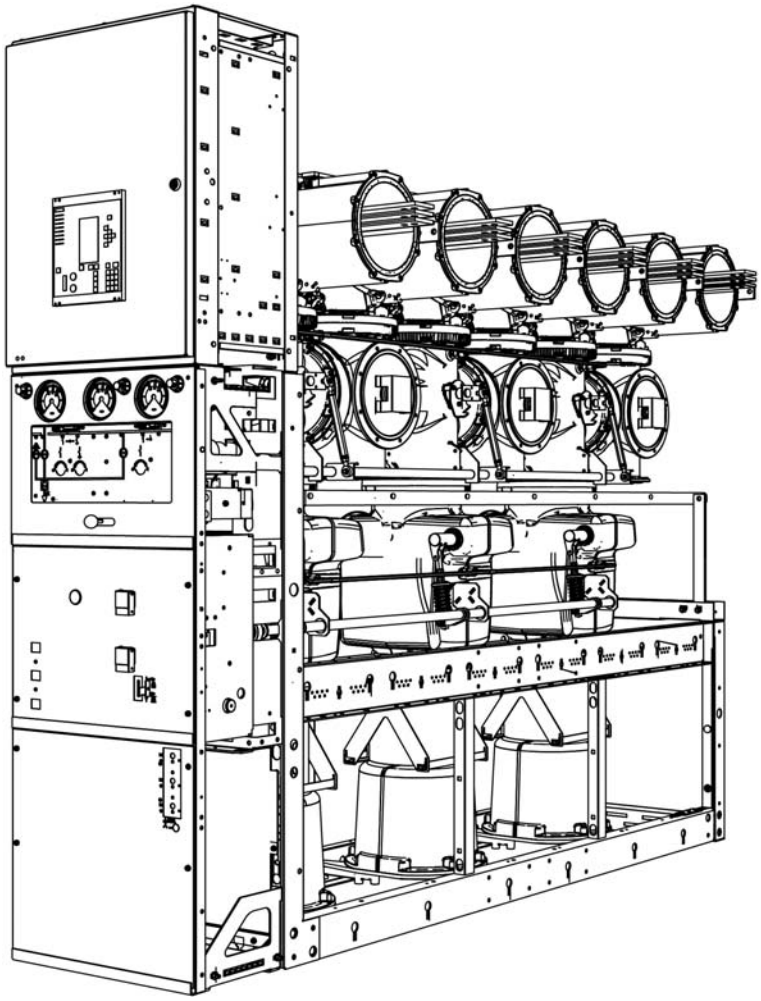
SIEMENS

Medium-Voltage Switchgear

Type 8DB10Extendable Fixed-Mounted Circuit-Breaker Switchgear up to 40.5 kV

Double Busbar, Single-pole Metal-Enclosed, Gas-Insulated



INSTALLATION AND OPERATING INSTRUCTIONS

Order No.: 864-5091.9
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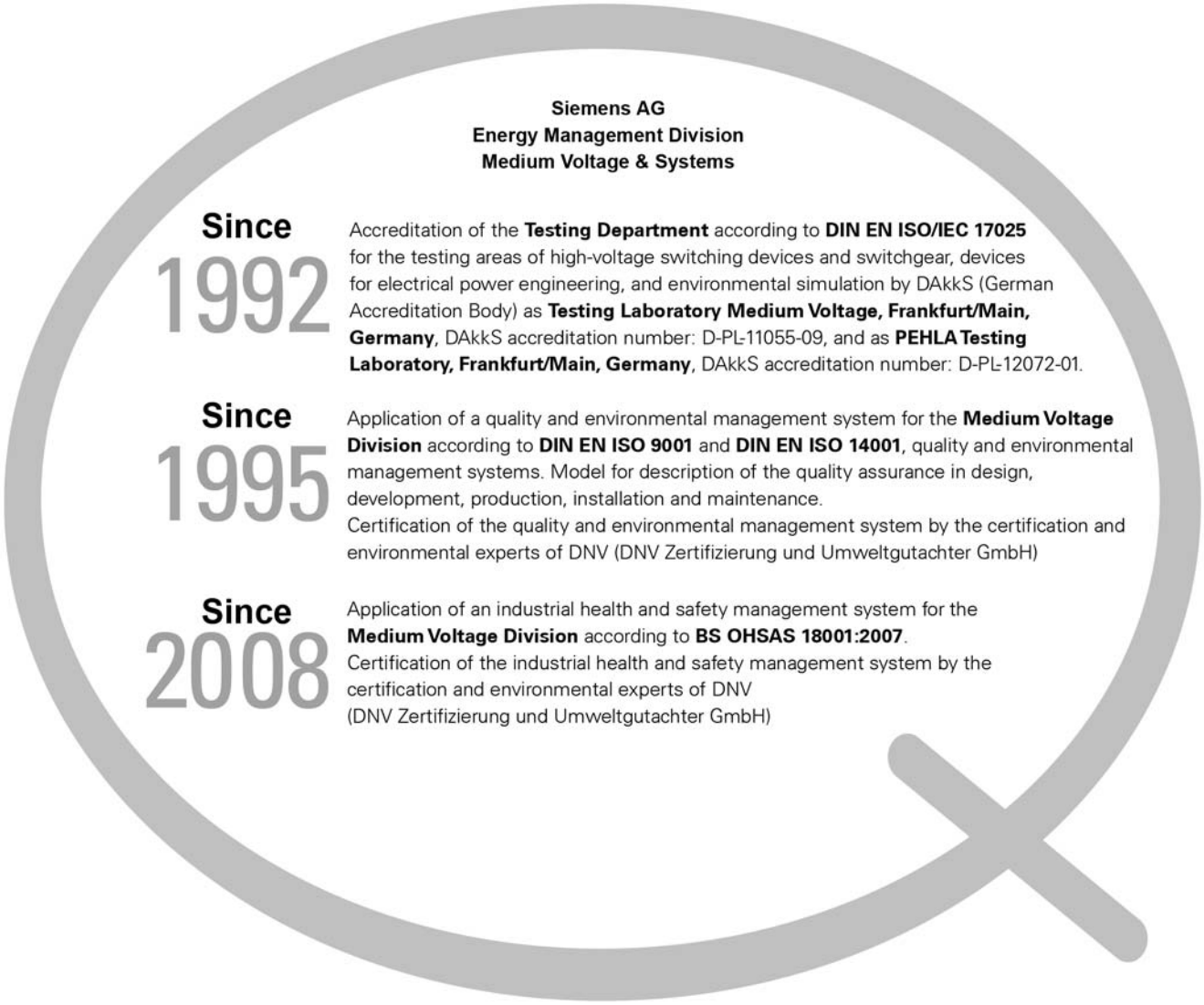

About these Instructions

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, combination of components, or operation.

Should further information be desired or should particular problems arise which are not covered sufficiently by these instructions, the matter should be referred to your regional Siemens representative.

The contents of this instruction manual shall not become part of 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 in this instruction manual do not create new warranties or modify the existing warranty.

To connect or install devices from other manufacturers, the associated user information and ratings have to be considered.

If you want to make suggestions for improvement of these instructions, or if there is something you do not understand, please contact the address given below:

Siemens AG

Energy Management

Medium Voltage & Systems

Switchgear Factory Frankfurt

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D-60386 Frankfurt

Germany

Subject to change without prior notice.

Contents

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.

Five Safety Rules of Electrical Engineering

The Five Safety Rules of Electrical Engineering must be complied with 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 substances

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 62271 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. In case of internal arc, full personal protection is not guaranteed, even if the personal protective equipment is worn.

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

The protective equipment consists of:

- Protective clothing
- Safety shoes
- Gloves
- Helmet and face protection
- Ear protection

Remove the front plate of the operating mechanism compartment

	**DANGER** Risk of injury by release of charged operating springs when the front plate of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence. ⇨ To avoid impermissible switching operations, switch off auxiliary voltage. ⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the cover: - Trip the miniature circuit-breaker. - Actuate the OFF pushbutton. - Actuate the ON pushbutton. - Actuate the OFF pushbutton. - Disconnect the control cables from the low-voltage compartment. ⇨ The spring energy store indicator must show "spring not charged".

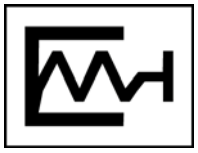


Fig. 1: Indication: "Spring not charged"

Fig. 2: Indication: "Spring charged"

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.

4 Qualified personnel

Description of qualified personnel

Qualified personnel in accordance with these operating instructions are persons who are familiar with transport, installation, commissioning, maintenance and operation of the product.

Medium-voltage switchgear type 8DB10 must be installed by certified personnel with supervisor status.

To get the required certificate, the personnel must have taken part successfully in a training for assembly and installation of Siemens gas-insulated medium-voltage switchgear type 8DB10 at the Siemens Switchgear Factory Frankfurt.

This installation training provides detailed information about transport, design, installation and operation of 8DB10 medium-voltage switchgear. After successful participation, the participants get a certificate signed by the trainer.

The certificate becomes valid:

- After first installation of switchgear type 8DB10 under supervision of a certified senior supervisor and his signature on the certificate, and
- after proof in form of an installation record for the Siemens Switchgear Factory Frankfurt am Main.

