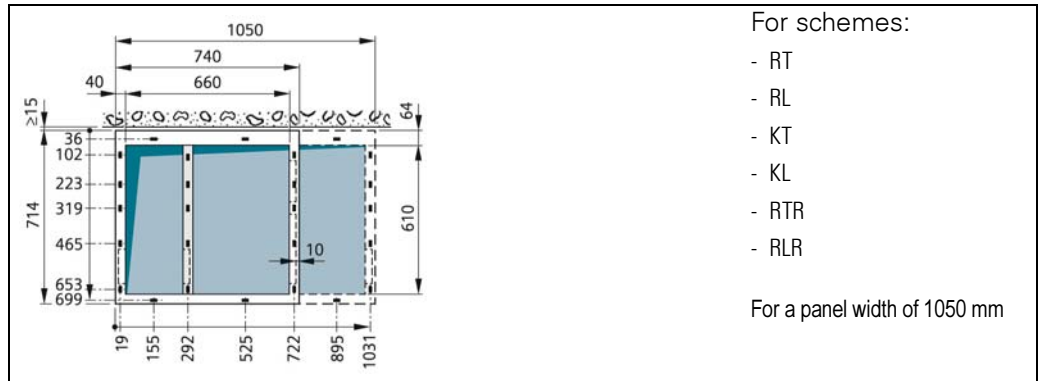
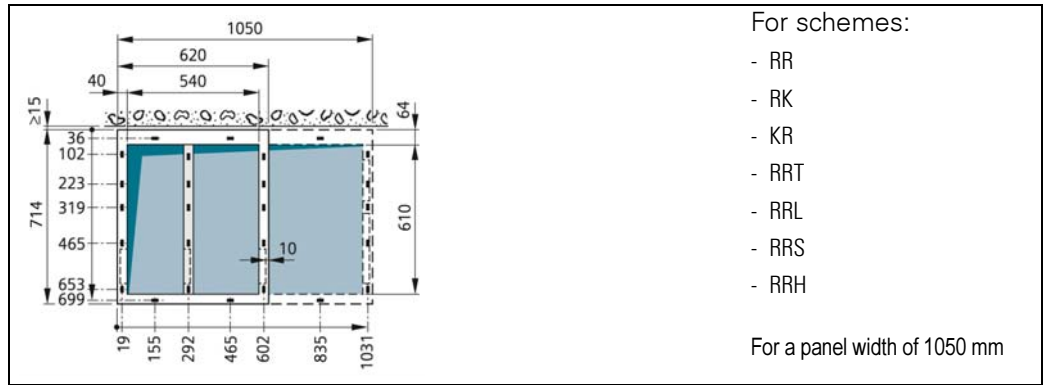
These examples show a recess in the subframe, which is required for switchgear with cable-type current transformers and a height of 1400 mm.

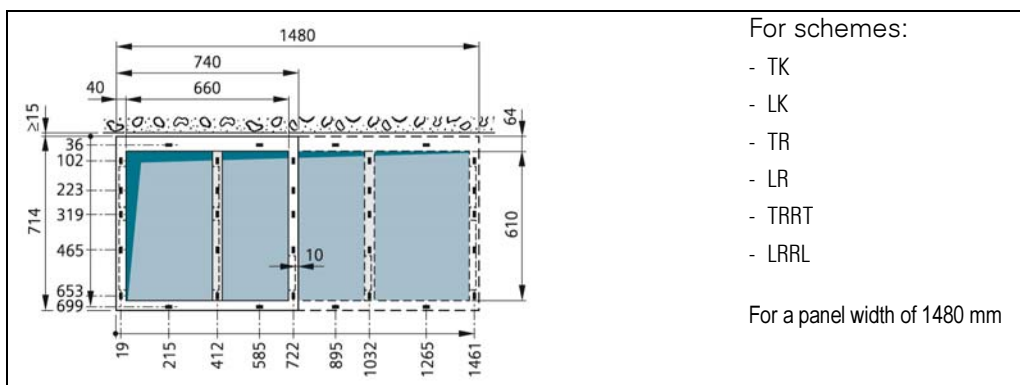
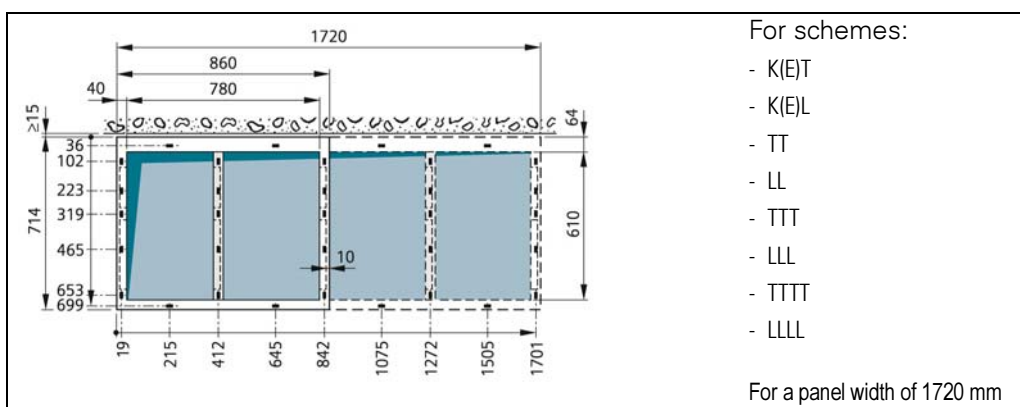
Standard*

	- For ring-main panel type R - For cable panel type K - For busbar earthing panel type E For a panel width of 310 mm
	- For cable panel with make-proof earthing switch type K(E) - For circuit-breaker panel type L - For transformer panel type T - For bus sectionalizer panel with switch-disconnector type S - For bus sectionalizer with switch-disconnector/fuse combination type H - For busbar voltage metering panel M(430) For a panel width of 430 mm
	- For ring-main panel type R(500) - For circuit-breaker panel type L(500) - For busbar earthing panel type E(500) - For bus sectionalizer panel with switch-disconnector type S(500) - For bus sectionalizer panel with circuit-breaker type V - For busbar voltage metering panel type M(500) For a panel width of 500 mm
	- For billing metering panel type M For a panel width of 840 mm

* For panel versions with double cables and deep cable compartment cover, as well as for other versions, please order the dimension drawings.

Standard* panel blocks

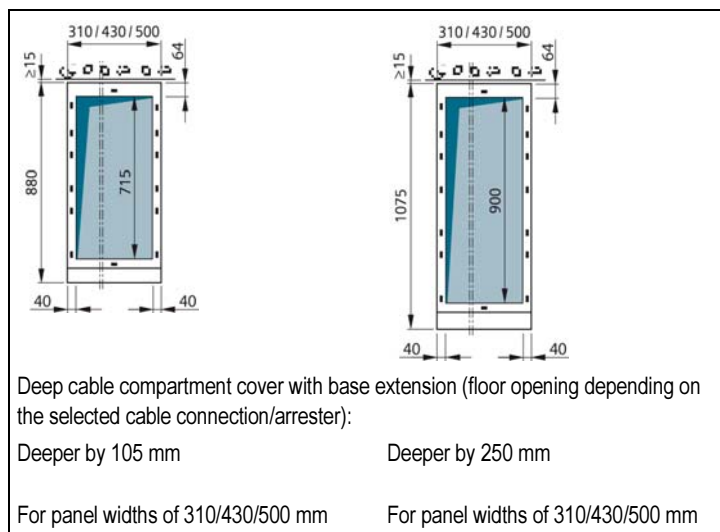
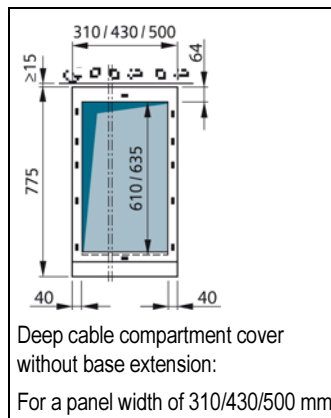




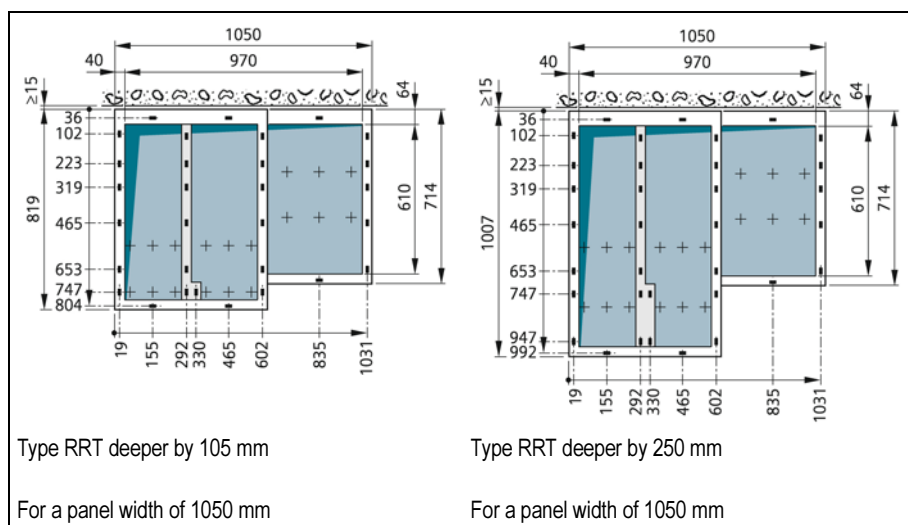
* For panel versions with double cables and deep cable compartment cover, as well as for other versions, please order the dimension drawings.

Versions with deep cable compartment covers

Versions with deep cable compartment covers (e.g. for double cable connections). Expansion joints are marked in the illustrations by dotted double lines.



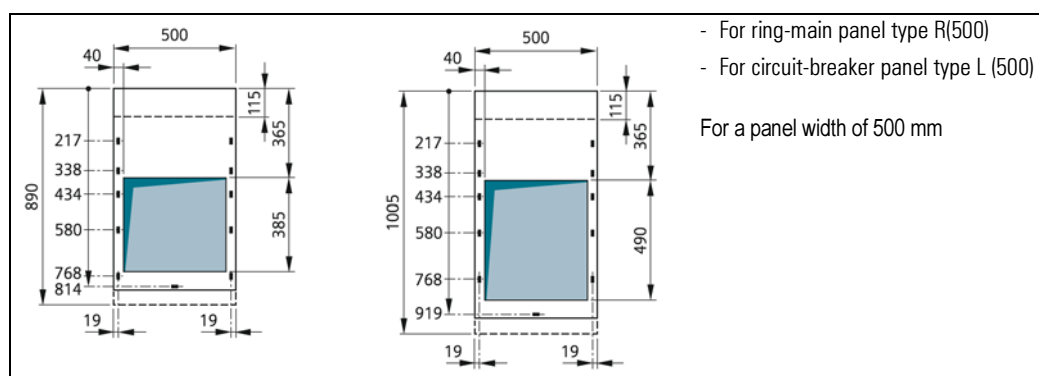
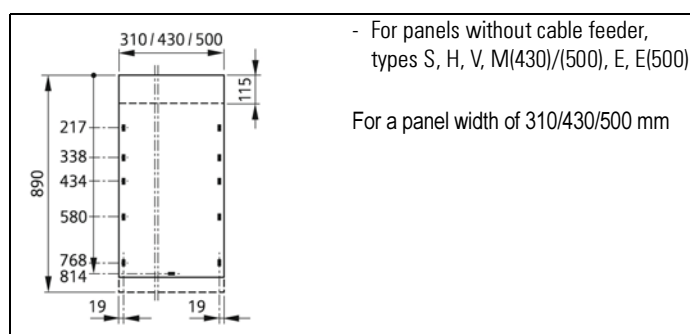
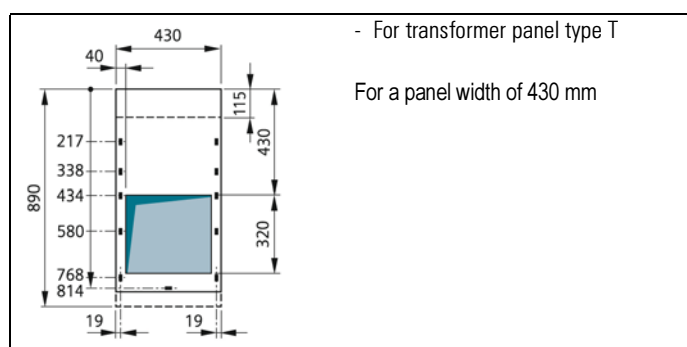
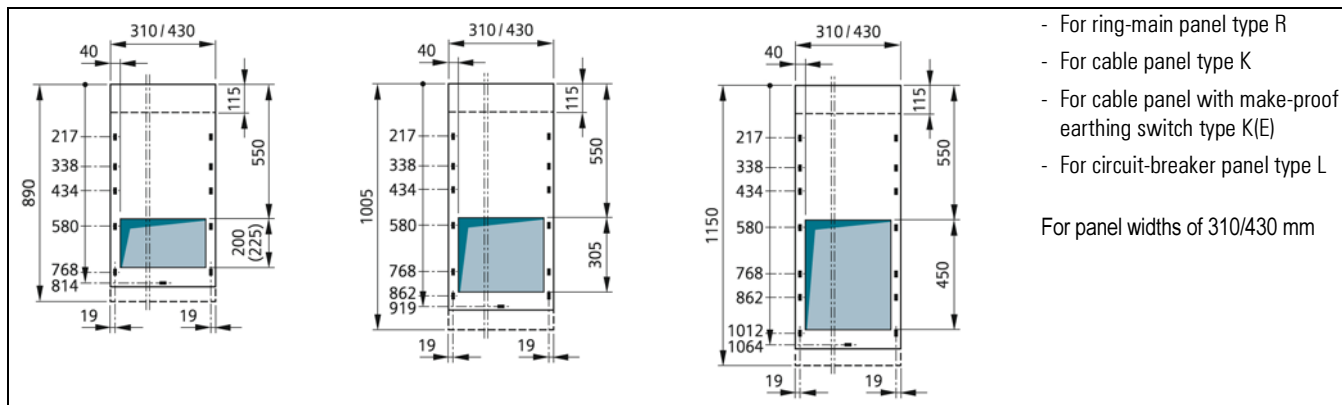
Example: Position of the floor openings and fixing points for double cable connection in panel blocks

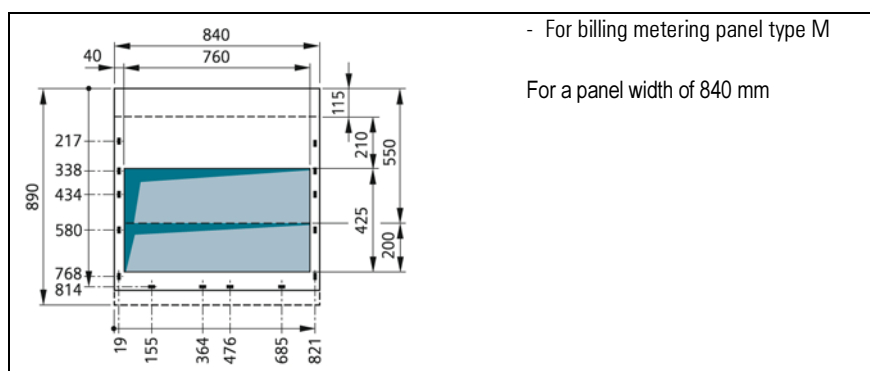


For concrete switchgear versions, please order the dimension drawings.

Versions combined with pressure absorbers and deep cable compartment covers

Versions combined with pressure absorbers and deep cable compartment covers. Expansion joints are marked in the illustrations by dotted double lines.





For concrete switchgear versions, please order the dimension drawings.

- ⇒ Remove the front cable compartment cover from the subframe of the panels. Undo any existing bolted joints of the cable compartment cover. Then lift the cable compartment cover and remove it to the front.



ATTENTION!

To install the switchgear or the cables, the cross members can be removed. Then, the switchgear must not be moved anymore, as there is no brace to guarantee stability during the movement.

- ⇒ Bring the switchgear to the required position.
- ⇒ Remove the cross members.
- ⇒ Do not move the switchgear as long as the cross members are removed.

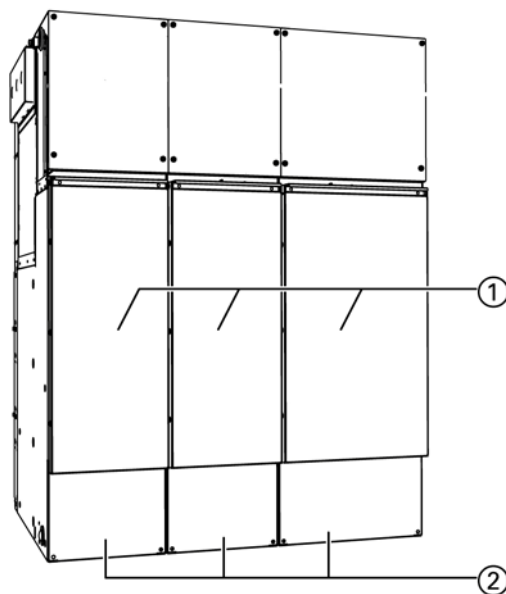


Fig. 52: Removing the cable compartment covers ① and the cross members ② if required

Mounting the partition in the cable compartment

If it was not pre-assembled by the factory, mount the lower partition again after having fixed the panels on the floor.

For switchgear with 16 kA pressure absorber and pressure relief to the rear, there is no partition available.

- ⇒ Remove the cable compartment covers.
- ⇒ Remove the cable bracket.
- ⇒ Fasten the lower partition. To do this, use M6 Torx bolts. Tightening torque: Maximum 12 Nm.

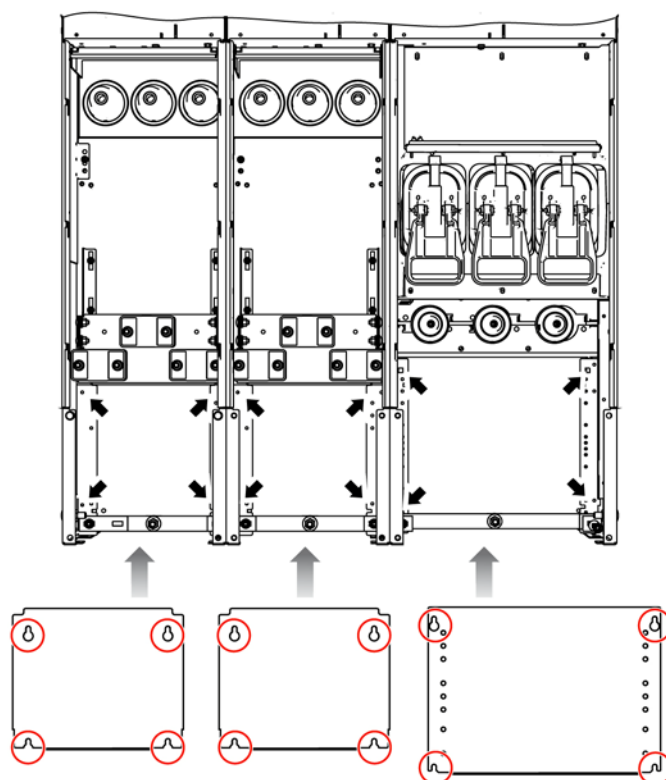


Fig. 53: Mounting the lower partition (front view)

- ⇒ The folding edges of the partition point to the rear.

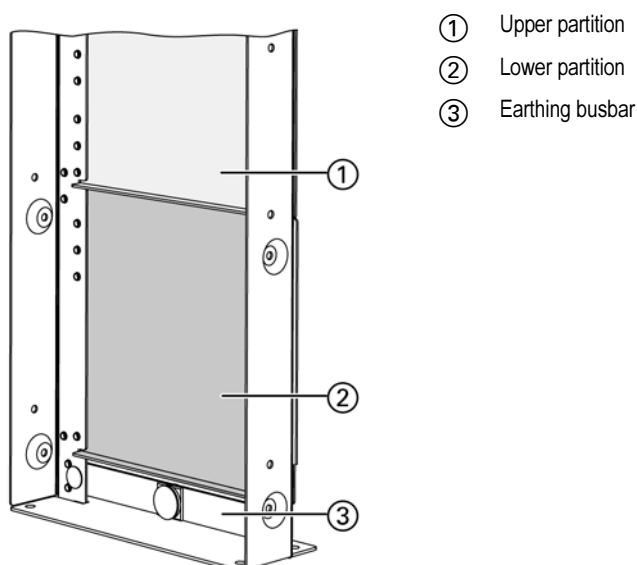


Fig. 54: Mounting position of the lower partition (rear view)

⇒ Adjust the correct height of the **cable brackets in the T panel**, and fix with Torx screws M6. Tightening torque: maximum 12 Nm.

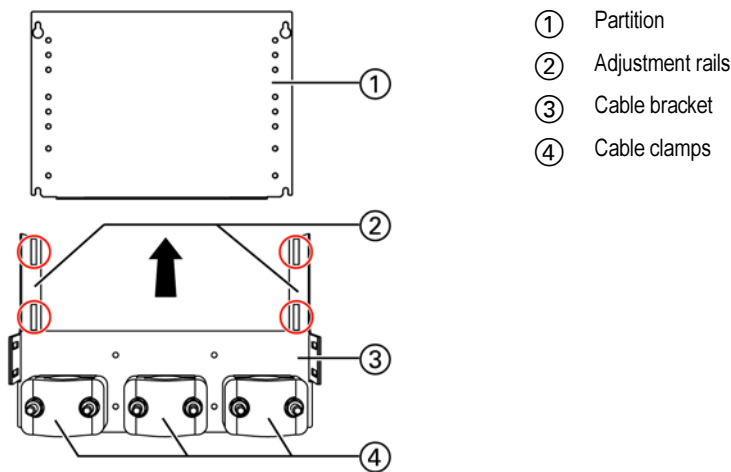


Fig. 55: Mounting the cable bracket in the T panel

12.3 Pressure relief options

In the standard design, the pressure is relieved downwards. In the case of non-extendable panel blocks with an overall height of 1400 and 1700 mm and wall-standing arrangement, the pressure can optionally be relieved to the rear.

Switchgear installation with pressure relief downwards

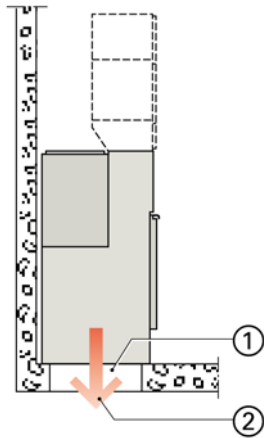


Fig. 56: Standard: Pressure relief downwards (side view)

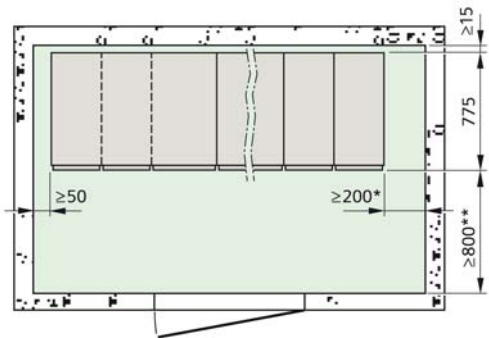


Fig. 57: Standard: Pressure relief downwards (top view)

Switchgear installation with pressure relief downwards or to the rear (option)

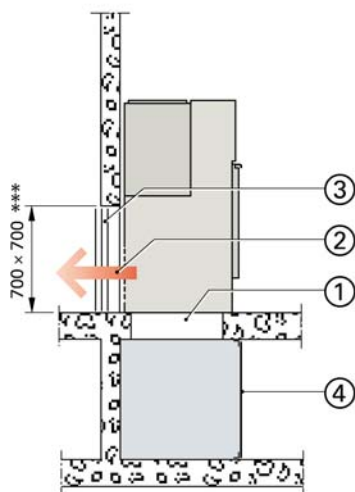


Fig. 58: Option: Pressure relief to the rear (side view)

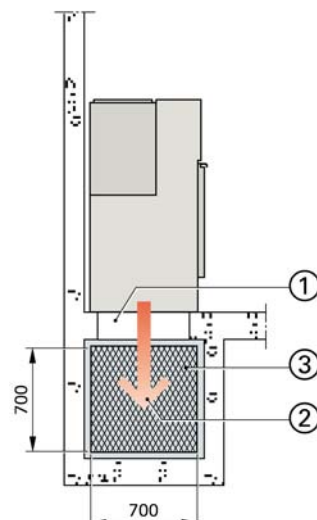


Fig. 59: Option: Pressure relief downwards (side view),
Volume = 0.75 m³

- ① Floor opening
- ② Direction of pressure relief
- ③ Expanded metal (supplied by site)
- ④ Partition (e.g. made of metal, supplied by site)

* For lined up switchgear

**) Depending on national requirements. For extension or panel replacement, a control aisle of at least 1000 mm is recommended.

***) Total opening minimum 0.48 m²

Switchgear installation with rear pressure relief duct (option) for switchgear blocks with IAC A FL or FLR up to 16 kA/1 s

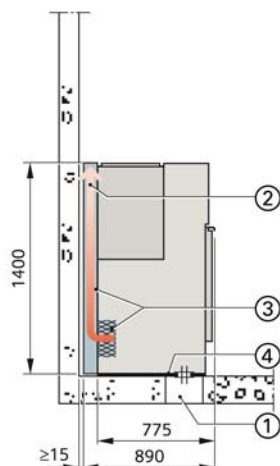


Fig. 60: For 1400 mm panels (side view)

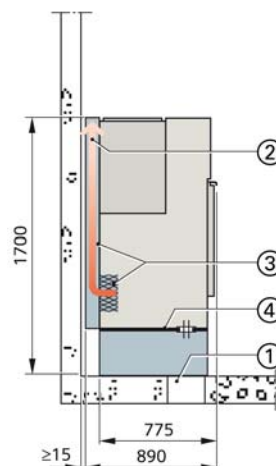


Fig. 61: For 1700 mm panels (side view)

- ① Floor opening
- ② Direction of pressure relief
- ③ Pressure absorber system with pressure relief duct directed upwards at the rear
- ④ Divided floor cover for cable insertion, local installation

* For lined up switchgear

Switchgear installation with base and rear pressure relief duct (option) for switchgear blocks with IAC A FL or FLR up to 21 kA/1 s

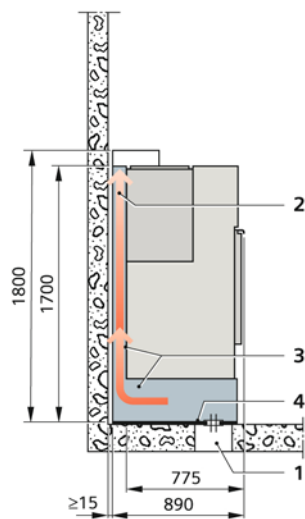


Fig. 62: Wall-standing arrangement without metering panel (side view)

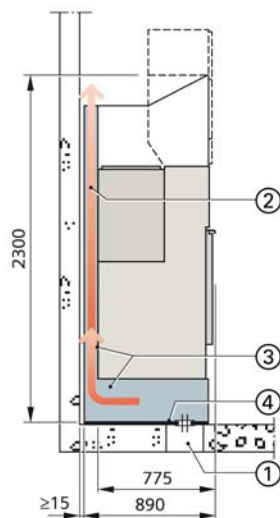


Fig. 63: Side view (free-standing arrangement, also metering panel for wall-standing arrangement)

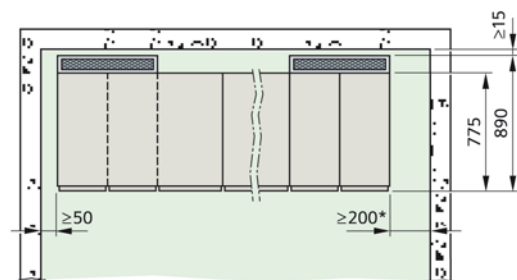


Fig. 64: Top view

- ① Floor opening
- ② Direction of pressure relief
- ③ Pressure absorber system with pressure relief duct directed upwards at the rear
- ④ Divided floor cover for cable insertion, local installation

* For lined up switchgear

Room heights for switchgear installation with pressure relief duct at the rear

Switchgear height	Room height
1400	≥ 2000
1700, 1800	≥ 2200
2300	≥ 2400
All data in mm	

12.4 Installing switchgear with pressure absorber

Overview: Pressure absorber designs

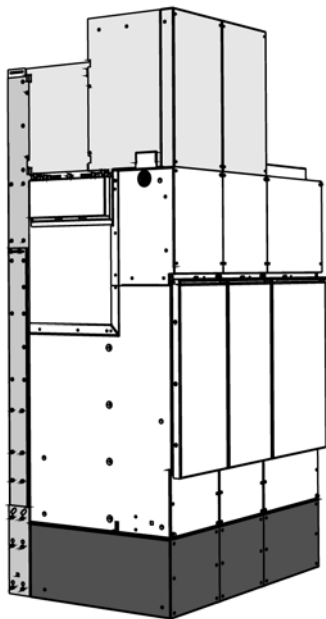


Fig. 65: Design for free-standing arrangement, IAC A FLR up to 21 kA/1s (height 2300 mm)

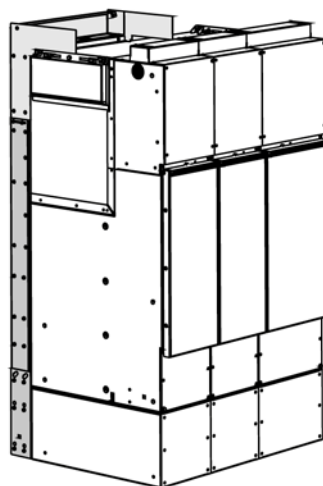


Fig. 66: Design for wall-standing arrangement, IAC A FL up to 21 kA/1s (height 1800 mm)

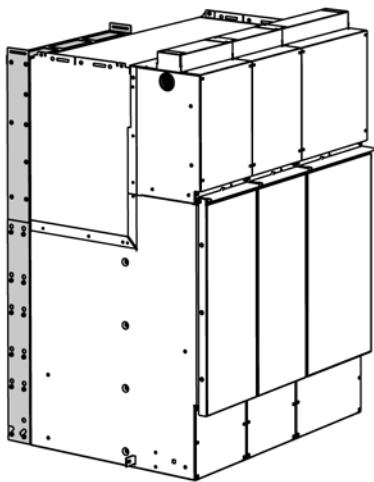


Fig. 67: Design for wall-standing and free-standing arrangement, IAC A FLR up to 16 kA/1s (height 1400 mm)

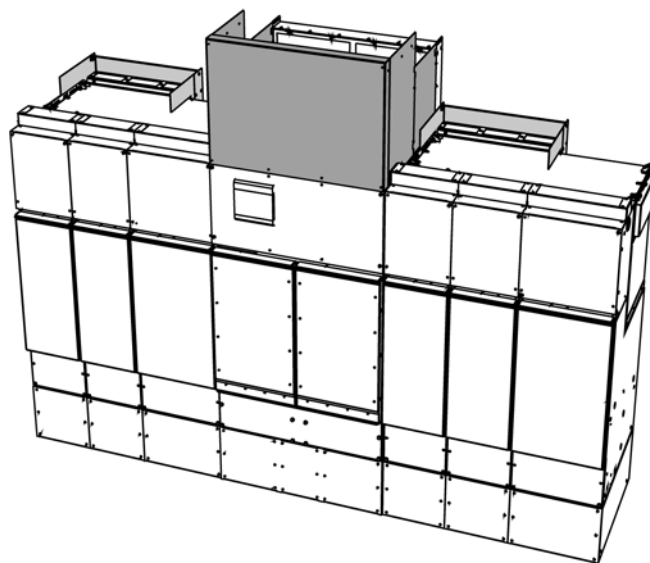
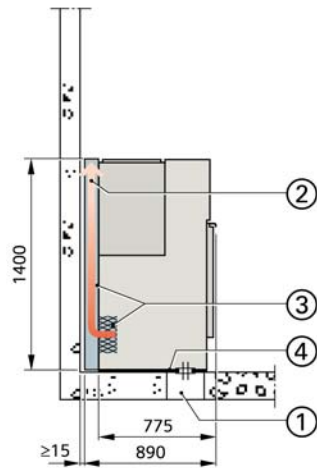


Fig. 68: Metering panel up to 21 kA/1s for wall-standing and free-standing arrangement (height 2300 mm)

Switchgear with integrated pressure absorber ≤ 16 kA



- ① Floor opening
- ② Direction of pressure relief
- ③ Pressure absorber system with pressure relief duct directed upwards at the rear
- ④ Divided floor cover for cable insertion, local installation

Fig. 69: Option: Switchgear installation with rear pressure relief duct for switchgear blocks with IAC A FL up to 16 kA/1s (side view)

Local installation of pressure relief duct

⇒ Mount the fixing brackets for the pressure relief duct on the rear wall of the switchgear frame using 6 bolt-and-washer assemblies M8.

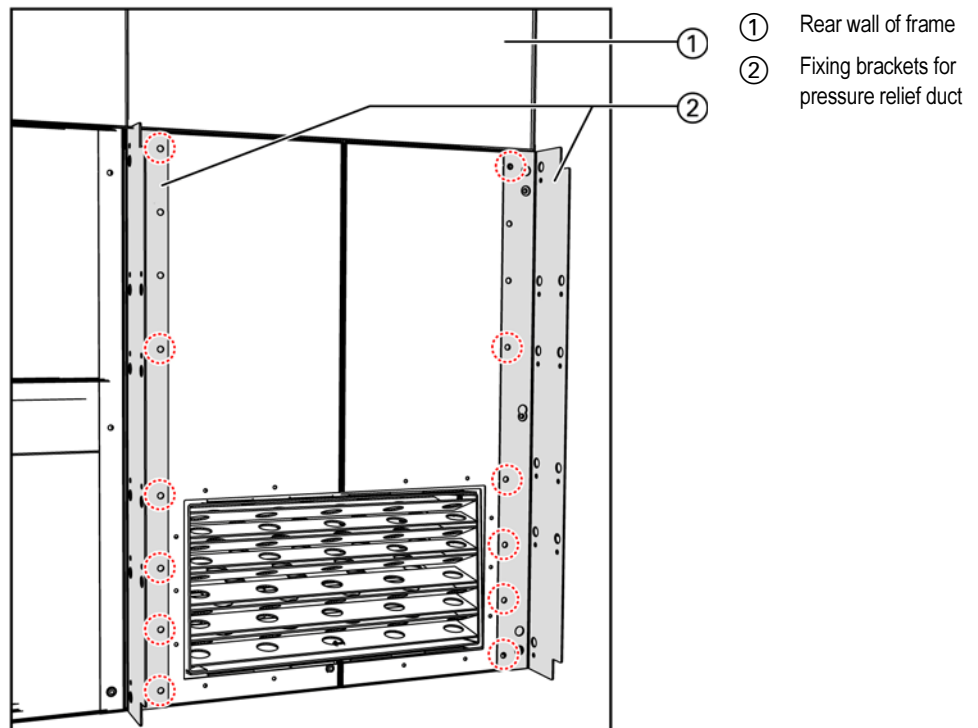


Fig. 70: Mounting the fixing brackets for the pressure relief duct

⇒ Bolt the pressure relief duct together with the fixing brackets on both sides of the panel. To do this, use 6 Torx bolts size M6.

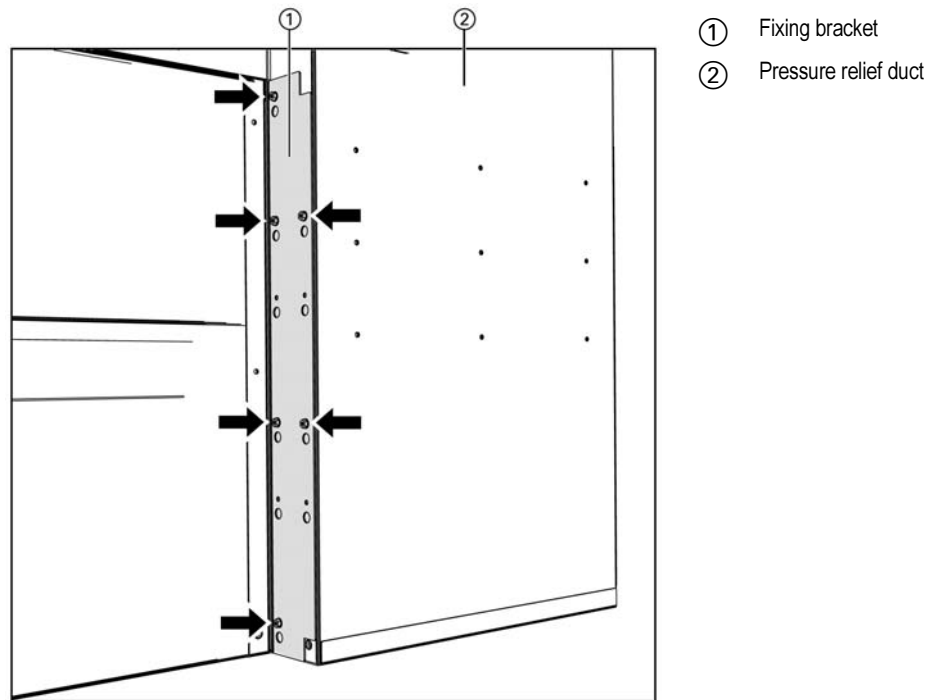


Fig. 71: Fastening the pressure relief duct

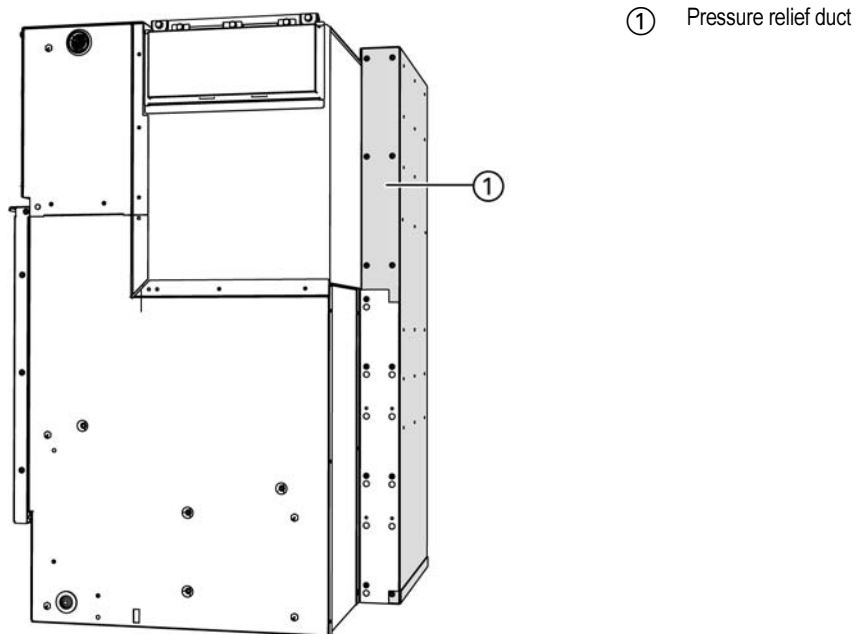


Fig. 72: Completely assembled pressure relief duct

Switchgear with pre-assembled pressure absorber ≤ 21 kA

The switchgear can be equipped with a pressure absorber which is either pre-assembled at the factory or supplied separately.

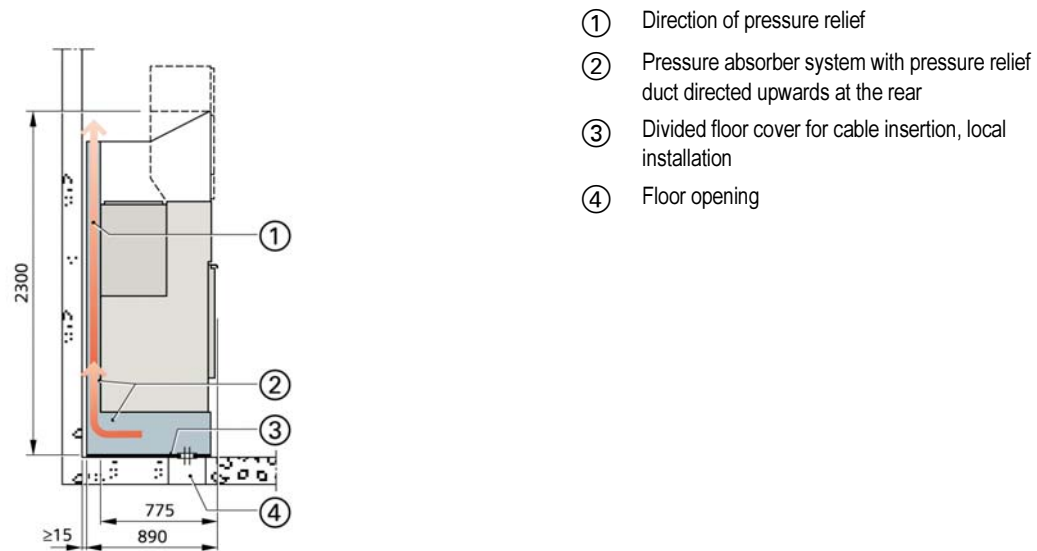


Fig. 73: Option: Switchgear installation with base and rear pressure relief duct for switchgear with IAC A FL or FLR up to 21 kA/1s (side view)

⇒ If the pressure absorber was pre-assembled: Set the switchgear with the pressure absorber onto the foundation or the foundation rails, align it and bolt it tight.

	NOTE! Always observe the following when the switchgear is ordered without low-voltage compartment: ⇒ Mount the top absorber unit.
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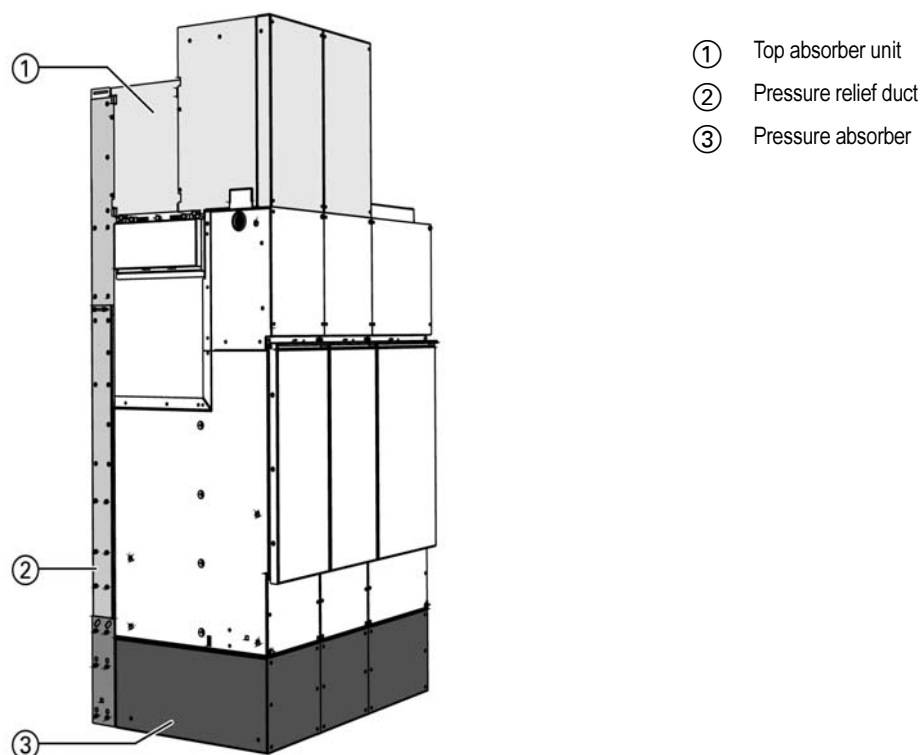


Fig. 74: Pressure absorber ≤ 21 kA with top absorber unit



ATTENTION!

If pressure relief duct and base are available separately:

⇒ Bolt the pressure relief duct together with the fixing brackets (absorber duct) on both sides of the base. Use 6 thread-ridging screws M6 per fixing bracket (absorber duct).

⇒ Install the bases of all transport units and line them up.

⇒ Bolt the bases together using 2 bolts M8 and nuts each.

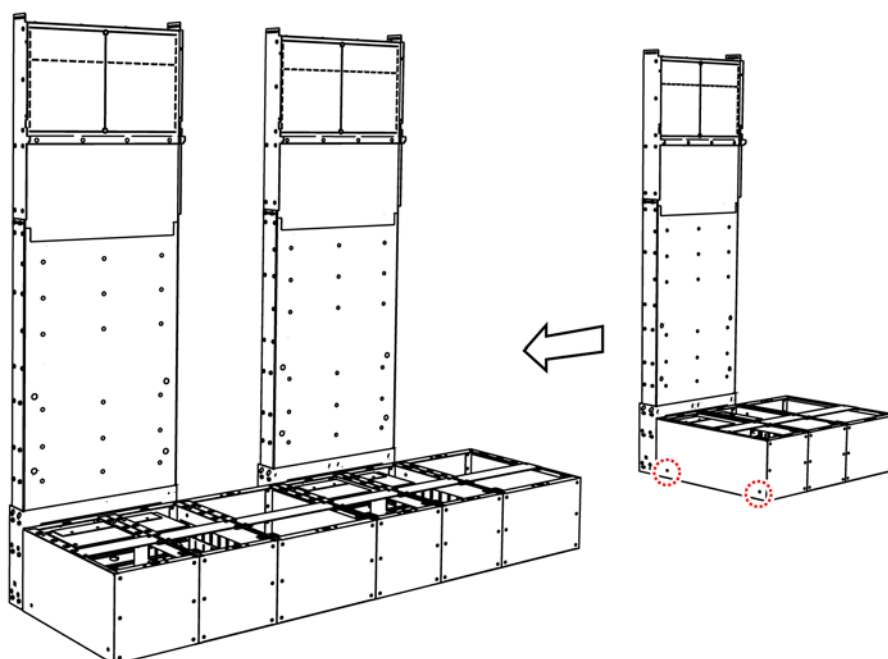


Fig. 75: Example: Fixing points at the bases

⇒ Fix all bases on the floor.

⇒ We recommend to fasten the switchgear with a minimum of 4 bolts M8 per panel.

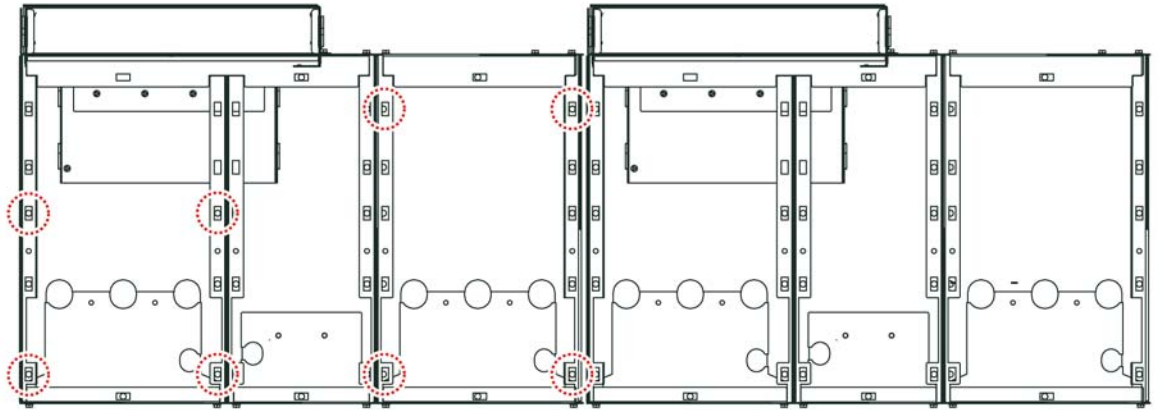


Fig. 76: Example: Fastening the base to the foundation

The fixing points of the absorber and the switchgear are described in the dimension drawings of the switchgear documentation.

Installing the panels on the bases



ATTENTION!

In order to be able to move the panels on the bases,

⇒ do not attach felt strips.

⇒ Lift the panel onto the base and move it into position.

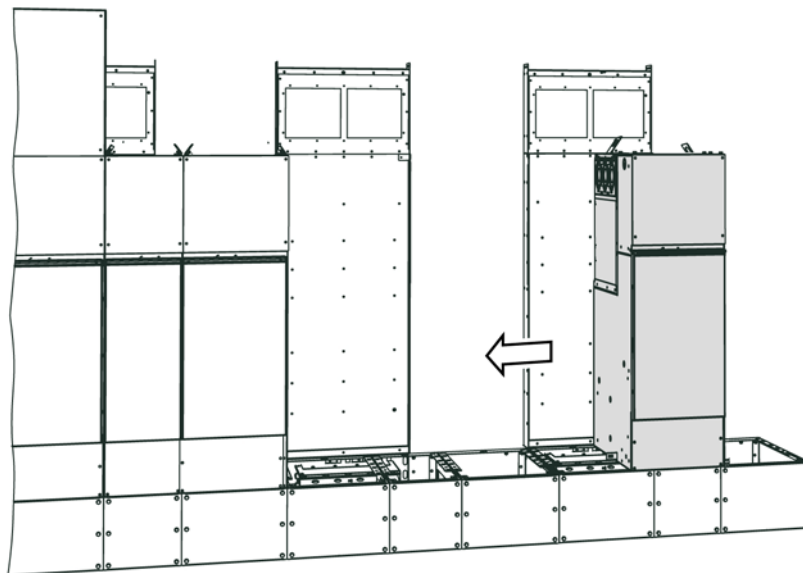


Fig. 77: Example: Positioning the panel on the base

⇒ Align the panel and the pressure absorber so that they are flush. Observe that the bolted joints between the absorber and the switchgear frame are in line.

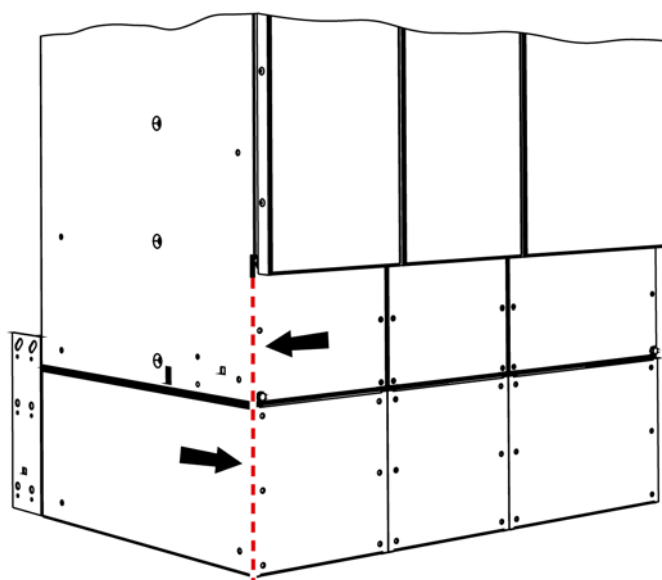


Fig. 78: Flush alignment of pressure absorber and switchgear

- ⇒ Undo the two thread-ridging screws size M6 of the cable compartment cover. Lift the cable compartment cover and remove it to the front..