After having been issued by the Siemens Switchgear Factory Frankfurt am Main, the certificate is valid for three years. The owner of the certificate commits himself to prove his received qualification by means of installation records, and to extend the certificate in due time.

In case of important constructional modifications of the medium-voltage switchgear type 8DB10, the owner of the certificate is further obliged to participate in a refresher training to extend the certificate.

Certified personnel	Certified personnel in the sense of these operating instructions are persons who own a valid installation certificate for medium-voltage switchgear type 8DB10.
Supervisor	Supervisor in the sense of these operating instructions are persons who own a valid installation certificate for medium-voltage switchgear type 8DB10, and who have installed medium-voltage switchgear type 8DB10 at least once on their own. Moreover, the supervisor is entitled to give instructions about the installation of the medium-voltage switchgear 8DB10 to other personnel.
Senior Supervisor	Senior supervisor in the sense of these operating instructions are persons who own a valid installation certificate for medium-voltage switchgear 8DB10, and who have installed medium-voltage switchgear type 8DB10 at least four times on their own. **The senior supervisor is further entitled to:** • Give instructions on the installation of the medium-voltage switchgear 8DB10 to other personnel • Sign an installation certificate in order to confirm its validity

Certificate

Fig. 3: Example for a certificate

Description

5 Features

Typical uses

Extendable fixed-mounted circuit-breaker switchgear of the 8DB10 series is mainly used in transformer and distribution substations as well as for switching duties in industrial plants.

The panels are designed for rated voltages up to 40.5 kV and rated currents up to 2500 A. In distribution systems up to 40.5 kV, a maximum short-circuit current of 40 kA is permissible.

Insulating gas SF_6

Sulfur hexafluoride SF_6 is used as insulating gas. SF_6 insulates live parts against the housing wall.

When several switchgear sections have to be delivered, the switchgear is delivered ex works partly with SF_6 filling ready for service. To fill all gas compartments completely with SF_6, SF_6 gas and a filling device must be provided on site. If the switchgear is delivered as one switchgear section (possible for switchgear assemblies comprising up to 4 panels), the switchgear is delivered ex works completely with SF_6 filling ready for service. The SF_6 filling is provided to last the total service life of the switchgear.

Filling quantity as per rating plate.

Technology

- Factory-assembled, type-tested and metal-enclosed switchgear for indoor installation
- Double busbar
- Single-pole metal enclosure

Personal safety

- Safe-to-touch connection and interconnection system for cables as well as for solid-insulated and gas-insulated bars
- Complete switchgear interlocking system with logical mechanical interlocks

Security of operation and availability

- Minimum fire load
- Primary part independent of environmental effects (pollution, humidity and small animals) due to hermetically sealed enclosure

Cost-efficiency

- Maintenance-free under normal ambient conditions according to IEC 62271-1 and VDE 0671-1

National approvals

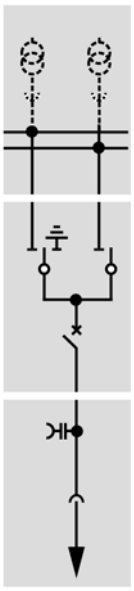
8DB10 switchgear has obtained the following national approval:

- GOST R certificate

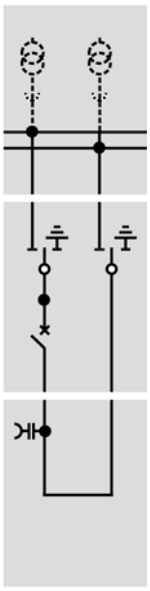
Seismic withstand capability (option)

8DB10 switchgear can be upgraded for operation in regions at risk from earthquakes, see the relevant order and delivery documents.

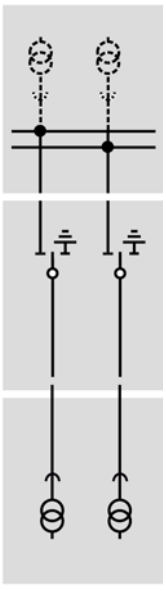
6 Panel types



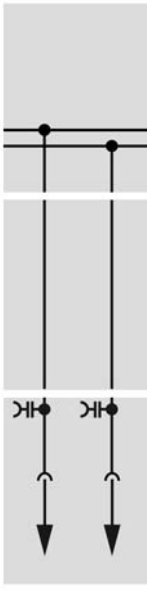
Circuit-breaker panel CB



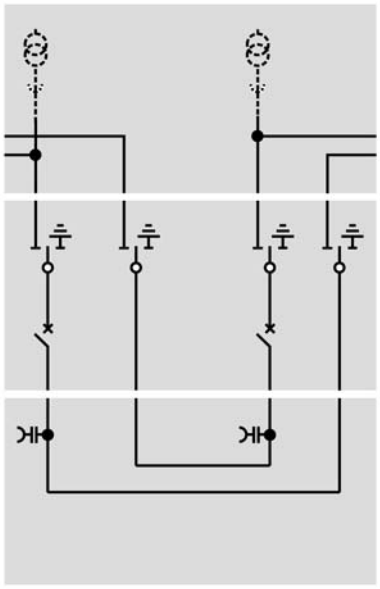
Bus coupler BC



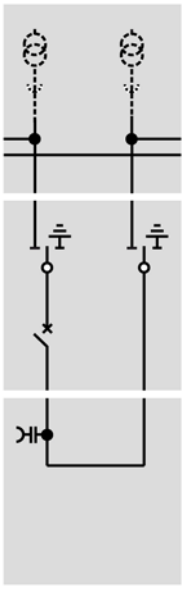
Metering panel ME



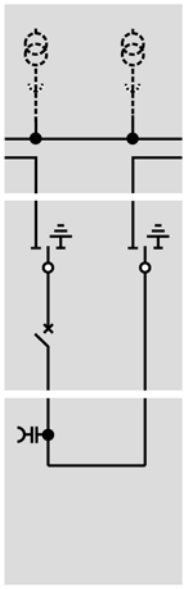
Cable connection panel CP



Bus sectionalizer BS up to 2500 A



Bus sectionalizer (2 panels) BS BB1



Bus sectionalizer (2 panels) BS BB2

Dummy panel

Vacuum circuit-breaker

Capacitive voltage detecting system

Plug-in voltage transformer

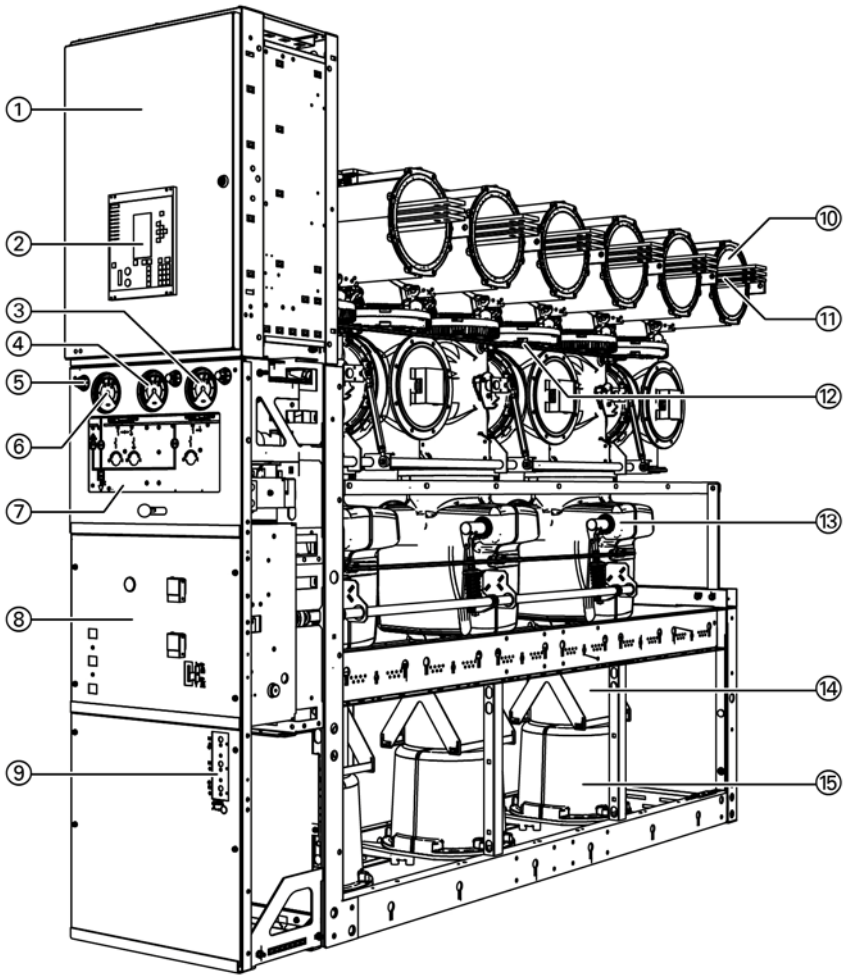
Plug-in cable (not included in the scope of supply)