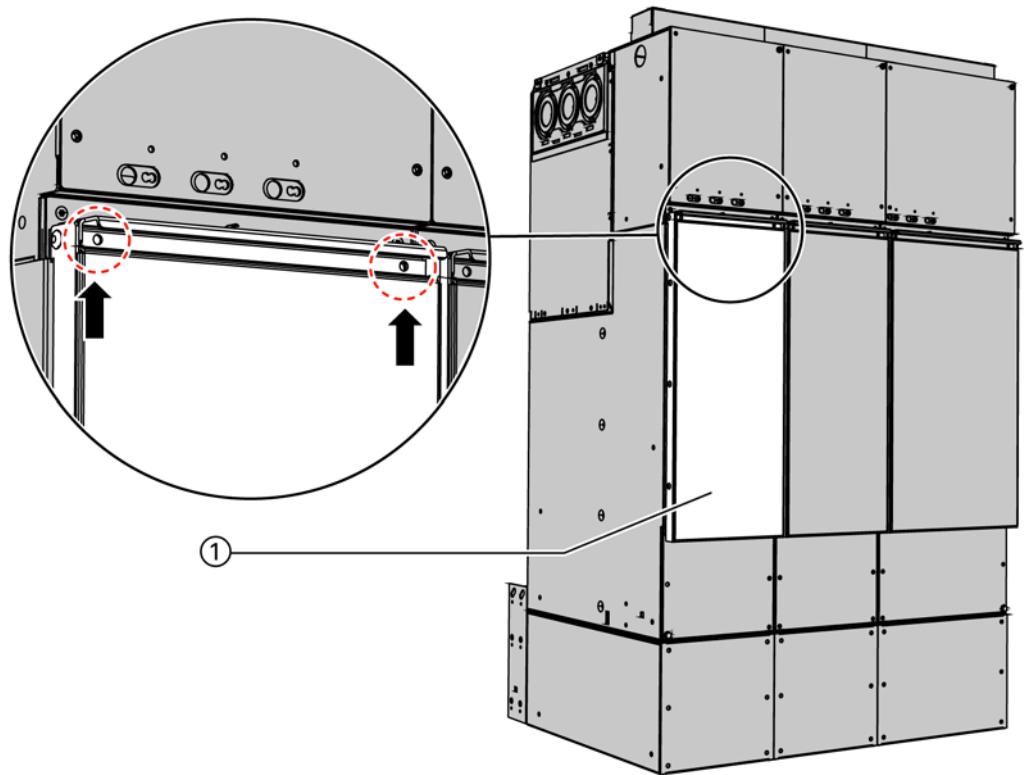


Fig. 79: Position of the bolts to be loosened at the cable compartment cover ①

- ⇒ Join the panels, see INSTALLATION AND OPERATING INSTRUCTIONS, "Feldverbund herstellen".

Mounting lower partition**ATTENTION!**

Do not yet mount the lower partition in order to guarantee accessibility for further work in the cable compartment.

⇒ If the lower partition was pre-assembled at the factory, remove it (bolt size M6)

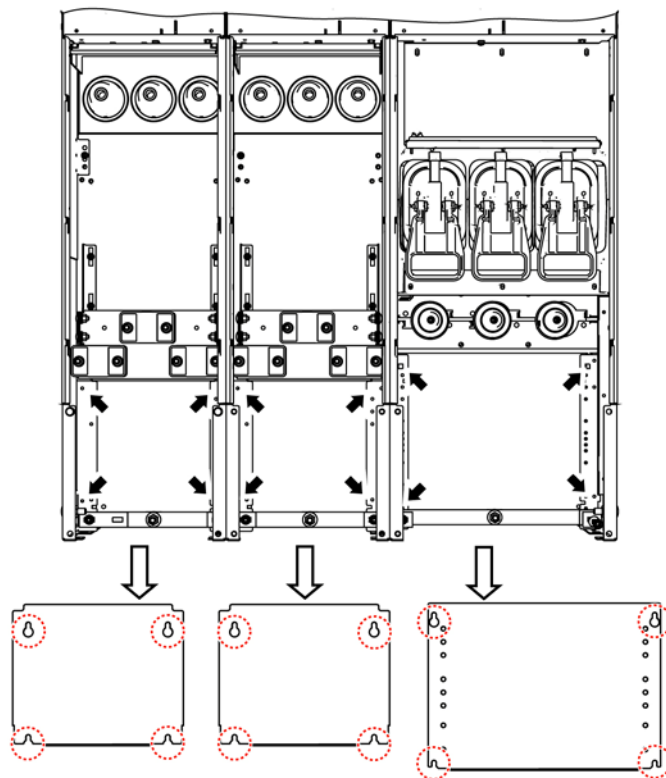


Fig. 80: Removing the lower partition

- ⇒ In the front area of the cable compartment, interconnect the switchgear frame and the base using two fixing clips. Mount the fixing clips with M8 bolts.

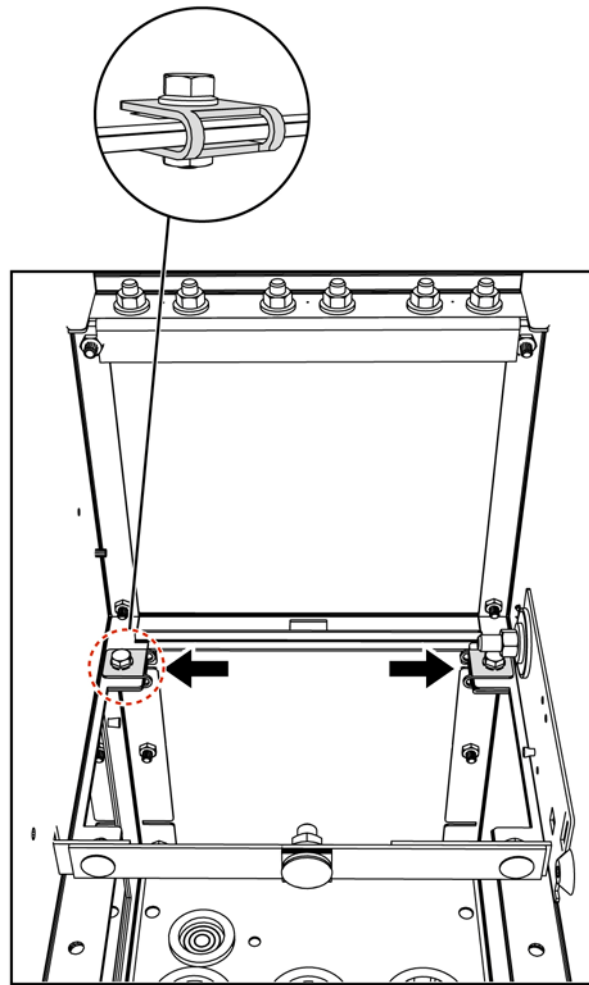


Fig. 81: Fixing points between switchgear and base (rear view into the cable compartment)

- ⇒ In the rear area of the cable compartment, interconnect the switchgear frame and the base using four fixing clips as a minimum. The position of two fixing clips can be selected freely. Mount the fixing clips with M8 bolts.

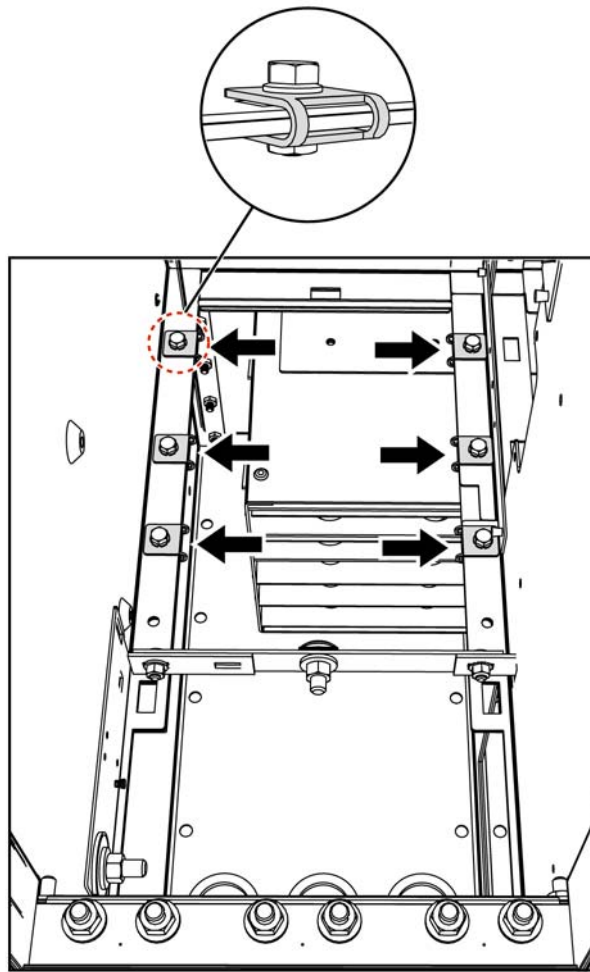


Fig. 82: Fixing points between switchgear and base (front view into the cable compartment)

⇒ Mount the tension brace on the base using four M8 bolts as a minimum.

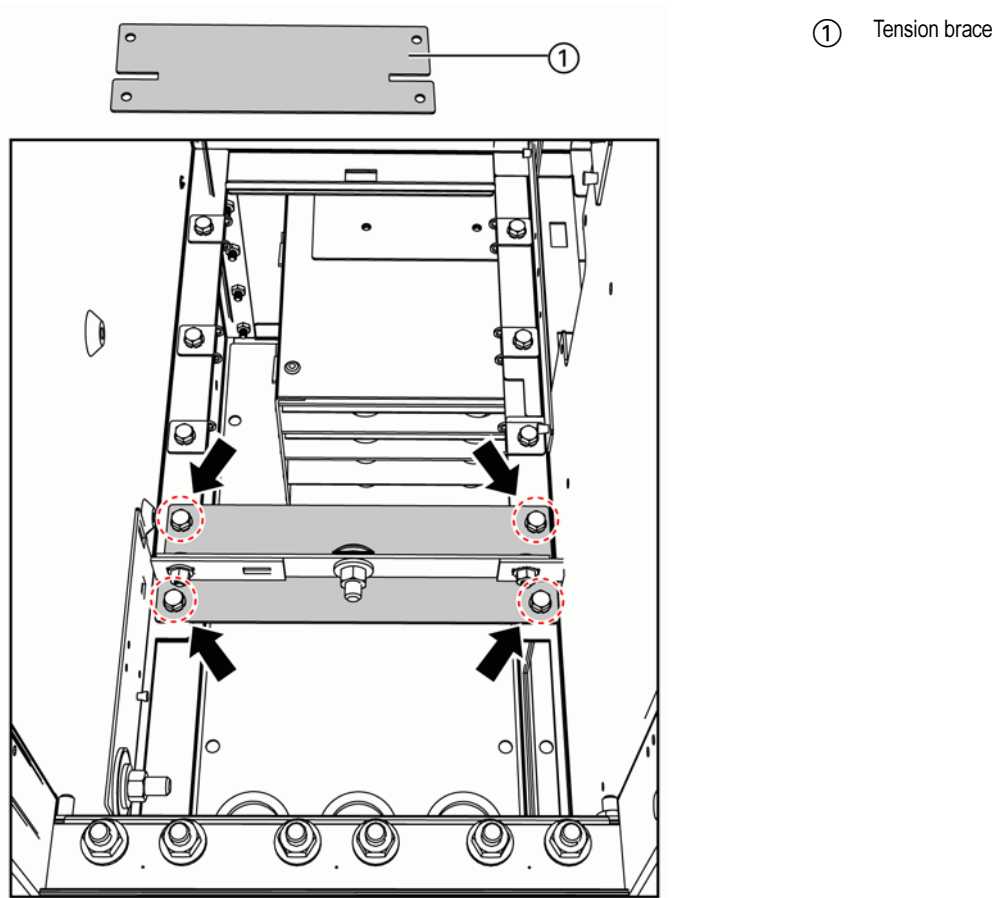


Fig. 83: Bolting the tension brace tight

Mounting the partition in the cable compartment

⇒ Fasten the lower partition. To do this, use thread-riding screws M6. Tightening torque: Maximum 12 Nm.

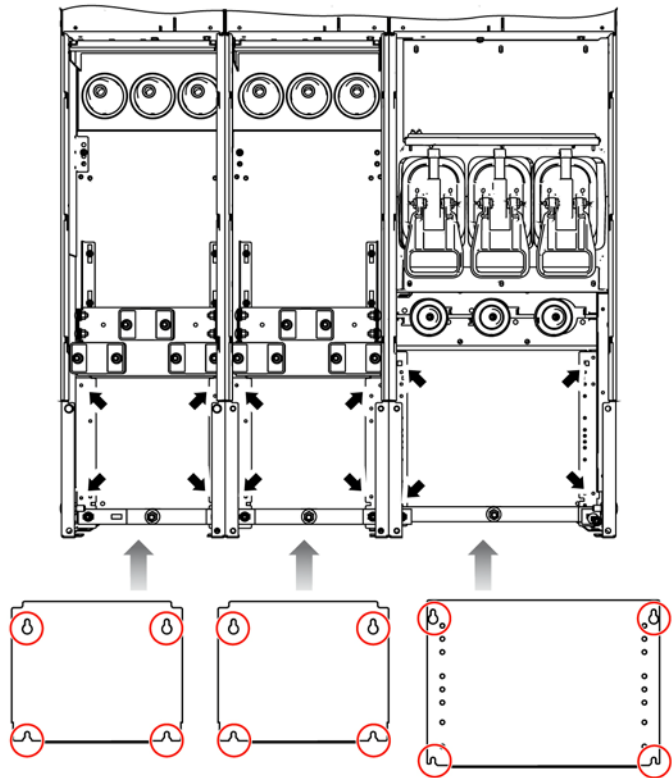


Fig. 84: Mounting the lower partition (front view)

**Mounting the cable bracket
(R panel)**

- ⇒ Bolt the cable bracket ②, the adjustment rail and the cable clamps together with the upper partition ① using four self-tapping screws M6 x 16. Tightening torque: Maximum 12 Nm.

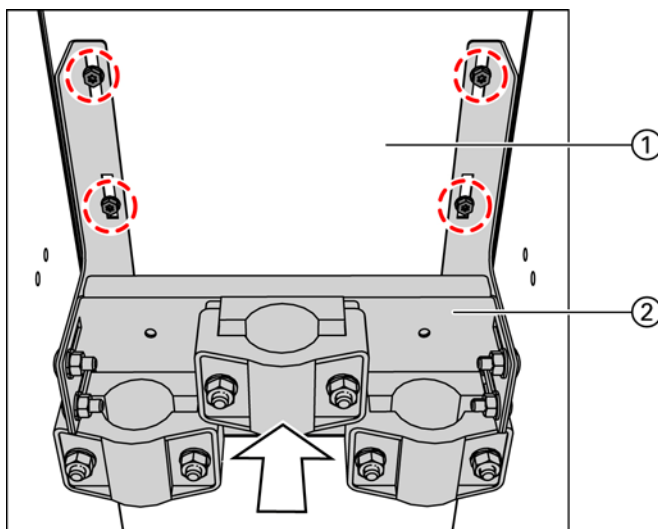


Fig. 85: Mounting the cable bracket (R panel)

- ⇒ Insert the lower partition ③ into the four self-tapping screws, and fasten.

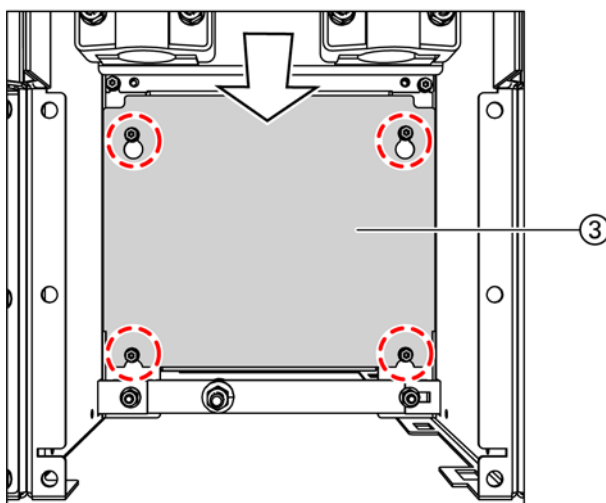


Fig. 86: Mounting the lower partition (R panel)

Mounting the cross member ⇒ Fasten the cross member ④ using six M8 bolts.

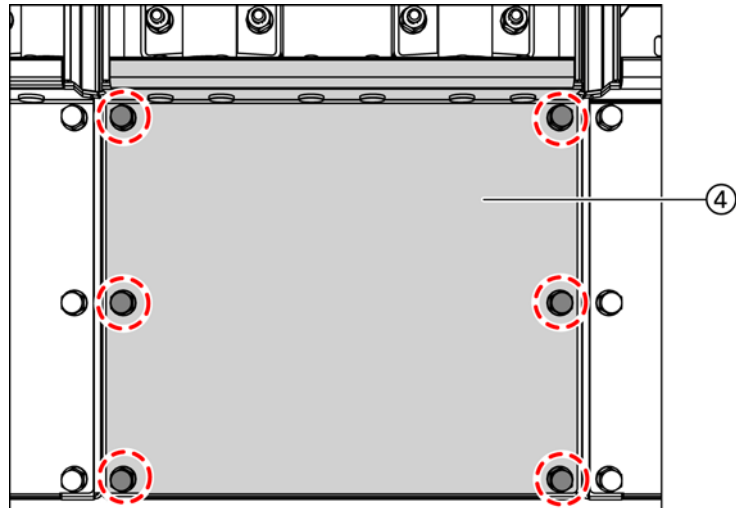


Fig. 87: Mounting the cross member (R panel)

Mounting the partition plate and the cable bracket (T panel) ⇒ Insert the partition ⑤ into the four self-tapping screws, and fasten.

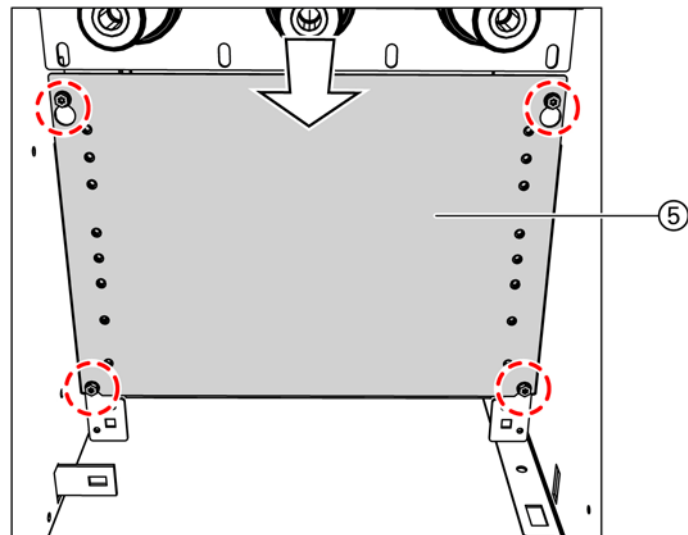


Fig. 88: Mounting the partition (T panel)

- ⇒ Bolt the cable bracket (6), the adjustment rail and the cable clamps together with the upper partition (5) using four self-tapping screws M6 x 16. Tightening torque: Maximum 12 Nm.

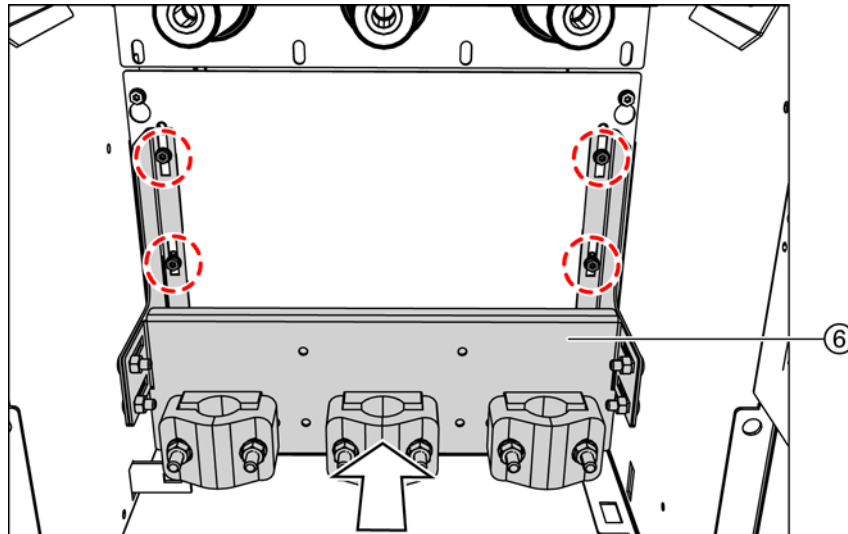


Fig. 89: Mounting the cable bracket (T panel)

Mounting the cross member

- ⇒ Fasten the cross member (7) using six M8 bolts.

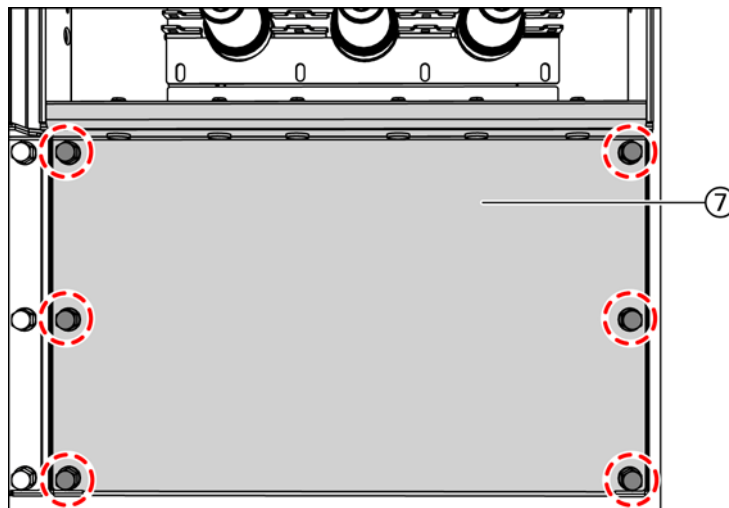


Fig. 90: Mounting the cross member (T panel)

- ⇒ Now it is possible to connect the cables.
- ⇒ Refit the cable compartment covers and bolt together with the two M6 bolts.

Installing the top pressure absorber unit

Mounting the fixing brackets

⇒ Fasten two fixing brackets for the covers in front of the wiring ducts on the inside using two M5 bolts each. For the time being, the external joints are not bolted together.

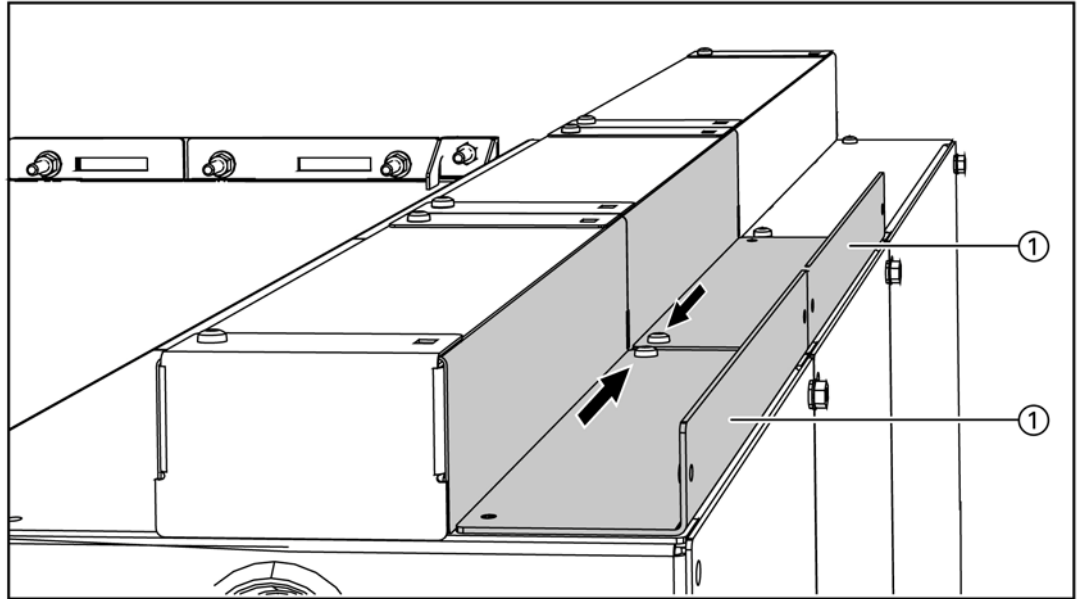


Fig. 91: Position of the fixing brackets ① for bolting the covers together

Mounting the supports and covers

⇒ Join the covers and bolt them together via the supports. Use one M8 bolt with nut.

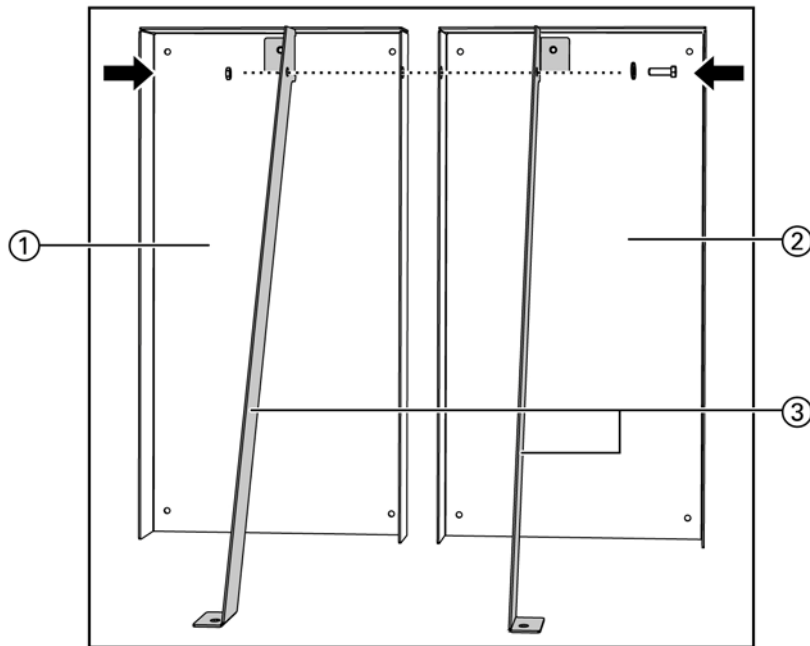


Fig. 92: Mounting the supports and interconnecting the front covers (rear view)

- | | | | |
|---|-------------|---|----------|
| ① | Right cover | ③ | Supports |
| ② | Left cover | | |

- ⇒ Fasten the covers with the supports onto the fixing brackets in front of the wiring ducts. To do this, use two M6 bolts with plastic washers each.

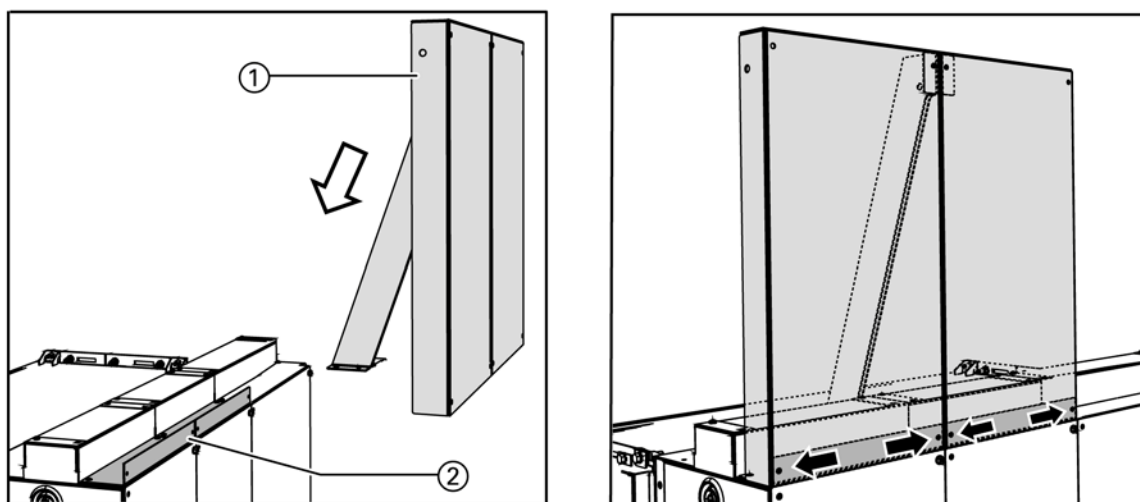


Fig. 93: Fastening the covers ① at the fixing brackets ②

- ⇒ Bolt the supports together with the roof plate using two M5 bolts.

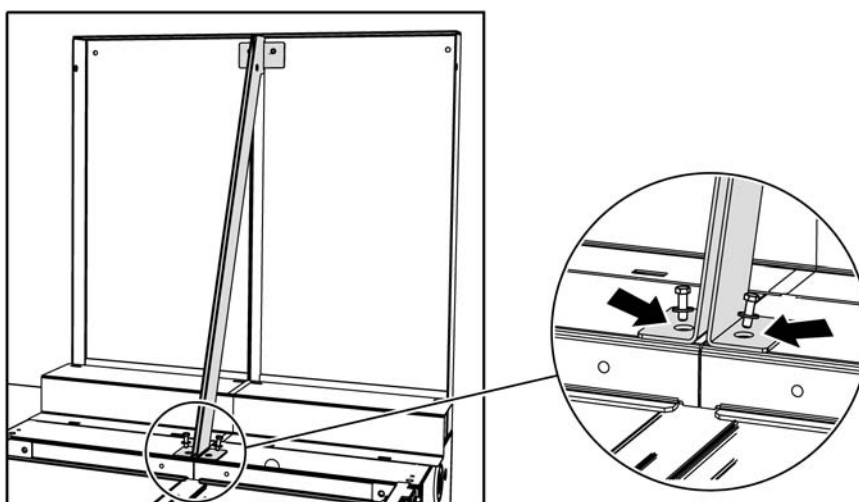


Fig. 94: Fastening the supports on the roof plate

**Mounting the
"front lateral part"**

⇒ Fasten the "front lateral part" for the top absorber unit onto the left and right upper edge of the switchgear roof plate using two M5 bolts each. Bolt together with the respective cover using one M8 bolt.

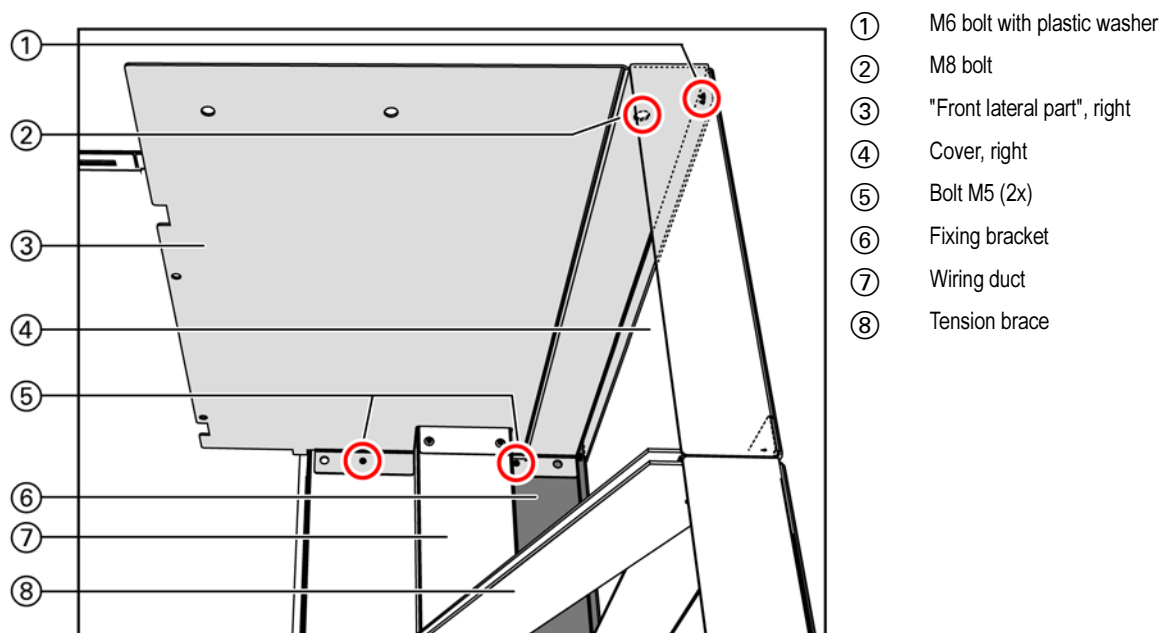


Fig. 95: Fixing points of the "front lateral part" at the switchgear vessel and the cover (inside view on right side of switchgear)

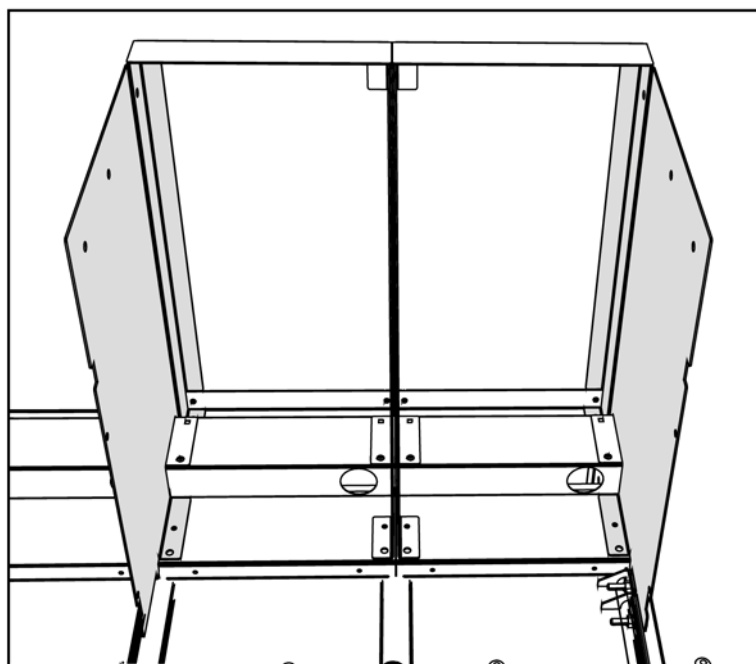


Fig. 96: Completely assembled "front lateral parts" of top absorber unit (rear view)

**If necessary,
mount offset plate**

⇒ Depending on the switchgear width, an offset plate must be mounted between the "front lateral part" and the "rear absorber collar". This offset plate can be omitted when two panels with 310 mm width are bolted together.

Mounting the "rear absorber collar"

- ⇒ Mount the "rear absorber collar" on both sides of the top absorber unit in order to close the gap between the pressure relief duct and the "front lateral parts" of the top absorber unit.
- ⇒ Mount the "absorber collar" with 4 bolts M6.

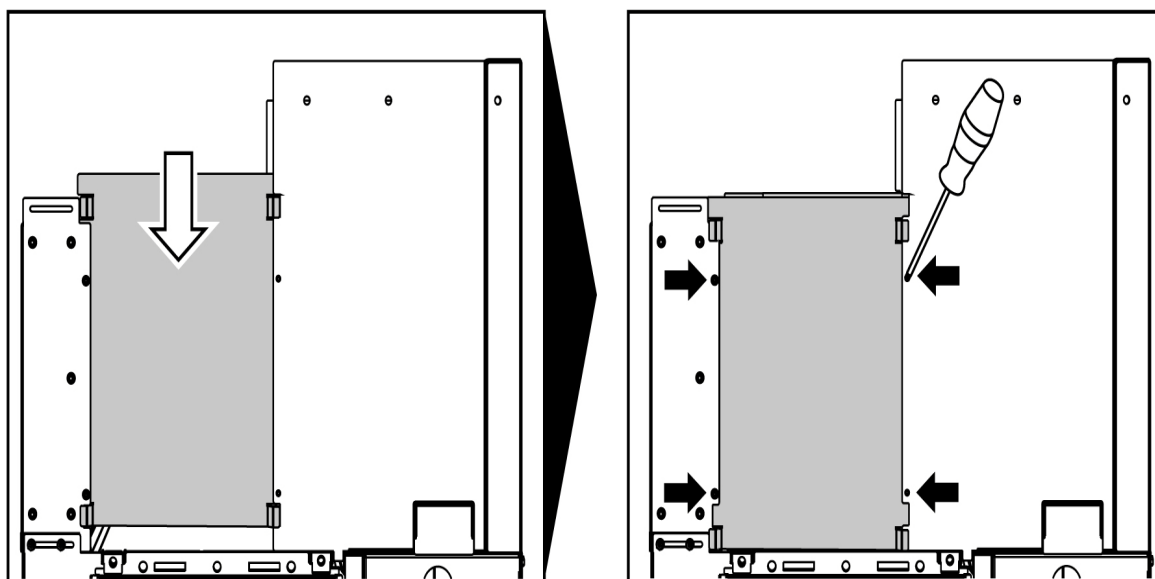


Fig. 97: Inserting the "rear absorber collar", and bolting together

Mounting the offset plate

If the total panel width of 2 panels in front of the absorber duct exceeds 740 mm, an offset plate is mounted between the "rear absorber collar" and the "front lateral part". The offset plate totally closes the gap between these two constructional units.

**Mounting offset plate
with installation dimension
120 to 190 mm**

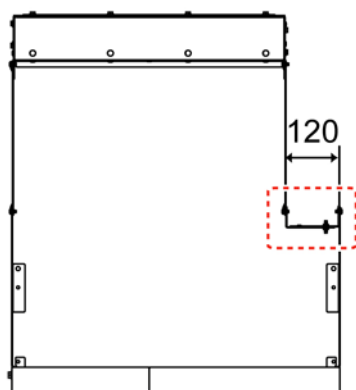


Fig. 98: Example: Installation dimension 120 mm

- ⇒ Cut the offset plate to the correct width with a side cutter.

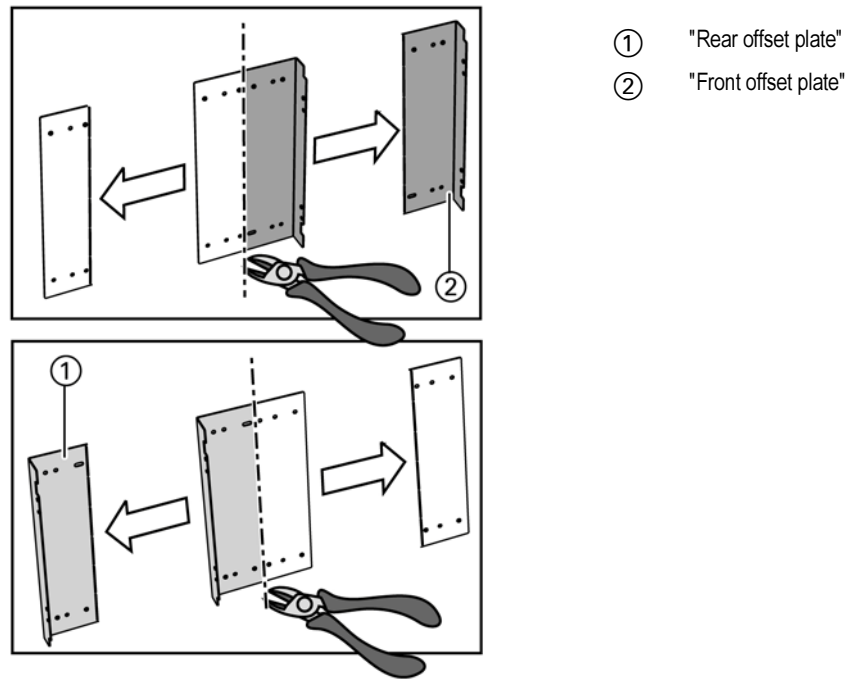


Fig. 99: Breaking the offset plate at the notches

⇒ Bolt the "front offset plate" and the "rear offset plate" together using 4 bolts M6 x 16. Additionally, bolt both plates together from inside using 2 bolts M6 x 16.

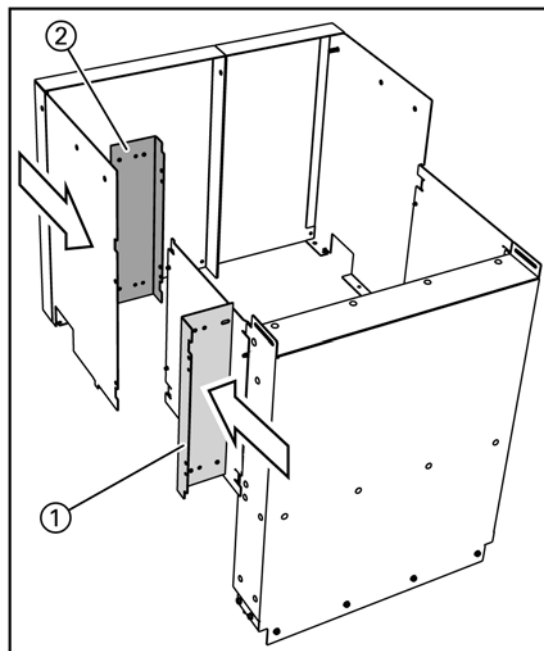


Fig. 100: Mounting direction: "Front offset plate" ① and "rear offset plate" ②

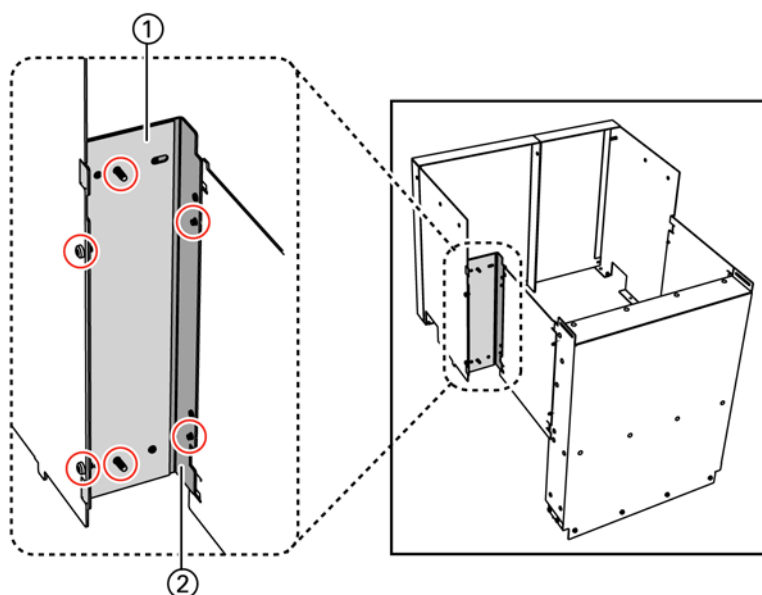


Fig. 101: Fixing points: "Front offset plate" ① and "rear offset plate" ②

**Mounting offset plate
with installation dimension
≥ 190 mm**

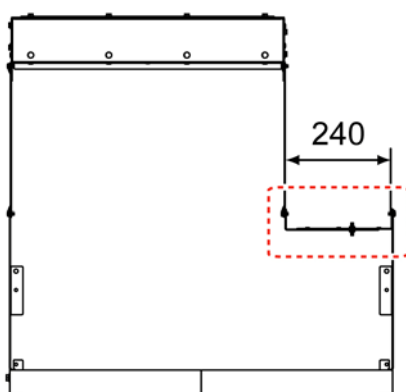


Fig. 102: Example: Installation dimension 240 mm

- ⇒ Bolt the "front offset plate" and the "rear offset plate" together using 4 bolts M6 x 16. Additionally, bolt both plates together from inside using 2 bolts M6 x 16.

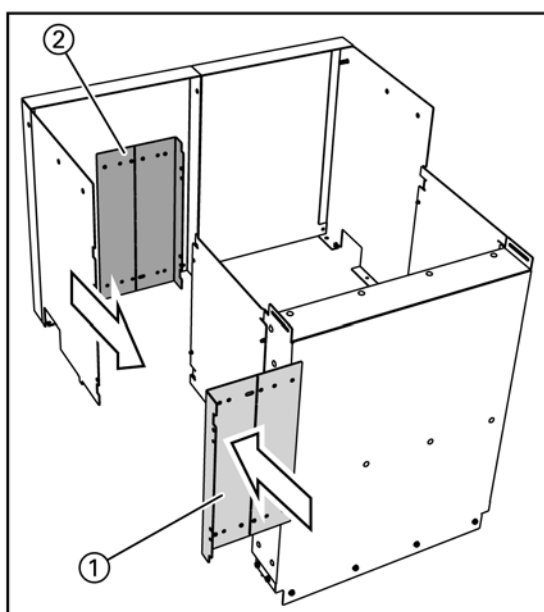


Fig. 103: Mounting direction: "Front offset plate" ① and "rear offset plate" ②

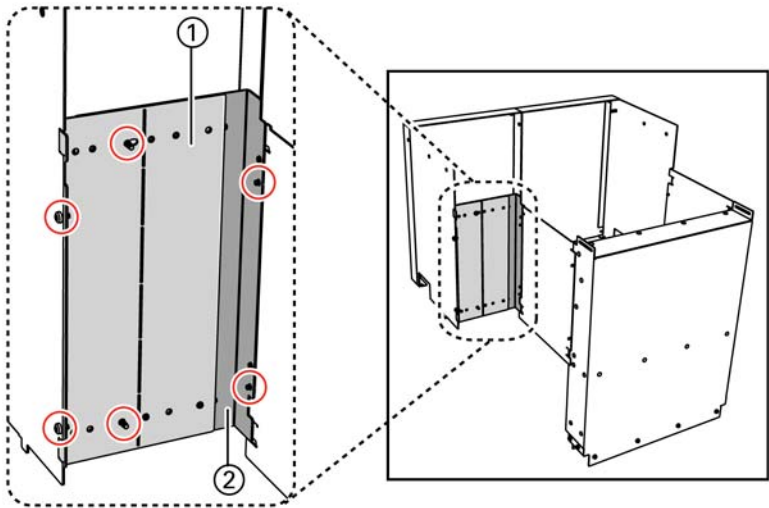


Fig. 104: Fixing points: "Front offset plate" ① and "rear offset plate" ②

Mounting the low-voltage compartment

	ATTENTION!
	If a low-voltage compartment is mounted, ⇒ both "rear absorber collars" of the top pressure absorber unit must be fixed.

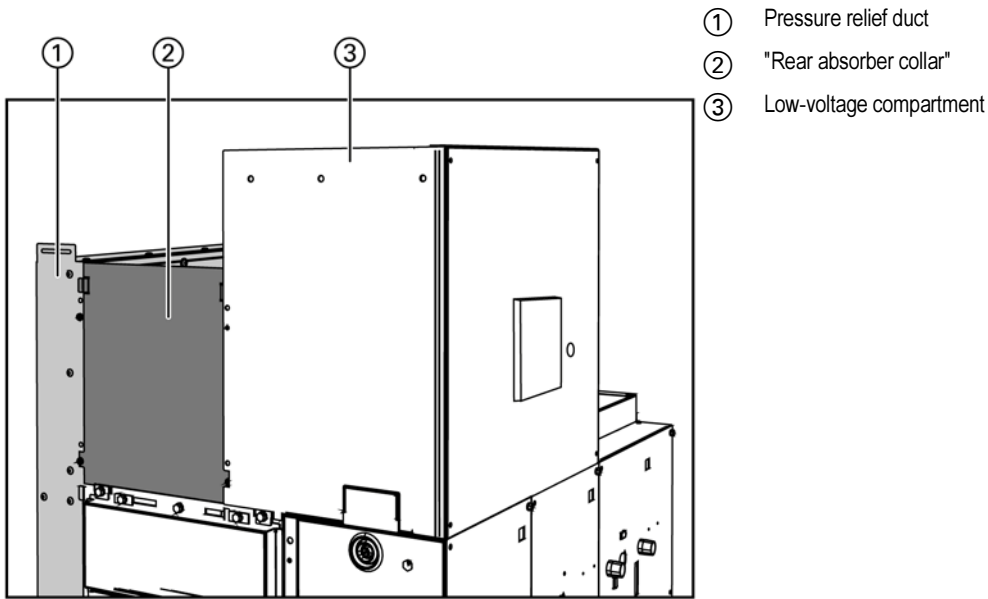


Fig. 105: Top pressure absorber unit with low-voltage compartment

⇒ The operations to be performed for the "rear absorber collar" are the same as those for installation of the covers.

⇒ Seal the joint between the switchgear and the base all around with silicone.