Three-position disconnector

These components are optionally selectable

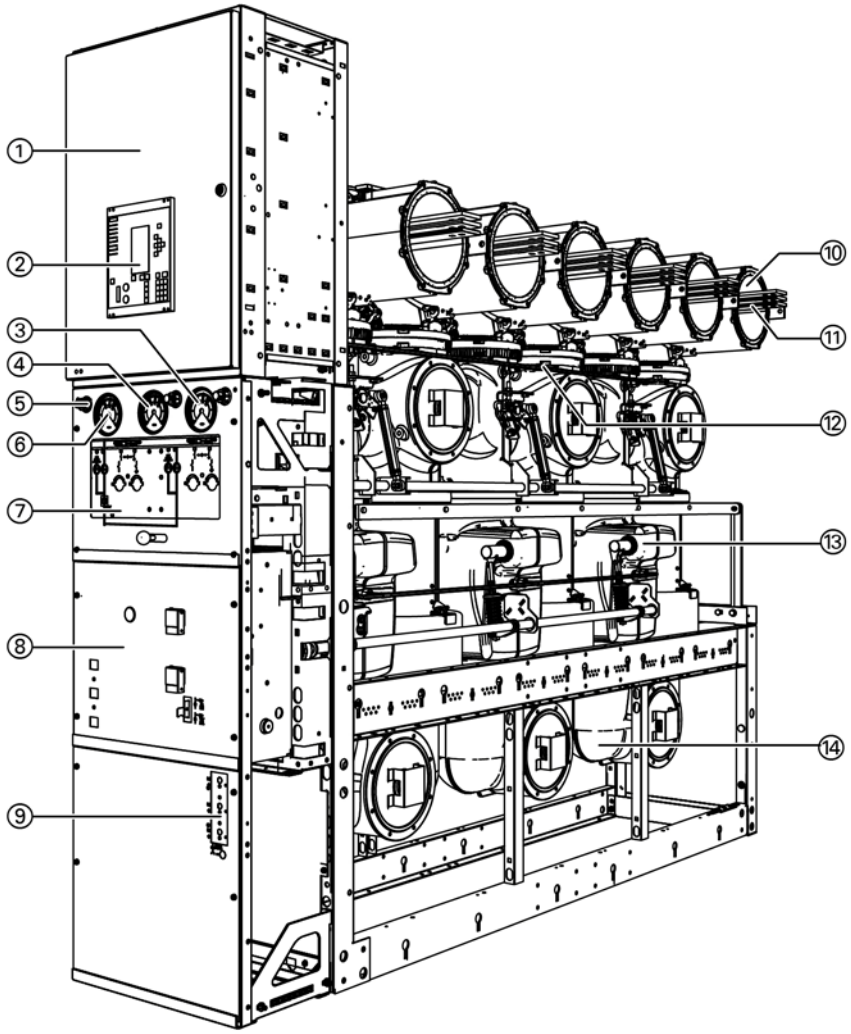
7 Examples for panel versions

Circuit-breaker panel up to 2500 A



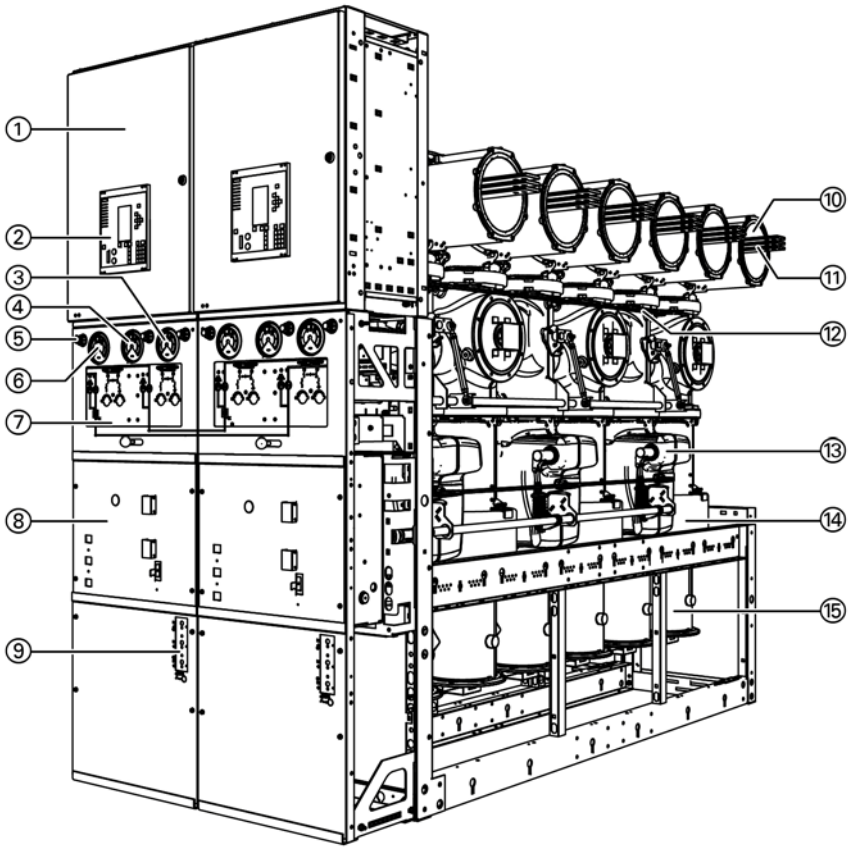
① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas pressure manometer for circuit-breaker housing
⑤ Gas filling valve
⑥ Gas pressure manometer for three-position disconnector housing in system 1
⑦ Operating mechanism of three-position disconnector
⑧ Circuit-breaker operating mechanism
⑨ Capacitive voltage detecting system
⑩ Busbar housing
⑪ Busbars
⑫ Gas pipe
⑬ Switchpanel pole housing with vacuum interrupter
⑭ 4MC4 current transformer
⑮ Panel connection housing with inside-cone bushings for cable plugs, voltage transformers and surge arresters, or for connection of bar systems

Bus coupler



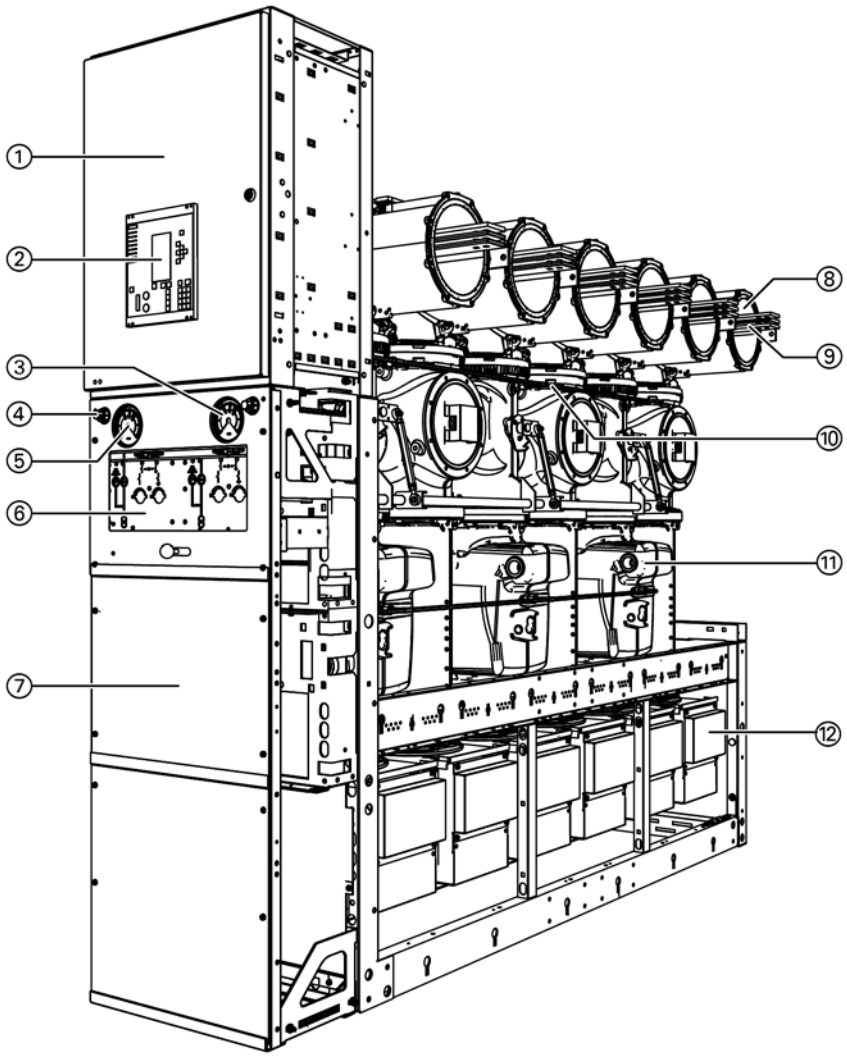
① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas pressure manometer for circuit-breaker housing
⑤ Gas filling valve
⑥ Gas pressure manometer for three-position disconnector housing in system 1
⑦ Operating mechanism of three-position disconnector
⑧ Circuit-breaker operating mechanism
⑨ Capacitive voltage detecting system
⑩ Busbar housing
⑪ Busbars
⑫ Gas pipe
⑬ Switchpanel pole housing
⑭ Coupling housing