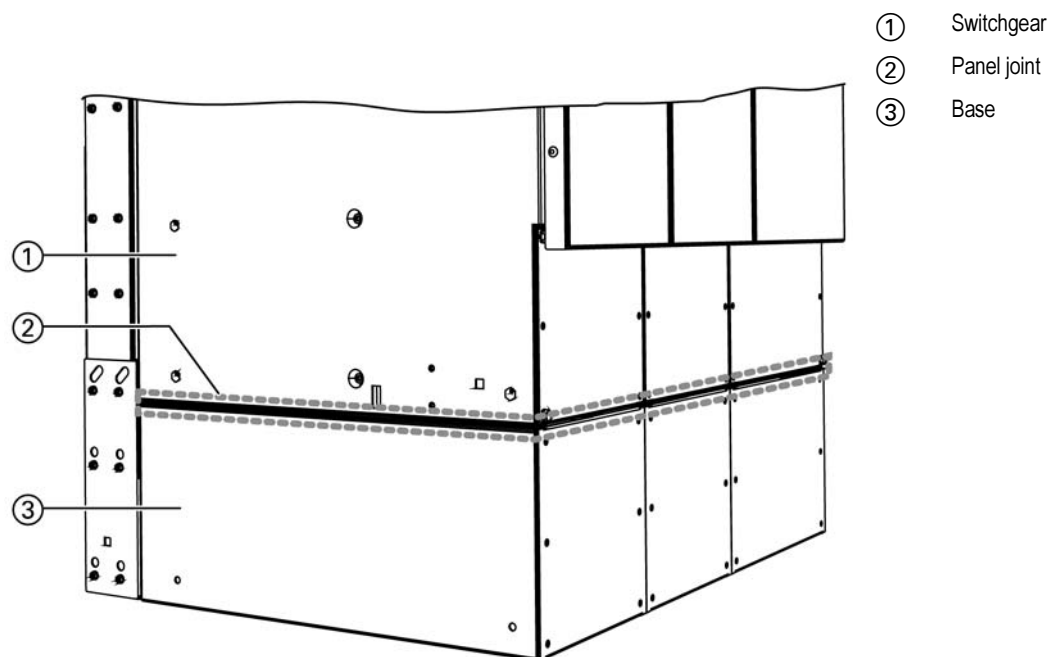


Fig. 106: Sealing the joint between the switchgear and the base

Wall-standing arrangement, IAC A FL up to 21 kA/1s

The absorber design for wall-standing arrangement, IAC A FL up to 21 kA/1s requires no 600 mm cover and no LV compartment.

Overall height: 1800 mm.

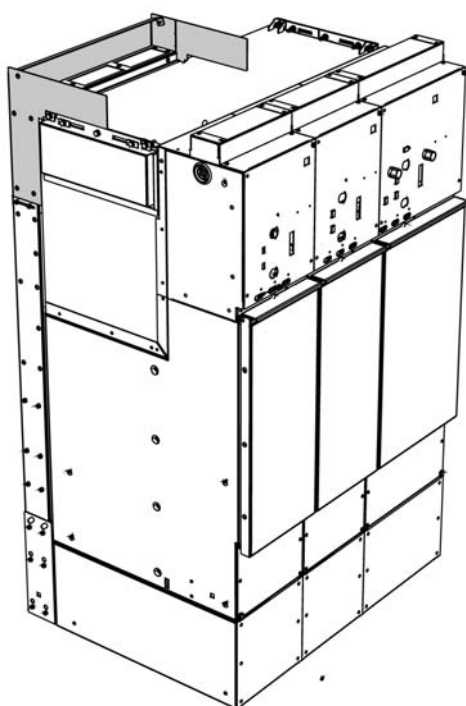


Fig. 107: Design for wall-standing arrangement up to 21 kA/1s

**Wall-standing arrangement
of metering panel**

The metering panel still requires the 600 mm addition.
Overall height: 2300 mm.

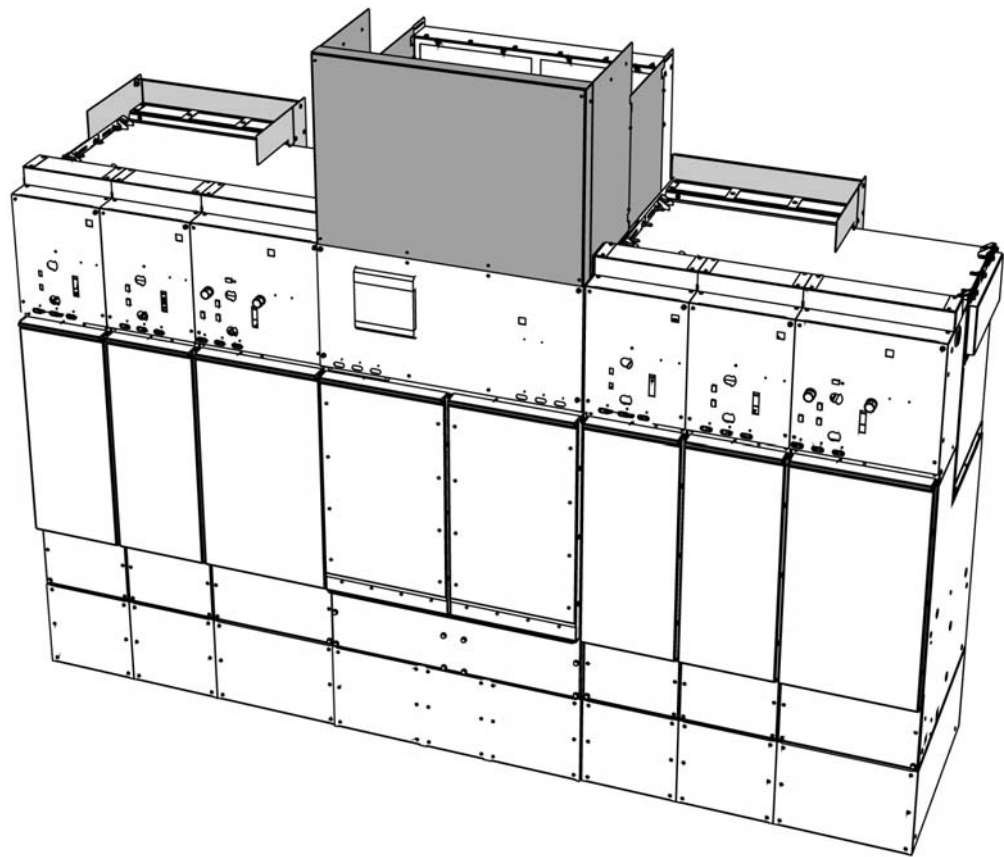


Fig. 108: Example: Wall-standing arrangement with metering panel

12.5 Extending existing switchgear or replacing components

In the instructions given in the following sections it is assumed that a new switchgear is being installed which has not yet been connected to the mains, and that it is therefore not live.

If you are going to extend an existing switchgear assembly or replace components, you have to take the following additional measures in advance:

**Space requirements for
lining up**

Make sure that there is sufficient space available for lining up individual panels or blocks. Keep the corresponding wall distances as well (see Page 73, "Installing the switchgear", room planning).

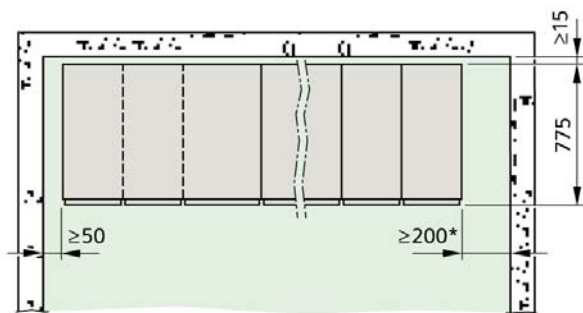


Fig. 109: Example: Space requirements for switchgear installation - top view (* for lined up switchgear)

Preconditions If you are going to line up individual panels or blocks, you have to take the following additional measures in advance:

Switching off high voltage

- ⇒ Isolate the switchgear.
- ⇒ Secure the switchgear against reclosing.
- ⇒ Verify safe isolation from supply of the switchgear (see Page 204, "Verification of safe isolation from supply").
- ⇒ Earth all feeders.

Switching off auxiliary voltage

- ⇒ Switch off auxiliary voltage.
- ⇒ Secure auxiliary voltage against reclosing.
- ⇒ Verify safe isolation from supply.

Discharging the spring energy store

- ⇒ Switch all transformer feeders off. Verify that the springs are discharged. The "spring not charged" indication must be visible.
- ⇒ Switch all circuit-breakers to the OPEN, CLOSED and again to the OPEN position one after the other. Verify that the springs are discharged. The "spring not charged" indication must be visible.

Spring energy store indicator for transformer feeders

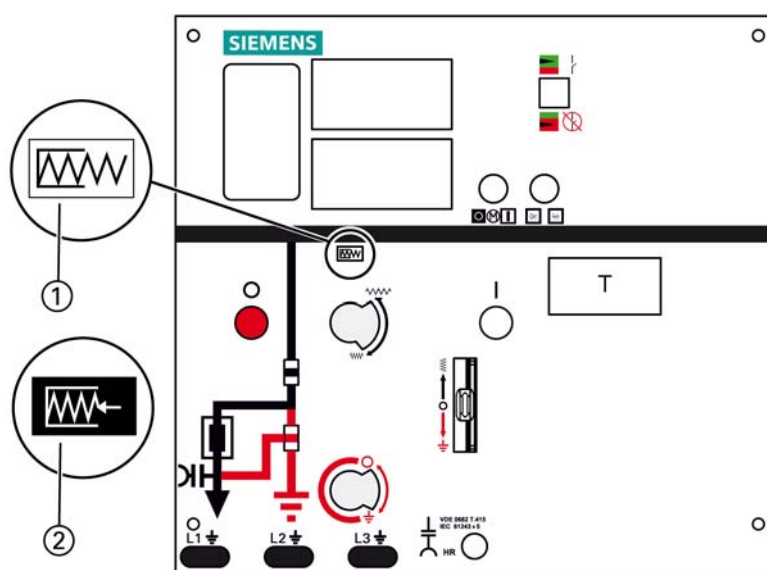


Fig. 110: Spring energy store indicator for transformer feeders: "Spring not charged"

- ① Spring energy store indicator: "Spring not charged"
- ② Spring energy store indicator: "Spring charged"

Spring energy store indicator for circuit-breaker type 2

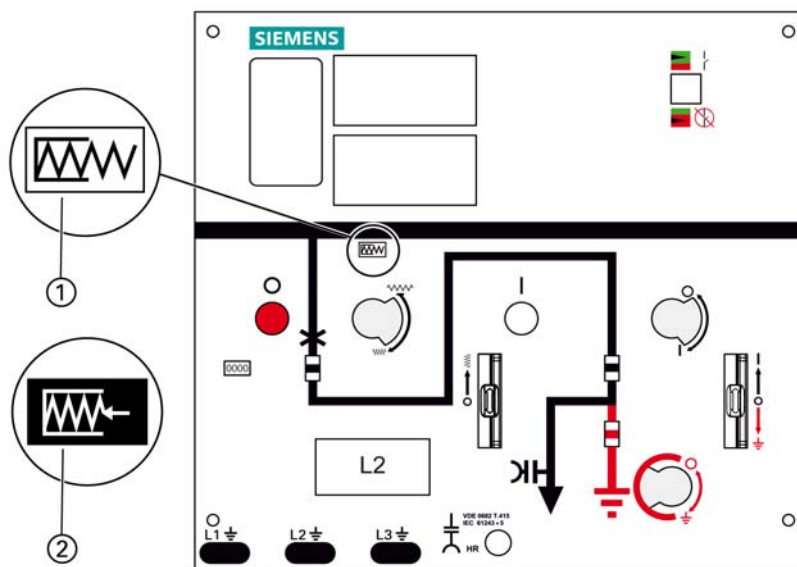
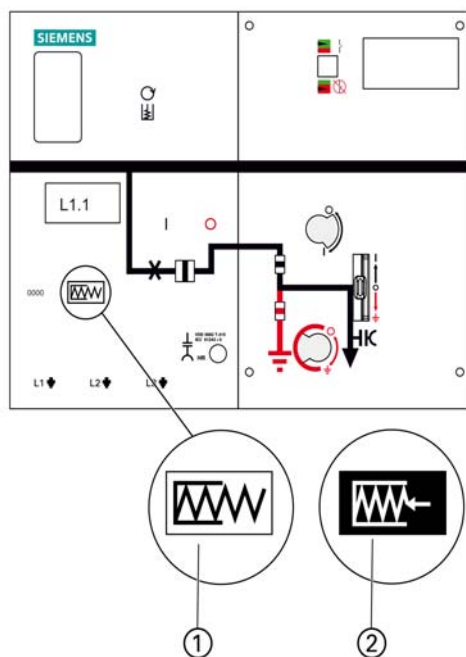


Fig. 111: Spring energy store indicator of the circuit-breaker type 2: "Spring not charged"

- ① Spring energy store indicator: "Spring not charged"
- ② Spring energy store indicator: "Spring charged"

Spring energy store indicator for circuit-breaker type 1.1



- ① Spring energy store indicator: "Spring not charged"
- ② Spring energy store indicator: "Spring charged"

Fig. 112: Spring energy store indicator of the circuit-breaker: type 1.1: "Spring not charged"

Preparations for lining up

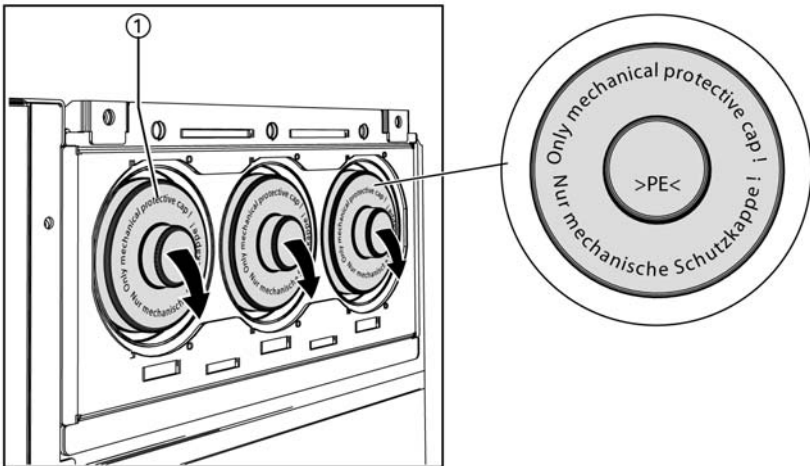
	DANGER!
	High voltage! Installation work on switchgear in operation is dangerous to life. ⇒ Make sure that high voltage and auxiliary voltage are off.

The first transport unit is on its mounting position and the others are placed at a small distance.

- ⇒ Align the first transport unit laterally.
- ⇒ Lay shims under the transport unit according to the measuring sheet of the base frame.
- ✓ All switchpanels must be in vertical position and at the same height.

12.6 Preparing panel interconnections

Preparation of left-hand panel

	ATTENTION!
	Remove the protective caps used for transport from the busbar bushes. Take care not to damage the busbar bushes. ⇒ The protective caps are only used as transport block. Do not use them as surge-proof caps under any circumstances. ⇒ Remove the protective caps downwards in inclined position. ⇒ Do not use any sharp or other objects as aids, which could damage the busbar bushes.  Fig. 113: Removing the protective caps from the busbar bushes

If they have not been pre-assembled at the factory, equip the right-hand busbar couplings with tension springs for earthing.

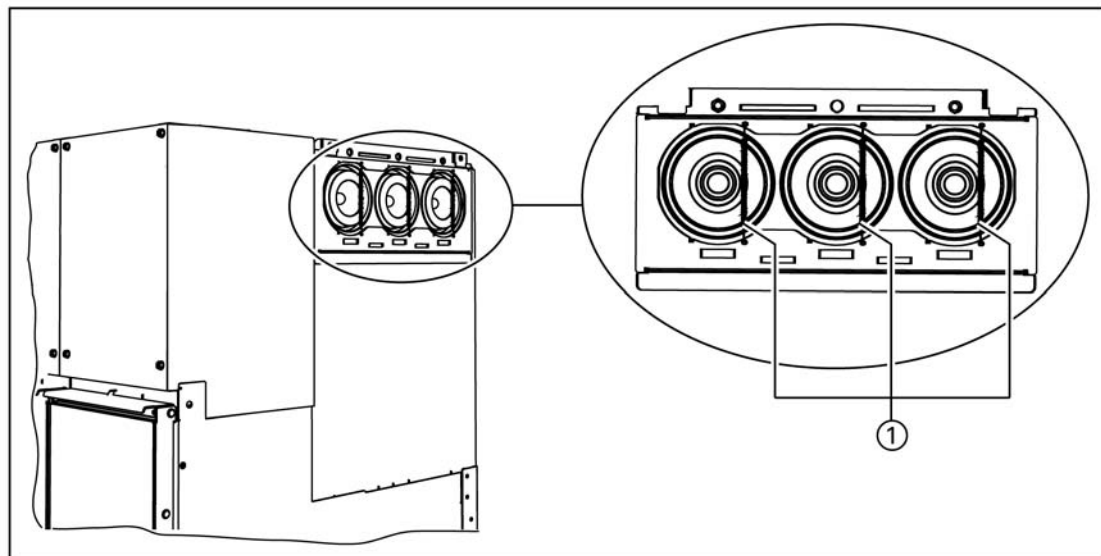


Fig. 114: Right-hand busbar coupling with tension springs for earthing

① Tension springs for earthing

⇒ Insert the guiding tension bolts ③ into the right-hand clamping plate (① and ②) and tighten them with nut-and-washer assemblies ④. Tightening torque: 30 Nm.

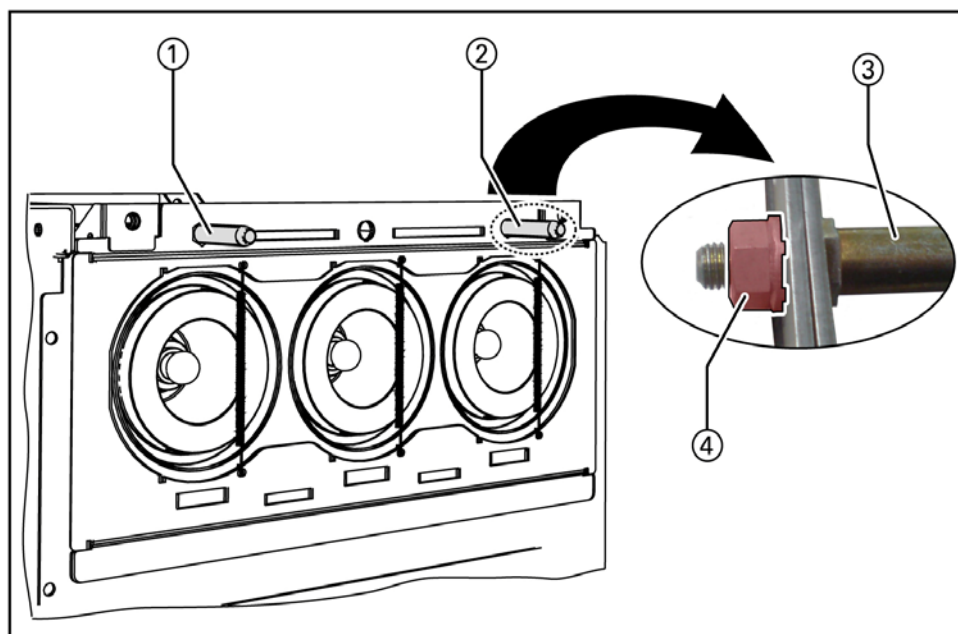


Fig. 115: Right-hand clamping plate with guiding tension bolts M8

① Guiding tension bolt at position 1

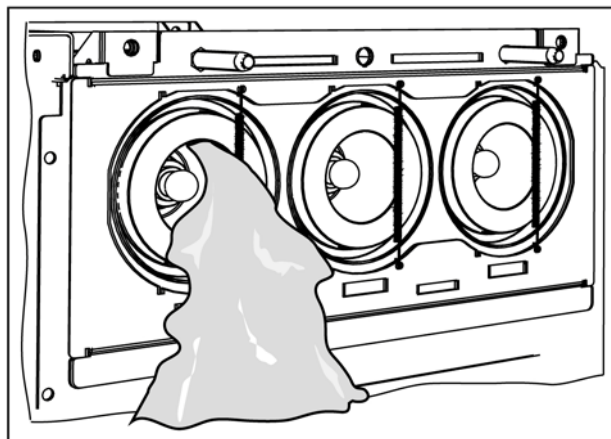
② Guiding tension bolt at position 2

③ Guiding tension bolt

④ Nut-and-washer assembly

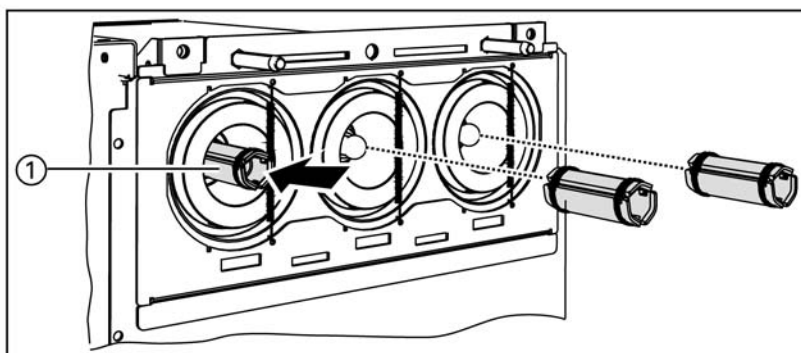
- ⇒ Clean the busbar bushes carefully inside with a lint-free cloth. Use the supplied mounting paste as cleaning agent.

	ATTENTION! Do only clean the cast resin, as the mounting paste (the grease) deteriorates the conductivity of the contact bolt! ⇒ Do not grease the contact bolt. Carefully remove the grease with a lint-free cloth, if necessary. ⇒ Do only clean the cast resin.
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	ATTENTION! Incorrectly inserted contact couplings can damage the switchgear. ⇒ Make sure that the contact couplings are seated in the bush completely and centrally.
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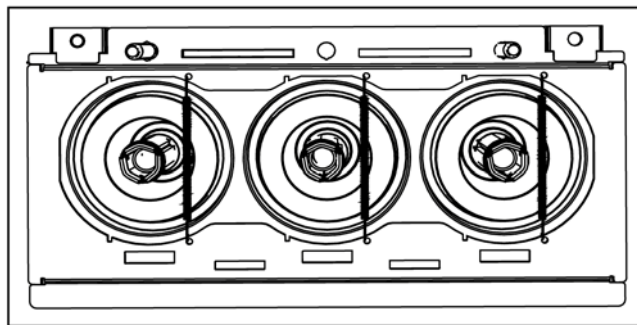
- ⇒ Push the contact coupling completely into the bush. Observe that the contact coupling is centered in the bush.
- ⇒ Push the contact couplings into the bushes as far as they will go.



① Contact coupling



Fig. 116: Incorrectly inserted contact coupling



All 3 contact couplings are correctly inserted in the busbar bushes

⇒ The silicone couplings are equipped with insertable sleeves at the factory.

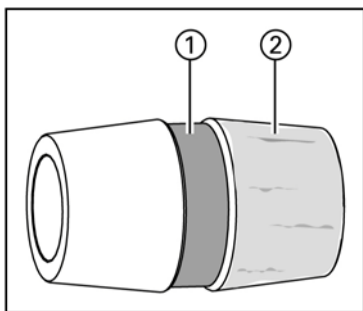
	ATTENTION!
	Observe extreme cleanliness. ⇒ Make sure that the insertable sleeves and silicone couplings are free of grease and pollution.

⇒ Clean the surfaces of the silicone couplings carefully.

	ATTENTION!
	If the electrical contact is insufficient or the push-on surfaces are dirty, the busbars will be damaged during operation. ⇒ The external layer of semi-conductive varnish must not be greased.

⇒ Grease the silicone coupling uniformly on one side only.

⇒ Use only the mounting paste provided for this purpose.



- ① External semi-conductive layer
- ② Greased side of silicone coupling

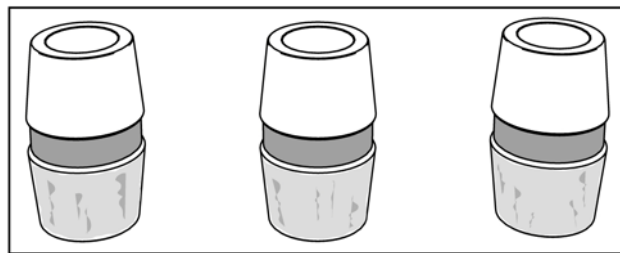


Fig. 117: Greased silicone couplings

⇒ Insert the silicone couplings - with the greased side - into the busbar bushes.



NOTE!

To simplify installation:

- ⇒ Turn the silicone coupling slightly while inserting.
- ⇒ Push the tension spring for earthing aside.

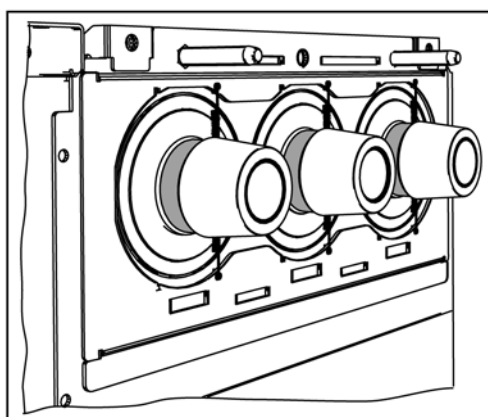
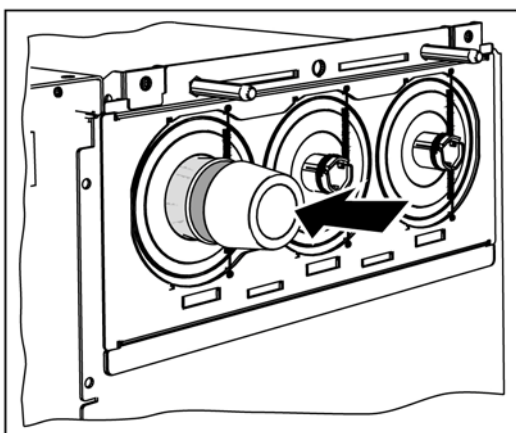
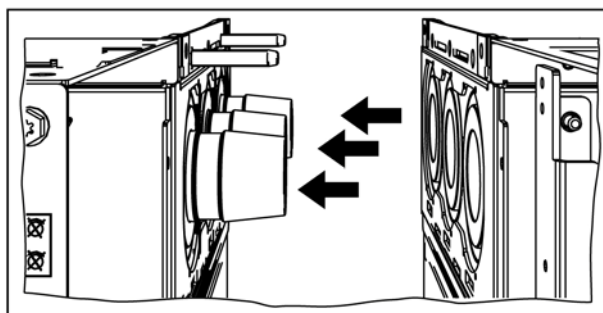


Fig. 118: All 3 silicone couplings greased on one side and correctly mounted

- ⇒ Push the silicone coupling into the busbar bush as far as it will go.
- ⇒ The tension spring for earthing must touch the semi-conductive layer of the silicone coupling (visual inspection).

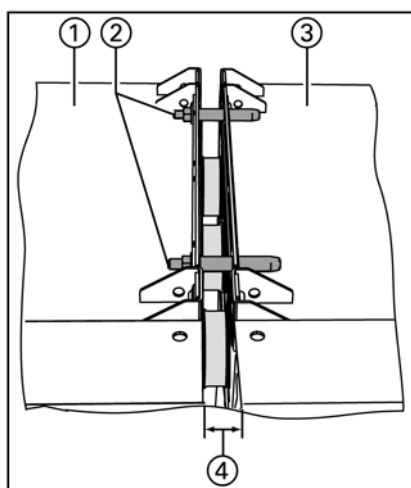
Preparation of right-hand panel

- ⇒ Clean the busbar bushes of the panel to be lined up carefully.
- ⇒ Grease the entire surface of the ungreased side of the silicone coupling.
- ⇒ Push the panel to be lined up close to the fixed-mounted switchgear panel.



- ⇒ "Thread" the panel to be lined up into the guiding tension bolts of the fixed-mounted switchgear panel.

Lining up



- ① Fixed-mounted switchgear, on the left
- ② Guiding tension bolts (screwing direction from the left to the right)
- ③ Switchgear to be lined up, on the right
- ④ Distance between the switchgear panels approx. 30 mm

Fig. 119: Guiding tension bolts threaded into the switchgear to be lined up (view from above)

- ⇒ Please observe that the distance between the two switchgear panels is approx. 30 mm.

- ⇒ Interconnect both switchgear panels with bolts M8 x 40 at the upper panel connection each (screwing direction from the right to the left).

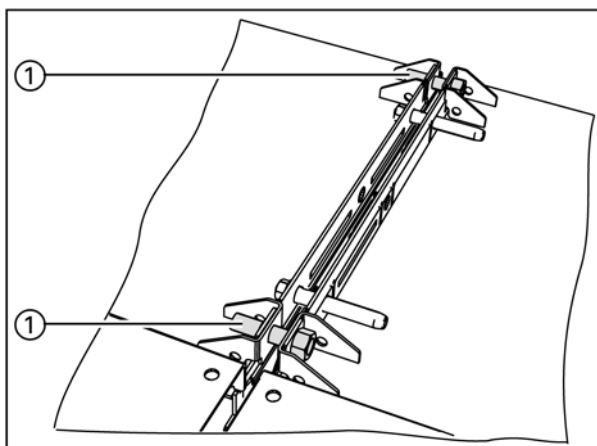
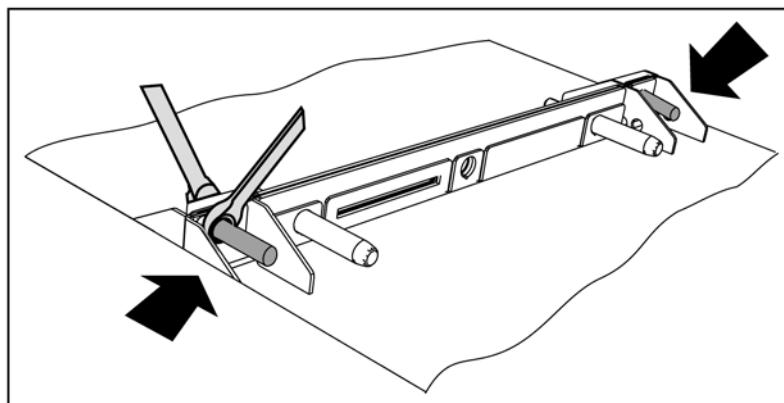


Fig. 120: Mounting the panel connecting bolts (view from above)

① Panel connecting bolts

- ⇒ Tighten the two panel connecting bolts alternatively to establish a uniform distance between the panels when bolting tight.
- ⇒ Then tighten the lower bolts in the subframe of the panels.
- ⇒ Tighten the panel connecting bolts until the two clamping plates are joined without any gaps.



ATTENTION!

Please observe for the right-hand switchgear side:

- ⇒ Screw the panel connecting bolts M8 x 20 into the setnuts provided for this purpose from the left to the right.

- ⇒ Tighten all panel connecting bolts in the subframe. Tightening torque: 30 Nm.

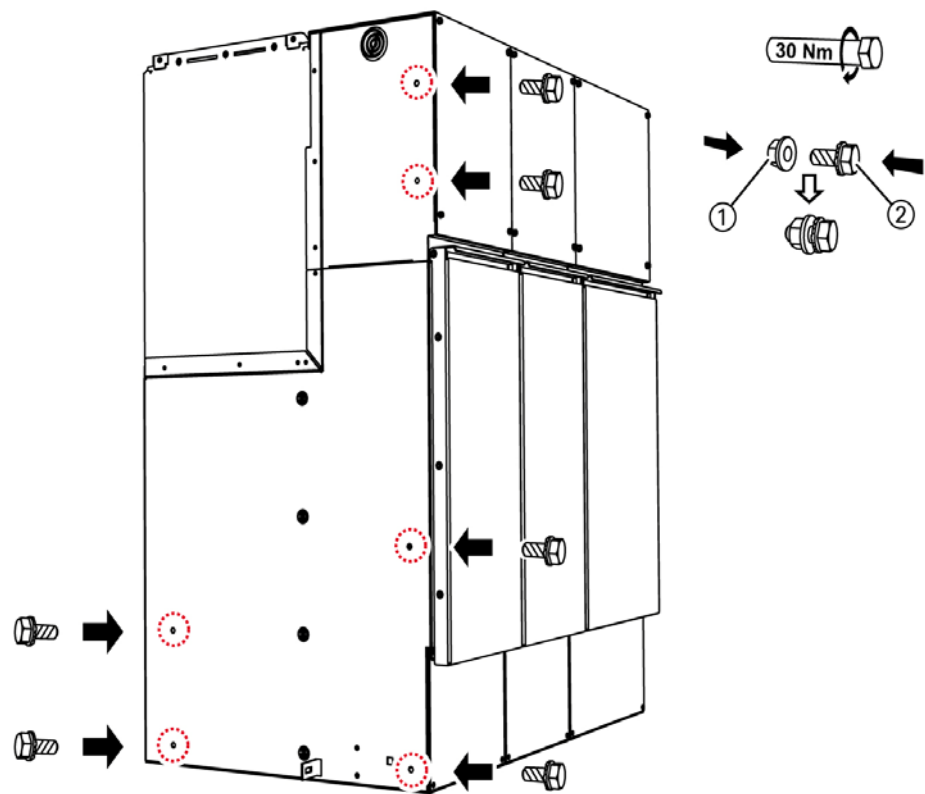


Fig. 121: Overview of bolted joints at the switchgear (example: R panel)

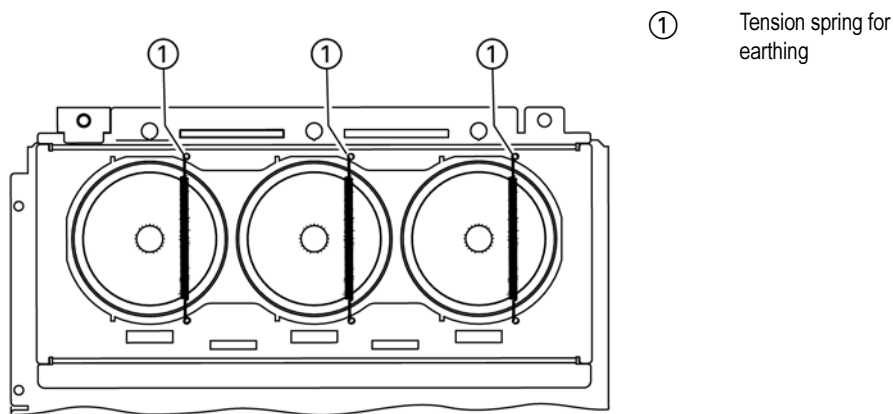
- ① Nut-and-washer assembly M8 ② Bolt-and-washer assembly M8 x 20

- ⇒ Bolt extended panel to the foundation.
- ⇒ Repeat the previous operations until all panels have been interconnected.

12.7 Mounting the busbar termination

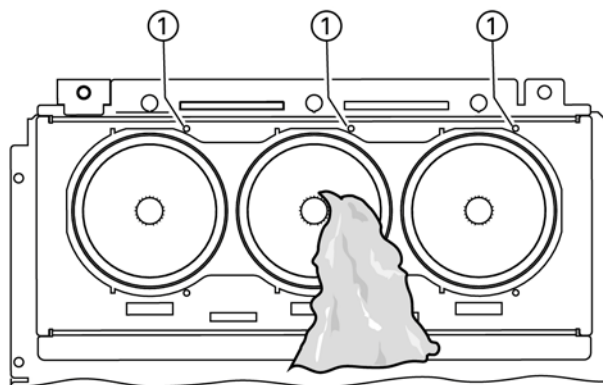
Preparing installation of the busbar coupling in the end panel

- ⇒ Busbar couplings can be equipped with tension springs for earthing.



	ATTENTION! For correct installation of the busbar coupling in the end panel: ⇒ Remove tension springs for earthing.
--	--

⇒ Clean the busbar bushes carefully.



⇒ The silicone dummy plugs are equipped with insertable sleeves at the factory.

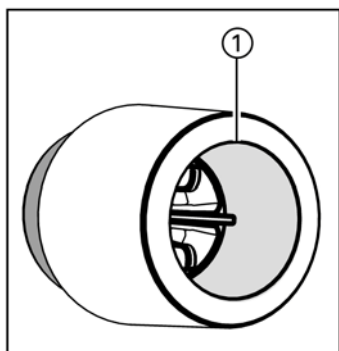


ATTENTION!

Observe extreme cleanliness.

⇒ The insertable sleeve and the silicone dummy plug must be free of pollution and grease.

⇒ Clean the surface of the silicone dummy plugs carefully.



① Insertable sleeve

Fig. 122: Silicone dummy plug with fitted insertable sleeve



ATTENTION!

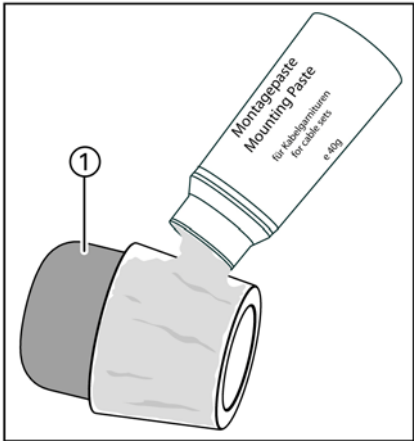
If the electrical contact is insufficient or the push-on surfaces are dirty, the conductive layer of the silicone dummy plug loses its conductivity. This causes the damage of the silicone dummy plug during operation.

⇒ The external layer of semi-conductive varnish must **not** be greased.

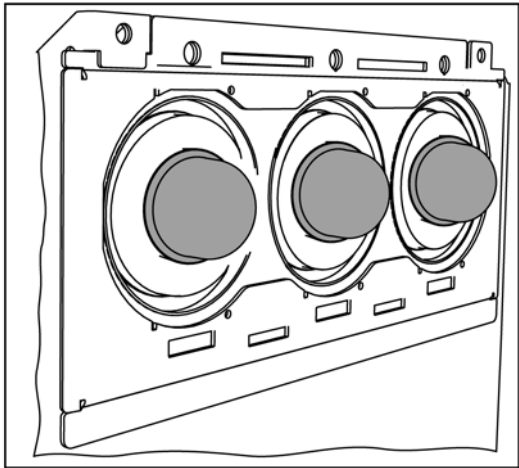
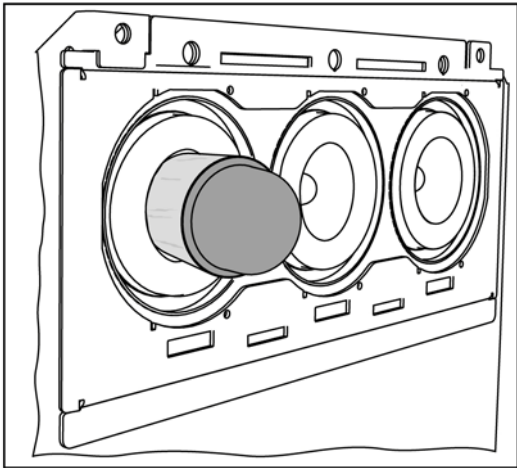
⇒ Grease the silicone dummy plug uniformly.

⇒ Use only the mounting paste provided for this purpose.

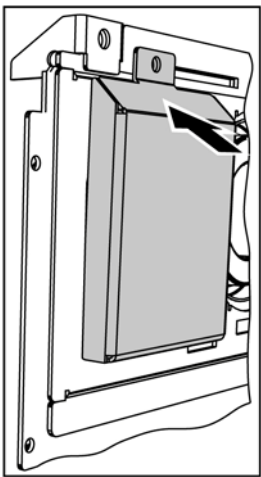
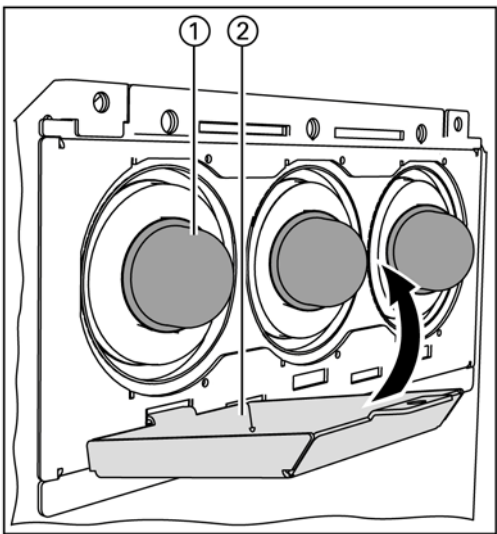
① external layer of semi-conductive varnish



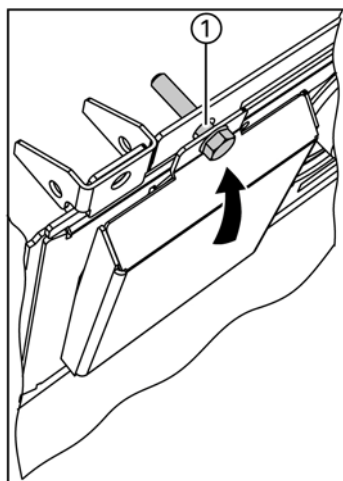
Closing busbar termination in a surge-proof way ⇒ Insert the dummy plugs.



⇒ Mount the clamping cover for the dummy plugs.

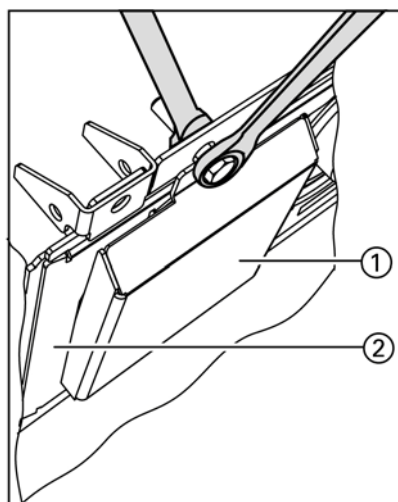


- ① Silicone dummy plug with insertable sleeve
- ② Clamping cover for dummy plugs



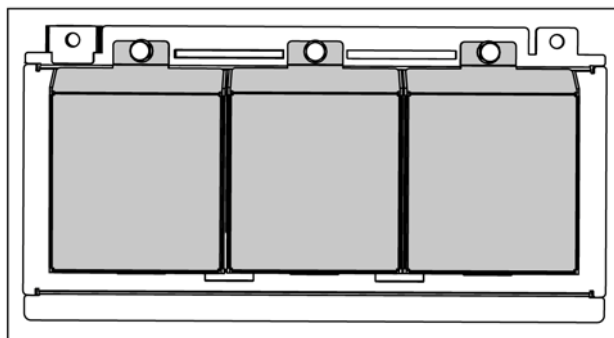
① Bolted joint

- ⇒ Press the clamping cover for dummy plugs on softly and fix it with the bolted joint M8.
- ⇒ Tighten the clamping cover for dummy plugs. Tightening torque: 30 Nm. In this way, the dummy plugs are fixed simultaneously.

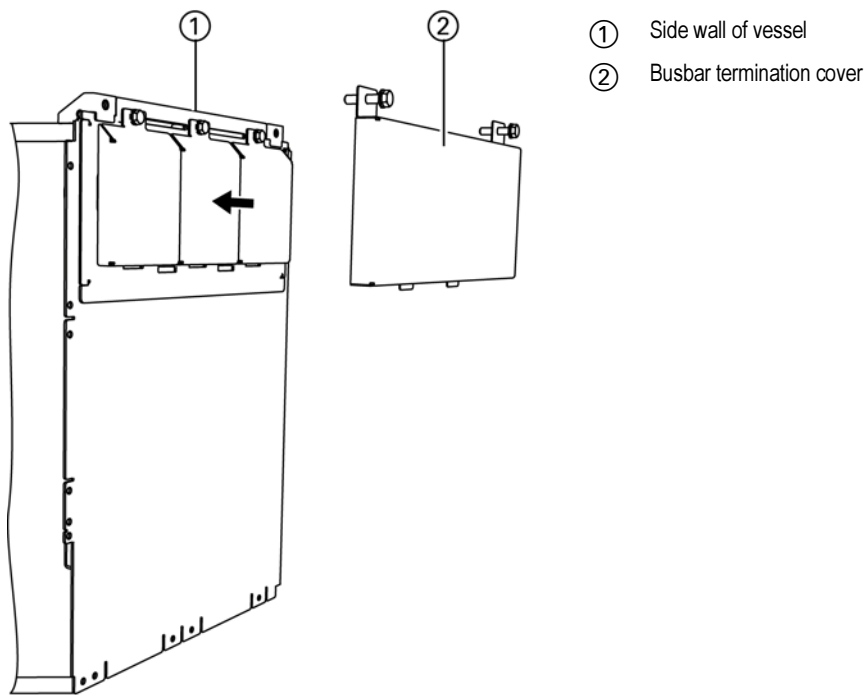


① Clamping plate
② Clamping cover for dummy plugs

- ⇒ Prepare the other two connections in the same way.



- ⇒ Lay the busbar termination cover over the three clamping covers for dummy plugs and fasten it. Tightening torque: 30 Nm.



12.8 Switchgear earthing

In the case of non-extendable switchgear, the switchgear is connected to the substation earth through an earthing bolt. In extendable switchgear assemblies, earthing takes place at the earthing point of the earthing busbar.

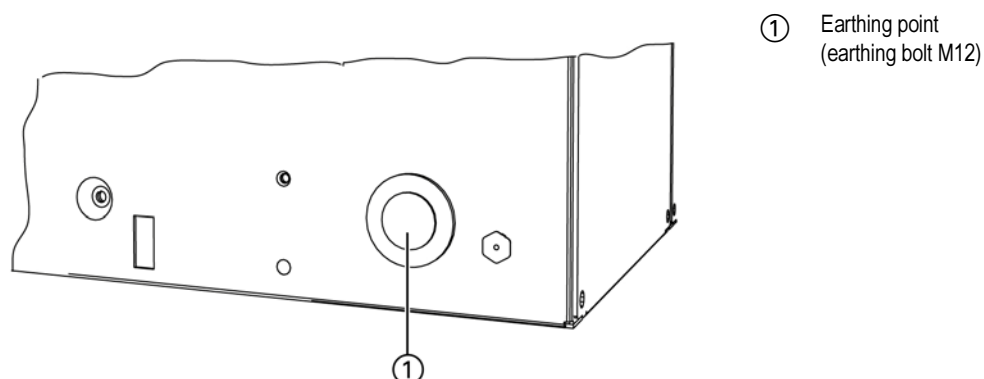


Fig. 123: Earthing via earthing point in **non**-extendable switchgear - view from outside

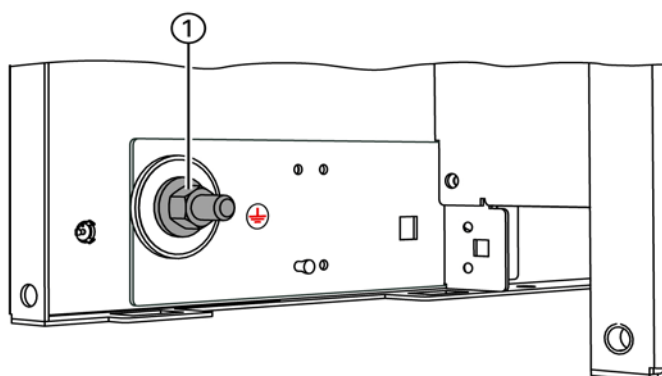


Fig. 124: Earthing via earthing point in **non**-extendable switchgear - view into cable compartment

⇒ Connect the earthing terminal (bolt M12) of one panel to the substation earth.

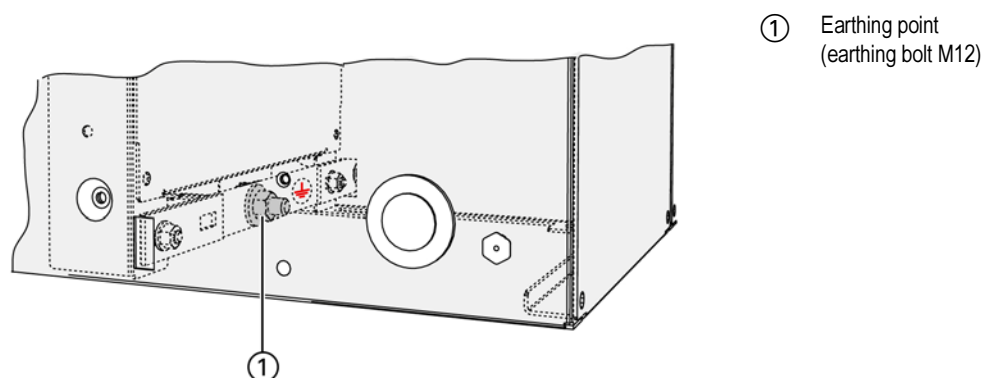


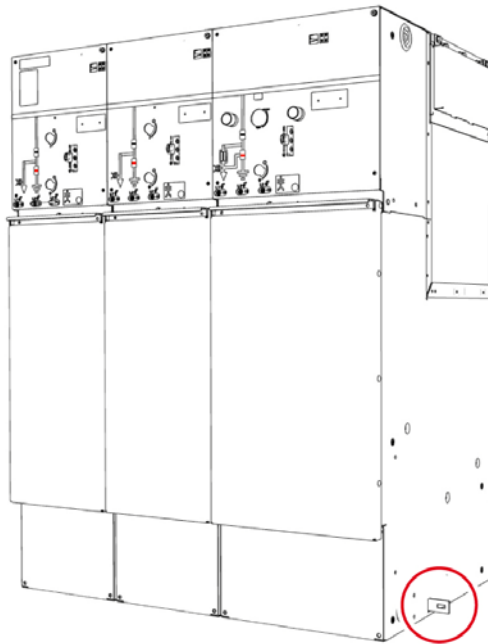
Fig. 125: Earthing via earthing point of earthing busbar in extendable switchgear

⇒ In blocks with up to 4 panels, it is enough to connect them to the substation earth once.

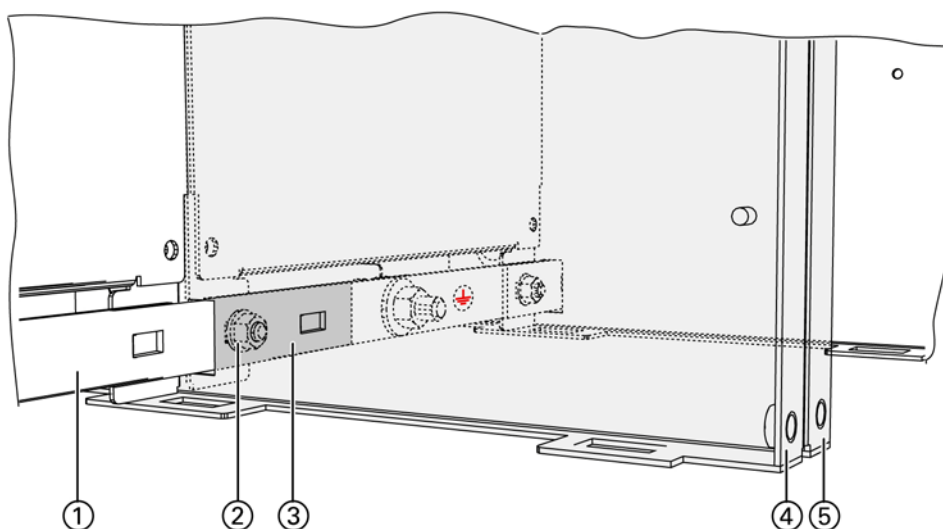
⇒ In panel groups of more than 4 panels, earth every fifth panel.

12.9 Installing the earthing busbar

The units of the earthing busbar must be interconnected at the joints of the panel blocks or individual panels.



⇒ Detach the pre-assembled link provided at the joint. To do this, remove the bolt M8.



- ① Earthing busbar of left-hand panel
- ② Bolt M8; tightening torque: 20 Nm
- ③ Link
- ④ Partition of left-hand panel
- ⑤ Partition of right-hand panel

Fig. 126: Detaching the link of the earthing busbar

⇒ Brush oxidized copper surfaces and apply a thin film of mounting paste.

⇒ Push the link through the opening in the side wall of the subframe, and bolt it together with the adjacent unit of the earthing busbar.

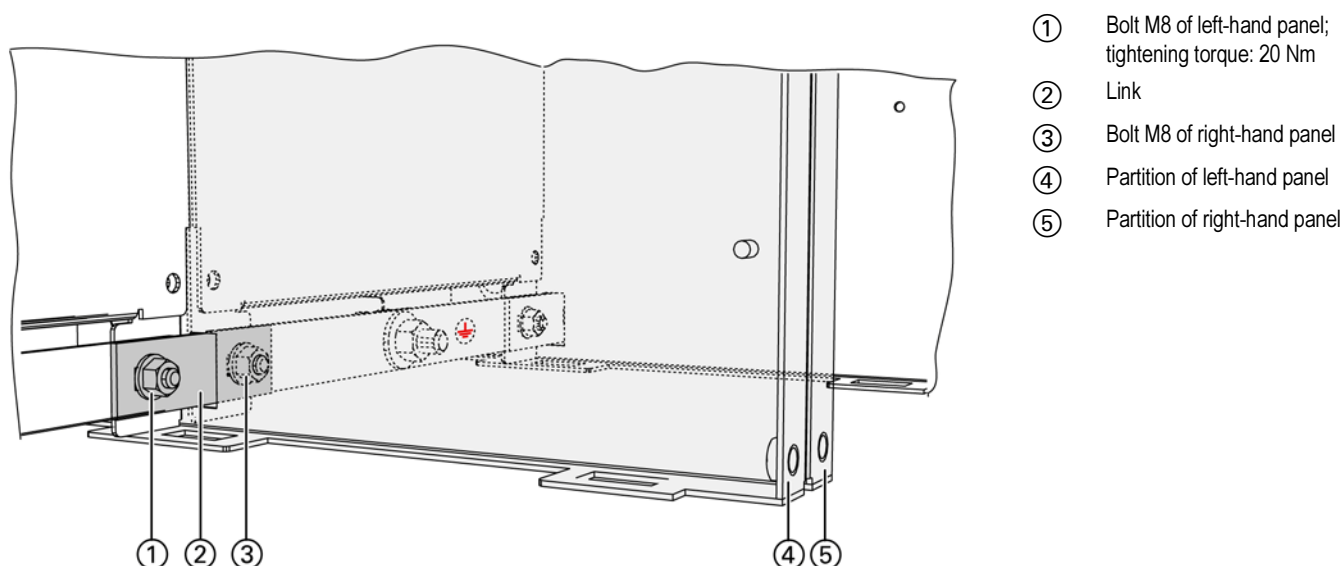


Fig. 127: Interconnecting the earthing busbars of the panels with the link

- ⇒ Proceed in the same way with the other joints.
- ✓ Now the units of the earthing busbar of the complete switchgear are interconnected.
- ⇒ After that, refit the cable brackets on all panels if these had been removed before.

12.10 Retrofit of motor operating mechanism

Options for motor operating mechanism

The manual operating mechanisms of 8DJH switchgear can be equipped with motor operating mechanisms for the three-position switch-disconnector.

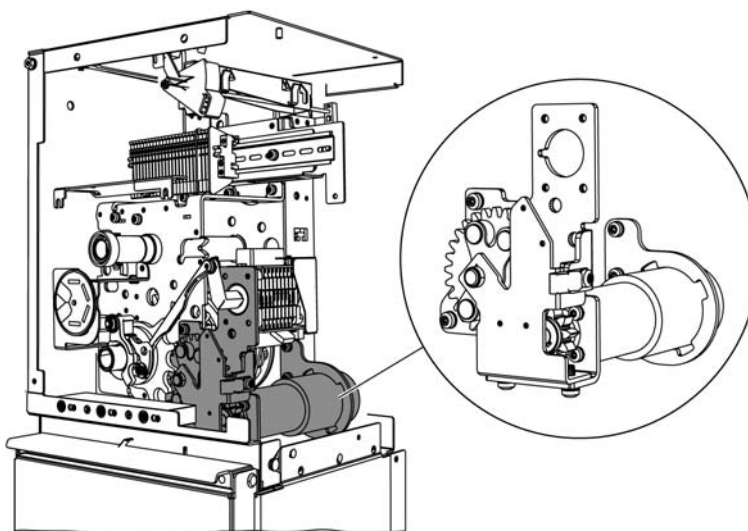


Fig. 128: Motor block assembly of spring-operated mechanism in ring-main feeder

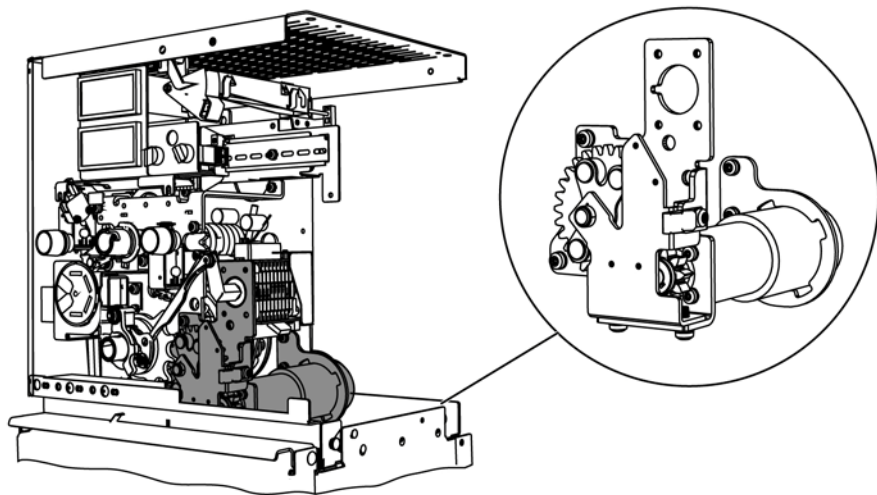


Fig. 129: Motor block assembly of spring-operated/stored-energy mechanism in transformer feeder

12.11 Installing low-voltage compartments

**Low-voltage compartments
pre-assembled at the
factory**

All circuit-breaker panels are equipped with low-voltage compartments to accommodate the secondary equipment; other panel types just according to their design.

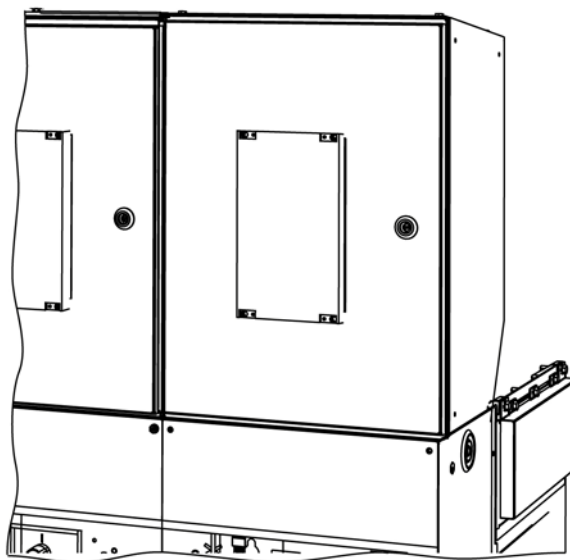


Fig. 130: Low-voltage compartment completely mounted on the switchgear panel

Normally, the low-voltage compartments are already mounted on the associated panel. After joining the panels, bolt the low-voltage compartments together at the joint at 3 points.

**Low-voltage compartments
supplied separately**

- ⇒ Put the low-voltage compartment on top of the associated panel.
- ⇒ Bolt the base plate of the low-voltage compartment together with the roof plate of the panel at the four corners. To do this, use four bolts M8.

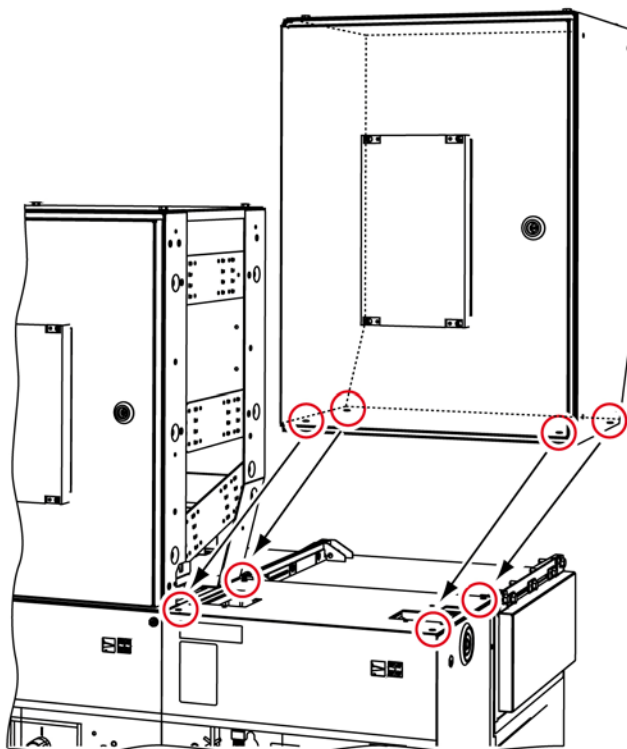


Fig. 131: Bolting low-voltage compartment together with panel

- ⇒ Proceed in the same way with the other low-voltage compartments.
- ⇒ Bolt the low-voltage compartments of adjacent panels together. To do this, use three bolts M8.

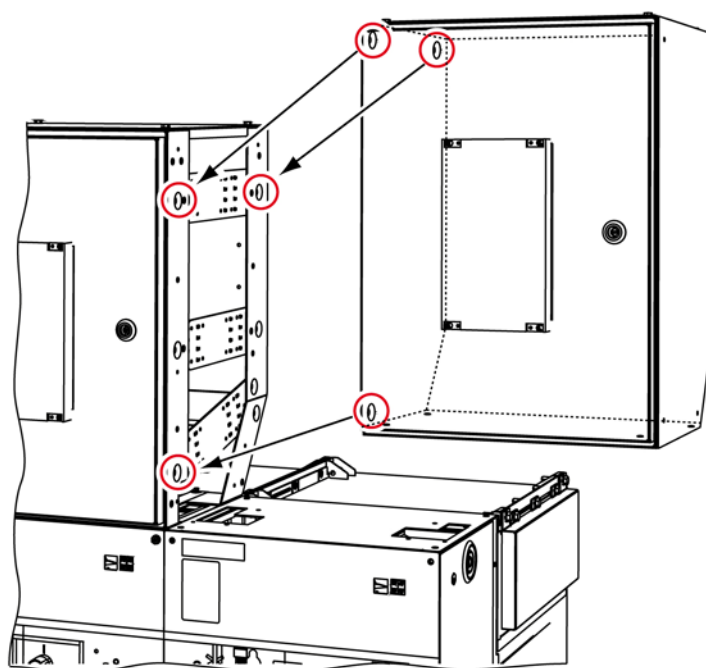


Fig. 132: Bolting low-voltage compartment together with panel

⇒ Establish the electrical connection according to the circuit manual.

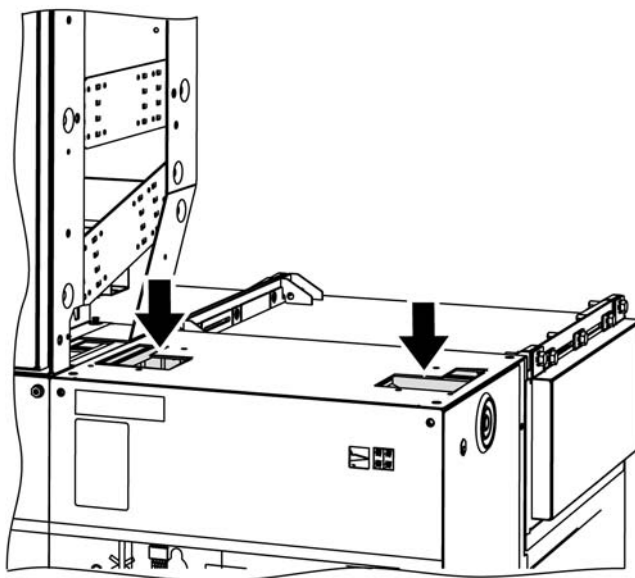


Fig. 133: Cutouts for low-voltage cables

13 Billing metering panel type M

13.1 Overview: Possibilities of connection for current and voltage transformers in the billing metering panel type M

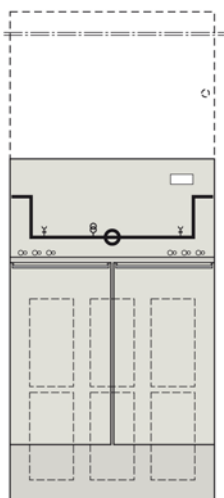


Fig. 134: Metering panel type busbar-busbar

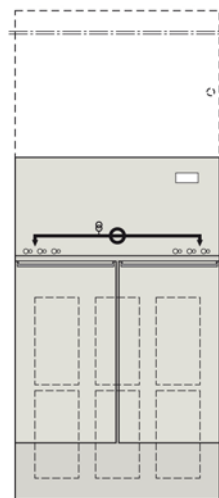
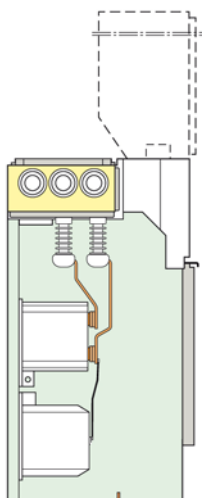


Fig. 135: Metering panel type cable-cable

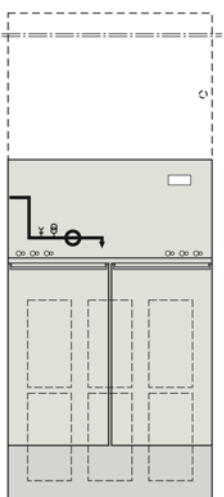
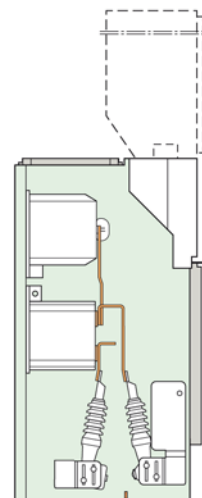


Fig. 136: Metering panel type busbar-cable

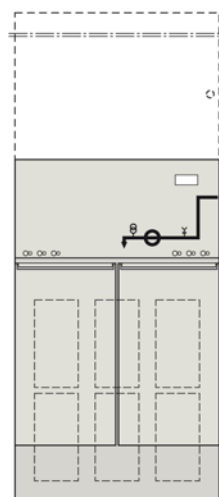
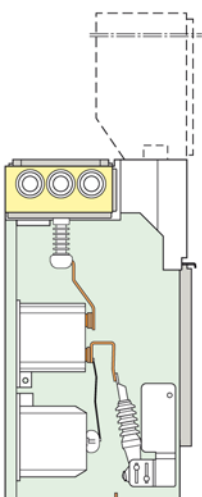
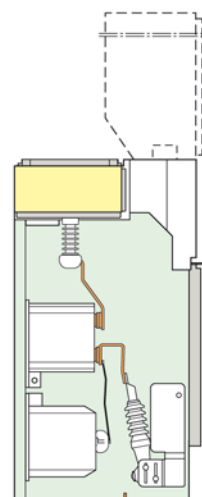


Fig. 137: Metering panel type cable-busbar



13.2 Routing of currents and bars in the metering panel

The direction of the current flow in the metering panel is from the left to the right side of the switchgear. The voltage transformers can be connected upstream of downstream of the current transformer.

Top view into the open vessel with the bushings and the busbars

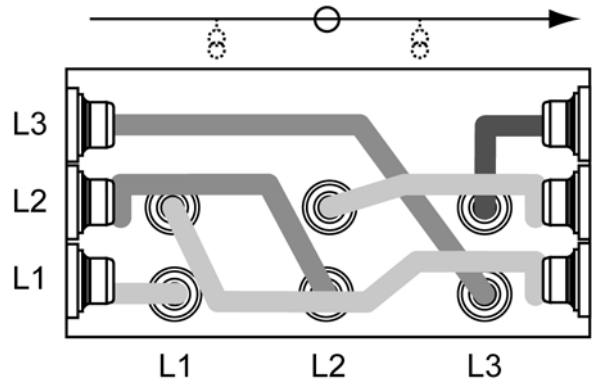


Fig. 138: Metering panel type **busbar-busbar**

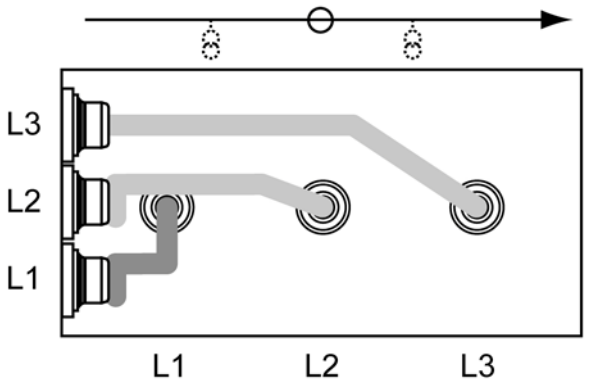


Fig. 139: Metering panel type **busbar-cable**

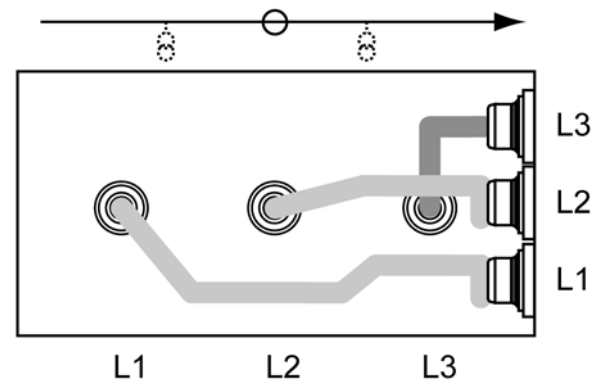


Fig. 140: Metering panel type **busbar-cable**

13.3 Installing transformers in the metering panel

	ATTENTION! To avoid personal and material damages, only transformers complying with the following standards may be used untested: ⇒ Dimensions according to DIN 42600-8 for current transformers 4MA7 ⇒ Dimensions according to DIN 42600-9 for voltage transformers 4MR
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Mounting position of the Z angle at the C profile

- ⇒ For 12 kV version: Z angle to fasten the C profile, turned to the front. For 24 kV version: Z angle to fasten the C profile, turned to the rear.

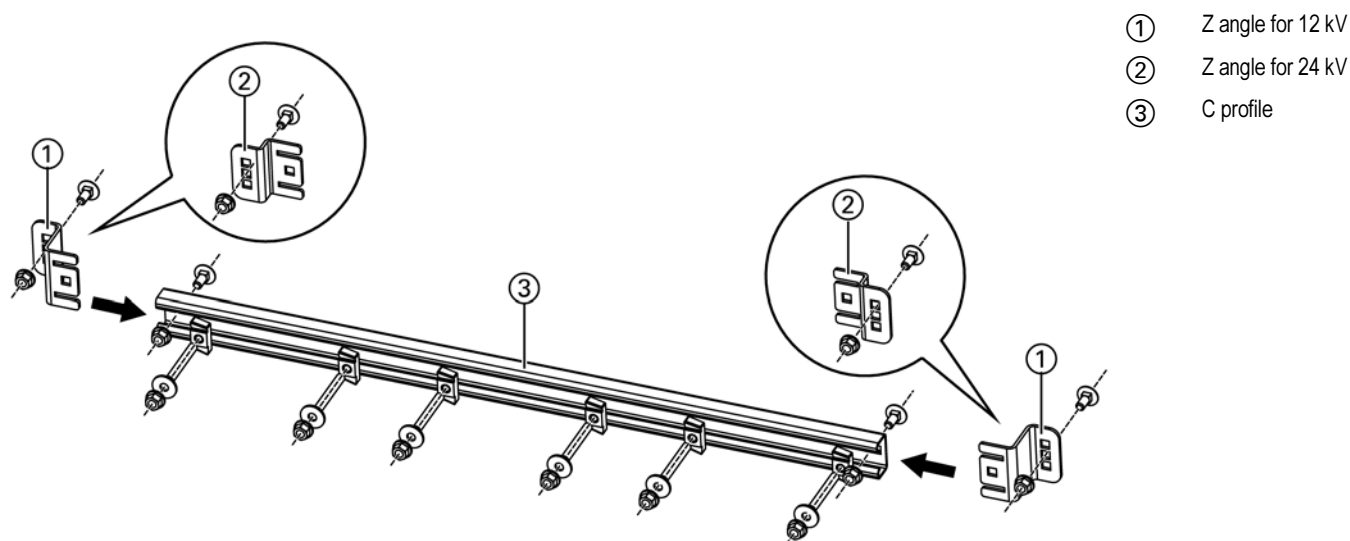


Fig. 141: Overview: Z angle

- ⇒ Bolt the current and voltage transformers for phase L2 centrally on the C profiles.
- ⇒ Bolt the other transformers onto the C profiles on both sides of the previously fixed transformer at a distance of 250 ± 2 mm each.

Dimensions and mounting positions of transformers in the metering panel

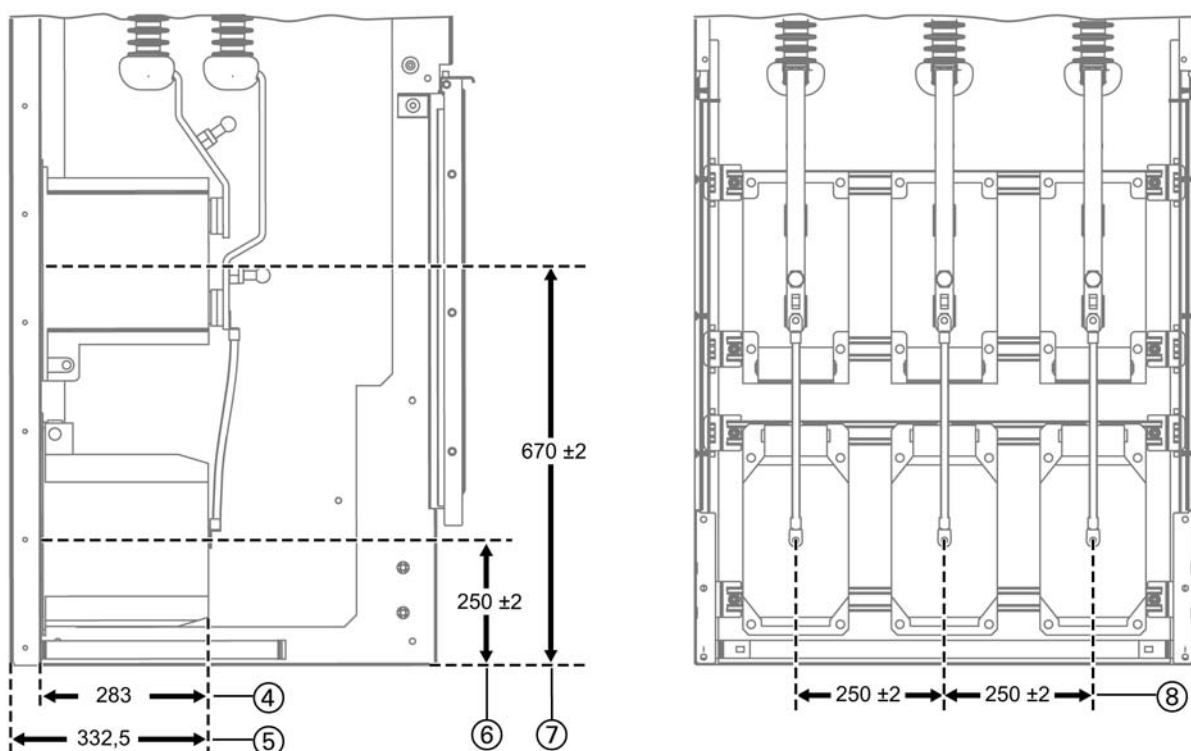


Fig. 142: Dimensions and mounting positions of transformers in air-insulated metering panel **type busbar-busbar**

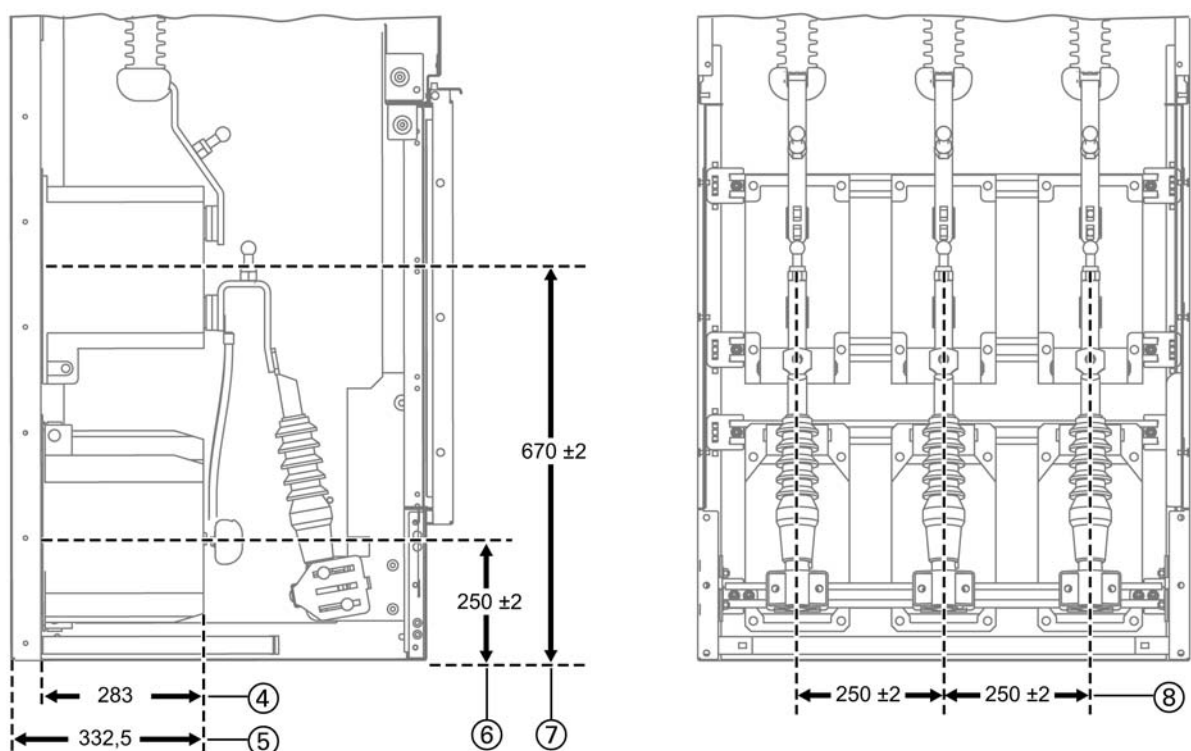


Fig. 143: Dimensions and mounting positions of transformers in air-insulated metering panel **type busbar-cable and cable-busbar**

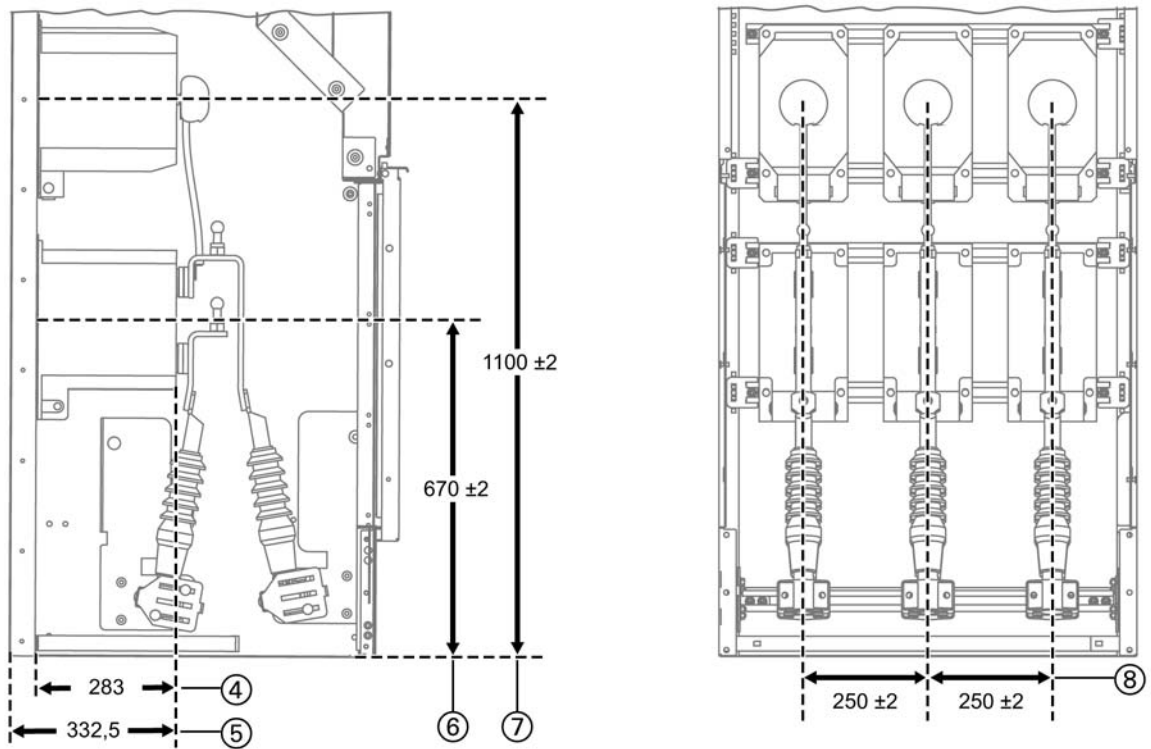


Fig. 144: Dimensions and mounting positions of transformers in air-insulated metering panel **type cable-cable** for 24 kV

- ④ Transformer height
 - ⑤ Dimension: From transformer to rear edge of rear wall
 - ⑥ Dimension: Center of transformer 1 to lower edge of panel
 - ⑦ Dimension: Center of transformer 2 to lower edge of panel
 - ⑧ Distance between the transformers, measured from the center of the transformer
- (Dimensions are given in mm)

Connecting current transformers

	ATTENTION! Insufficient electrical contact increases the contact resistance. ⇒ Clean oxidized contact points. ⇒ Do not damage contact surfaces. ⇒ Mount the busbar without distortions and gaps.
	ATTENTION! Polluted vessel bushings will cause flashovers. ⇒ Clean vessel bushing.
	ATTENTION! Low insulation at the busbar will cause damages at the switchgear due to voltage transitions. ⇒ Mount the control cap at the vessel bushing. ⇒ Check the control cap insulation for defective spots.

Connecting the busbar

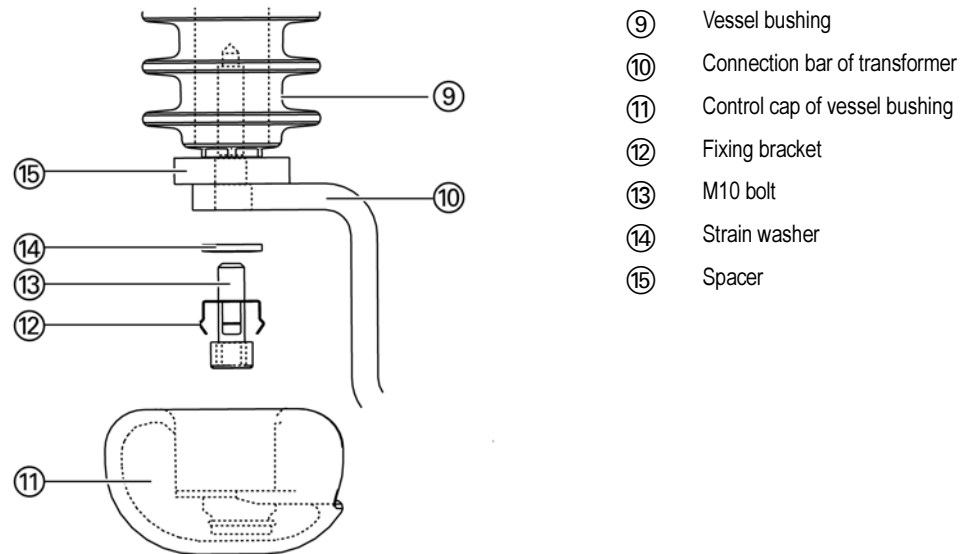


Fig. 145: Example: Connecting the busbar at the metering panel type busbar-busbar

- ⇒ Clean the vessel bushing with cleaning agent and a lint-free cloth.
- ⇒ Dry the vessel bushing with a lint-free cloth.
- ⇒ Fit bolted joints with nuts M10. Tightening torque: 50 Nm.
- ⇒ Mount the control cap with the fixing bracket onto the vessel bushing of the busbar.
- ⇒ Verify firm seat of control cap.

Connecting current transformers at the metering panel

- ⇒ Mount the spacers and the connection bar of the busbar on the transformer.
- ⇒ Fit bolted joints with nuts M12. Tightening torque: 40 Nm.

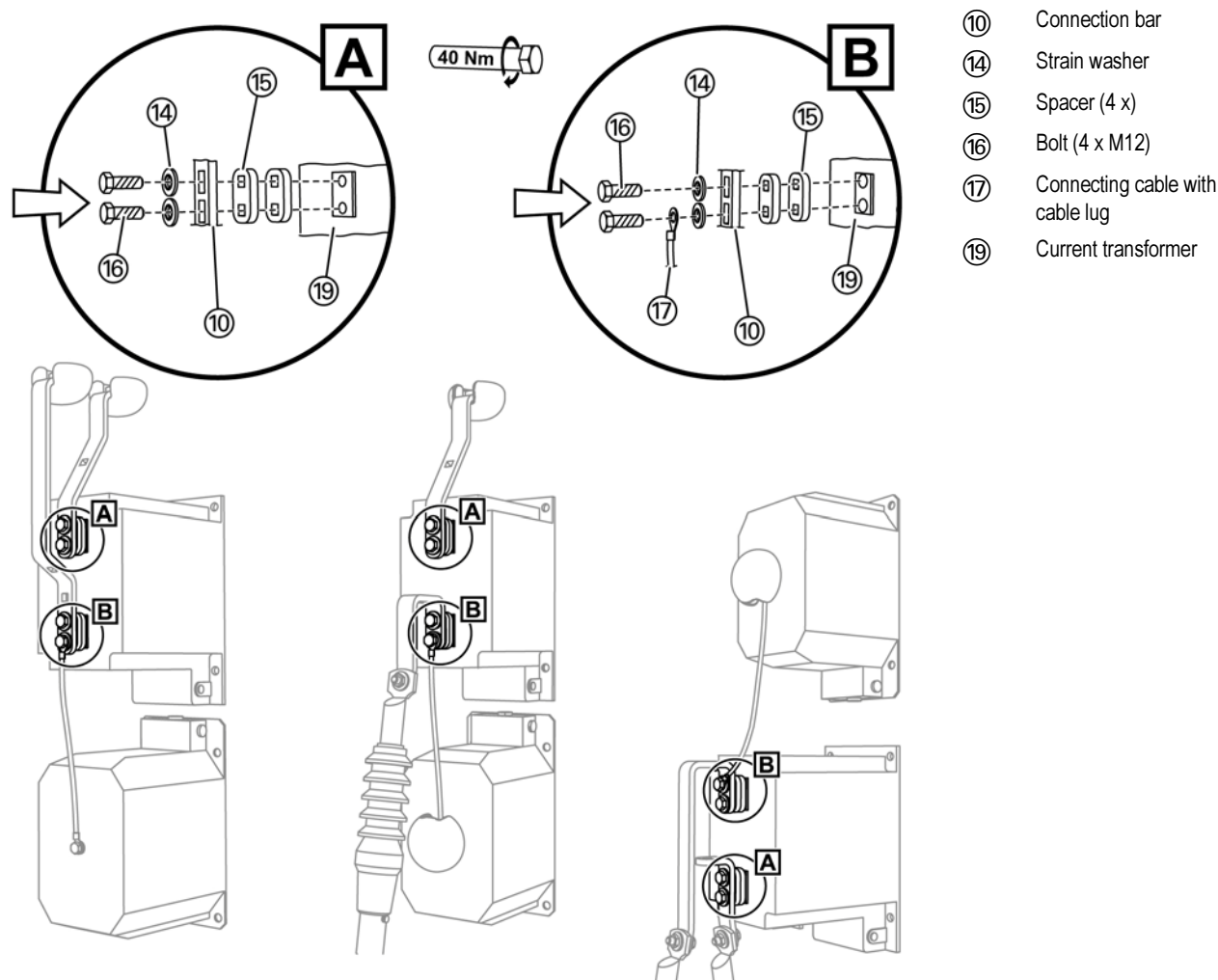


Fig. 146: Current transformer connection in the metering panel

Connecting voltage transformers

	ATTENTION! Risk of flashover if the minimum distances between the connecting cables of the current and voltage transformers are too small. ⇒ Cut the connecting cables between the current and voltage transformers in a suitable way, so that the requested minimum distances to live parts are guaranteed during operation. ⇒ The deflection of the connecting cable between the current and the voltage transformer may not be more than 10 mm in every direction.
	ATTENTION! Risk of flashover if the minimum distances between live parts and the flexible steel tubes for cable routing are too small. ⇒ If flexible steel tubes are used in the cable compartment for cable routing: Lay the flexible steel tube keeping enough minimum distance to live parts.

In metering panels type busbar-busbar, busbar-cable and cable-busbar, the voltage transformers are pre-assembled in the metering panels **below** the current transformers at the factory. In the metering panel type cable-cable, the voltage transformers are pre-assembled in the metering panels **above** the current transformers at the factory.

The voltage transformers must be connected to the current transformers on site with the connecting cables supplied with the voltage transformers.

The voltage transformers can be connected either at the lower or upper terminals of the current transformers, depending on the circuit diagrams.

- ⇒ Cut the connecting cable to suit the distance between the current and voltage transformer terminal.
- ⇒ Strip the insulation of the connecting cable and press the cable lug on.
- ⇒ Connect the connecting cable to the current and voltage transformer according to the circuit diagrams.

The deflection between the connecting cable of current and voltage transformer may not be more than 10 mm in each direction.

It is permissible for the flexible connecting cable to touch parts of the same phase.

Cutting the connecting cable between the voltage and the current transformer to the desired length

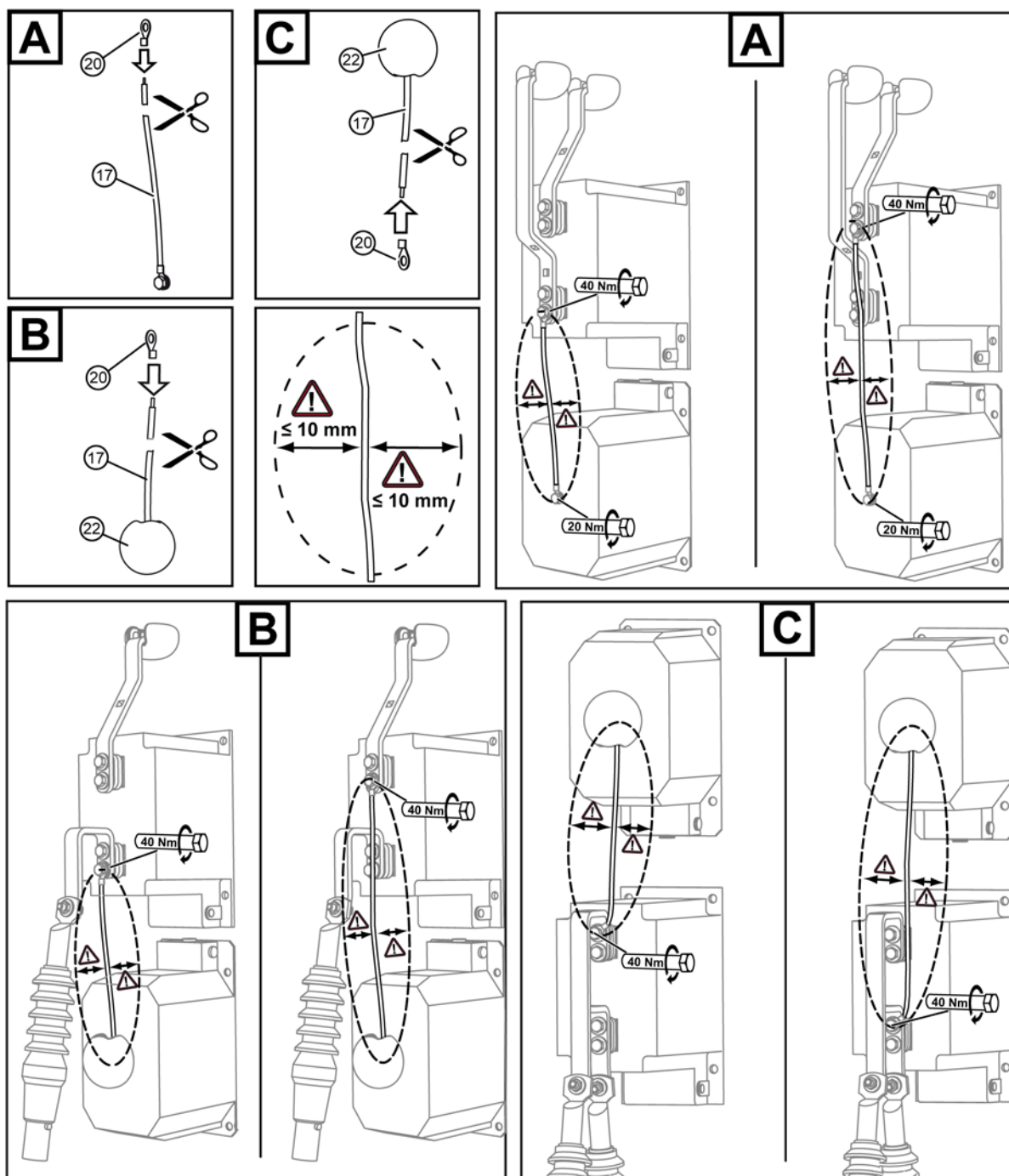


Fig. 147: Overview: Connecting cable mounted at the upper and lower current transformer terminal

17 Connecting cable between current and voltage transformer
20 Cable lug

22 Control cap at the voltage transformer

2-pole voltage transformer

Cutting the connecting cable between the voltage and current transformer to the desired length

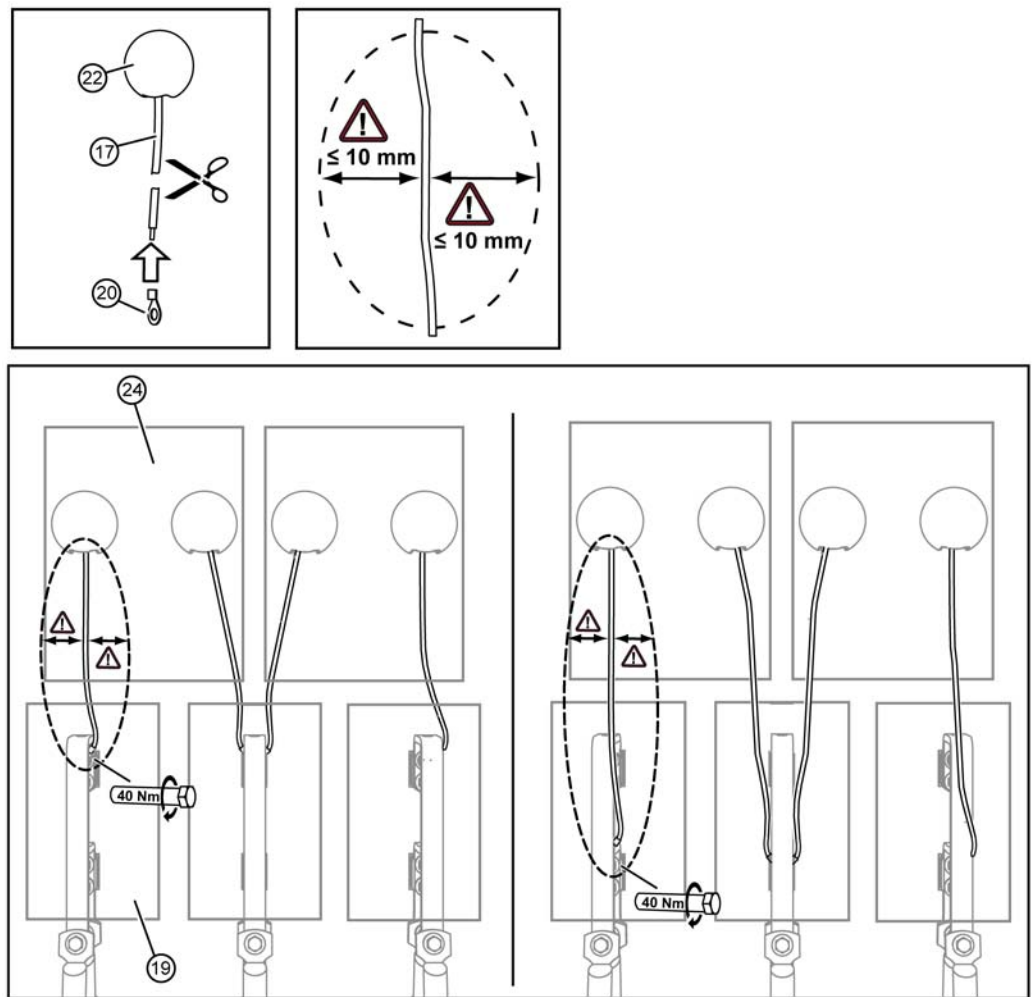


Fig. 148: Overview: Connecting cable mounted at the upper and lower current transformer terminal

17	Connecting cable between current and voltage transformer	22	Control cap of voltage transformer
19	Current transformer	24	2-pole voltage transformer
20	Cable lug		

13.4 Connecting high-voltage cables in the metering panel

	ATTENTION!
	When connecting the cable ends, please observe the following: ⇒ Mount the sealing end according to the manufacturer's stipulations. ⇒ If the manufacturer has not made any stipulations, the bolted joints must be tightened with max. 50 Nm.

Minimum distances for cable connections

The following minimum distances must be adhered to for connection of high-voltage cables in metering panels.

	ATTENTION!
	Risk of flashover if the minimum distances between high-voltage cables and live or earthed parts are too small. ⇒ Minimum distances according to IEC 61939/VDE 0101 must be observed and checked during installation of the high-voltage cables, and verified: - For 24 kV, the minimum distance is ≥ 220 mm - For 12 kV, the minimum distance is ≥ 120 mm ⇒ If the minimum distances are too small, it must be proved by means of a dielectric test that there is no risk of flashover.

⇒ Connect high-voltage cables at the upper and lower current transformer terminal.

Constructional distances for the cable connections in the metering panel (dimensions given in mm)

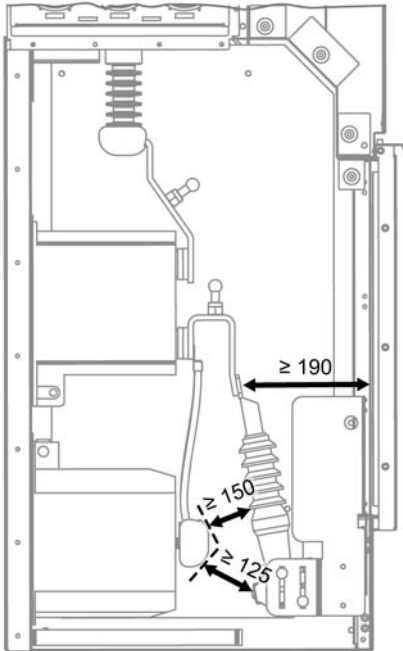


Fig. 149: Metering panel type busbar-cable and cable-busbar

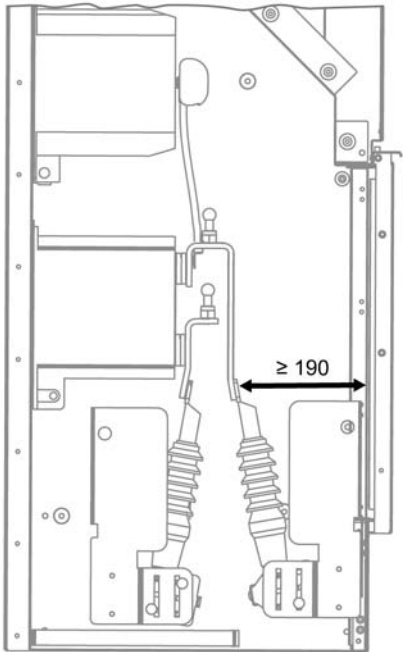


Fig. 150: Metering panel type cable-cable

13.5 Mounting position of the earthing bolts in the metering panel

To earth the metering panel busbars or the high-voltage cables when the current transformers are removed, earthing bolts must be mounted on the busbars or the cable connection links. The earthing bolts are available as accessories.

⇒ Mount the earthing bolts directly on the connection bars at the current transformer, at the upper or lower cable connection link. Tightening torque: 25 Nm.