Bus sectionalizer BS up to 2500 A (busbar system 1 and 2)



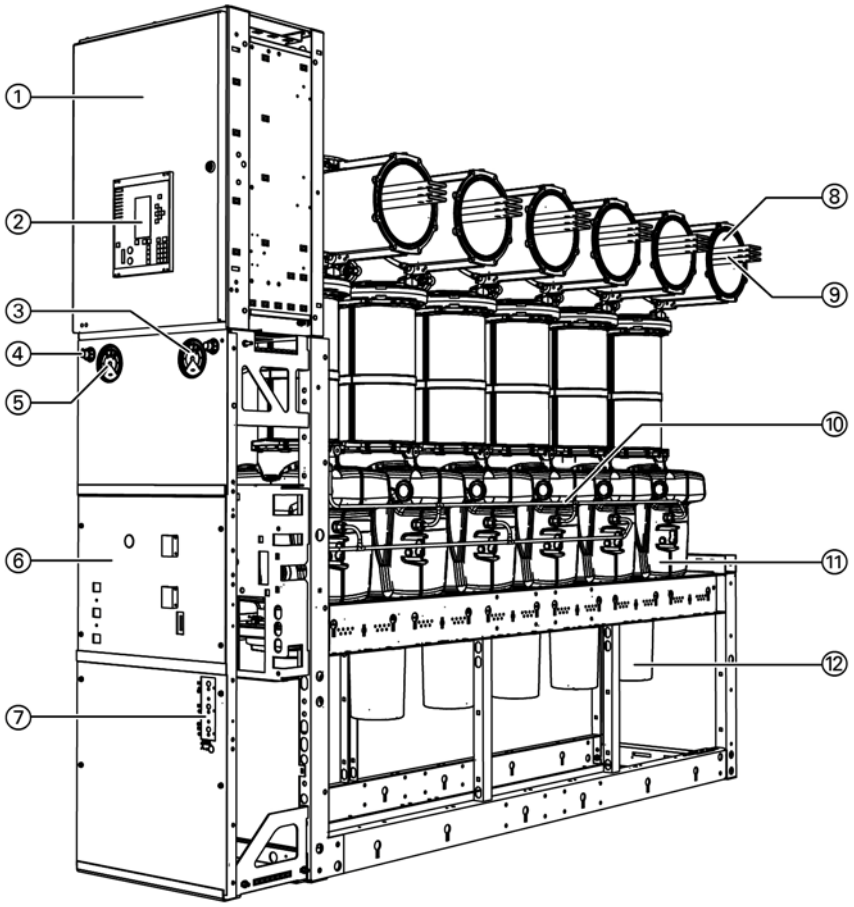
① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas pressure manometer for circuit-breaker housing
⑤ Gas filling valve
⑥ Gas pressure manometer for three-position disconnector housing in system 1
⑦ Operating mechanism of three-position disconnector
⑧ Circuit-breaker operating mechanism
⑨ Capacitive voltage detecting system
⑩ Busbar housing
⑪ Busbars
⑫ Gas pipe
⑬ Bus riser housing
⑭ 4MC4 current transformer
⑮ Bus sectionalizer