Possible mounting positions of the earthing bolts

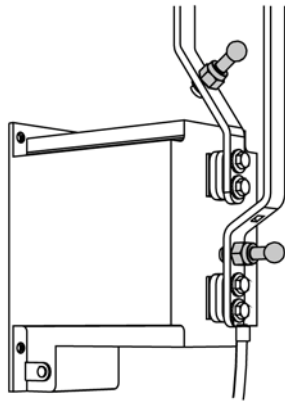


Fig. 151: Earthing bolts on type busbar-busbar

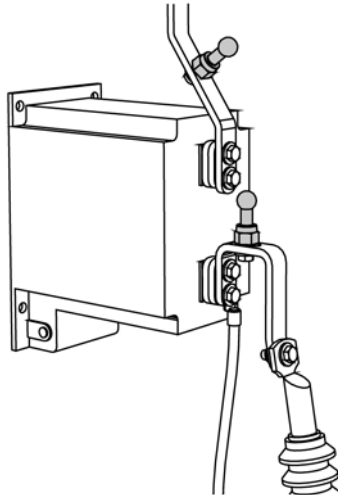


Fig. 152: Earthing bolts on type busbar-cable (cable-busbar type accordingly)

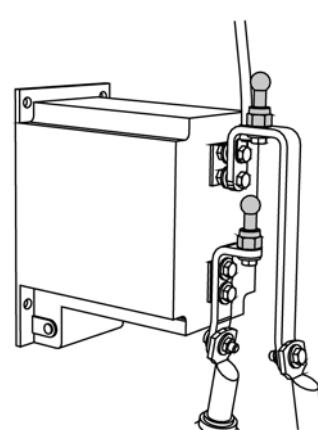


Fig. 153: Earthing bolts on type cable-cable

	ATTENTION! Risk of flashover if the minimum distances between the earthing bolts and live parts are too small. ⇒ Minimum distances according to IEC 61939/VDE 0101 must be observed and checked during installation of the earthing bolts. - For 24 kV, the minimum distance is ≥ 220 mm - For 12 kV, the minimum distance is ≥ 120 mm
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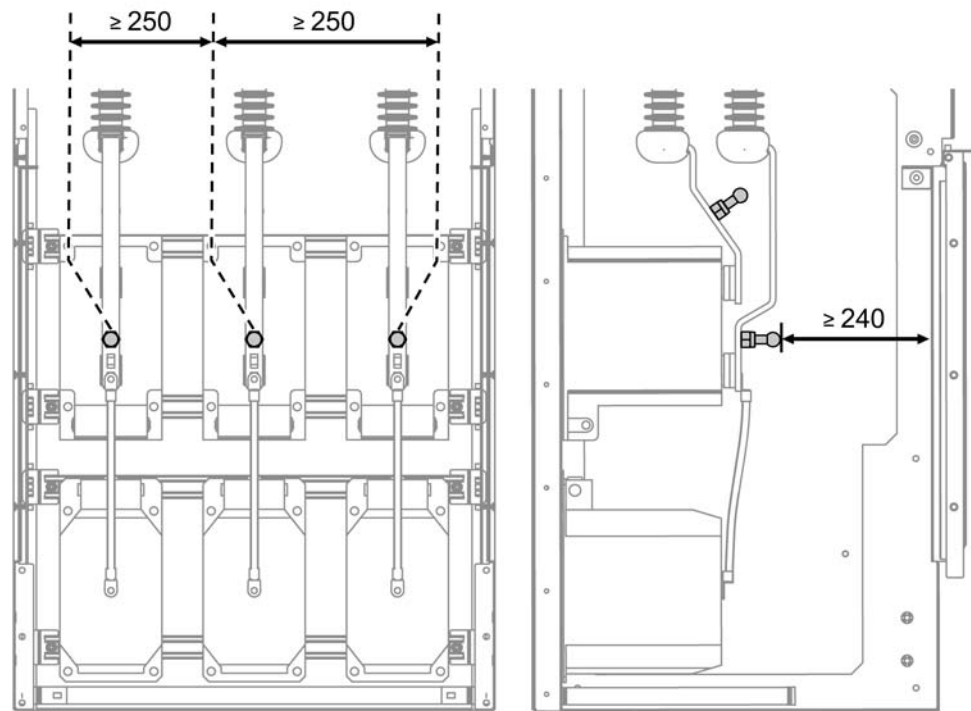


Fig. 154: Constructional distances of the earthing bolts in the metering panel **type busbar-busbar**

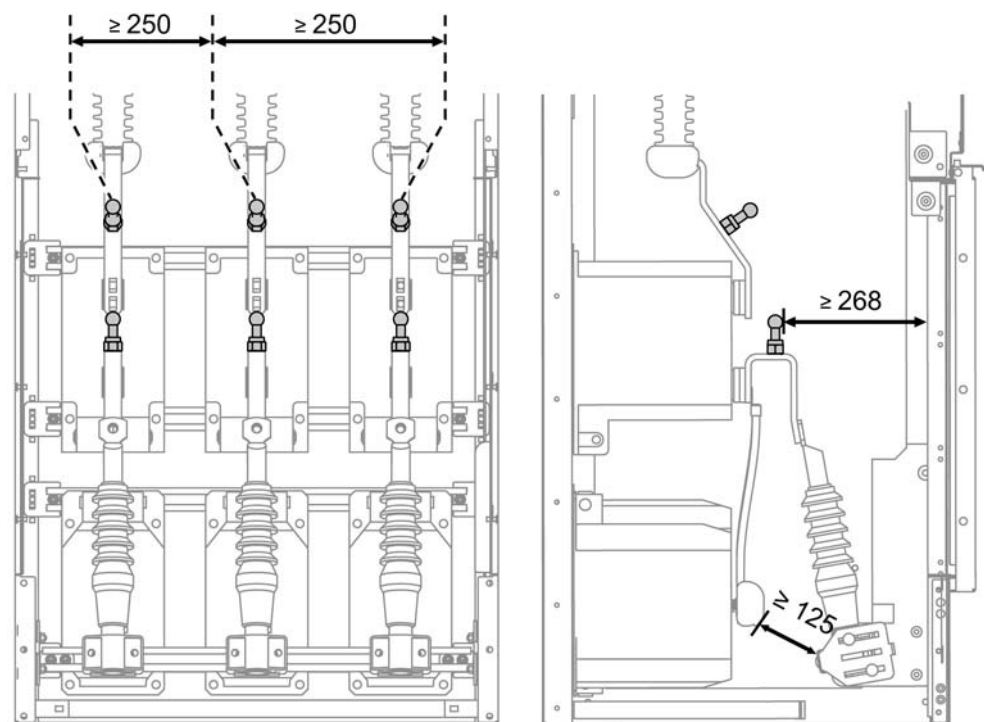


Fig. 155: Constructional distances of the earthing bolts in the metering panel **type busbar-cable**
(analogously cable-busbar)

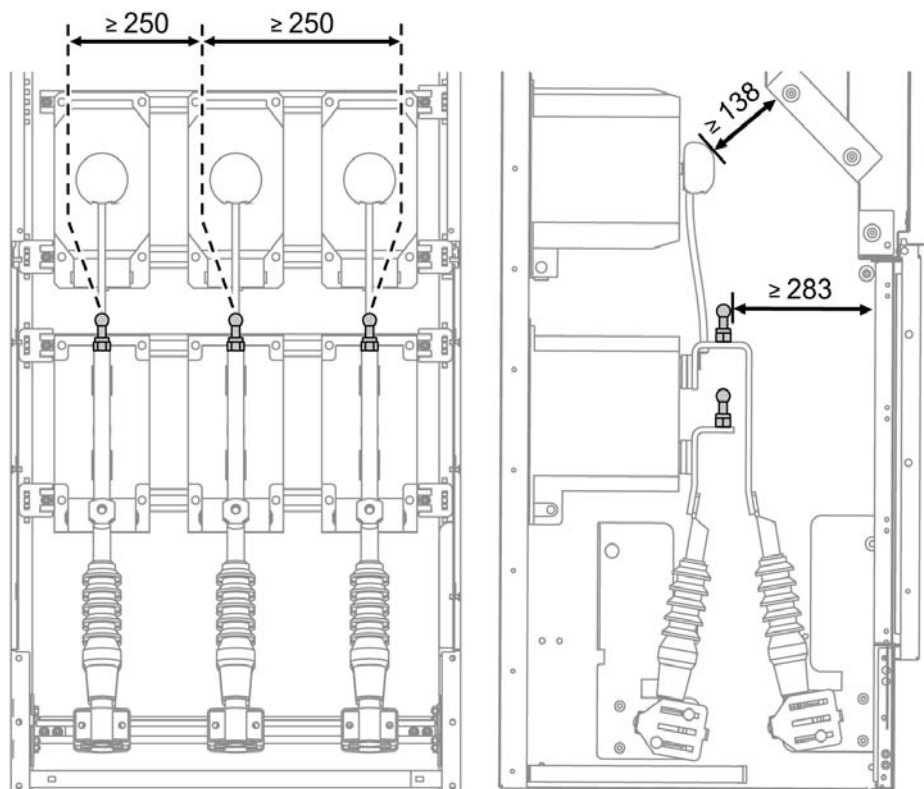


Fig. 156: Constructional distances of the earthing bolts in the metering panel **type cable-cable**

13.6 Mounting earthing accessories in the metering panel type M

⇒ Mount the earthing accessories on the earthing connection in metering panel M as shown below.

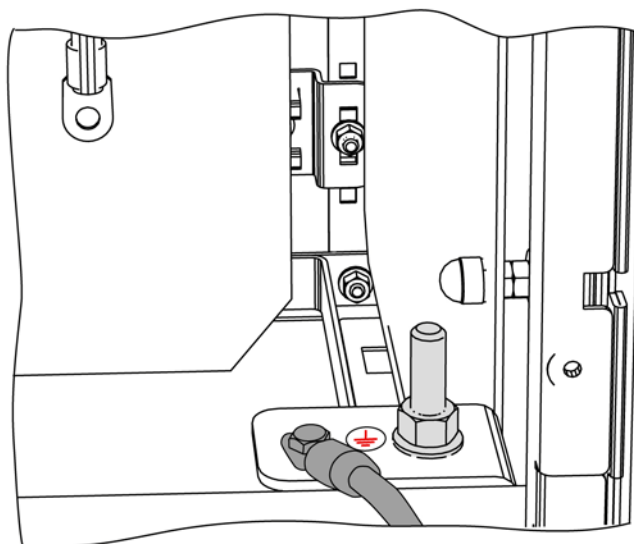


Fig. 157: Earthing accessories in the metering panel - view into the cable compartment

13.7 Installing the protection against small animals for metering panels

The following floor covers made of expanded metal can be installed in the panels as protection against small animals:



Fig. 158: Floor cover for panels without cable feeder

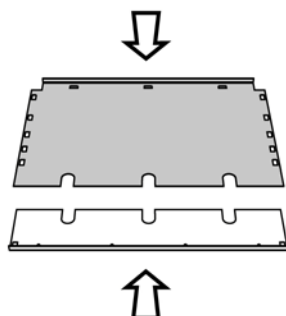


Fig. 159: Floor cover for panels with one cable feeder (combination of two plates)

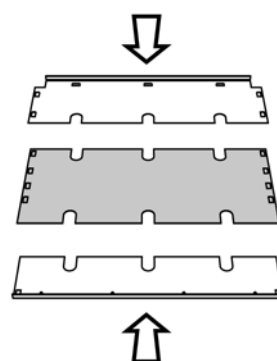


Fig. 160: Floor cover for panels with two cable feeders (combination of three plates)

⇒ Install the floor covers in such a way that the screwed-on angle ① points to the front.

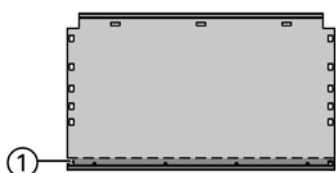


Fig. 161: Mounting direction of the floor cover for panels without cable feeder

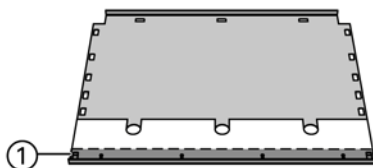


Fig. 162: Mounting direction of the floor cover for panels with one cable feeder

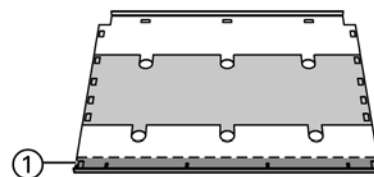


Fig. 163: Mounting direction of the floor cover for panels with two cable feeders

⇒ Elongated holes are provided in the floor covers for fastening to the foundation. Bolt the floor covers to the foundation together with the subframe.

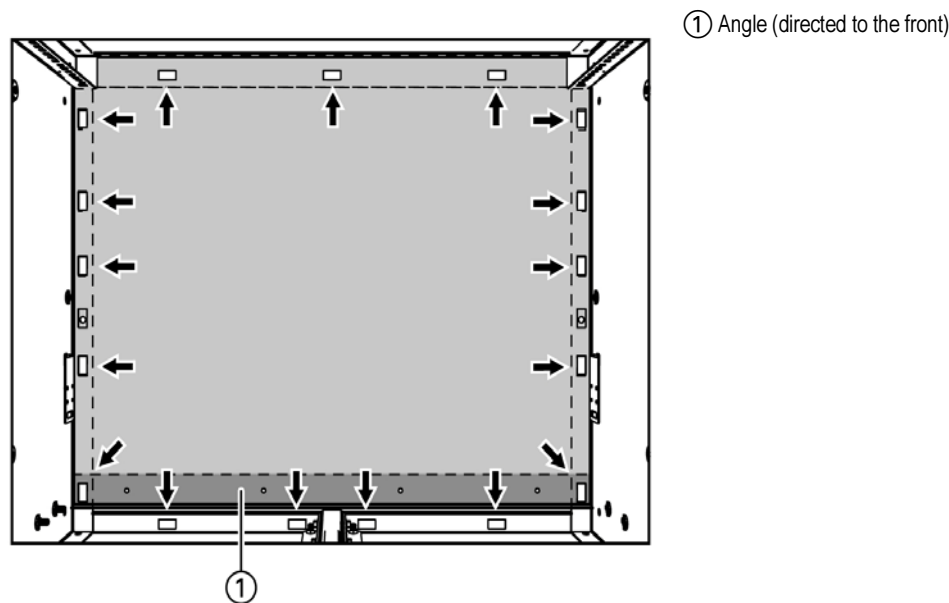


Fig. 164: Fixing points for panels without cable routing

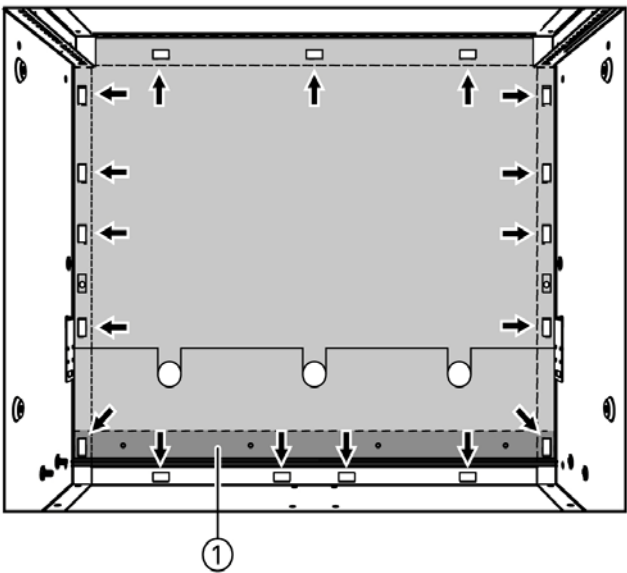


Fig. 165: Fixing points for panels with one cable routing

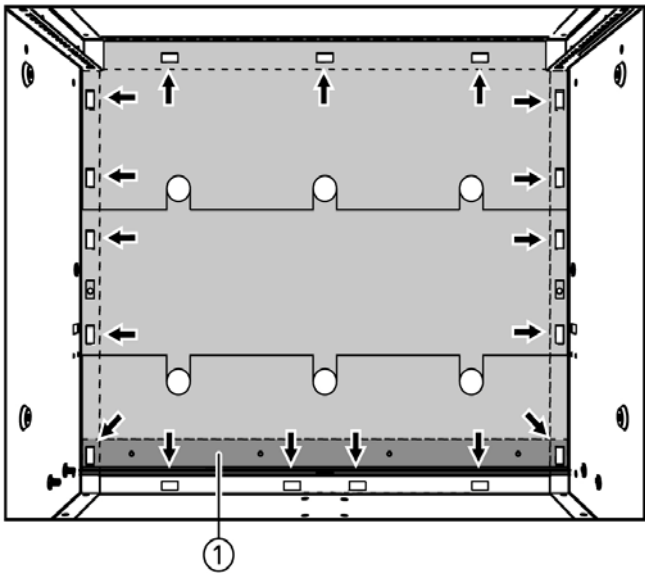


Fig. 166: Fixing points for panels with two cable routings

13.8 Installing metering panels with interconnection to panels

The following components are needed for lining up a metering panel:

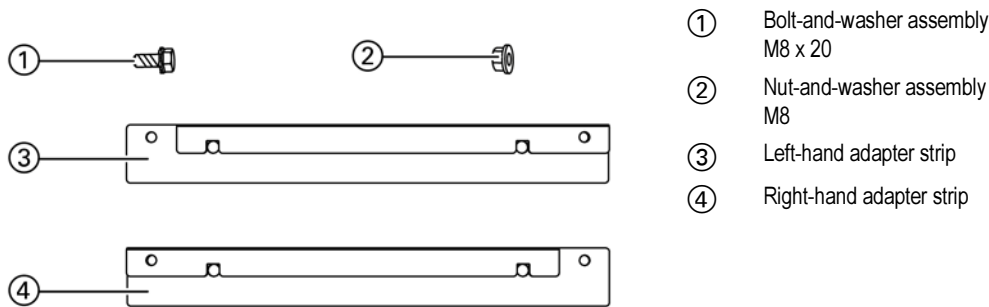


Fig. 167: Components required for lining up metering panels

Lining up the metering panel type cable-cable

⇒ Approach the cable-cable metering panel ⑥ to be lined up to the fixed-mounted switchgear ⑤.

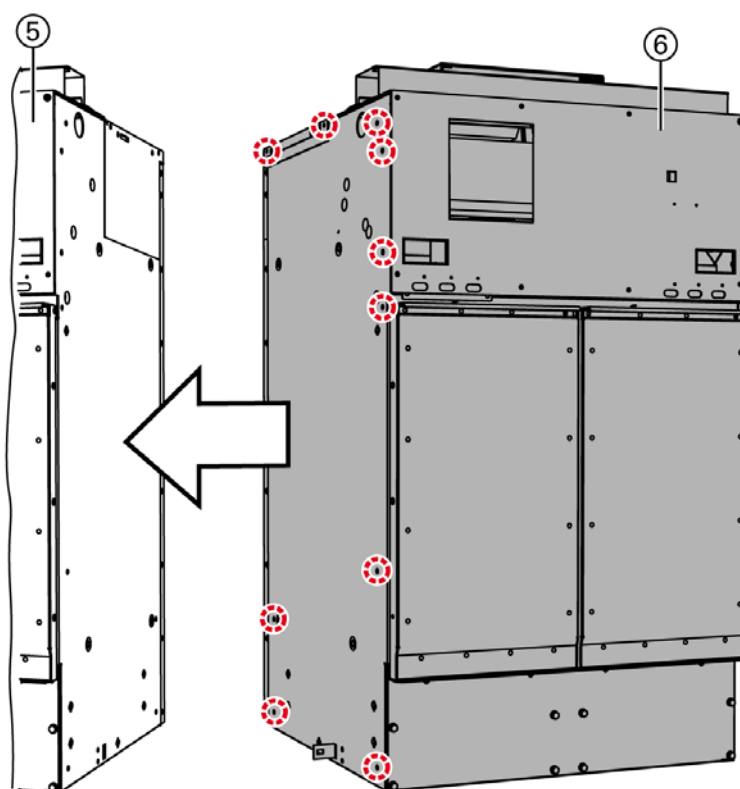


Fig. 168: Approaching the metering panel type cable-cable

⇒ For lining up the metering panel from the right: Mount right-hand adapter strip. For lining up the metering panel from the left: Mount left-hand adapter strip. To do this, use two bolt-and-washer assemblies M8 x 20 with nuts each.

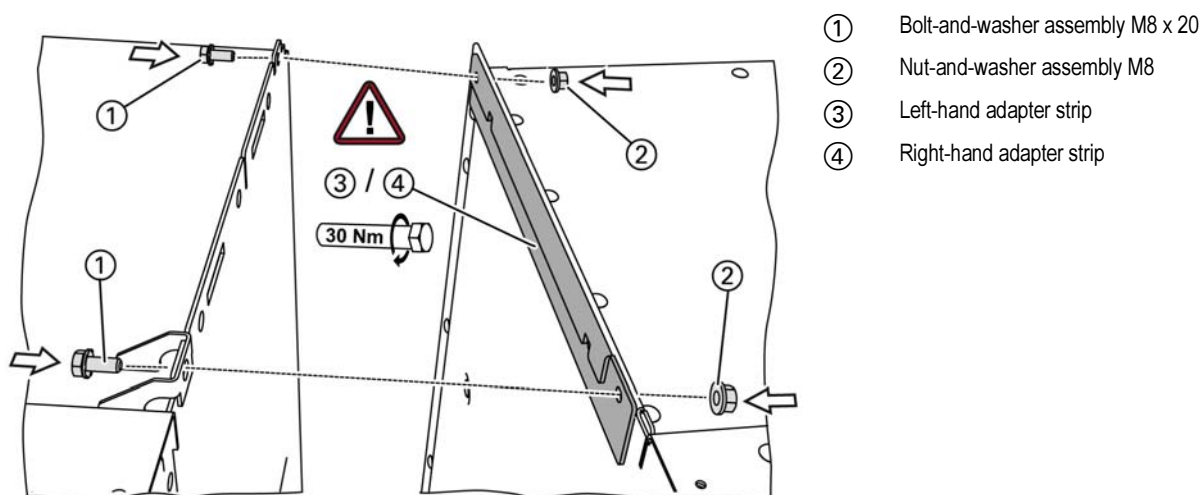


Fig. 169: Example: Mounting the right-hand adapter strip

Lining up the metering panel types busbar-busbar, cable-busbar or busbar-cable

⇒ Approach the busbar-busbar, cable-busbar or busbar-cable metering panel ⑥ to be lined up to the fixed-mounted switchgear ⑤.

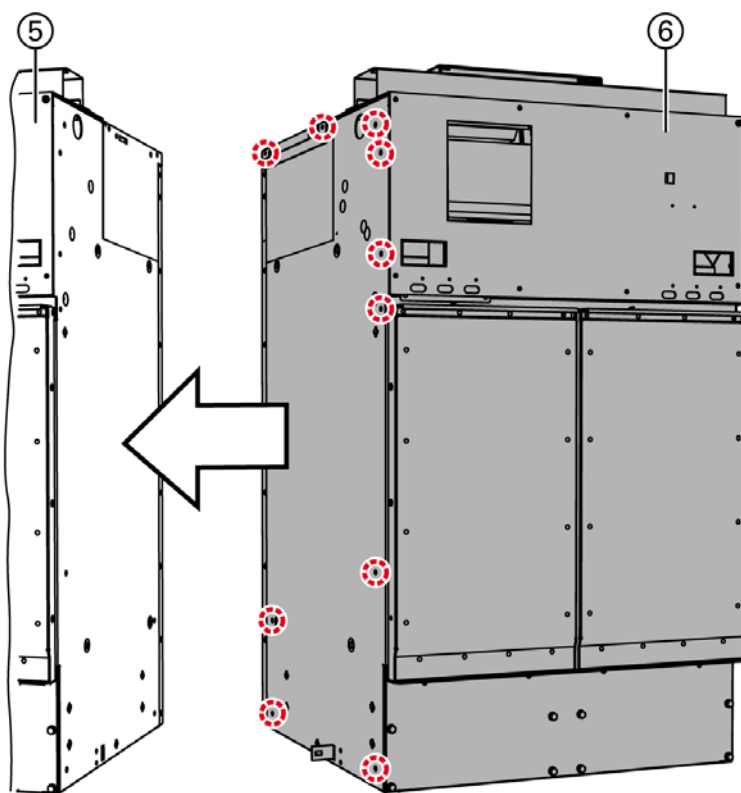


Fig. 170: Approaching the metering panel types busbar-busbar, cable-busbar or busbar-cable

⇒ For lining up the metering panel, mount the right and left-hand adapter strips. To do this, use two bolt-and-washer assemblies M8 x 20 with nuts each.

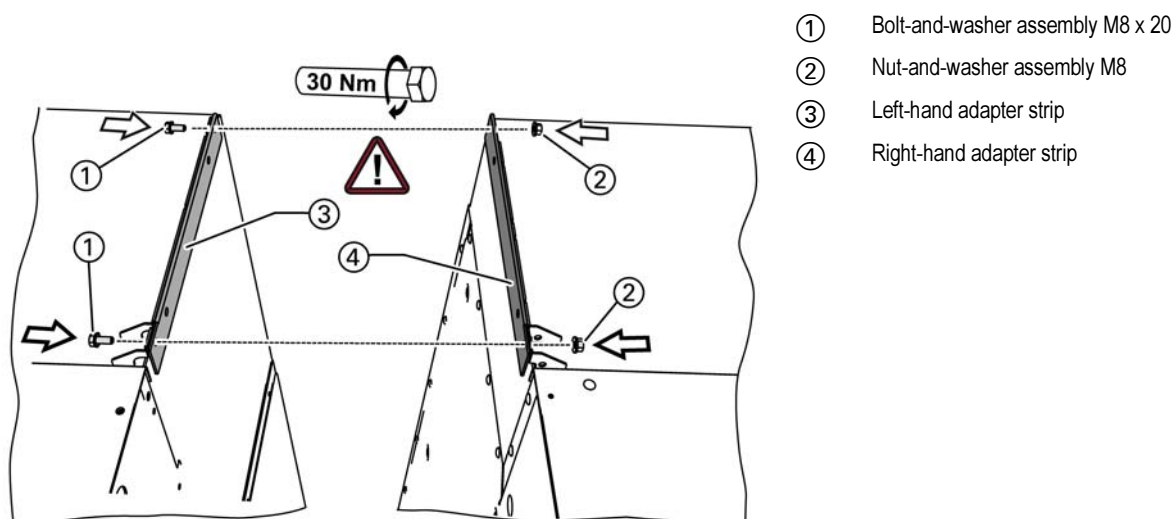


Fig. 171: Example: Mounting the right-hand adapter strip

14 Electrical connections

14.1 Connecting high-voltage cables

For common features and suitable cable sets (see Page 28, "Cable connection").

	ATTENTION! The high-quality joints at the bushings can easily be damaged by incorrect handling. ⇒ Observe extreme cleanliness. ⇒ Avoid damages caused by the threaded bolt while pushing on.
	ATTENTION! If there are any spare feeders without connected cables, please observe the following: ⇒ Switch the three-position switch to "EARTHED" position and lock it. ⇒ Alternatively: Mount surge-proof caps.
	ATTENTION! During metal work, please ensure the following: ⇒ Do not drill into the vessel. ⇒ Do not leave any metal cuttings on the vessel in order to avoid rust layers.

Connecting feeder cables

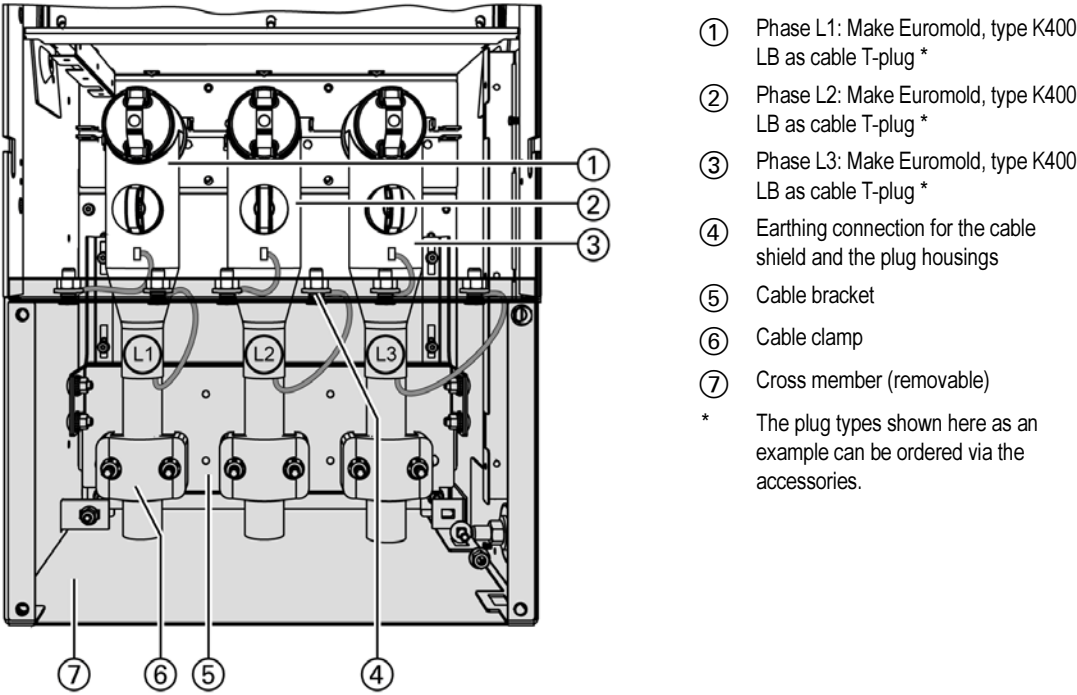
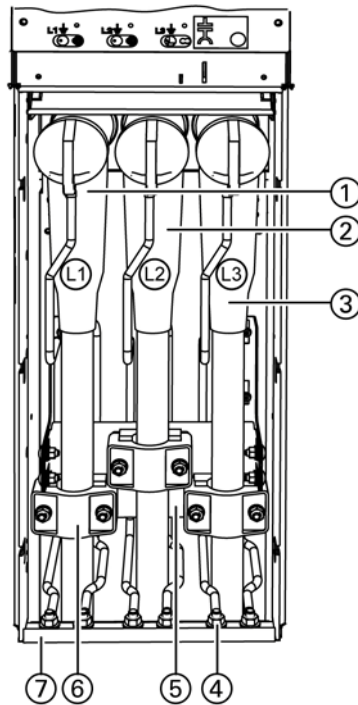


Fig. 172: Cable connection type A for transformer feeders



- ① Phase L1: Make Euromold, type K400 TB as cable T-plug *
- ② Phase L2: Make Euromold, type K400 TB as cable T-plug *
- ③ Phase L3: Make Euromold, type K400 TB as cable T-plug *
- ④ Earthing connection for the cable shield and the plug housings
- ⑤ Cable bracket
- ⑥ Cable clamp
- ⑦ Cross member (removable)

* The plug types shown here as an example can be ordered via the accessories.

Fig. 173: Cable connection type C for ring-main and circuit-breaker feeders

- ⇒ If necessary, detach the cross members ⑦ to swing in the cables.
- ⇒ Pre-adjust the cable bracket ⑤ and the lower part of the cable clamps ⑥.
- ⇒ If available, mount cable-type current transformers (see Page 156, "Cable connection with cable-type current transformers").
- ⇒ Fit the plugs on the conductor ends according to the manufacturer's instructions.
- ⇒ Carefully coat the push-on surfaces (high-quality joints) in the plug sets and the bushing cone with mounting paste (scope of supply of the plug set).
- ⇒ Push the plug sets ① to ③ onto the bushing and fix them according to the manufacturer's instructions. Observe the phase sequence!
- ⇒ Mount the upper part of the cable clamps ⑥, align the cable bracket and bolt it tight.
- ⇒ Connect the cable shield and the earthing of the plug housing at the front cross member ⑦.

Double cables and surge arresters can be connected to ring-main feeders using adequate plug-in cable systems.

Please observe the following:

- Depending on their type, double cable connections require a deep cable compartment cover and larger floor openings.
- Depending on their type, surge arresters also require a deep cable compartment cover.

For details, please refer to the order documents.

Assembly operations at the panel for fastening the cable plug Raychem RICS5xxx with RDA 24

- ⇒ Remove upper cross member. To do this, undo the two bolt-and-washer assemblies M8 x 20.

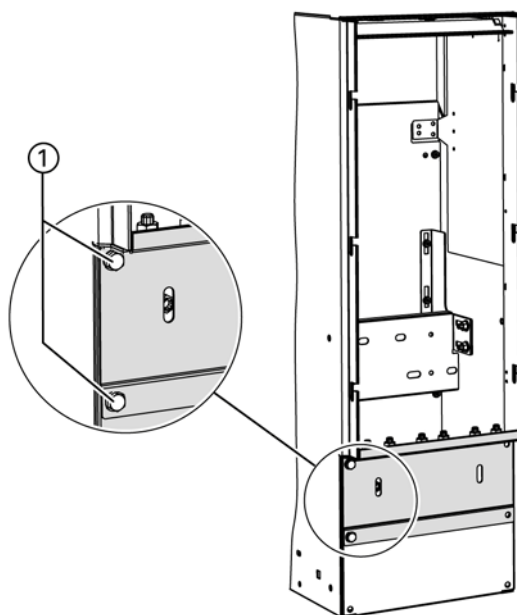


Fig. 174: Removing bolt-and-washer assemblies ① at the upper cross member.

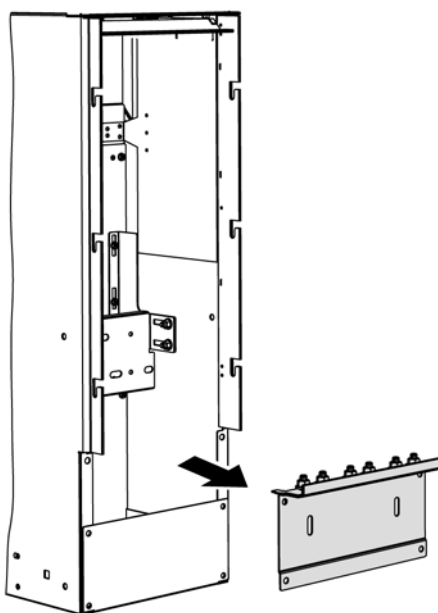


Fig. 175: Removing upper cross member

- ⇒ Mount cable plug type Rayschem RICS5xxx with surge arrester RDA according to the manufacturer's instructions (see order documents).
- ⇒ Fasten adapter feet with hexagonal nuts M12 and strain washers to the surge arrester plate.

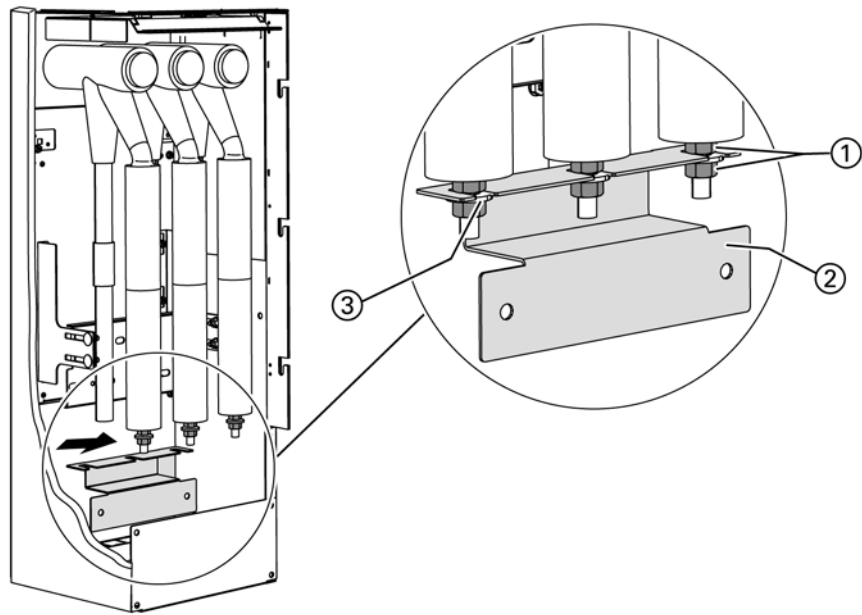


Fig. 176: Push the surge arrester plate ② between the hexagonal nuts M12 of the adapter feet, and tighten it. Use hexagonal nuts M12 ① with strain washers ③.

⇒ Fasten upper cross member with two bolt-and-washer assemblies M8 x 20.

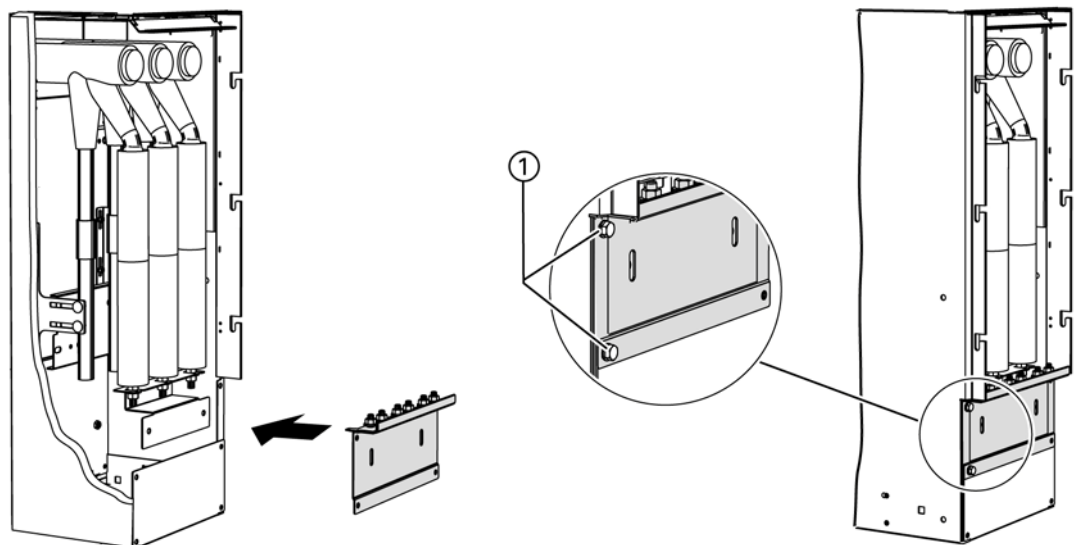


Fig. 177: Mounting bolt-and-washer assemblies ① on the upper cross member.

- ⇒ Fasten the surge arrester plate with two bolt-and-washer assemblies M8 x 20 and washers to the upper cross member.

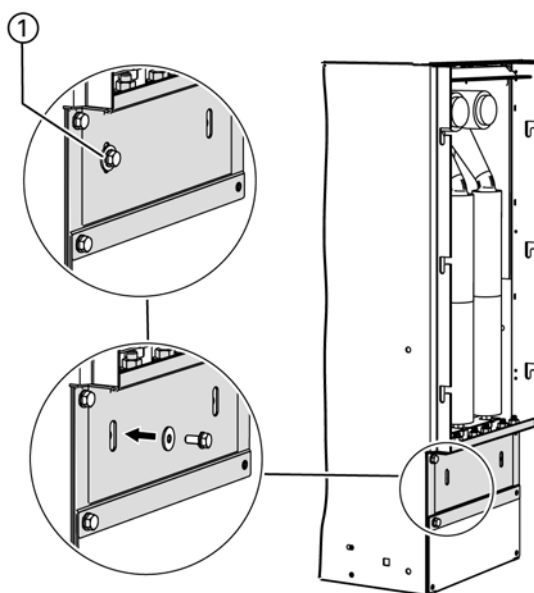
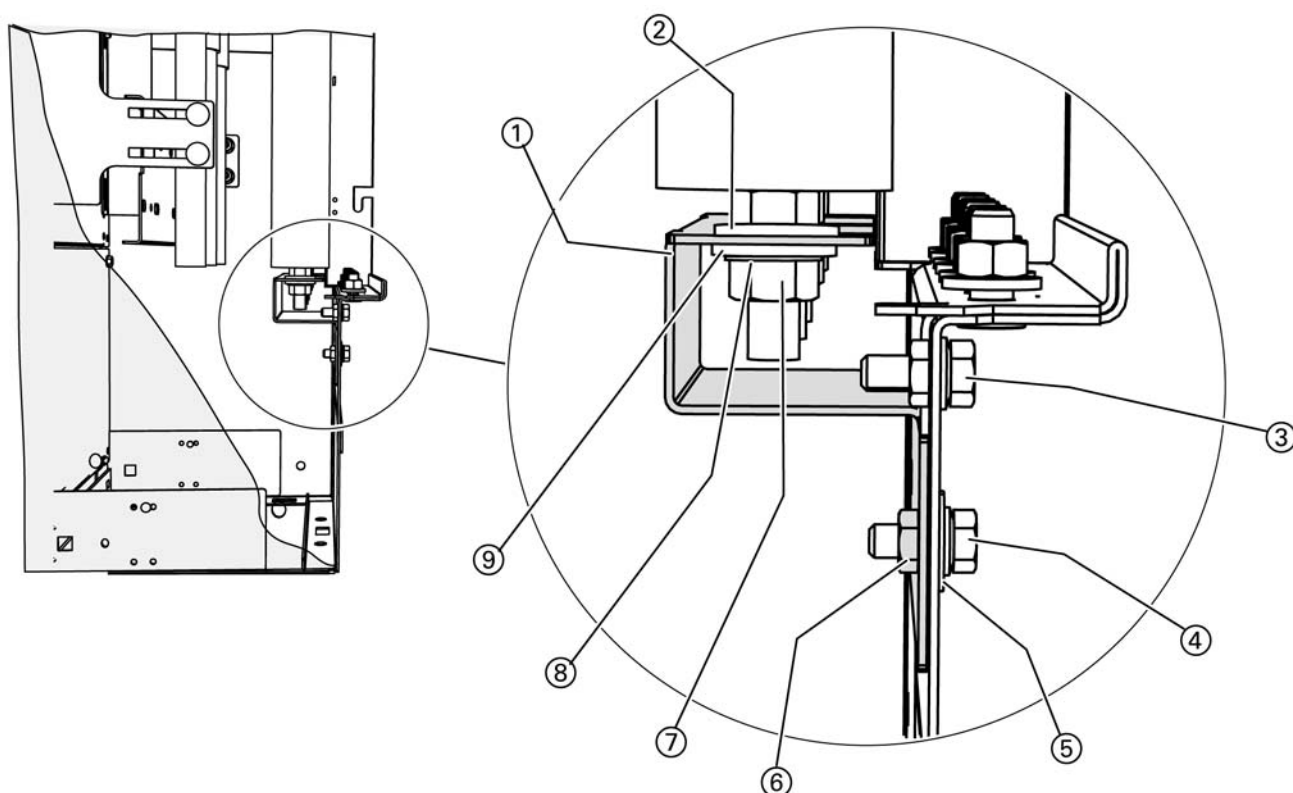


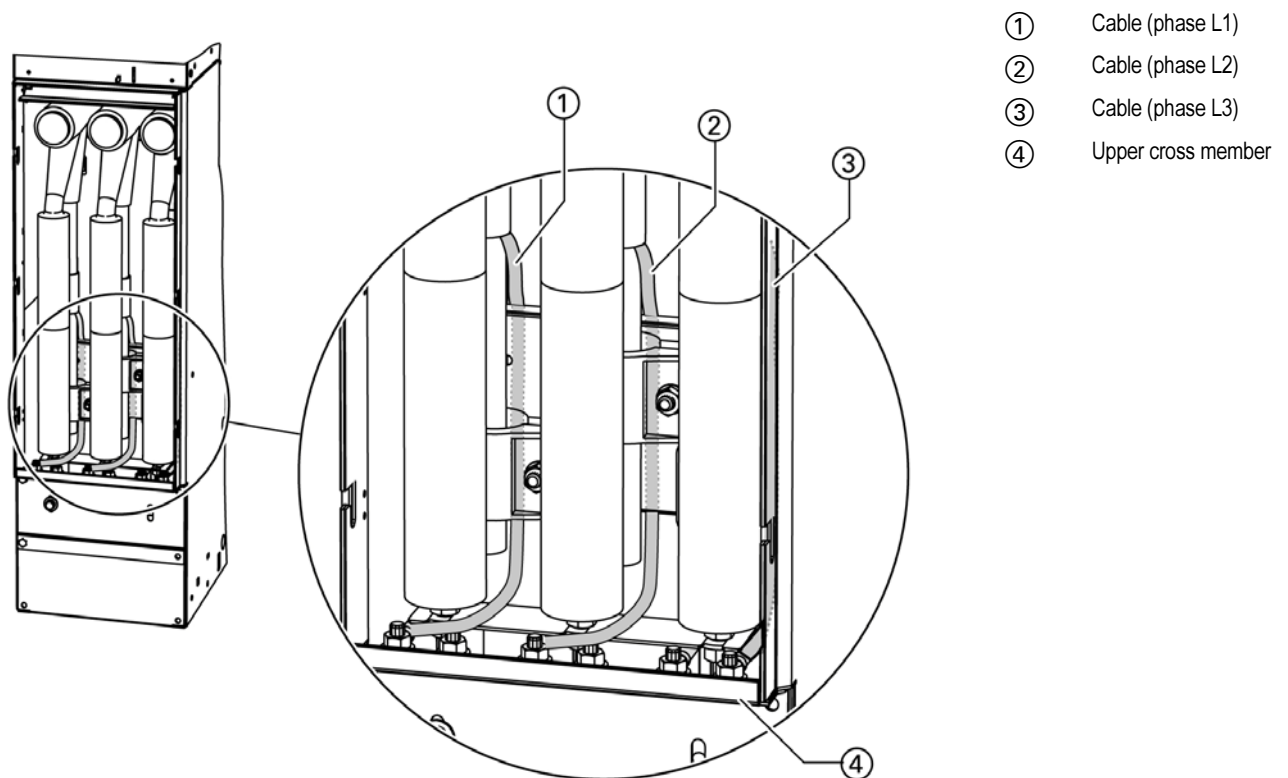
Fig. 178: Mounting the surge arrester plate with bolt-and-washer assemblies ① and washers on the upper cross member.

- ✓ Completely assembled surge arrester plate:



- | | | | |
|---|---|---|--|
| ① | Surge arrester plate | ⑥ | Locknut pre-assembled on the surge arrester plate at the factory |
| ② | Upper washer (pre-assembled by the manufacturer) | ⑦ | Bolt-and-washer assembly (pre-assembled by the manufacturer) |
| ③ | Bolt-and-washer assembly M8 x 16 with locknut | ⑧ | Spring washer (pre-assembled by the manufacturer) |
| ④ | Bolt-and-washer assembly M8 x 20 with fixed locknut | ⑨ | Lower washer (pre-assembled by the manufacturer) |
| ⑤ | Plain washer | | |

	NOTE!
	When connecting cable plugs type Raychem RICS5xxx with surge arresters type RDA 24, earth the cable as shown below. ⇒ The cable shield of the cables L1, L2, L3 is earthed via cable lugs/earthing bolts size M10 at the upper cross member.



- ⇒ For details, please refer to the order documents.
- ⇒ For connection of unscreened cable plugs / surge arresters, keep the necessary minimum distances according to the manufacturer's instructions.
- ⇒ If the minimum distances cannot be kept, please contact your regional Siemens representative.

**Cable installation in
switchgear with pressure
absorber up to 16 kA**

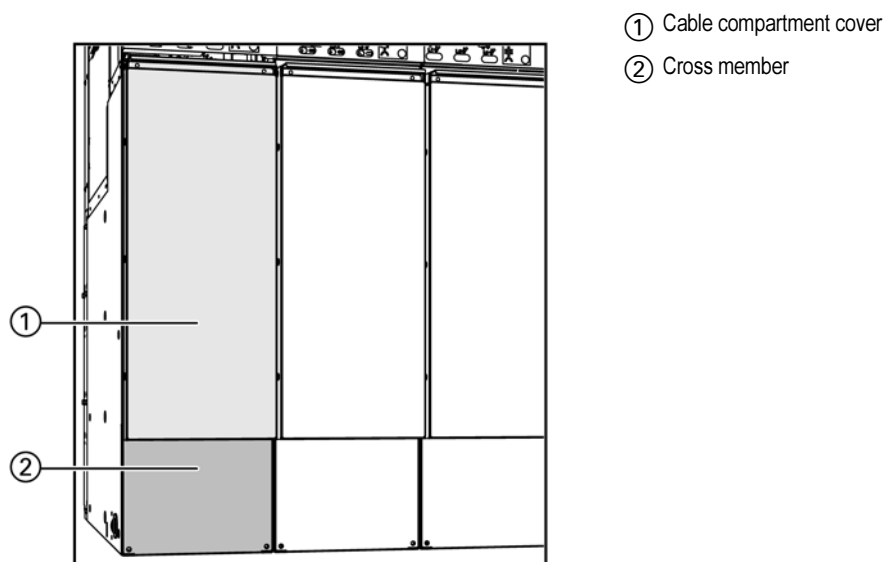


Fig. 179: Switchgear with pressure absorber up to 16 kA

- ⇒ Lift the cable compartment cover ① and remove it to the front..
- ⇒ Remove the cross member ②. To do this, undo the 6 bolt-and-washer assemblies M8.
- ⇒ Take the front floor cover out.
- ⇒ Lead the high-voltage cables into the cable compartment.
- ⇒ Push rubber sleeves over the high-voltage cables.
- ⇒ Push the high-voltage cables with the rubber sleeves into the cutouts provided for this purpose in the floor cover.
- ⇒ Refit the floor cover, observing that the floor cover is correctly seated in the slots of the rubber sleeves.
- ⇒ Bolt the front floor cover to the foundation together with the switchgear frame using one bolt.

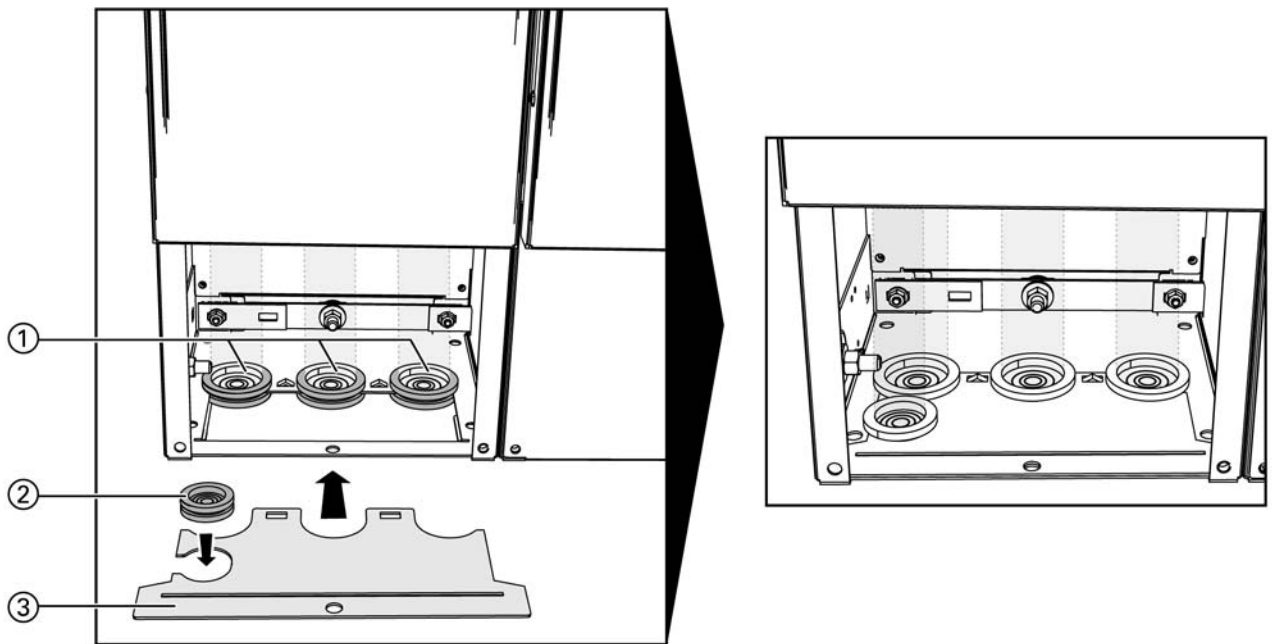


Fig. 180: Inserting the front floor cover and the rubber sleeves (switchgear up to 16 kA)

- ① Rubber sleeves for cable entry (diameter 70 mm)
- ② If required, use rubber sleeves for control cables (diameter 56 mm) / screened cable plugs
- ③ Front floor cover

⇒ Mount the cross member and the cable compartment cover.

**Cable installation in
switchgear with pressure
absorber up to 21 kA**

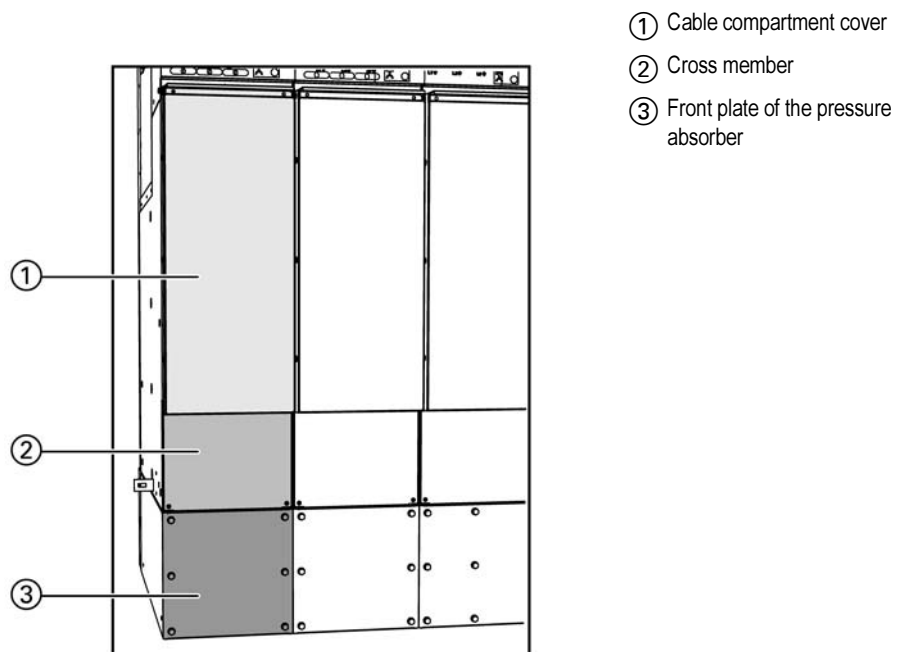


Fig. 181: Switchgear with pressure absorber up to 21 kA

- ⇒ Remove the two thread-ridging screws M6 of the cable compartment cover ①. Lift the cable compartment cover and remove it to the front..
- ⇒ Remove the cross member ②. To do this, undo the 6 bolt-and-washer assemblies M8.

- ⇒ Remove the front plate ③ of the pressure absorber. To do this, undo the 6 bolt-and-washer assemblies M8.
- ⇒ Take the front floor cover out.
- ⇒ Lead the high-voltage cables into the cable compartment.
- ⇒ Push rubber sleeves over the high-voltage cables.
- ⇒ Push the high-voltage cables with the rubber sleeves into the cutout provided for this purpose in the front floor cover.
- ⇒ Refit the front floor cover observing that the floor cover fits correctly into the slot of the rubber sleeve.

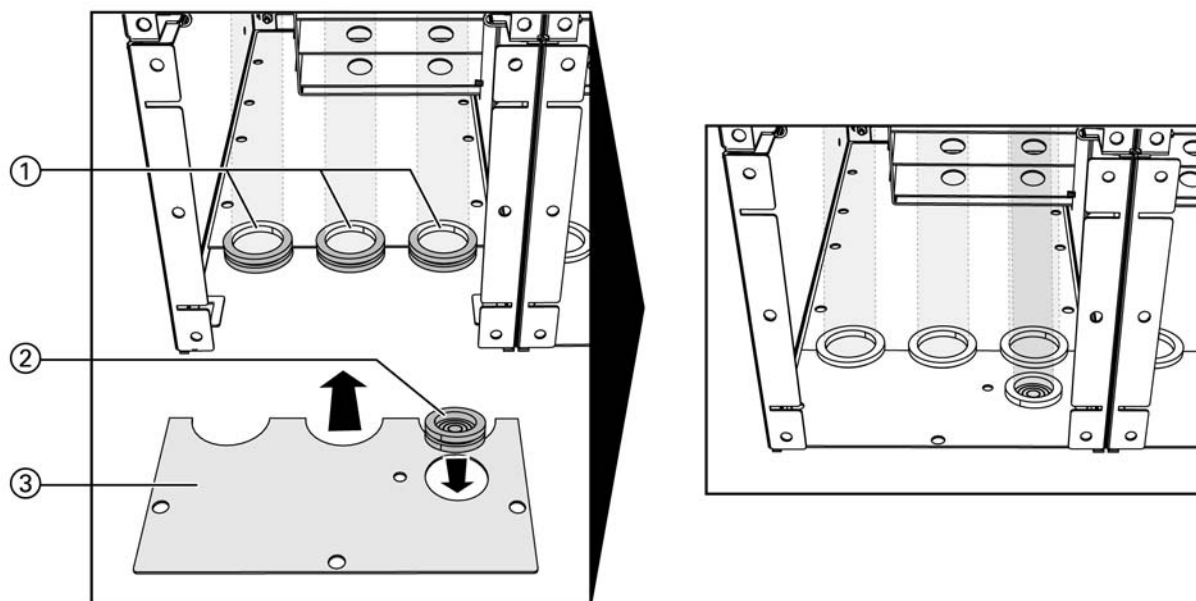


Fig. 182: Inserting the front floor cover and the rubber sleeves (switchgear up to 21 kA)

- | | | | |
|---|--|---|-------------------|
| ① | Rubber sleeves for cable entry (diameter 70 mm) | ③ | Front floor cover |
| ② | If required, use rubber sleeves for control cables (diameter 56 mm) / screened cable plugs | | |

- ⇒ Bolt the front floor cover to the foundation together with the switchgear frame using three bolts.
- ⇒ Mount the cross member, the front plate of the pressure absorber and the cable compartment cover.

14.2 Cable connection with cable-type current transformers

Mounting position of cable-type current transformers

The transformer mounting plates are pre-assembled on the cable bracket at the factory. The cable-type current transformers are supplied in the cable compartment and must be mounted on the high-voltage cables at site.

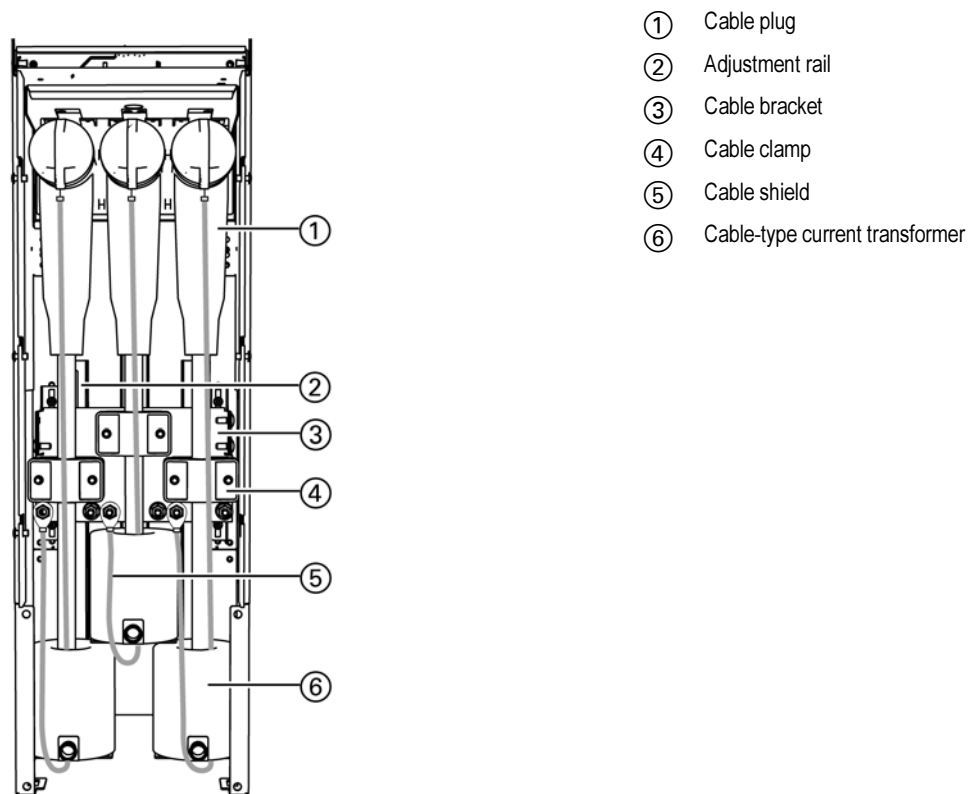
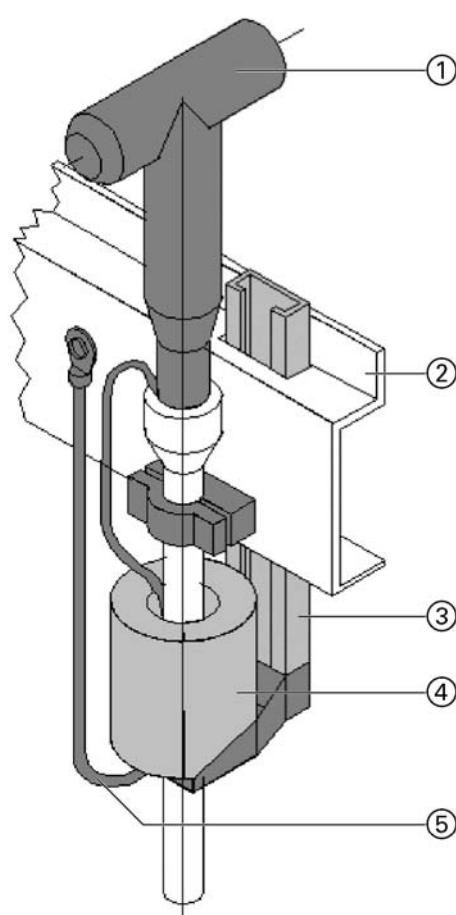


Fig. 183: Cable connection with cable-type current transformers type 4MC7032

Principle of installation for cable-type current transformers



- ① Cable plug
- ② Cable bracket
- ③ Transformer mounting plate
- ④ Cable-type current transformer
- ⑤ Cable shield

Fig. 184: Cable connection with cable-type current transformers type 4MC7033

Installation of cable-type current transformers

- ⇒ Remove the cable compartment cover.
- ⇒ If necessary, remove the lower cross member of the switchgear frame.
- ⇒ Take the supplied cable-type current transformers out of the cable compartment.
- ⇒ Push the cable-type current transformers on the high-voltage cables.
- ⇒ Mount the cable plugs according to the manufacturer's instructions.
- ⇒ Position the pre-assembled transformer mounting plates at the cable bracket in such a way that all three cable-type current transformers can be mounted.
- ⇒ Lead the cable shield back through the transformer, and fasten it at the earthing point.
- ⇒ Swing the high-voltage cables in together with the cable-type current transformers, and connect the cable plugs to the cable feeder (see Page 147, "Connecting high-voltage cables").

14.3 Connecting voltage transformers 4MT8 at the cable feeder

Preparations

- ⇒ Remove the cable compartment cover of the feeder.
 - ⇒ If the cables are still connected, remove them.
 - ⇒ Undo the transport fixing of the transformer connection leads.
 - ⇒ Remove the transformer fixing bolts and protective caps of the bushings (②, ③ and ④).
- The transformer mounting plate ① is located directly over the cable connections.

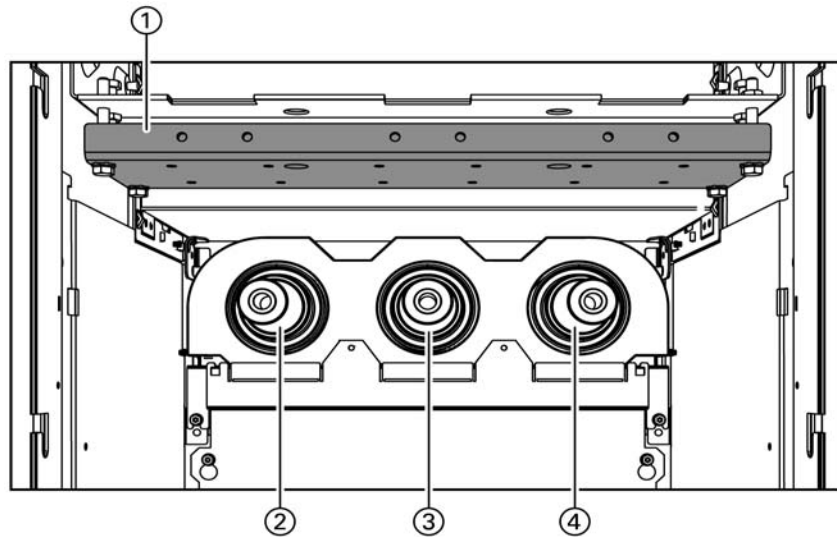


Fig. 185: Position of transformer mounting plate

- | | |
|------------------------------|----------------------|
| ① Transformer mounting plate | ③ Central bushing |
| ② Left-hand bushing | ④ Right-hand bushing |

Adjusting the transformer mounting plate

- ⇒ Screw the centering bolt into the right-hand bushing. The centering bolt serves as adjustment aid for correct positioning of the transformers, and is removed again before connecting the transformers.

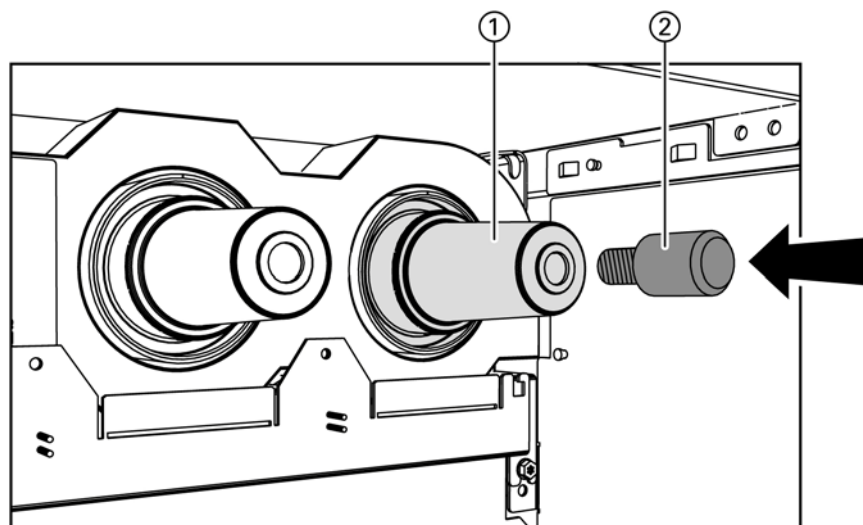


Fig. 186: Screwing the centering bolt ② into the right-hand bushing ①

- ⇒ Bolt the transformer slide ① onto the transformer mounting plate, if it was not pre-assembled at the factory.

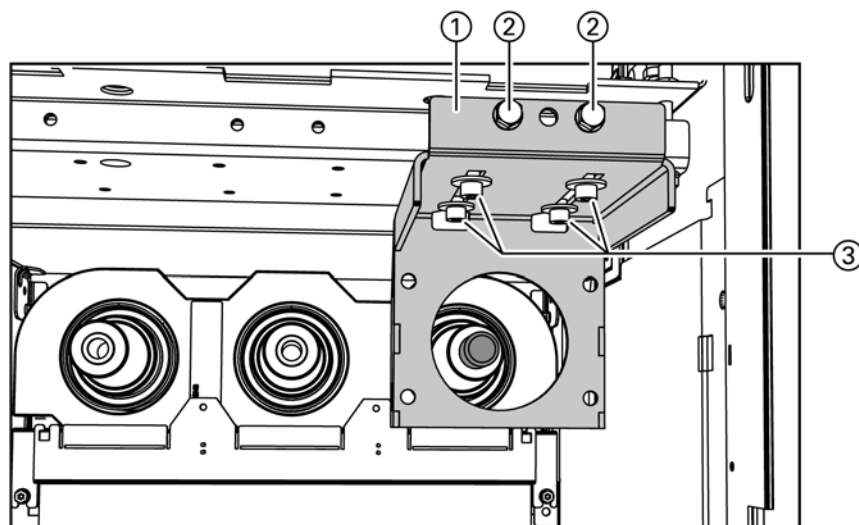


Fig. 187: Mounting the transformer slide ①

- ① Transformer slide
- ② Guide bolts (hexagon socket-head bolt M8 x 20 with washer) for adjusting the transformer distance
- ③ Hexagonal bolt M8 x 70 for fixing the transformer slide at the transformer mounting plate

- ⇒ Fasten the transformer at the transformer slide.

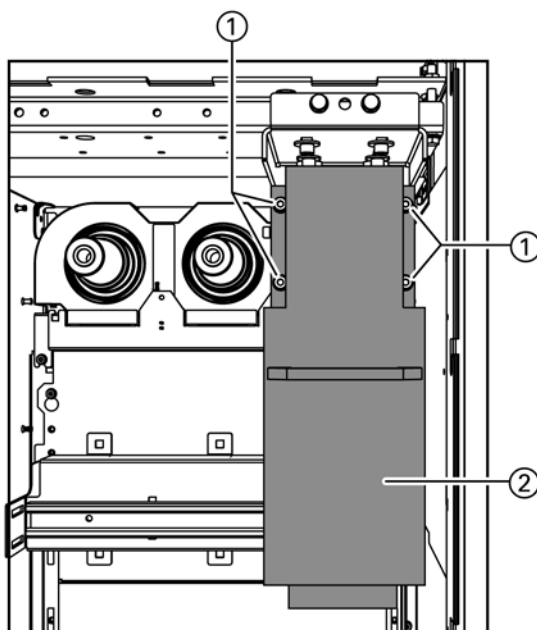


Fig. 188: Fixing points for the transformer ② at the transformer slide (hexagon socket-head bolts M8 x 40)

- ✓ The centering bolt must penetrate easily into the connection socket of the transformer.

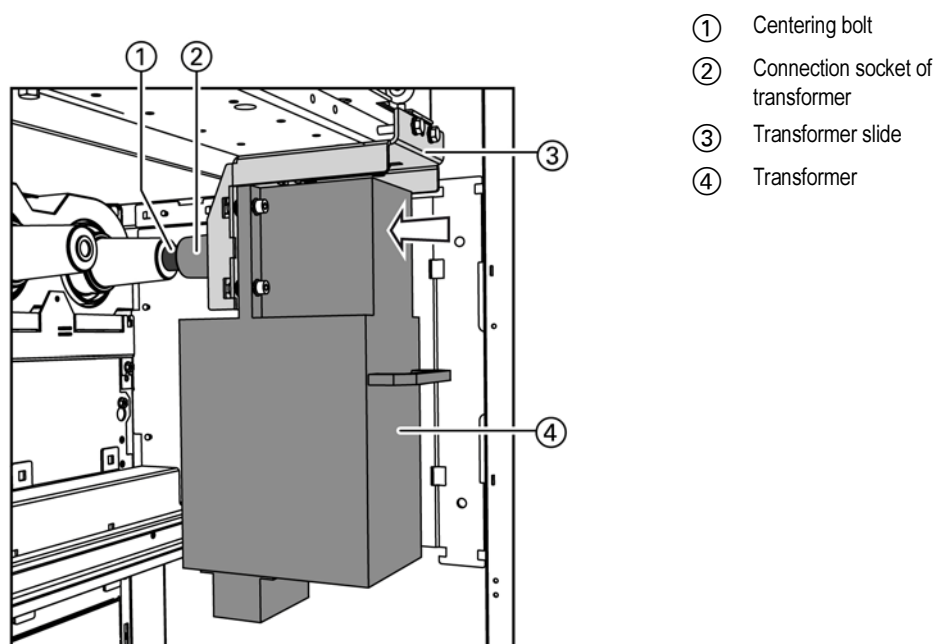


Fig. 189: Positioning the transformer correctly

- ⇒ If required, correct the position of the transformer mounting plate ③ by adjusting the upper nuts ①. Check again. Fix the transformer mounting plate by means of the lower nuts ②. **Adjust both ends of the transformer mounting plate, and fix.**

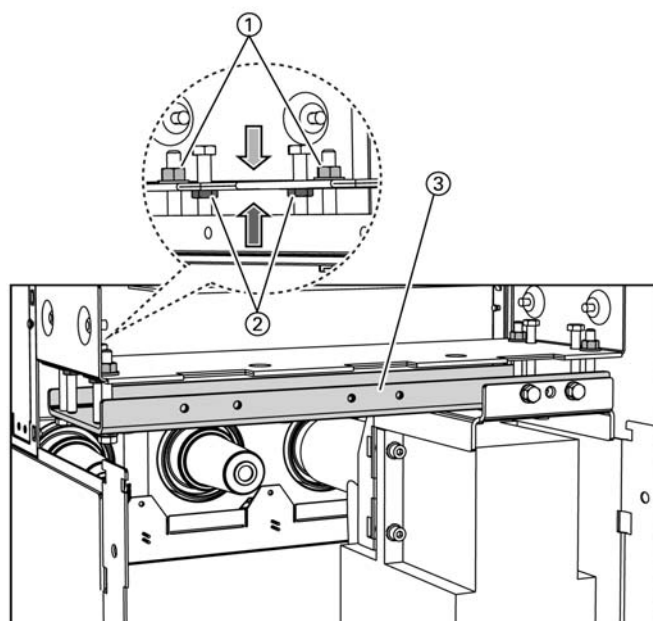


Fig. 190: If required, correct the position of the transformer mounting plate

- ⇒ Screw the centering bolt into the left-hand bushing and adjust in the same way.
⇒ Screw the centering bolt into the central bushing and adjust in the same way.
⇒ Remove the centering bolt.
✓ Now the transformer fixing is adjusted for transformer installation. The cables can be connected to the feeder.

Connecting the transformers

If a power-frequency voltage test is planned at site after installation (see Page 175, "Preparing the power-frequency voltage test"), do not mount the voltage transformers yet.

The height of the transformer mounting plate must have been adjusted before connecting the cables. The cables are connected to the feeder, the stoppers of the cable plugs must be removed.

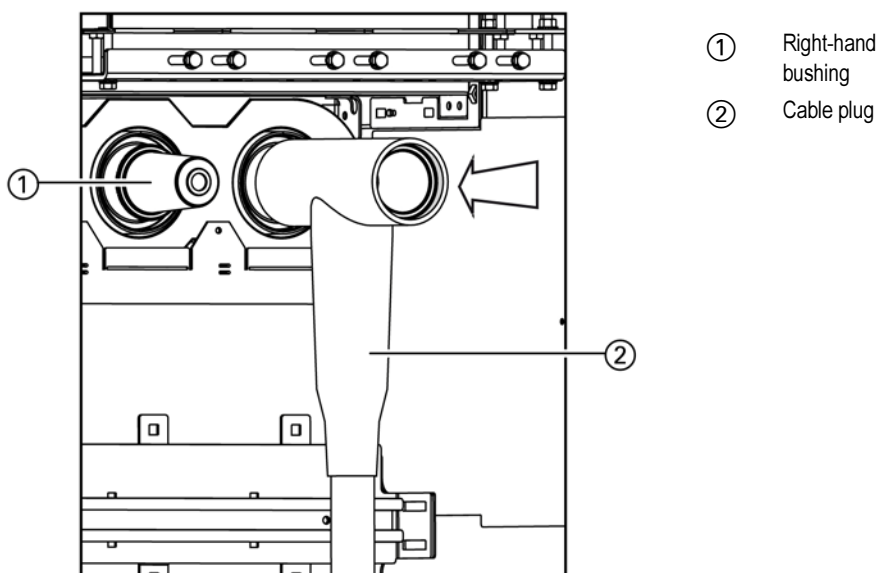


Fig. 191: Connecting the cable

- ⇒ Screw in the transformer onto the transformer slide in front of the cable plug ① (right-hand bushing).
- ⇒ The transformer cone must be completely inserted in the T-plug .

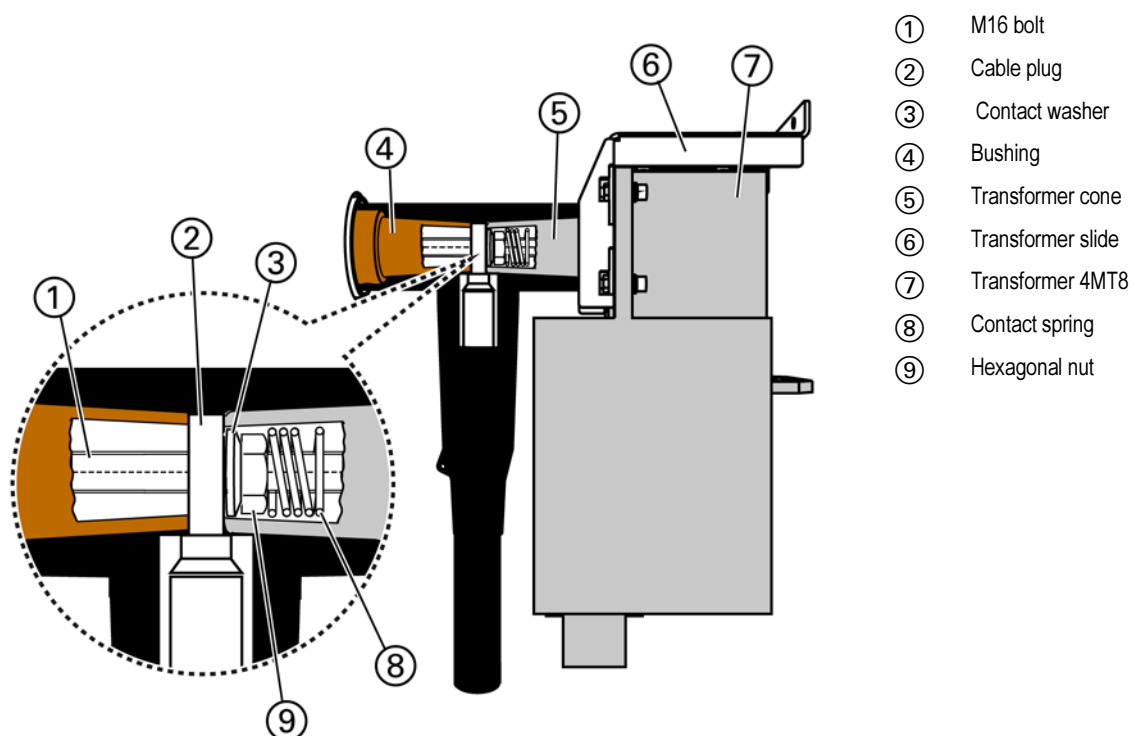


Fig. 192: Mounting the transformer

- ⇒ Tighten the transformer fixing bolts ① by turns and uniformly. Tightening torque: 20 Nm.

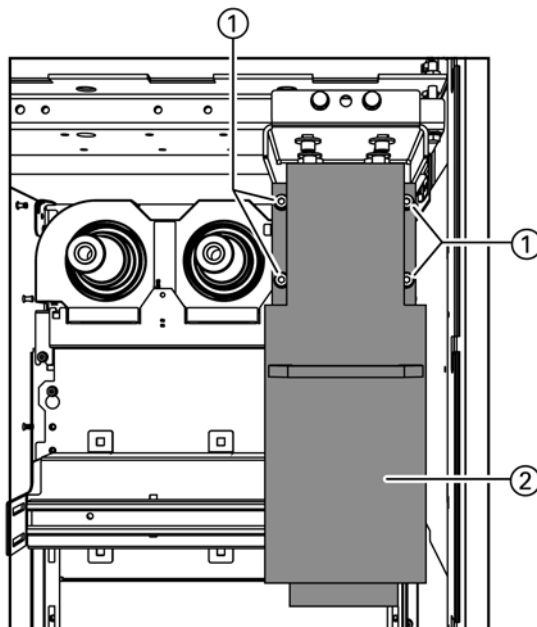


Fig. 193: Fixing points for the transformer (2) at the transformer slide (4 x hexagonal socket-head bolts M8 x 40: (1))

- ⇒ Mount the right-hand transformer in the same way, then the central one.
- ⇒ Plug the low-voltage connector into the transformers according to the phase designation.
- ✓ Now the voltage transformers are connected to the cable feeder.

(1) Low-voltage plug connector

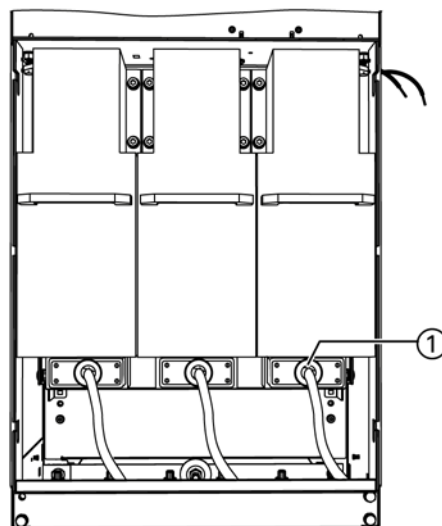


Fig. 194: Fitting low-voltage plug connectors

14.4 Installing/removing busbar voltage transformers

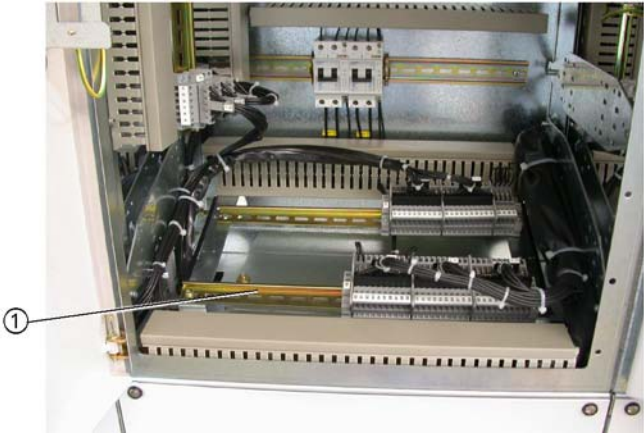
	ATTENTION!
	While mounting metal-coated voltage transformers, the coating may be scratched or damaged. Then, the voltage transformers are not safe-to-touch anymore.
	⇒ Work carefully while mounting metal-coated voltage transformers. ⇒ Take care not to scratch or damage the metal coating.

If a power-frequency voltage test is performed before commissioning (see Page 175, "Preparing the power-frequency voltage test"), the voltage transformers must be removed.

To replace busbar voltage transformers, the panels concerned must be accessible from the rear and from above.

Preparing removal or installation

- ⇒ Open the low-voltage compartment. For low-voltage compartments with a lot of equipment, undo the front top-hat rail ①



- ⇒ If there are no transformers mounted yet: Take the surge-proof caps off the busbar bushings.

Removing the cover (option)

- ⇒ Remove the two bolts M8 of the voltage transformer cover (option).

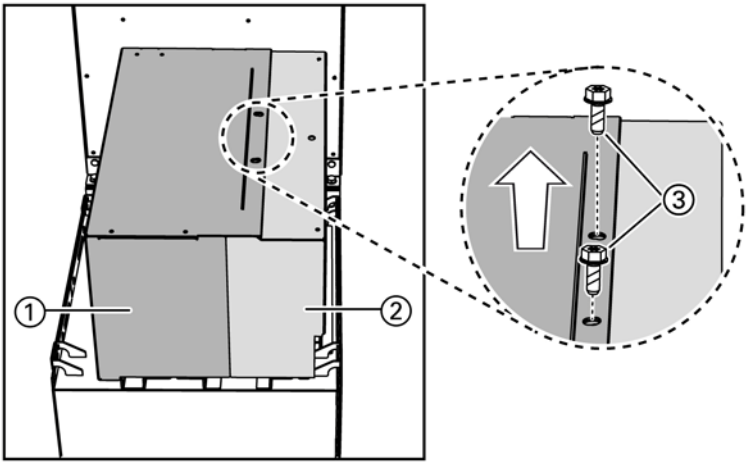


Fig. 195: Removing the bolts of the voltage transformer cover

- ① Cover (right side)
- ② Cover (left side)
- ③ M8 bolts (2x)

⇒ Open the cover (right side), push backwards and remove to the side.

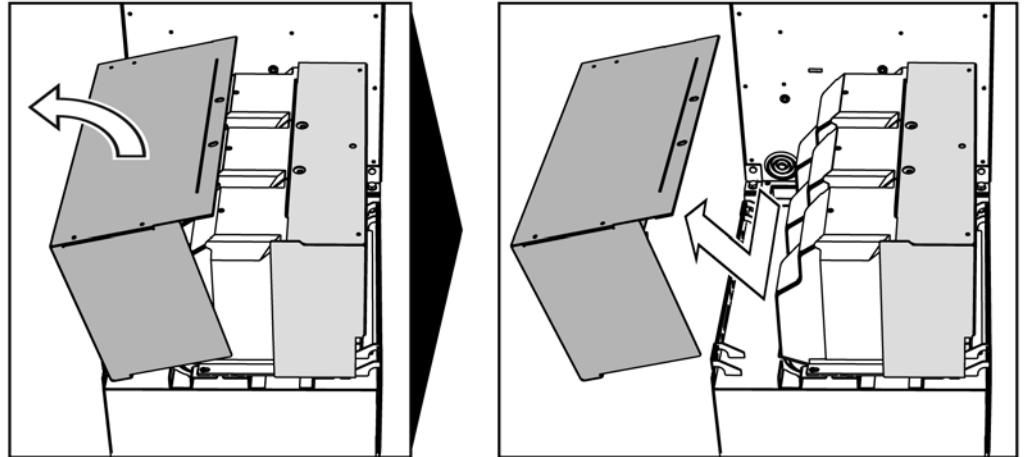


Fig. 196: Removing the cover (right side)

⇒ Push the cover (left side) backwards and remove it to the top.

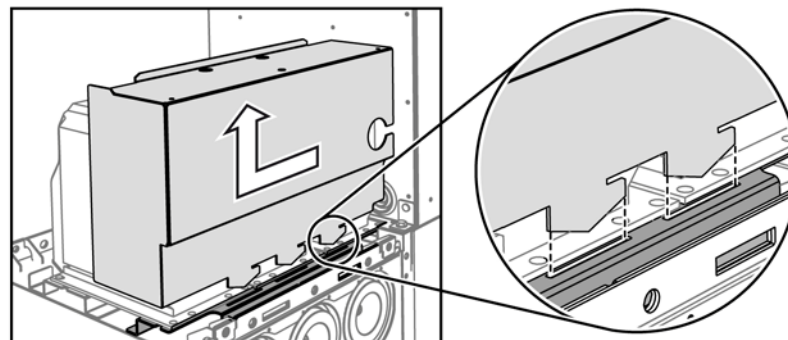


Fig. 197: Removing the cover (left side)

Removing the voltage transformer

⇒ Detach the low-voltage plug connectors from the voltage transformers.

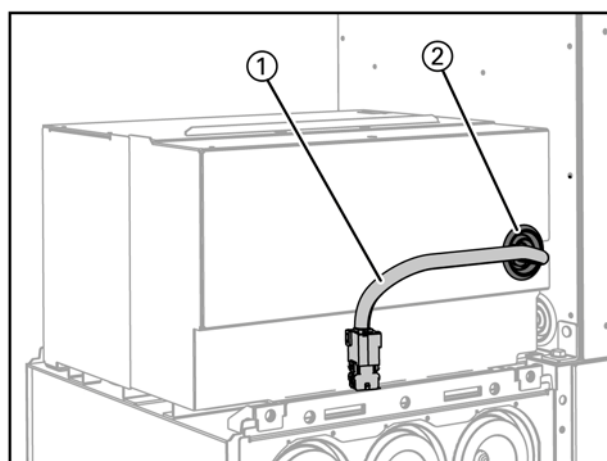


Fig. 198: Removing the low-voltage plug connector ① and the cover ②

⇒ Mount the handles supplied.

⇒ Undo the transformer fixing bolts. Tools required:

- Socket spanner extension
- SW 10 insert with magnet

To hold the bolt in the insert, grease may also be used.

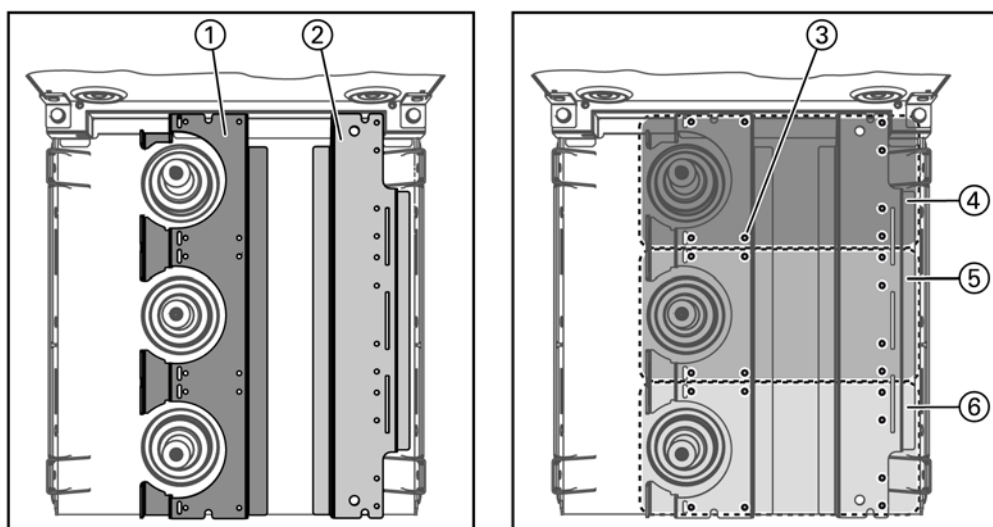


Fig. 199: Fixing the voltage transformers (top view)

- | | |
|--|-----------------------------------|
| ① Transformer mounting plate | ④ Position of front transformer |
| ② Transformer support | ⑤ Position of central transformer |
| ③ Fixing point (8 fixing points per transformer) | ⑥ Position of rear transformer |

⇒ Remove the voltage transformers upwards.

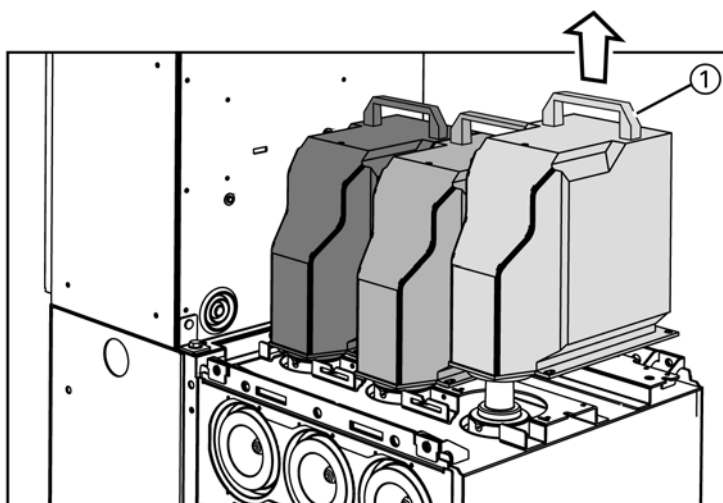
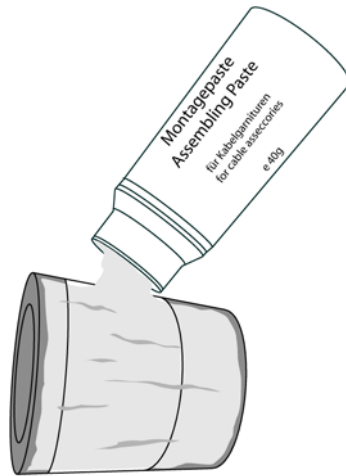


Fig. 200: Lifting the voltage transformers by the handles ①

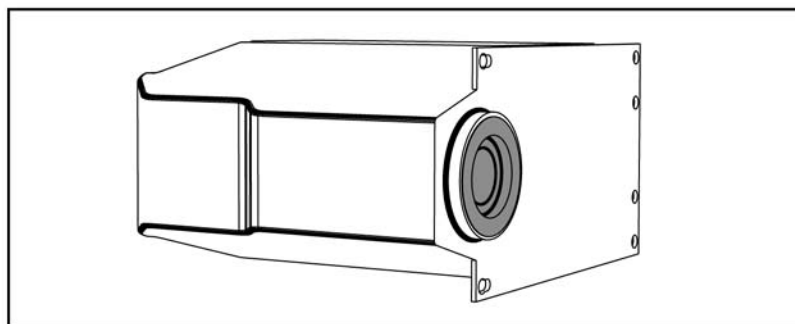
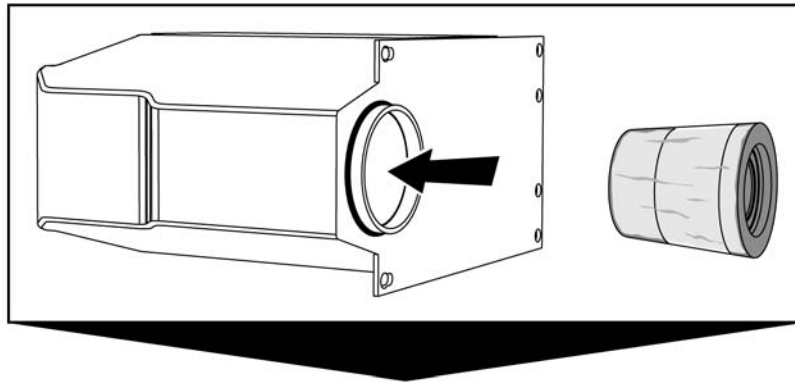
⇒ If the voltage transformers are not going to be mounted again, the bushings must be closed with surge-proof caps.

Preparing transformer installation

- ⇒ Screw the handle on the transformer and remove the transformer type plate.
- ⇒ Coat the inside cone of the transformer with mounting paste.



- ⇒ Insert the transformer cone.



Positioning and connecting the voltage transformers

- ⇒ To let excess air out, put a nylon thread or cable strap ① into the inside cone and fix it on the outside of the transformer (adhesive tape ②).

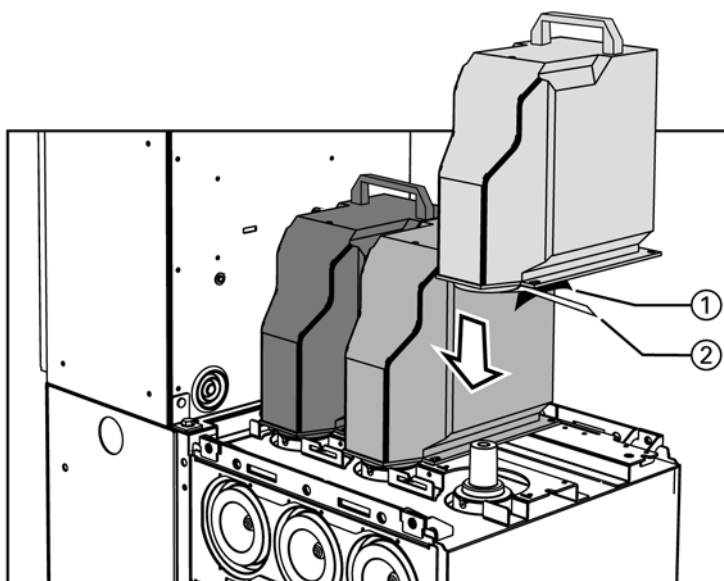


Fig. 201: Setting the voltage transformer down on the bushing

- ⇒ Take the transformer by the handle and mount it onto the bushing from above. Take care that the nylon thread does not get out of place.
- ⇒ Fasten the transformer with eight bolts (tightening torque: 12 Nm) and pull the nylon thread out carefully. Tools required:
- Socket spanner extension
 - SW 10 insert with magnet

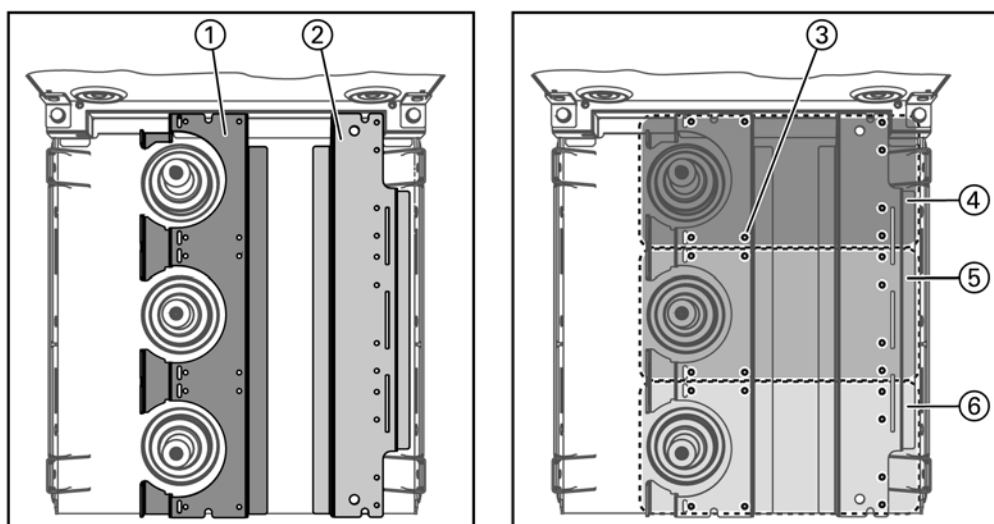


Fig. 202: Fixing the voltage transformers (top view)

- | | |
|--|-----------------------------------|
| ① Transformer mounting plate | ④ Position of front transformer |
| ② Transformer support | ⑤ Position of central transformer |
| ③ Fixing point (8 fixing points per transformer) | ⑥ Position of rear transformer |

- ⇒ Mount the two other transformers in the same way.

Mounting the cover (option)

⇒ Hook the cover (left side) in, and push to the front.

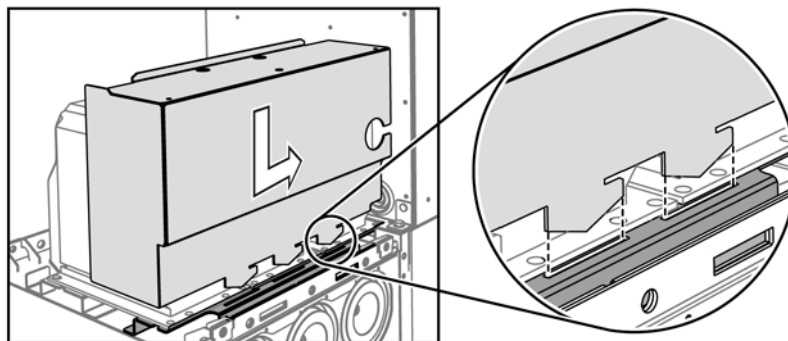


Fig. 203: Mounting the cover (right side)

⇒ Hook the cover (right side) in, push to the front, and close.

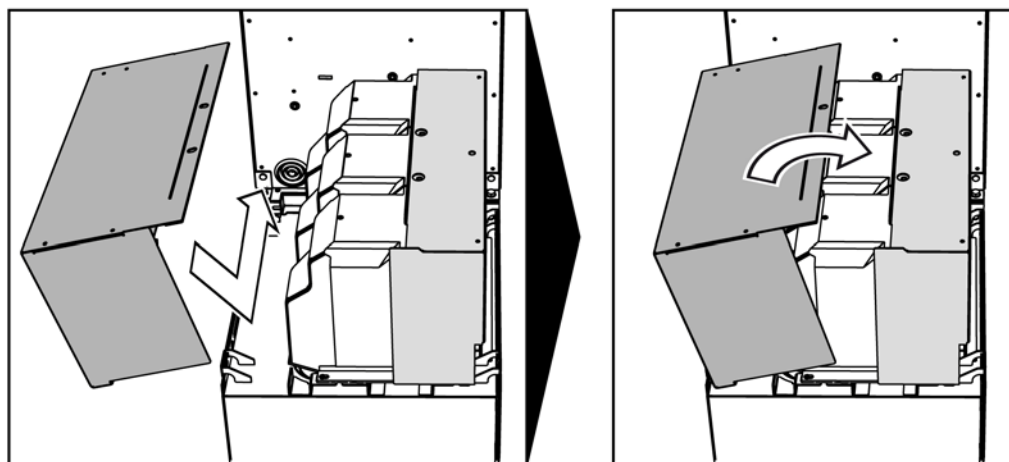


Fig. 204: Mounting the cover (right side)

⇒ Fix the cover using two bolts M8.

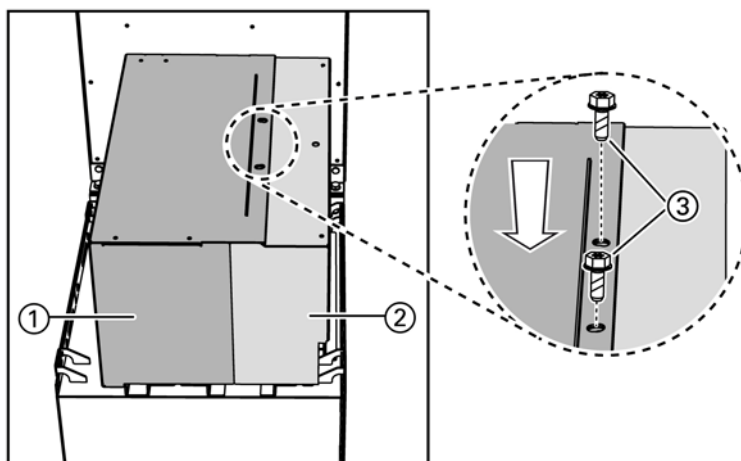


Fig. 205: Fixing the cover

- ⇒ Lead the low-voltage plug connectors through the low-voltage compartment out of the cover for further routing.

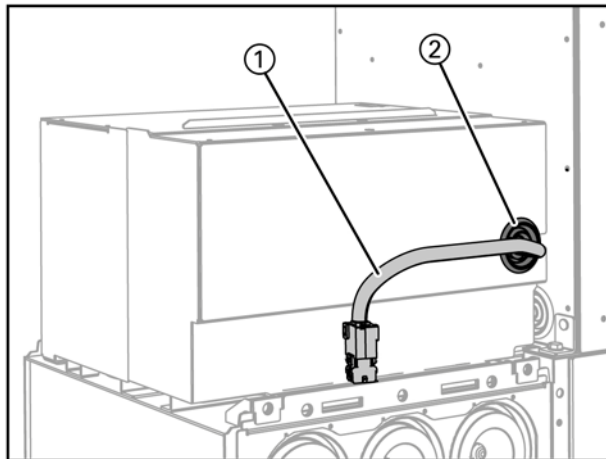


Fig. 206: Pushing the low-voltage plug connector ① through the cover ②

- Final work**
- ⇒ Lead the low-voltage plug connector from the transformers into the low-voltage compartment, and connect it to the mating socket according to the phase designation.
 - ⇒ Fix loosened top-hat rail again, if required.
 - ⇒ Close the low-voltage compartment.
 - ✓ Now the voltage transformers are connected to the busbar.

14.5 Connecting secondary equipment

	ATTENTION!
	The transmission linkage of the ready-for-service indicator ② must move freely. ⇒ Lay the cables following the dotted line.

The terminal strips of the secondary equipment supplied are assigned to the associated operating mechanisms/feeders. For external connection you will require the circuit diagrams supplied.

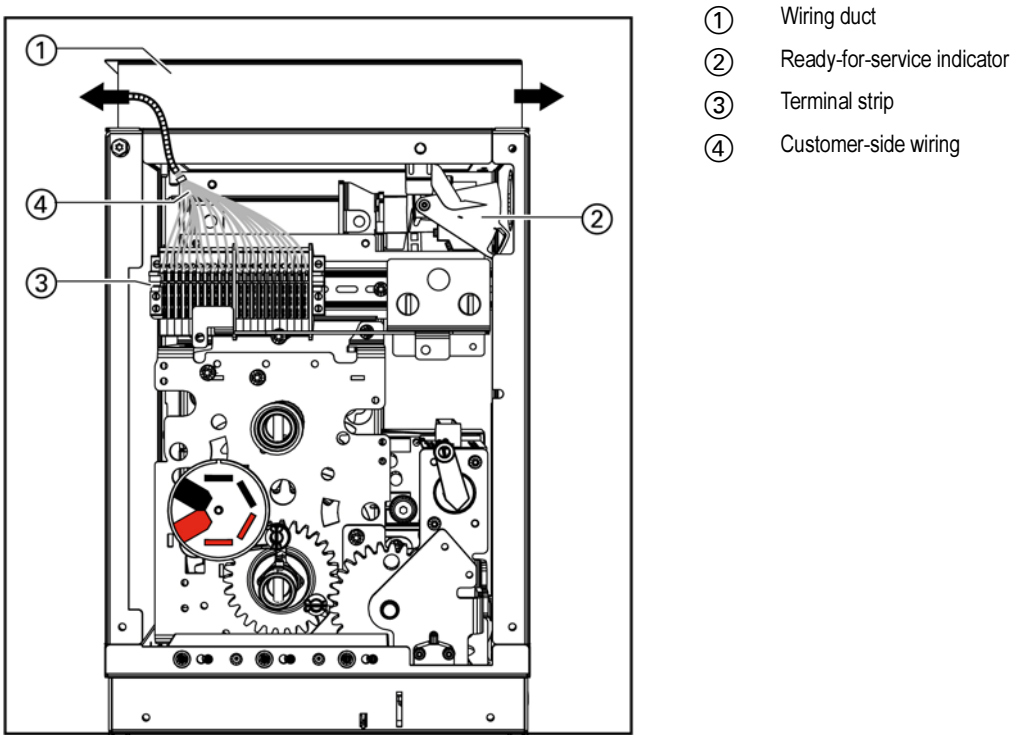


Fig. 207: Operating mechanism box in ring-main panel

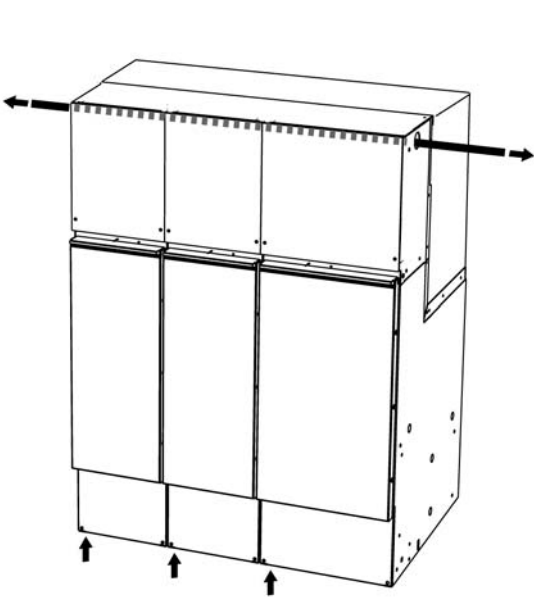


Fig. 208: Wire routing for switchgear without wiring duct

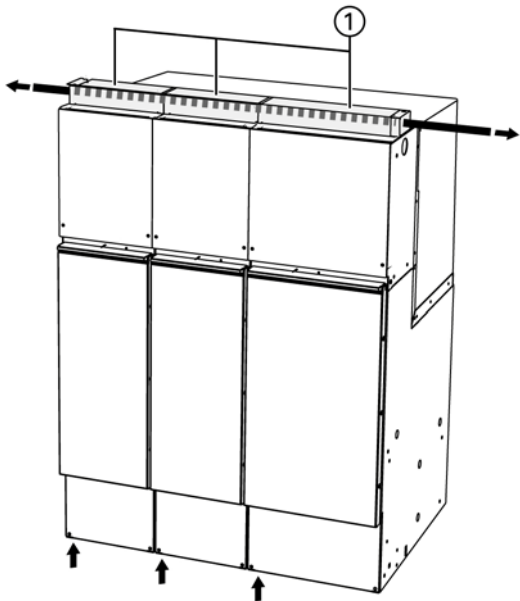


Fig. 209: Wire routing for switchgear with wiring duct

Recommended wire routing for secondary equipment: from the side, from the rear and from above. For access from below, use screened cable plugs. Wire routing through the wiring duct is possible for panel blocks. For extendable switchgear, wire routing through the wiring duct is recommended.

- ⇒ Remove the fixing bolts of the front plate.
- ⇒ Remove the front plate of the switchgear to the front.
- ⇒ Following the circuit diagrams, connect the wires ④ to the terminal strip ③ or directly to equipment terminals (e. g. CAPDIS S2+, short-circuit indicator) and lay them cleanly. Wire routing laterally to the outside (arrow) through cut-out stopper. If possible, use the wiring cable duct ①.
- ⇒ Do not switch on auxiliary voltage yet.

14.6 Correcting circuit diagrams

- ⇒ Note any modifications which may have been made during installation or commissioning in the supplied circuit diagrams.
- ⇒ Send the corrected documentation to the regional Siemens representative so that the modifications can be included.

15 Commissioning

	ATTENTION! During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled. ⇒ Do not remove covers. ⇒ Do not reach into openings.
--	---

15.1 Final tests after installation

Rating plate	⇒ Check the data on the rating plate and the auxiliary voltage of the control and end devices according to the requirements.
Readiness for service	⇒ Check ready-for-service indicator (see Page 69, "Checking the ready-for-service indicator").
Switchgear fastening/ Switchgear earthing	⇒ Check switchgear fastening. ⇒ Check connection to substation earth.
High-voltage connections	⇒ Check earthing of cable terminations on all connected high-voltage cables. ⇒ If provided by the customer, perform cable test (see Page 209, "Cable testing")
Feeder without cables	⇒ Switch the switching device to EARTHED position and lock it, or cover the bushings with surge-proof caps.
Bolted joints	⇒ Check the tightening torques of the bolted joints of the low-voltage equipment at random. ⇒ Check all parts of the switchgear that have been disassembled and assembled again at site during installation, or that have been installed subsequently, to verify correct assembly and completeness.
Auxiliary cable connections	⇒ Check correct wiring according to the circuit diagrams. ⇒ Check clamping and plug-in connections at random (perfect contact, labels, etc.).
Final work	⇒ Remove any attached instruction labels or documents that are not required anymore for operation.

- ⇒ Remove any tools, materials etc. that are not required anymore from the area of switchgear.
- ⇒ Remove dirt from the area of switchgear.
- ⇒ Fit all covers.
- ⇒ Put the caps on the capacitive test sockets.
- ⇒ Touch up scratches and impacts in the surface painting, if necessary. To do this, a paint pen is available optionally.

Checking the accessories

- ⇒ Ensure that the following accessories are ready to hand:
 - Operating instructions
 - Operating lever to operate the switchgear
 - Circuit diagrams
 - Warning signs

15.2 Mechanical and electrical function test

	DANGER!
	Putting defective switchgear into operation can endanger the life of people and damage the switchgear.
	⇒ Never put switchgear into operation if you notice during test operation that a part of it does not work as described in here. ⇒ Perform test operations with auxiliary voltage only!

Mechanical function test

- The mechanical function is tested without high-voltage.
- ⇒ Switch the operating mechanism several times by hand. Check position indicators and interlocks, and verify smooth operation of covers.
 - ⇒ Test fuse tripping with test fuse.
 - ⇒ Install and check HV HRC fuse-links.
 - ⇒ Check the ready-for-service indicator. Then, the pointer must be in the green area.

Test operation/ Electrical function test

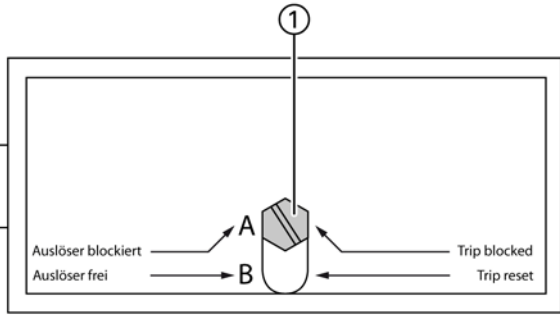
- Test operation helps you to verify the perfect operation of the switchgear without high voltage before commissioning.
- ⇒ Switch the three-position switch-disconnector with motor operation several times to CLOSED and OPEN position.
 - ⇒ Make sure that the three-position switch is switched to OPEN position after completion of test operation.
 - ⇒ Switch on all auxiliary and control voltages and verify correct polarity.
 - ⇒ Check whether the mechanical and/or electrical interlocking conditions are fulfilled without using excessive force.
 - ⇒ Check whether the switch positions of the three-position switches are displayed correctly.

Test operation at the circuit-breaker type 2 without auxiliary voltage

Circuit-breaker type 2 is optionally equipped with an undervoltage release.

Blocking the undervoltage release

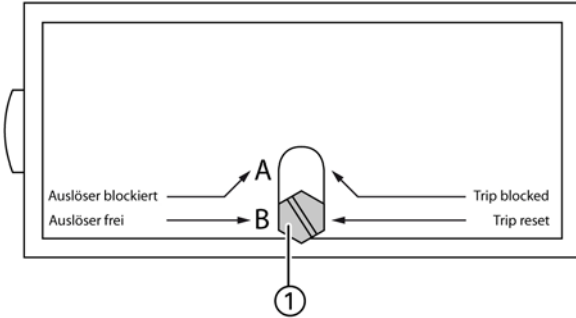
	ATTENTION!
	Avoid no-load operations as this can damage the circuit-breaker type 2. ⇒ Always close circuit-breaker type 2 first, and then open it.

	ATTENTION!
	To operate the circuit-breaker type 2 for test without auxiliary voltage, the undervoltage release must be blocked. ⇒ Insert retaining screw of the striker at the undervoltage release in position A.  Fig. 210: Retaining screw ① of the striker at the undervoltage release in position A.

Perform the following actions to guarantee that the circuit-breaker is ready for operation:

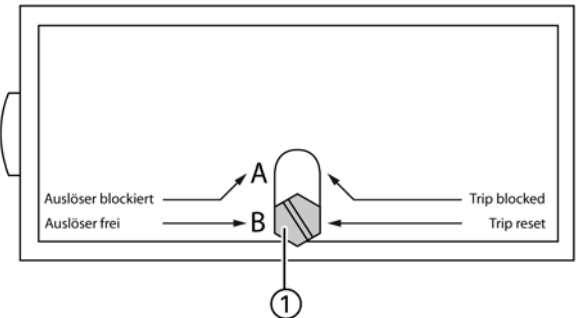
- ⇒ Charge the closing spring.
- ⇒ Operate the ON pushbutton in the circuit-breaker control board.
- ✓ The circuit-breaker is closed.
- ⇒ Operate the OFF pushbutton in the circuit-breaker control board.
- ✓ The circuit-breaker is open.

Activating the undervoltage release

	ATTENTION!
	If the retaining screw of the striker at the undervoltage release is not set back from position A to position B after test operation without auxiliary voltage, the undervoltage release will not function. ⇒ Reactivate the undervoltage release after test operation without auxiliary voltage. ⇒ Insert retaining screw of the striker in position B. Now the circuit-breaker operating mechanism is ready for operation with undervoltage release.  Fig. 211: Retaining screw ① of the striker at the undervoltage release in position B.

Test operation at the circuit-breaker type 1.1 with auxiliary voltage

Circuit-breaker type 1.1 is optionally equipped with an undervoltage release.

	ATTENTION!
	If an undervoltage release was ordered, test operation of circuit-breaker type 1.1 must only be performed with auxiliary voltage as the undervoltage release is delivered in free condition. ⇒ Test operation of circuit-breaker type 1.1 is only possible with auxiliary voltage.  Fig. 212: Retaining screw ① of the striker at the undervoltage release in position B

Malfunction during test operation

If there are any faults that cannot be cleared at site:

- ⇒ Do not put the switchgear into operation.
- ⇒ Inform the competent Siemens representative.

15.3 Preparing the power-frequency voltage test

On request, a power-frequency voltage test can be performed at site on the ready-assembled switchgear. In this case, prepare the test as follows:

- ⇒ The voltage transformers as well as the surge arresters and surge limiters must be removed.
- ⇒ Short-circuit the current transformers at the secondary terminals.
- ⇒ Protect bushings of transformers, surge arresters and surge limiters in a surge-proof way using suitable sealing caps.
- ⇒ Earth the capacitive test sockets.
- ✓ Now you can carry out the test.

15.4 Instructing the operating personnel

- ⇒ Instruct operating personnel in theory and practice of switchgear operation.

15.5 Applying operating voltage

Preparations before switching on

The operating personnel must have been instructed, the installation work checked, and test operation must have been performed without faults.

- ⇒ Close all covers.
- ⇒ Make sure that the capacitive test sockets are covered.
- ⇒ Switch switching devices in feeders without connected cables to EARTHED position and lock them, or cover the bushings with surge-proof caps.
- ⇒ Reset short-circuit indicators.
- ✓ Now you can apply operational high voltage and put the switchgear into operation as described hereafter.

Switching on the first outgoing/incoming feeder

- ⇒ First, apply voltage from opposite substation, then switch feeder from OPEN to CLOSED position.

	DANGER!
	Short-circuit in case of different phase sequence of the incoming feeders. ⇒ Make sure that all incoming feeders have the same phase sequence. ⇒ To check the phase sequence, use only phase comparison test units which are adequate for HR or LRM test sockets.

- ⇒ Verify correct phase sequence of the next incoming feeder and switch on.
- ⇒ Switch on the tested incoming feeder.

The three-position switch-disconnector of the feeder to be tested must be in "OPEN" position. The opposite substation must be de-earthed and live.

Verify correct terminal-phase connections using a phase comparison test unit at the capacitive test sockets of the panel to be tested and a panel that has already been connected.

- ⇒ Plug the measuring cables of the phase comparison test unit into the "L1" test sockets of the two panels.



- ⇒ Read the indication.
- ⇒ Proceed in the same way with the test sockets of the two other phases ("L2" and "L3").
- ✓ If the test unit shows "coincidence" in any case, the phase sequence of the tested feeder is correct.
- ✓

Switching on consumer feeders

When all incoming feeders are switched on:

- ⇒ One after the other, switch on all outgoing feeders that are connected to consumers only.
- ✓ Now, all feeders are switched on; the switchgear is totally in operation.

Operation

	DANGER! The internal arc classification of the switchgear according to IEC 62271-200 has only been proved by tests for the switchgear sides with internal arc classification and with closed high-voltage compartments. ⇒ Determine the IAC classification of the switchgear by means of the data on the rating plate (see Page 61, "Rating plates"). ⇒ Regulations for access to switchgear areas without internal arc classification according to IEC 62271-200 must be defined by the entrepreneur or the switchgear owner.
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16 Indicators and control elements

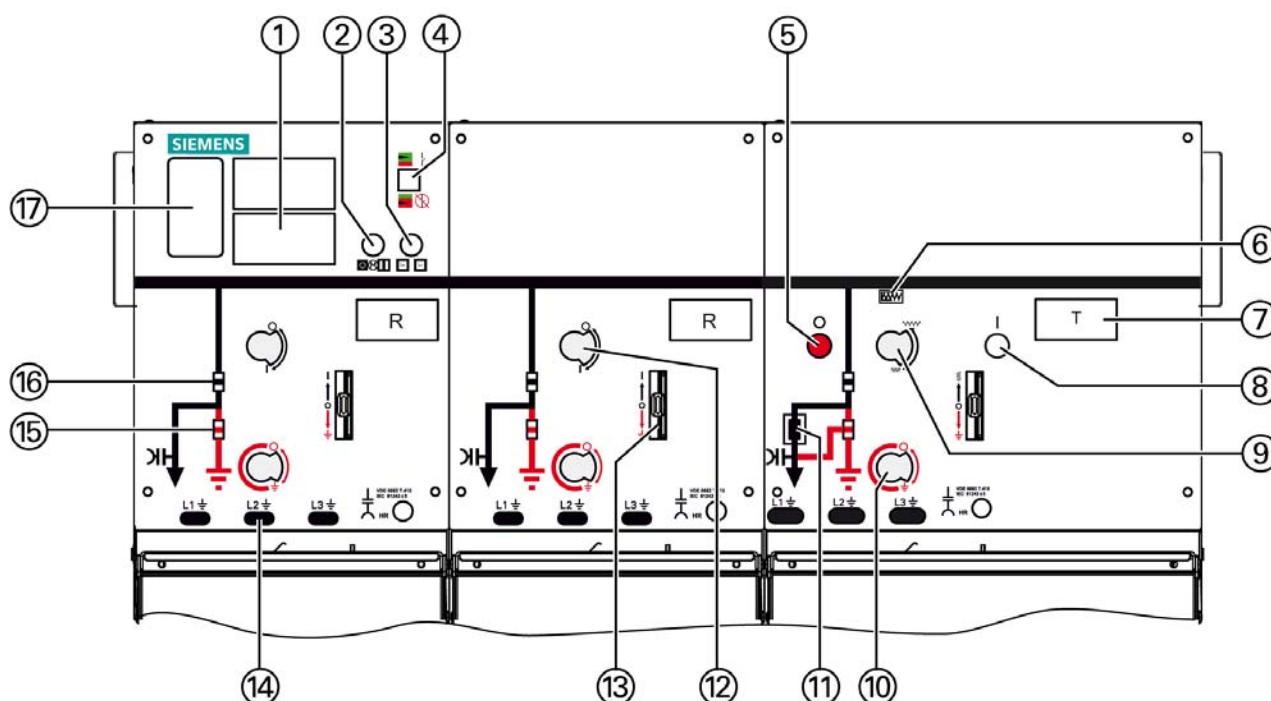
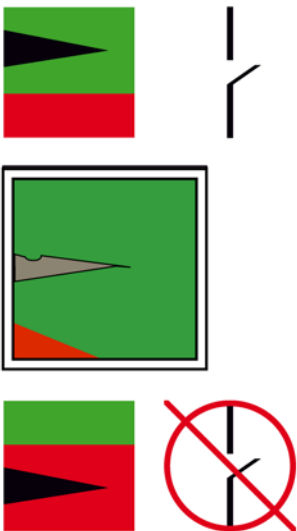


Fig. 213: 8DJH: RRT block

- | | |
|--|---|
| ① Short-circuit/earth-fault indicator | ⑩ Manual operation for the mechanism of the earthing function CLOSED/OPEN |
| ② ON/OFF pushbutton for motor operating mechanism (option) | ⑪ "Fuse tripped" indicator |
| ③ Local/remote switch for motor operating mechanism (option) | ⑫ Manual operation for the mechanism of the load-break function CLOSED/OPEN |
| ④ Ready-for-service indicator | ⑬ Control gate/locking device (option for three-position switch-disconnector) |
| ⑤ OFF pushbutton (transformer feeder only) | ⑭ Socket of capacitive voltage detecting system (HR system) |
| ⑥ Spring "charged/not charged" indicator | ⑮ Position indicator for earthing switch |
| ⑦ Feeder designation labels | ⑯ Position indicator for disconnector |
| ⑧ ON pushbutton (transformer feeder only) | ⑰ Rating plate |
| ⑨ Actuating opening for SPRING CHARGING | |

17 Operating the three-position switch-disconnector

	DANGER!
	During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled. ⇒ Do not remove covers. ⇒ Do not reach into openings.

	DANGER!
	If the gas filling is insufficient, this can cause personal injuries and material damages. ⇒ Check readiness for service before performing any switching operation; to do this, verify that the pointer of the ready-for-service indicator is in the green area.  ⇒ If the pointer is in the red area: - Do not operate the switchgear - Isolate the switchgear and put it out of service.

	ATTENTION!
	Earthing a live incoming cable will trip the upstream circuit-breaker. ⇒ Verify safe isolation from supply of the feeder before earthing.

17.1 Operations

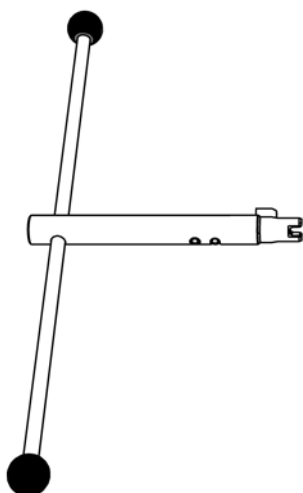


Fig. 214: Standard operating lever, short

Standard: Single-lever operation with black handle and coding as universal lever.

Alternative 1: One operating lever with red handle for earthing and de-earthing, and one operating lever with black handle for load breaking.

Alternative 2: Single-lever operation via anti-reflex lever with and without coding.

All operating levers are available in short and long design. The long operating lever is equipped with an additional spacing tube.

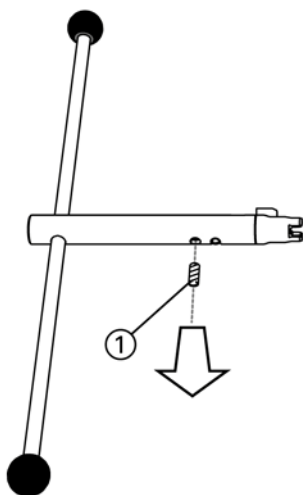


Fig. 215: Converting the standard operating lever into an anti-reflex lever

① Setscrew

Remove setscrew as shown in the illustration to get an anti-reflex lever.

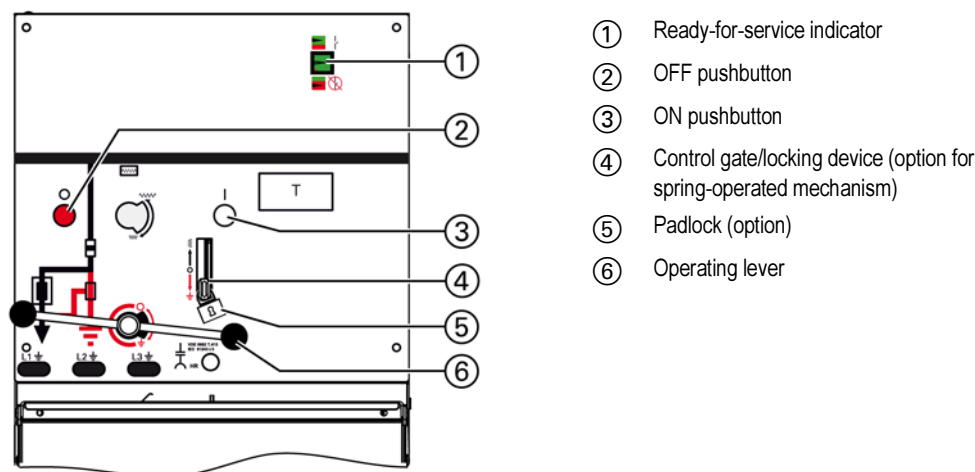


Fig. 216: Control board of three-position switch with spring-operated mechanism

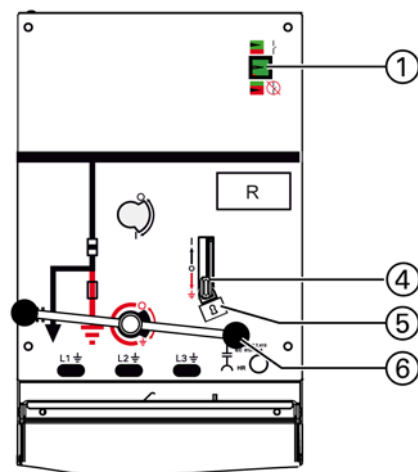


Fig. 217: Control board of three-position switch with stored-energy mechanism

	DANGER! Non-observance of the following instructions can endanger people or damage the switchgear. ⇒ The sequence of the following instructions has to be followed by all means. ⇒ All instructions have to be executed.
--	---

**Operations for CLOSING
(spring-operated
mechanism)**

- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Push control gate ④ (optional depending on situation) upwards to release the switching gate, and hold it tight.
- ⇒ Insert operating lever ⑥ and move straight to CLOSED position.
- ✓ The switchgear is energized.
- ⇒ Remove operating lever. The control gate moves to the center position automatically.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

**Operations for OPENING
(spring-operated
mechanism)**

- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Push control gate ④ (optional depending on situation) upwards to release the switching gate, and hold it tight.
- ⇒ Insert operating lever ⑥ and move straight to OPEN position.
- ✓ The switchgear is de-energized.
- ⇒ Remove operating lever. The control gate moves to the center position automatically.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

**Operations for CLOSING
(stored-energy mechanism)**

- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Push control gate ④ (optional depending on situation) upwards to release the switching gate, and hold it tight.
- ⇒ Insert operating lever ⑥ and move straight to the switch position (switchgear prepared for CLOSING).
- ⇒ Remove operating lever. The control gate moves to the center position automatically.
- ✓ The switchgear is prepared for CLOSING.
- ⇒ Actuate ON pushbutton ③.
- ✓ The switchgear is energized and the spring energy store for CLOSING is not charged.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

**Operations for OPENING
(stored-energy mechanism)**

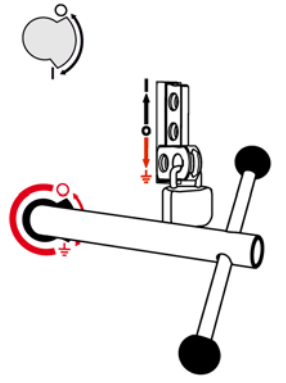
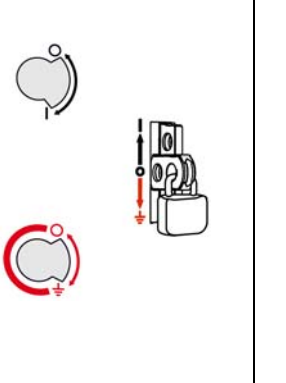
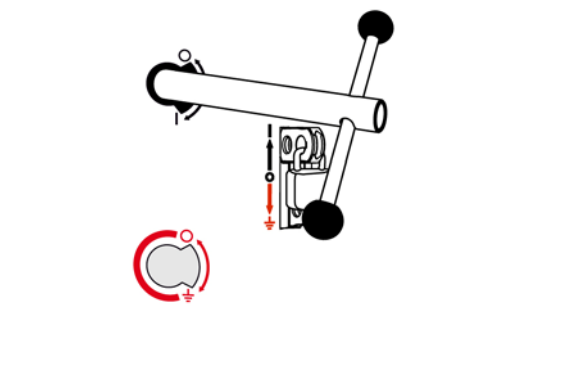
- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Actuate OFF pushbutton ②.
- ✓ The switchgear is de-energized and the spring energy store for OPENING is not charged.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

**Operations for earthing
switch CLOSED**

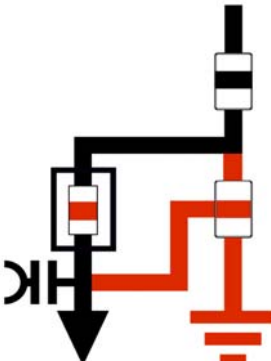
- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Operate control gate ④ (optional depending on situation) downwards to release the switching gate, and hold it tight.
- ⇒ Insert operating lever ⑥ and move straight to the switch position (EARTHED).
- ✓ The switchgear is earthed.
- ⇒ Remove operating lever. The control gate moves to the center position automatically.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

Operations for earthing switch OPEN

- ⇒ Check ready-for-service indicator ①.
- ⇒ Remove padlock ⑤ (optional).
- ⇒ Operate control gate ④ (optional depending on situation) downwards to release the switching gate, and hold it tight.
- ⇒ Insert operating lever ⑥ and move straight to the switch position (OPEN).
- ✓ The switchgear is de-energized.
- ⇒ Remove operating lever. The control gate moves to the center position automatically.
- ⇒ Refit padlock at desired position.
- ✓ The locking device (optional depending on situation) of the switching gate can be padlocked in all three switch positions.

				
Padlock	Down	Center	Up	
Actuating opening	Earthing switch	-	Disconnecter/switch-disconnector	Circuit-breaker/transformer switch
Possible switching operations	Only EARTHING and DE-EARTHING possible	No switching operations possible Precondition: Spring energy store not charged	- Only CLOSING and OPENING possible - Only possible if the circuit-breaker is open	- Charging the spring

17.2 Protection tripping for the three-position switch-disconnector with spring-operated/ stored-energy mechanism

	NOTE!
	If the opening spring of the transformer switch was tripped by a fuse-link: ⇒ The fuse indicator shows red. ⇒ The motor operating mechanism (option) is out of operation. 

Re-establishing service readiness

- ⇒ Earth the switching device.
- ⇒ Replace **all** HV HRC fuse-links (see Page 205, "Replacing HV HRC fuse-links"). HV HRC fuse-links may also be damaged if their striker was not tripped.

17.3 Ring-main and circuit-breaker panels: Operating the three-position switch

Connecting the feeder to the busbar:

Initial situation (three-position switch OPEN, earthing switch OPEN)	Push control gate upwards	Switch three-position switch to CLOSED position (insert operating lever and turn approx. 70° clockwise)	Remove operating lever (control gate returns to its initial position)

Disconnecting the feeder from the busbar:

Initial situation (three-position switch CLOSED, earthing switch OPEN)	Push control gate upwards	Switch three-position switch to OPEN position (insert operating lever and turn approx. 70° counter-clockwise)	Remove operating lever (control gate returns to its initial position)

Feeder earthing:

Initial situation (three-position switch OPEN, earthing switch OPEN)	Push control gate downwards	Switch earthing switch to CLOSED position (insert operating lever and turn approx. 55° clockwise)	Remove operating lever (control gate returns to its initial position)

Feeder de-earthing:

Initial situation (three-position switch OPEN, earthing switch CLOSED)	Push control gate downwards	Switch earthing switch to OPEN position (insert operating lever and turn approx. 55° counter-clockwise)	Remove operating lever (control gate returns to its initial position)

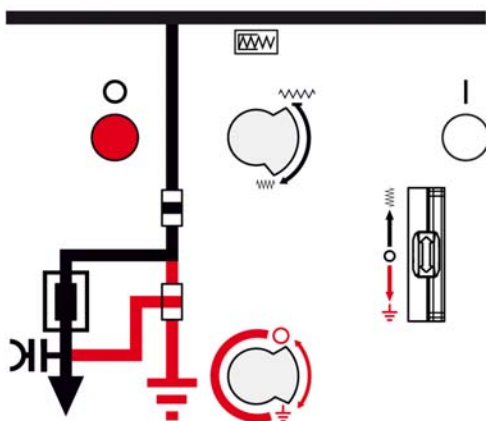
17.4 Operating the transformer feeder

	DANGER!
	If the operating lever is still inserted when the transformer switch is tripped by means of a test fuse, persons can be injured. ⇒ Remove the operating lever.

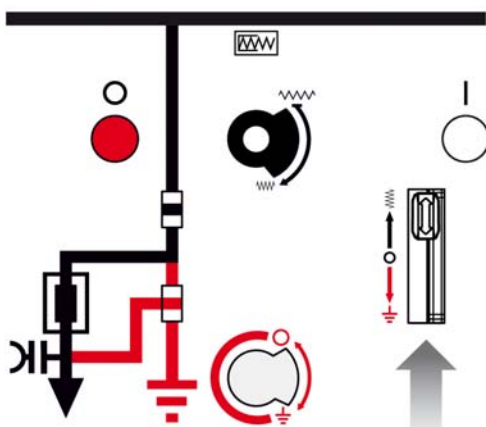
	ATTENTION!
	Avoid no-load operations as this can damage the operating mechanism. ⇒ Close the operating mechanism first, and then open it .

Connecting the transformer feeder to the busbar

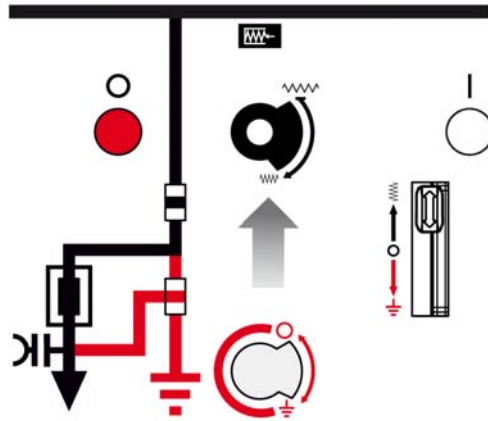
⇒ Initial situation OPEN.



⇒ Push control gate upwards.

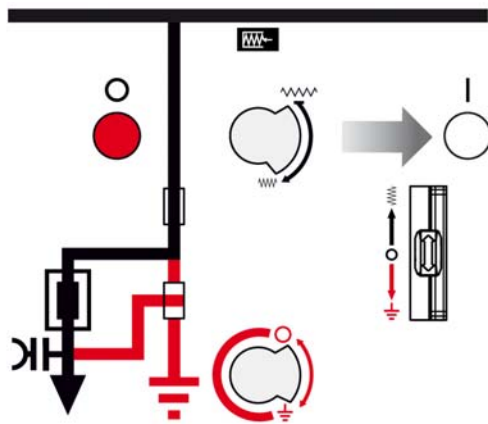


⇒ Insert operating lever and turn 70° clockwise.



⇒ Remove operating lever (control gate returns to its initial position).

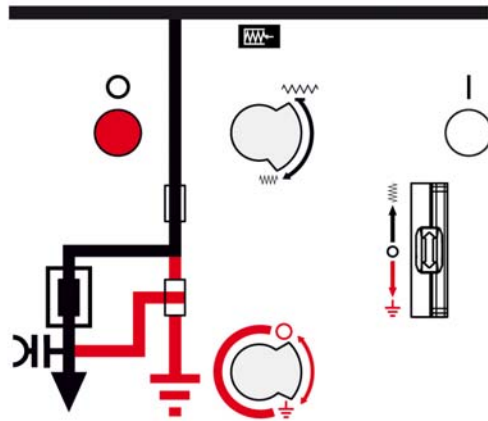
⇒ Actuate the "ON" pushbutton.



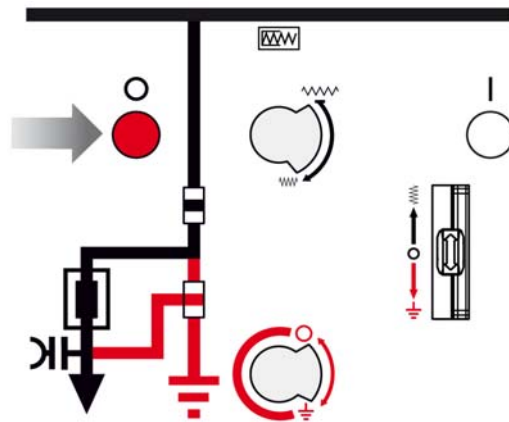
✓ The feeder is closed.

Disconnecting the transformer feeder from the busbar

⇒ Initial situation CLOSED.



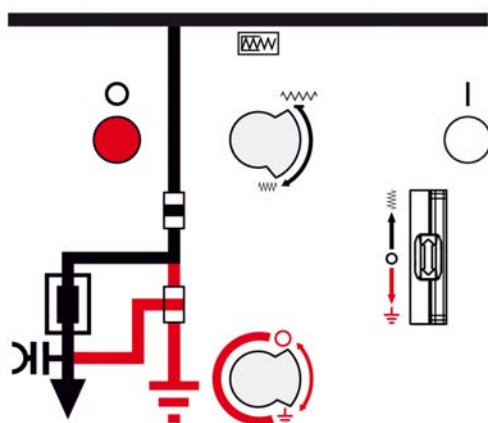
⇒ Actuate the "OFF" pushbutton.



✓ The feeder is open.

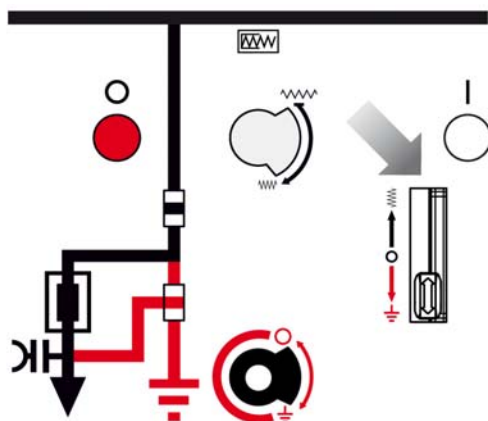
Earthing the transformer feeder

⇒ Initial situation OPEN.

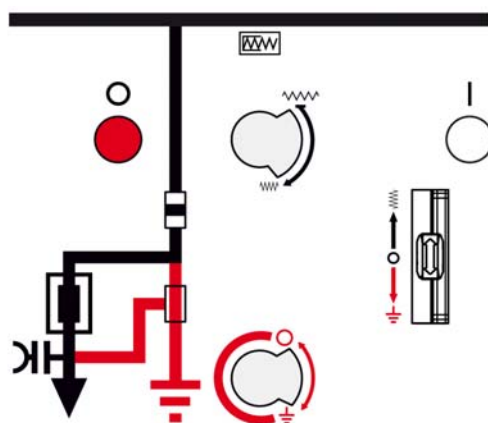


⇒ Push control gate downwards.

⇒ Insert operating lever and turn 55° clockwise.



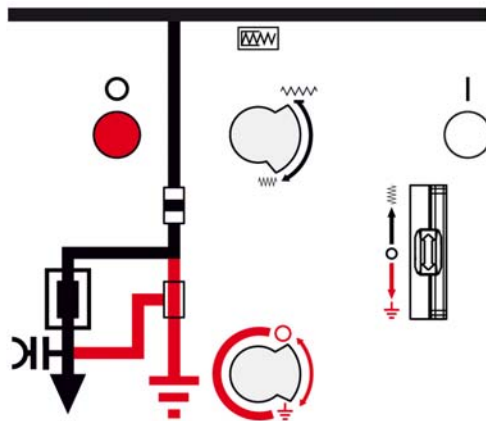
⇒ Remove operating lever (control gate returns to its initial position).



✓ The feeder is earthed.

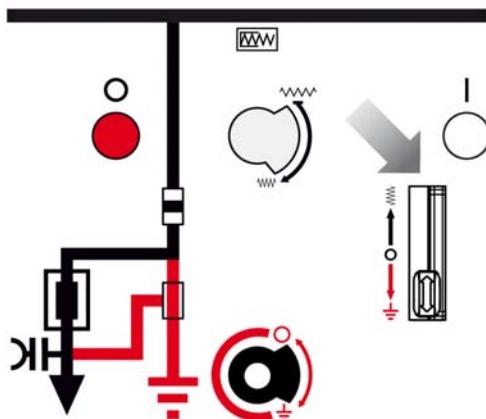
De-earthing the transformer feeder

⇒ Initial situation EARTHED.

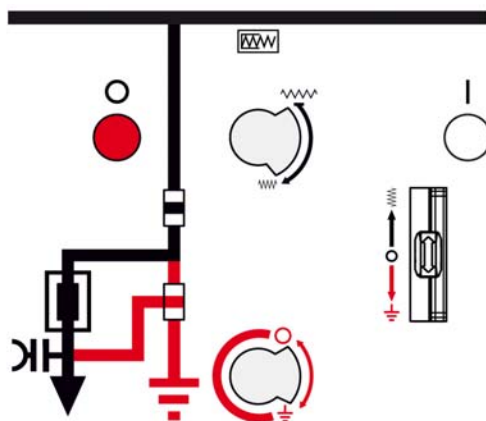


⇒ Push control gate downwards.

⇒ Insert operating lever and turn 55° counter-clockwise.



⇒ Remove operating lever (control gate returns to its initial position).



✓ The feeder is de-earthed.

18 **Operating the vacuum circuit-breaker type 2**

Possible switching operations:

- Manual local operation, i.e. at the panel itself
- Electrical remote operation, e.g. from the control center
- Automatic operation from the installed protection equipment, e.g. SIPROTEC

	ATTENTION!
	Avoid no-load switching as this can damage circuit-breaker type 2. ⇒ After charging the spring energy store, close circuit-breaker type 2 first, and then open it.

If the circuit-breaker is equipped with a motor operating mechanism, the closing and opening springs are charged automatically after applying auxiliary voltage. The circuit-breaker can be closed via a closing pulse supplied by the closing coil.

If the circuit-breaker is operated manually, the closing and opening springs must be charged manually (see Page 191, "Charging the spring energy store manually").

The circuit-breaker can be closed and opened with the pushbuttons.

The opening spring is charged together with the closing spring.

The control elements of the circuit-breaker are located at the panel front in the upper control board.

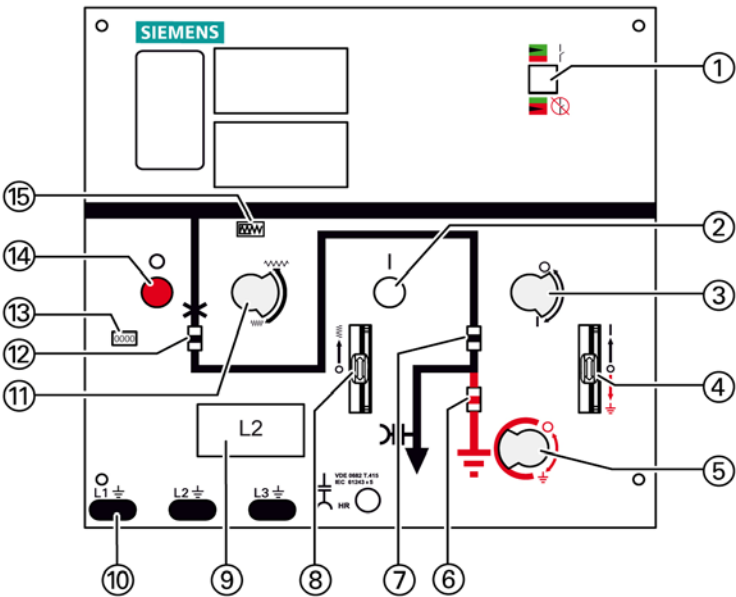


Fig. 218: Control board of circuit-breaker panel type 2

- ① Ready-for-service indicator
- ② ON pushbutton for circuit-breaker
- ③ Actuating opening for DISCONNECTING, three-position disconnect
- ④ Control gate/locking device for three-position disconnect
- ⑤ Actuating opening for EARTHING
- ⑥ Position indicator for earthing switch
- ⑦ Position indicator for disconnect
- ⑧ Control gate/locking device for circuit-breaker
- ⑨ Feeder designation label
- ⑩ Socket of capacitive voltage detecting system (HR system)
- ⑪ Actuating opening for "spring charging" at the circuit-breaker
- ⑫ Position indicator for circuit-breaker
- ⑬ Operations counter (option)
- ⑭ OFF pushbutton for circuit-breaker
- ⑮ Indicator for the circuit-breaker closing and opening springs (not charged / charged)

	ATTENTION!
	Please do absolutely observe the following: ⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 46, "Three-position disconnect" and see Page 45, "Three-position switch-disconnector").

18.1 Closing the circuit-breaker type 2 "locally"

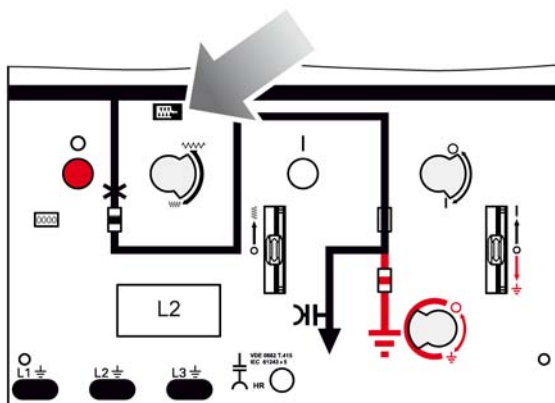
How to close the circuit-breaker depends on the equipment of the switchgear panel.

There are two versions of circuit-breaker operating mechanisms:

- Stored-energy spring mechanism
- Stored-energy spring mechanism with motor (option)

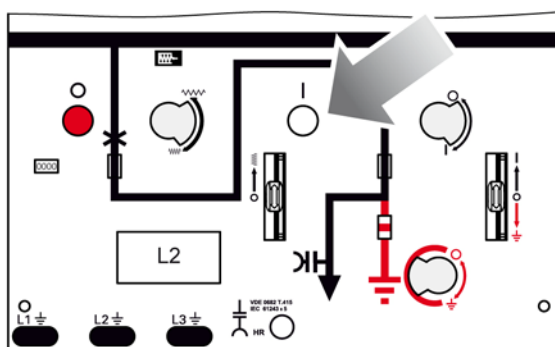
Closing with stored-energy mechanism

⇒ Make sure that the closing and opening springs of the stored-energy mechanism are charged.



⇒ Actuate the "ON" pushbutton.

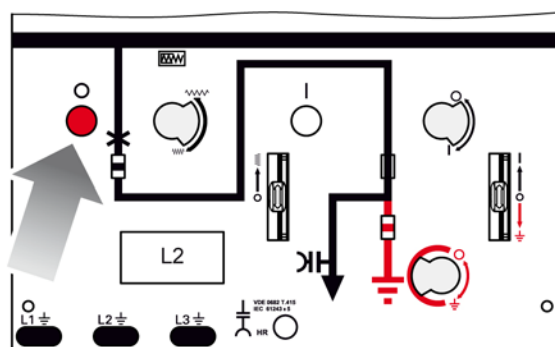
⇒ The position indicator of the circuit-breaker in the mimic diagram is in CLOSED position.



✓ The circuit-breaker is closed.

18.2 Opening the circuit-breaker type 2 "locally"

⇒ Actuate the "OFF" pushbutton.

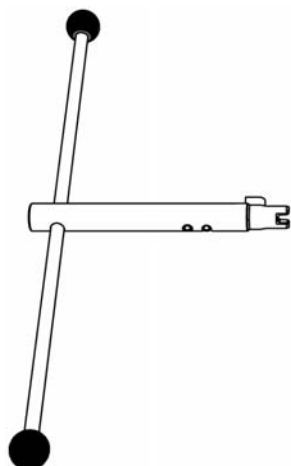


✓ The position indicator of the circuit-breaker in the mimic diagram is in OPEN position.

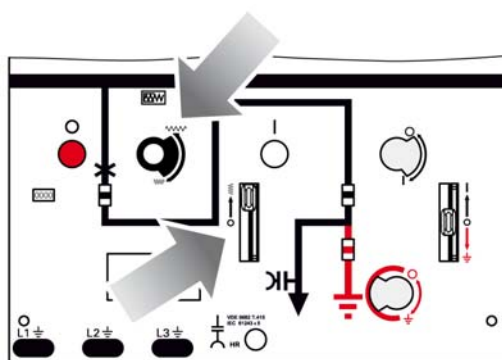
18.3 Charging the spring energy store manually

During manual operation or if the auxiliary voltage fails (motor operating mechanism), the spring energy store must be charged manually. The closing and opening springs are charged automatically after applying control voltage.

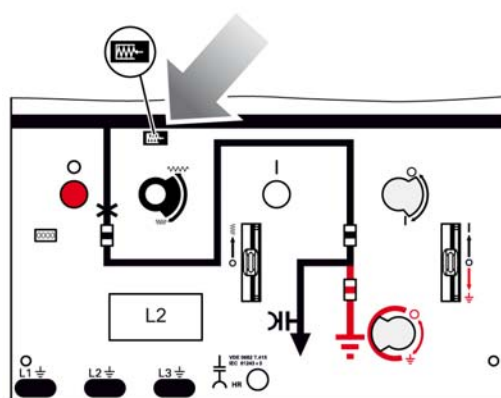
Auxiliary means required: Operating lever.



The opening for the operating lever is located top-left at the control board.



- ⇒ Open the locking device.
- ⇒ Insert the operating lever.
- ⇒ Turn the operating lever approx. 70° clockwise until the "spring charged" indication appears in the inspection window.

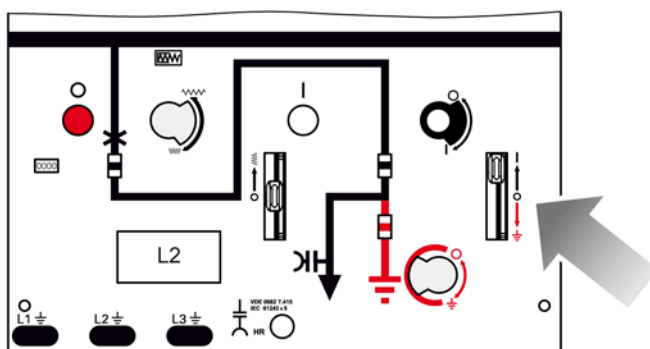


- ⇒ Remove the operating lever.
- ⇒ The control gate moves to the center position automatically. The actuating opening is closed.
- ✓ The closing and opening springs of the circuit-breaker are charged. The circuit-breaker can be closed and opened again.

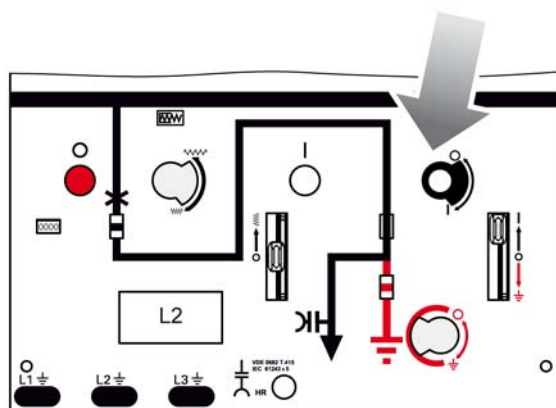
18.4 Closing the three-position disconnecter in the circuit-breaker panel type 2

	ATTENTION! Please do absolutely observe the following: ⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 47, "Vacuum circuit-breaker " and see Page 46, "Three-position disconnecter ").
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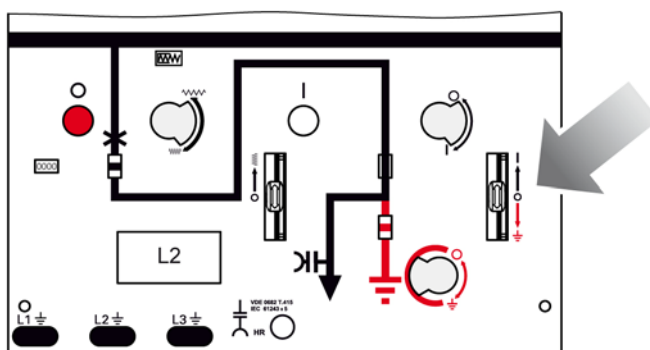
- ⇒ Push the control gate of the disconnecter upwards. The actuating opening for the disconnecter is free. Only possible with the circuit-breaker in OPEN position.



- ⇒ Insert the operating lever and turn 70° clockwise. The position indicator of the disconnecter in the mimic diagram is in CLOSED position.



- ⇒ Remove the operating lever.
- ⇒ The control gate of the disconnecter moves to the center position automatically. The actuating opening is closed.



- ✓ The disconnecter is closed.

18.5 Opening the three-position disconnecter in the circuit-breaker panel type 2

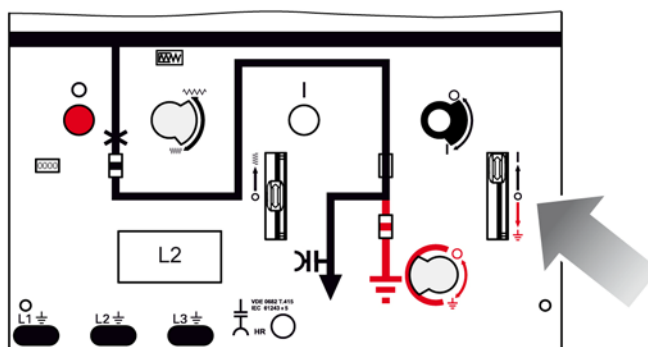


ATTENTION!

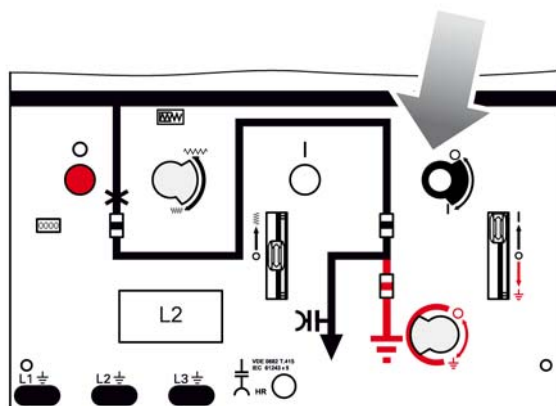
Please do absolutely observe the following:

- ⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 47, "Vacuum circuit-breaker" and see Page 46, "Three-position disconnecter").

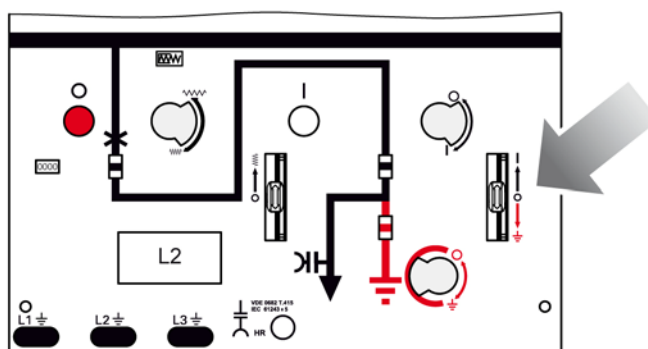
- ⇒ Push the control gate of the disconnecter upwards. The actuating opening for the disconnecter is free.



- ⇒ Insert the operating lever and turn 70° counter-clockwise. The position indicator of the disconnecter in the mimic diagram is in OPEN position.



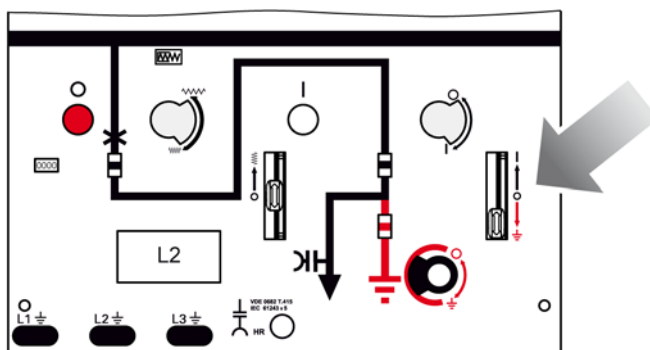
- ⇒ Remove the operating lever.
- ⇒ The control gate of the disconnecter moves to the center position automatically. The actuating opening is closed.



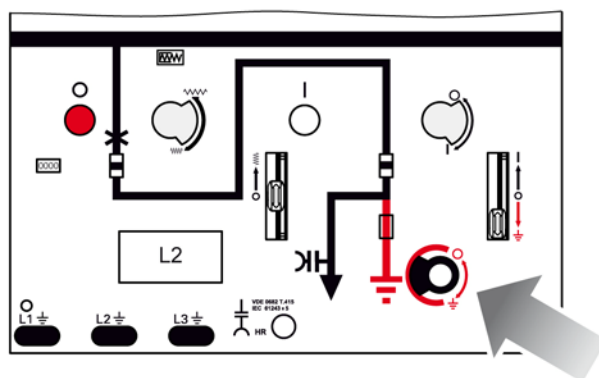
- ✓ The disconnecter is open.

18.6 Three-position disconnecter in the circuit-breaker panel type 2: EARTHED position

⇒ Push the control gate of the disconnecter downwards. The actuating opening is free.

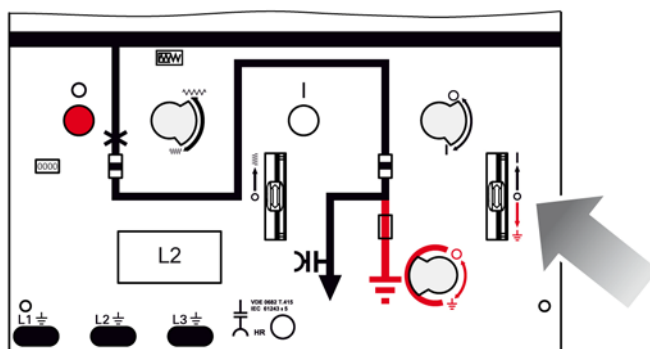


⇒ Insert the operating lever and turn 55° clockwise.



⇒ Remove the operating lever.

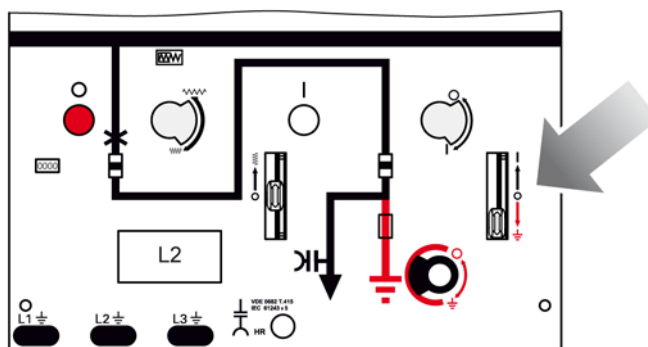
⇒ The control gate moves to the center position automatically. The actuating opening is closed.



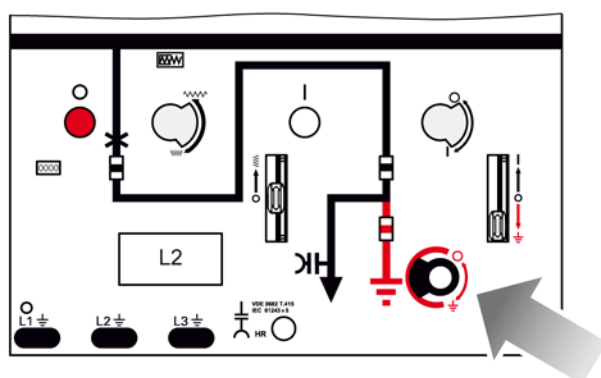
✓ The circuit-breaker panel is earthed.

18.7 Three-position disconnecter in the circuit-breaker panel type 2: Deactivating the EARTHED position

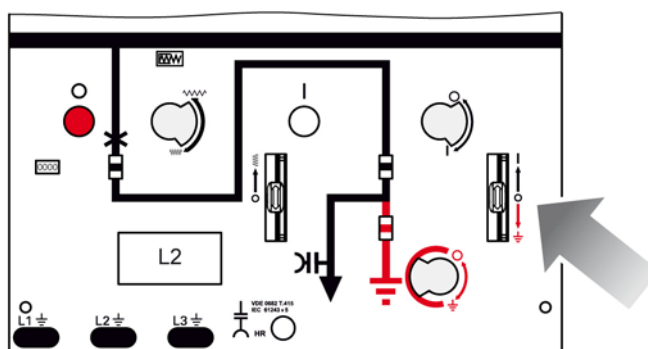
- ⇒ Push the control gate of the disconnecter downwards. The actuating opening for the earthing switch is free.



- ⇒ Insert the operating lever and turn 55 ° counter-clockwise.



- ⇒ Remove the operating lever.
- ⇒ The control gate moves to the center position automatically. The actuating opening is closed.



- ⇒ The circuit-breaker panel is de-earthed.

19 Operating the vacuum circuit-breaker type 1.1

Possible switching operations:

- Manual local operation, i.e. at the panel itself
- Electrical remote operation, e.g. from the control center
- Automatic operation from the installed protection equipment, e.g. SIPROTEC

If the circuit-breaker is equipped with a motor operating mechanism, the closing spring is charged automatically after applying auxiliary voltage. The circuit-breaker can be closed via a closing pulse supplied by the closing coil.

If the circuit-breaker is operated manually, the closing spring must be charged manually (see Page 198, "Charging the spring energy store manually").

The circuit-breaker can be closed and opened with the pushbuttons.

The control elements of the circuit-breaker are located at the panel front in the upper control board.

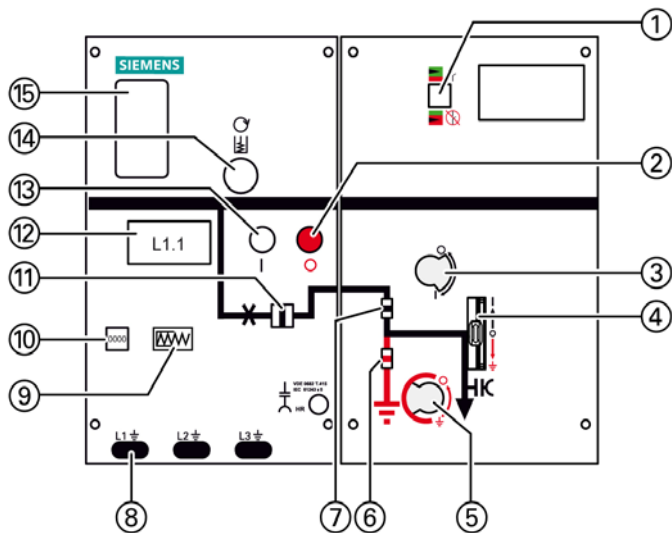


Fig. 219: Control board of circuit-breaker panel type 1.1

- ① Ready-for-service indicator
- ② OFF pushbutton for circuit-breaker
- ③ Actuating opening for DISCONNECTING, three-position disconnecting
- ④ Control gate/locking device for three-position disconnecting
- ⑤ Actuating opening for EARTHING
- ⑥ Position indicator for earthing switch
- ⑦ Position indicator for disconnecting
- ⑧ Socket of capacitive voltage detecting system (HR system)
- ⑨ Indicator for the circuit-breaker closing spring (not charged / charged)
- ⑩ Operations counter
- ⑪ Position indicator for circuit-breaker
- ⑫ Feeder designation label
- ⑬ ON pushbutton for circuit-breaker
- ⑭ Actuating opening for "spring charging" at the circuit-breaker
- ⑮ Rating plate

	ATTENTION! Please do absolutely observe the following: ⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 47, "Vacuum circuit-breaker " and see Page 46, "Three-position disconnecting").
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19.1 Closing the circuit-breaker type 1.1 "locally"

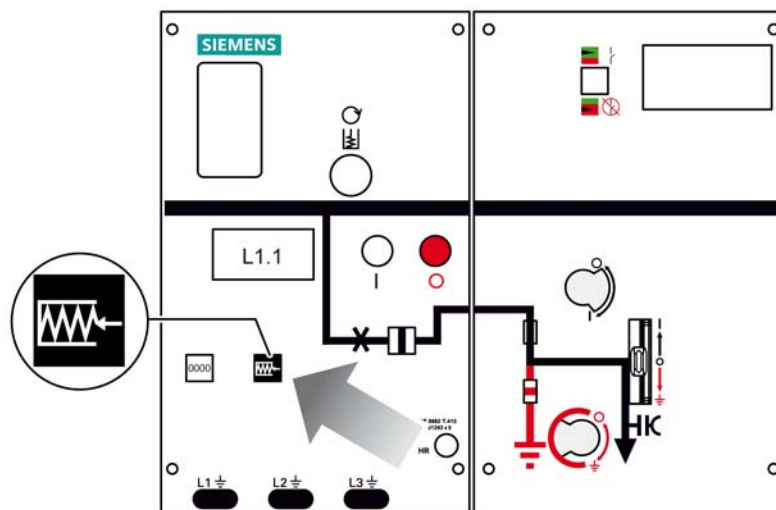
How to close the circuit-breaker depends on the equipment of the switchgear panel.

There are two versions of circuit-breaker operating mechanisms:

- Stored-energy spring mechanism
- Stored-energy spring mechanism with motor (option)

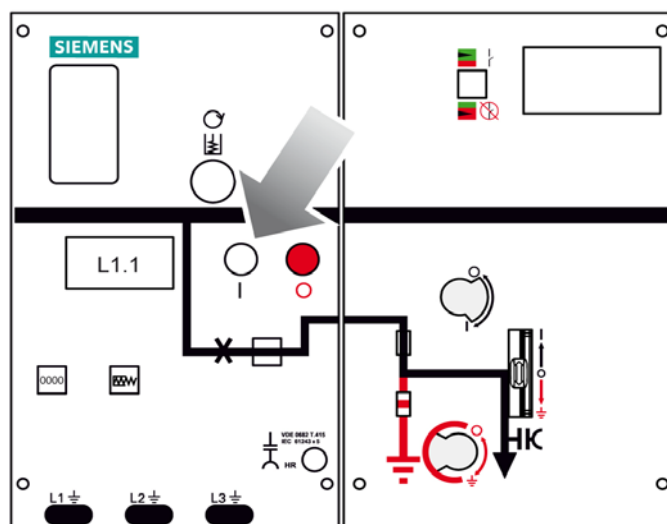
Closing with stored-energy mechanism

⇒ Make sure that the closing spring of the stored-energy mechanism is charged.



⇒ Actuate the "ON" pushbutton.

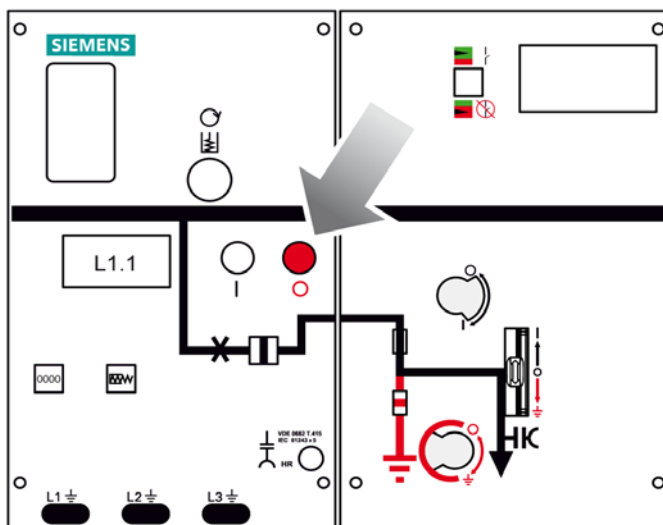
⇒ The position indicator of the circuit-breaker in the mimic diagram is in CLOSED position.



✓ The circuit-breaker is closed.

19.2 Opening the circuit-breaker type 1.1 "locally"

⇒ Actuate the "OFF" pushbutton.



✓ The position indicator of the circuit-breaker in the mimic diagram is in OPEN position.

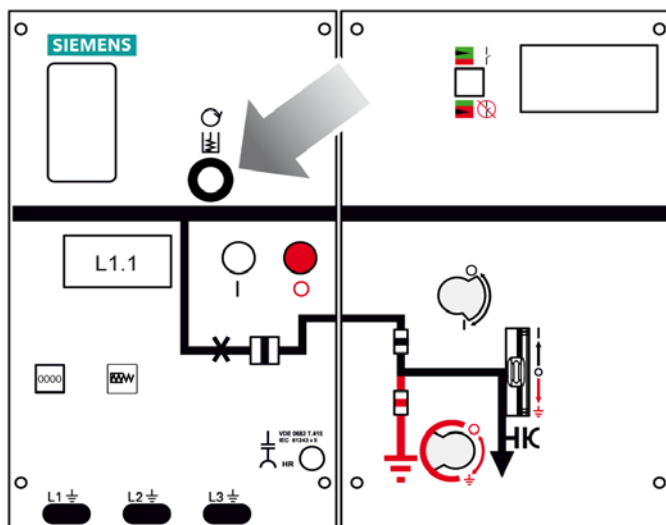
19.3 Charging the spring energy store manually

During manual operation or if the auxiliary voltage fails (motor operating mechanism), the spring energy store must be charged manually. The closing spring is charged automatically after applying control voltage.

Auxiliary means required: Hand crank.



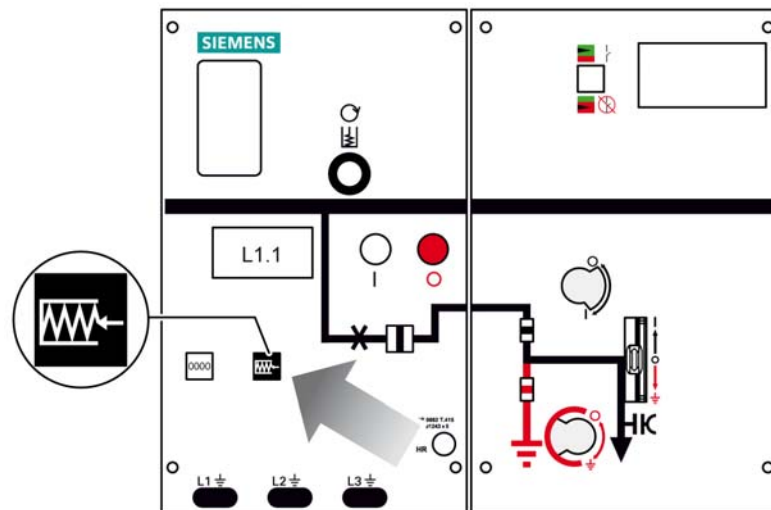
The opening for the hand crank is located top-left at the control board.



⇒ Remove the protective cap.

⇒ Insert the hand crank.

- ⇒ Turn the hand crank clockwise until the "spring charged" indication appears in the inspection window.

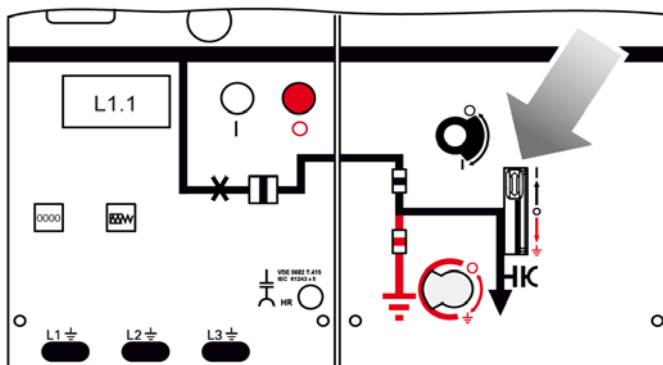


- ⇒ Remove the hand crank.
- ✓ The circuit-breaker closing spring is charged. The circuit-breaker can be closed and opened again. Please observe that the spring must be re-charged manually after closing in order to ensure the operating sequence O - 0.3s - CO for automatic reclosing. Then, refit the protective cover.

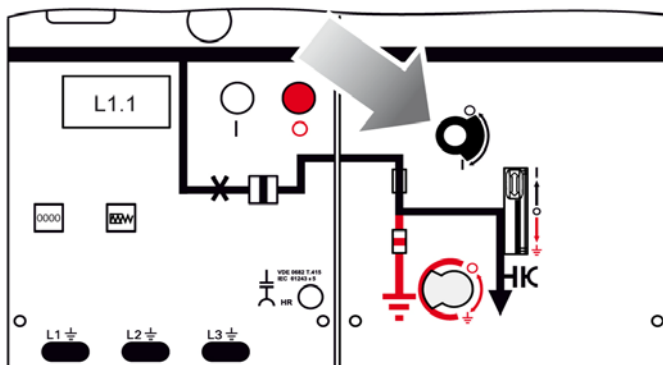
19.4 Closing the three-position disconnecter in the circuit-breaker panel type 1.1

	ATTENTION! Please do absolutely observe the following: ⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 47, "Vacuum circuit-breaker " and see Page 46, "Three-position disconnecter ").
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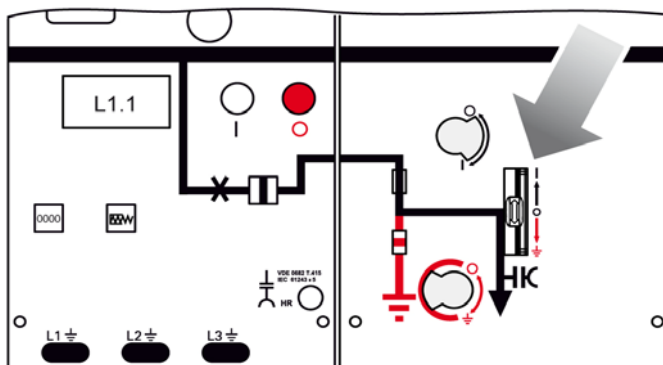
- ⇒ Push the control gate of the disconnecter upwards. The actuating opening for the disconnecter is free. Only possible if the vacuum circuit-breaker is in OPEN position.



- ⇒ Insert the operating lever and turn 70° clockwise.



- ⇒ Remove the operating lever.
- ⇒ The control gate moves to the center position automatically. The actuating opening is closed.



- ✓ The disconnecter is closed.

19.5 Opening the three-position disconnecter in the circuit-breaker panel type 1.1

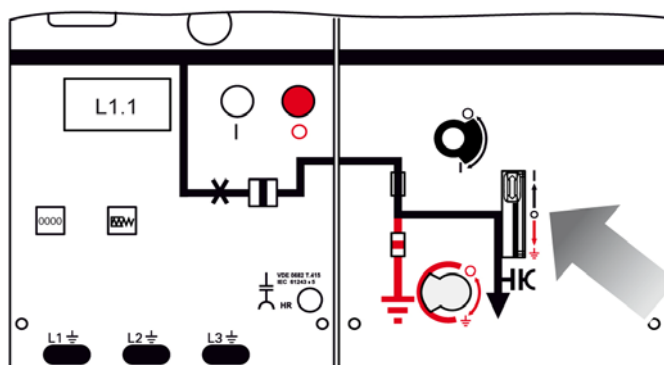


ATTENTION!

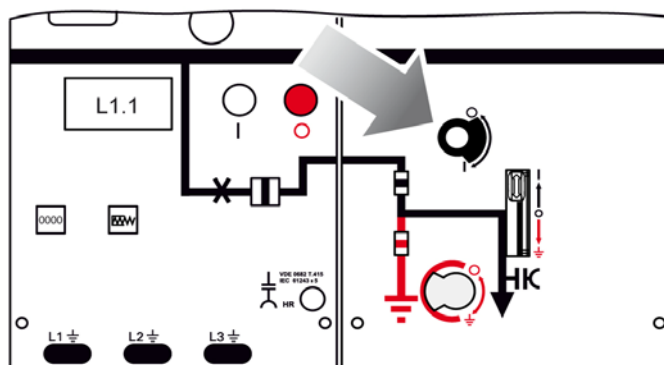
Please do absolutely observe the following:

⇒ The max. service life of the circuit-breaker panel depends on the permissible number of switching operations of the switching device used (see Page 47, "Vacuum circuit-breaker" and see Page 46, "Three-position disconnecter").

⇒ Push the control gate of the disconnecter upwards. The actuating opening for the disconnecter is free.

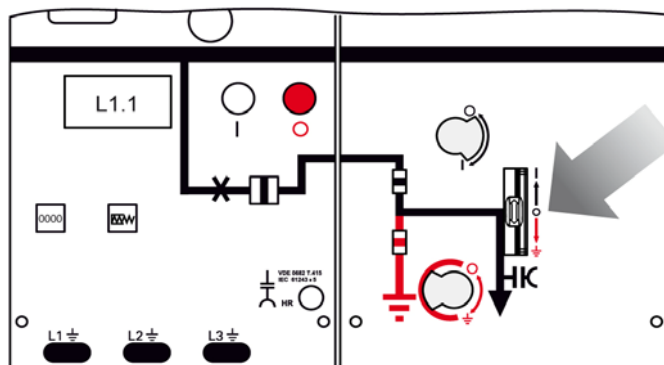


⇒ Insert the operating lever and turn 70° counter-clockwise.



⇒ Remove the operating lever.

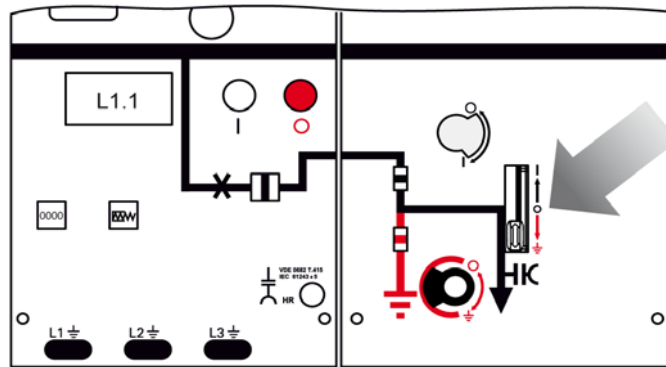
⇒ The control gate of the disconnecter moves to the center position automatically. The actuating opening is closed.



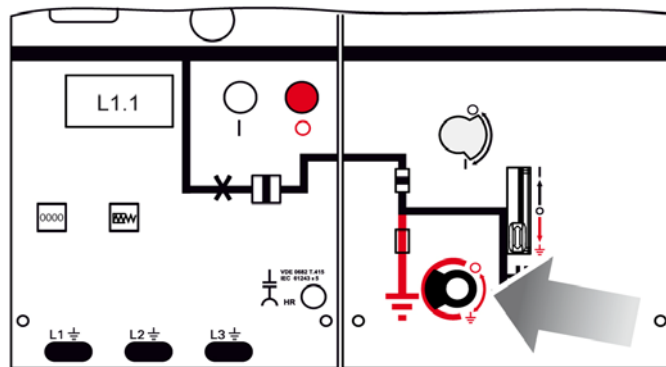
✓ The disconnecter is open.

19.6 Three-position disconnecter in the circuit-breaker panel type 1.1: EARTHED position

⇒ Push the control gate of the disconnecter downwards. The actuating opening is free.

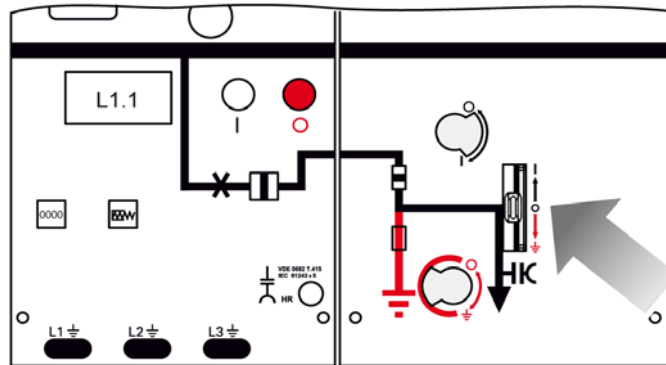


⇒ Insert the operating lever and turn 55° clockwise. The position indicator of the disconnecter in the mimic diagram shows EARTHED position.



⇒ Remove the operating lever.

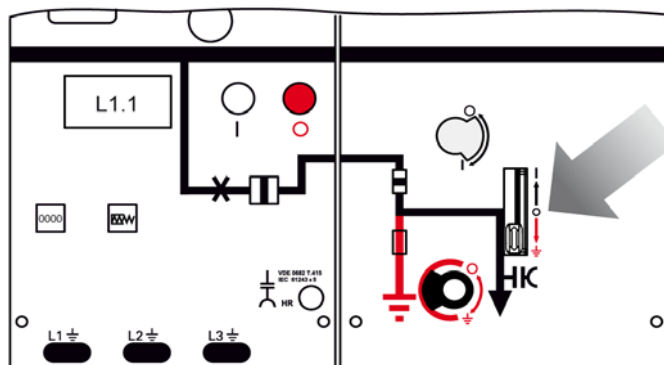
⇒ The control gate moves to the center position automatically. The actuating opening is closed.



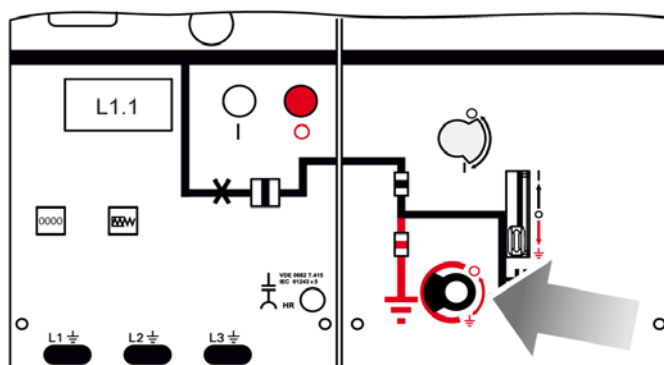
✓ The circuit-breaker panel is earthed.

19.7 Three-position disconnecter in the circuit-breaker panel type 1.1: Deactivating the EARTHED position

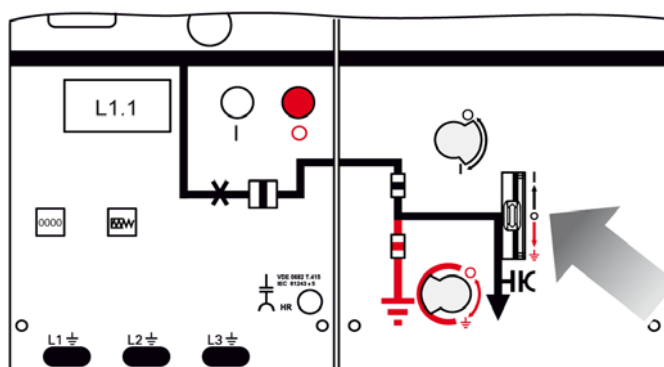
- ⇒ Push the control gate of the disconnecter downwards. The actuating opening for the earthing switch is free.



- ⇒ Insert the operating lever and turn 55° counter-clockwise. The position indicator of the disconnecter in the mimic diagram shows DE-EARTHED position.



- ⇒ Remove the operating lever.
- ⇒ The control gate moves to the center position automatically. The actuating opening is closed.



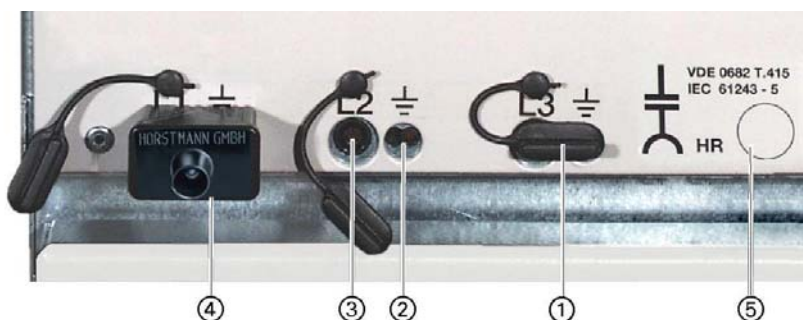
- ⇒ The circuit-breaker is open.
- ✓ The circuit-breaker panel is de-earthed.

20 Verification of safe isolation from supply

	DANGER! Mortal danger if safe isolation from supply is verified incorrectly! ⇒ Verify the perfect function of the voltage indicator and the coupling section in accordance with national standards - on live equipment - with a test unit according to IEC 61243-5/EN 61243-5 - on all poles ⇒ Use only voltage indicators or devices to test the function of the coupling section according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415. (There have been no changes as against the old standard VDE 0681 Part 7 regarding the interface conditions, so that the corresponding indicators can still be usedn.) ⇒ Perform repeat test of interface conditions at the capacitive interfaces, as well as on the indicators according to the customer's specifications or national standards. ⇒ Do not use short-circuiting jumpers as separate plugs. The function of the surge arrester installed is not guaranteed anymore if short-circuiting jumpers are used (see Page 33, "Voltage detecting systems").
---	---

Safe isolation from supply can be verified either with an HR or LRM voltage indicator or with a CAPDIS system.

HR/LRM system



- ① Cover for test sockets
- ② Earth socket
- ③ Capacitive test socket for L2
- ④ Voltage indicator type HR, make Horstmann
- ⑤ Documentation to repeat test of interface condition

- ⇒ Remove covers from capacitive interface.
- ⇒ Insert voltage indicators in the test sockets of the capacitive interface. If the indicator does not flash or light up in any case, the feeder is not live. The feeder can be earthed. If the indicator flashes or lights up, the feeder is live.
- ⇒ Refit covers of capacitive interface to protect it from pollution.

Indications CAPDIS -S1+/-S2+

- ⇒ Verify safe isolation from supply on the display of CAPDIS-S1+/-S2+ (see Page 33, "Voltage detecting systems").

21 Replacing HV HRC fuse-links

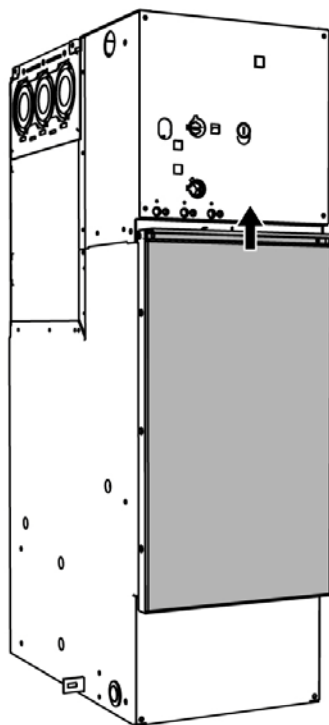
For data to usable HV HRC fuse-links, see Page 24, "HV HRC fuse assembly" and see Page 56, "Transformer protection table: Recommendation for the allocation of HV HRC fuse-links make SIBA and transformers".

Removing the HV HRC fuse compartment cover

The HV HRC fuse compartment cover can only be removed if the earthing switch is in "EARTHED" position.

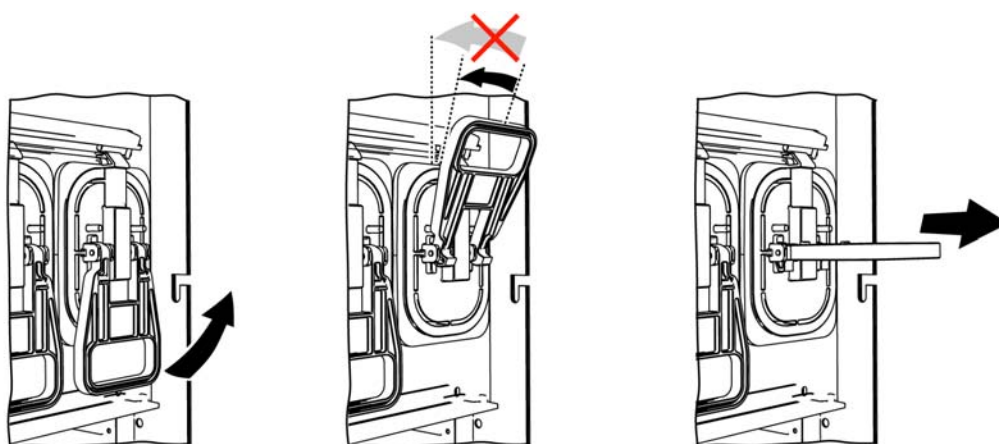
When the HV HRC fuse compartment cover is removed, the earthing switch is interlocked in "EARTHED" position.

⇒ Isolate and earth the transformer feeder.



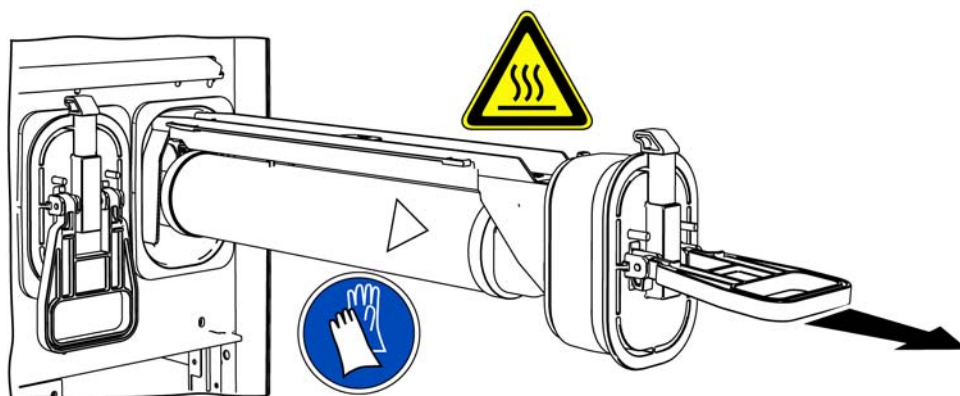
Detaching the gasket of the fuse slide

⇒ Push the handle of the fuse slide **slightly** upwards towards the stop in order to detach the gasket in this way and be able to pull the fuse slide out more easily.



Removing the HV HRC fuse slide

	ATTENTION!
	HV HRC fuse-links may be hot! ⇒ Let HV HRC fuse-links cool down or wear gloves to withdraw the fuse slide.



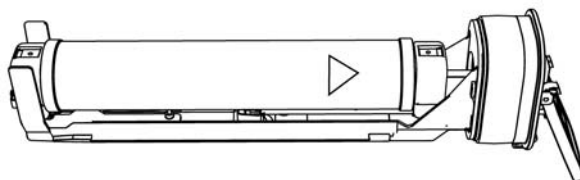
⇒ Withdraw the HV HRC fuse slide with the fuse-link.

Replacing HV HRC fuse-links

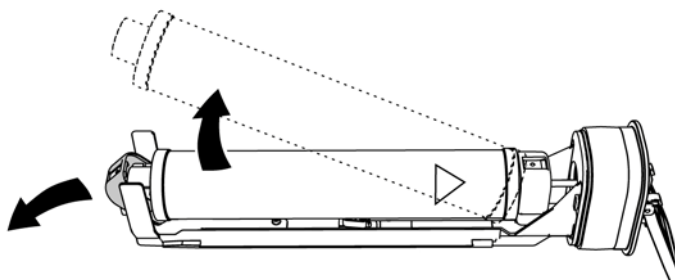
If one HV HRC fuse has tripped, always replace the fuses in all three phases.

	ATTENTION!
	Incorrectly selected or mounted fuse-links and extension tubes can damage the fuse box or the switchgear. ⇒ 7.2 kV fuse-links with dimension 192 mm and 24 kV fuse-links with dimension 292 mm are not permissible.

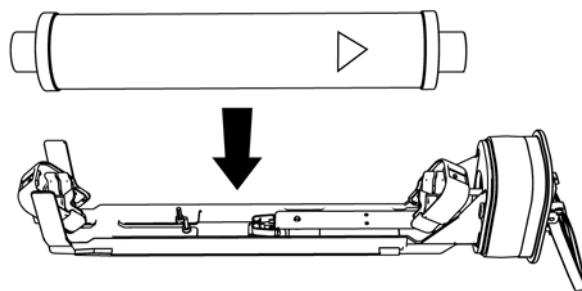
⇒ Lay the HV HRC fuse-link on a flat, clean and firm underground.



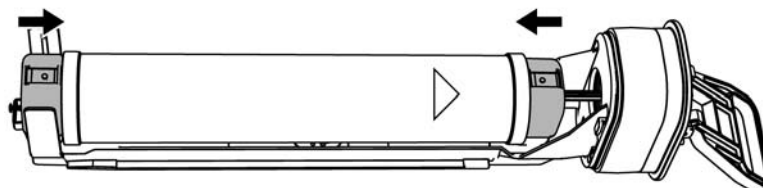
⇒ Push the cover of the HV HRC fuse-link (on the opposite side of the housing cover) aside, and pull the HV HRC fuse out of the fuse slide.



- ⇒ Fit new HV HRC fuse-link into the contact springs observing the striker position. The arrow on the HV HRC fuse points to the housing cover.



- ⇒ Verify correct seating of the covers and the fuse.



Inserting the HV HRC fuse slide

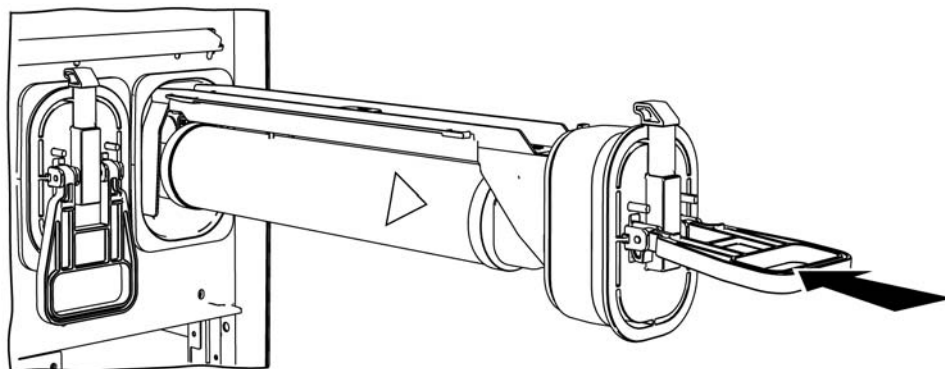


ATTENTION!

Incorrectly selected or mounted fuse-links and extension tubes can damage the fuse box or the switchgear.

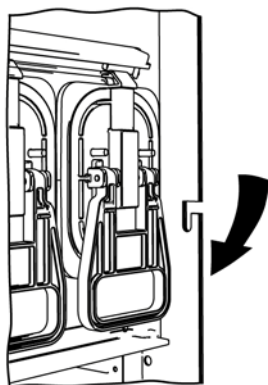
- ⇒ 7.2 kV fuse-links with dimension 192 mm and 24 kV fuse-links with dimension 292 mm are **not** permissible.

- ⇒ Insert the HV HRC fuse slide into the guide slot of the HV HRC fuse box.



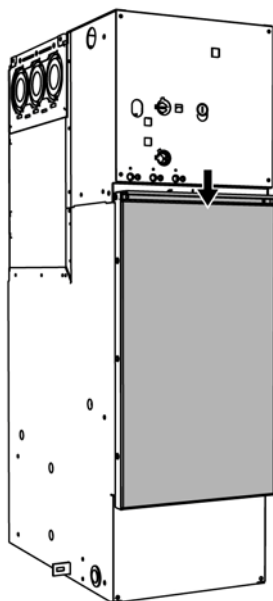
- ⇒ Insert the HV HRC fuse slide into the HV HRC fuse box as far as it will go. The collar of the HV HRC fuse slide cover must rest on the cast-resin frame of the HV HRC fuse box.

- ⇒ Push the handle of the fuse slide down as far as it will go, until the fuse slide latches tight.



Closing the HV HRC fuse compartment cover

- ⇒ Fit the HV HRC fuse compartment cover from above and let it slip down.



- ⇒ Due to a rail provided at the rear, the cover can only be closed if the HV HRC fuse slides have latched in correctly.

22 Cable testing

22.1 Cable testing via cable plugs

	DANGER! Cable testing with connected cables represents a special stress for the isolating distance. If the busbar of the switchgear under test or the opposite substation are live with operating voltage, adequate measures must be taken in order to prevent overvoltages. Normally, the switch-disconnector is not interlocked during the cable test. ⇒ Fit switching prohibition signs. ⇒ Secure the locking device (option) with a lock.
---	--

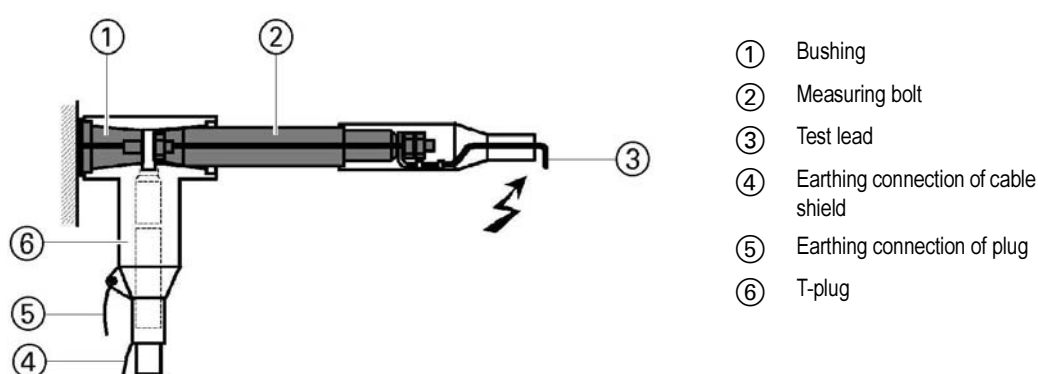
	ATTENTION! In cable panels type K (E), the switching operation for the EARTHED position has no influence on the voltage state of the radial cable behind the screwed-on cable compartment cover. ⇒ Before removing the screwed-on cable compartment cover, isolate and earth the radial cable in the opposite substation.
---	---

Isolating and earthing the feeder under test

- ⇒ Disconnect the feeder under test.
- ⇒ Make sure that the feeder in the opposite substation has also been isolated and secured against reclosing.
- ⇒ Verify safe isolation from supply.
- ⇒ Earth the feeder.

Preparations

- ⇒ Remove the cable compartment cover.
- ⇒ Undo the screw-type cone at the T-plug or at the adapter.
- ⇒ Fit cable test equipment (e.g. measuring bolts) according to the operating instructions of the plug manufacturers.



Testing Maximum values for the test voltage:

Rated voltage of the switchgear [kV]	DC test voltage, maximum value [kV]	AC test voltage VLF* 0.1 Hz, maximum value [kV]
12	48	19
24	70	38

* Very Low Frequency

	ATTENTION!
	Cables, cable plugs and voltage detecting systems may be damaged by too high test voltages. ⇒ Observe the manufacturer's instructions for the cables, cable plugs and voltage detecting systems (maximum test values).

- ⇒ De-earth.
- ⇒ Perform the test in accordance with the cable manufacturers' recommendations or the customers' specifications.

After completion of test

- ⇒ Earth the feeder under test
- ⇒ Remove cable test elements.
- ⇒ Clean the screw-type cone, apply mounting paste and mount it on the T-plug according to the manufacturer's instructions.
- ⇒ Fit and lock the cable compartment cover.
- ⇒ De-earth the feeder in the switchgear and in the opposite substation and switch the feeder on again.

22.2 Cable sheath testing

	DANGER!
	Normally, the switch-disconnector panel is not interlocked during the cable sheath test. Prevent switching to OPEN or CLOSED position as follows: ⇒ Fit switching prohibition signs. ⇒ Secure the locking device (option) with a lock. ⇒ Closing lock-out (option)

	ATTENTION!
	In cable panels type K (E), the switching operation for the EARTHED position has no influence on the voltage state of the radial cable behind the screwed-on cable compartment cover. ⇒ Before removing the screwed-on cable compartment cover, isolate and earth the radial cable in the opposite substation.

Work operations

- ⇒ Isolate and earth the feeder under test.
- ⇒ Remove the cable compartment cover.
- ⇒ De-earth the cable shield at the cross member of the subframe as well as in the opposite substation.
- ⇒ Perform the cable sheath test according to the manufacturer's instructions or the customer's specifications.
- ⇒ Earth the cable shield again at the cross member of the subframe as well as in the opposite substation.
- ⇒ Refit and lock the cable compartment cover.
- ⇒ De-earth the feeder in the switchgear and in the opposite substation and switch the feeder on again.

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