Metering panel



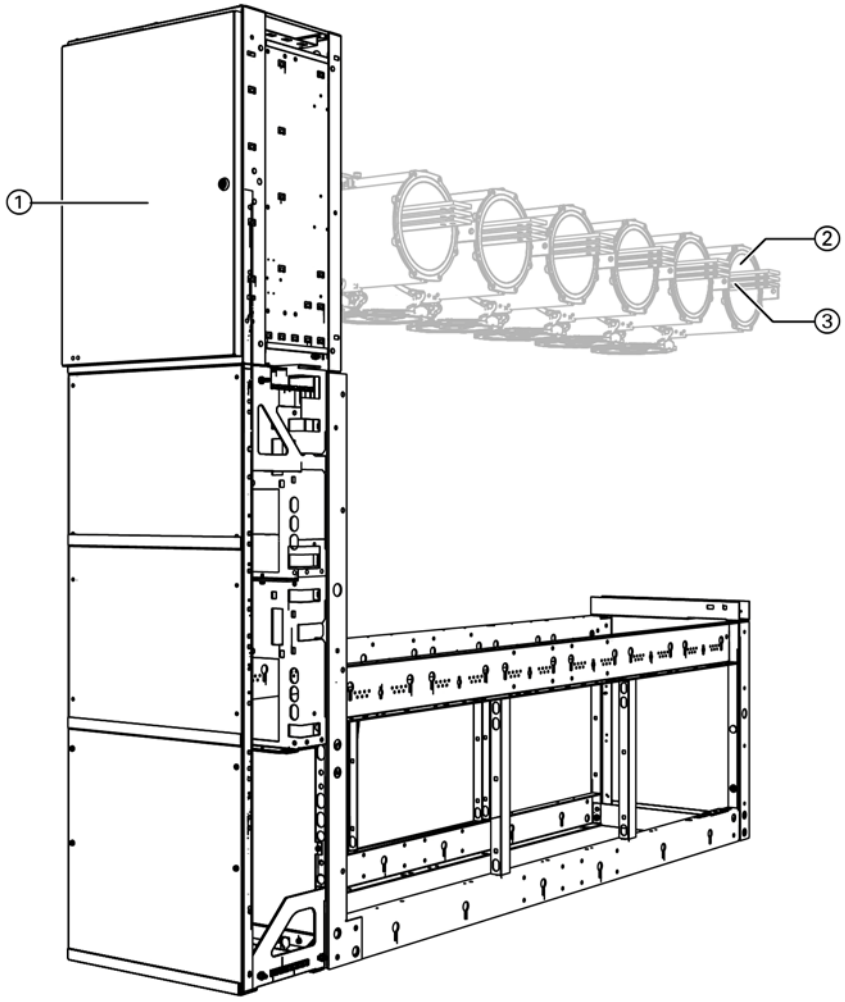
① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas filling valve
⑤ Gas pressure manometer for three-position disconnector housing in system 1
⑥ Operating mechanism of three-position disconnector
⑦ Dummy cover for circuit-breaker operating mechanism
⑧ Busbar housing
⑨ Busbars
⑩ Gas pipe
⑪ Housing
⑫ Voltage transformer

Cable connection panel up to 2500 A



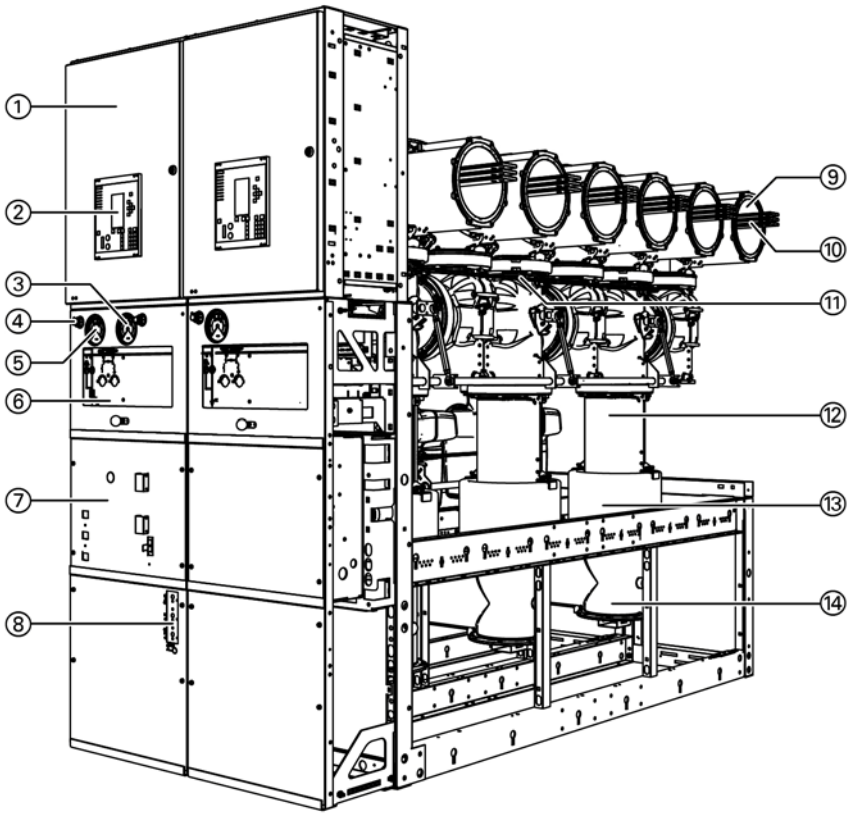
① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for switchpanel pole housing in system 2
④ Gas filling valve
⑤ Gas pressure manometer for switchpanel pole housing in system 1
⑥ Dummy cover for circuit-breaker operating mechanism
⑦ Capacitive voltage detecting system
⑧ Busbar housing
⑨ Busbars
⑩ Gas pipe
⑪ Switchpanel pole housing
⑫ Panel connection housing with inside-cone bushings for cable plugs, voltage transformers and surge arresters, or for connection of bar systems

Dummy panel



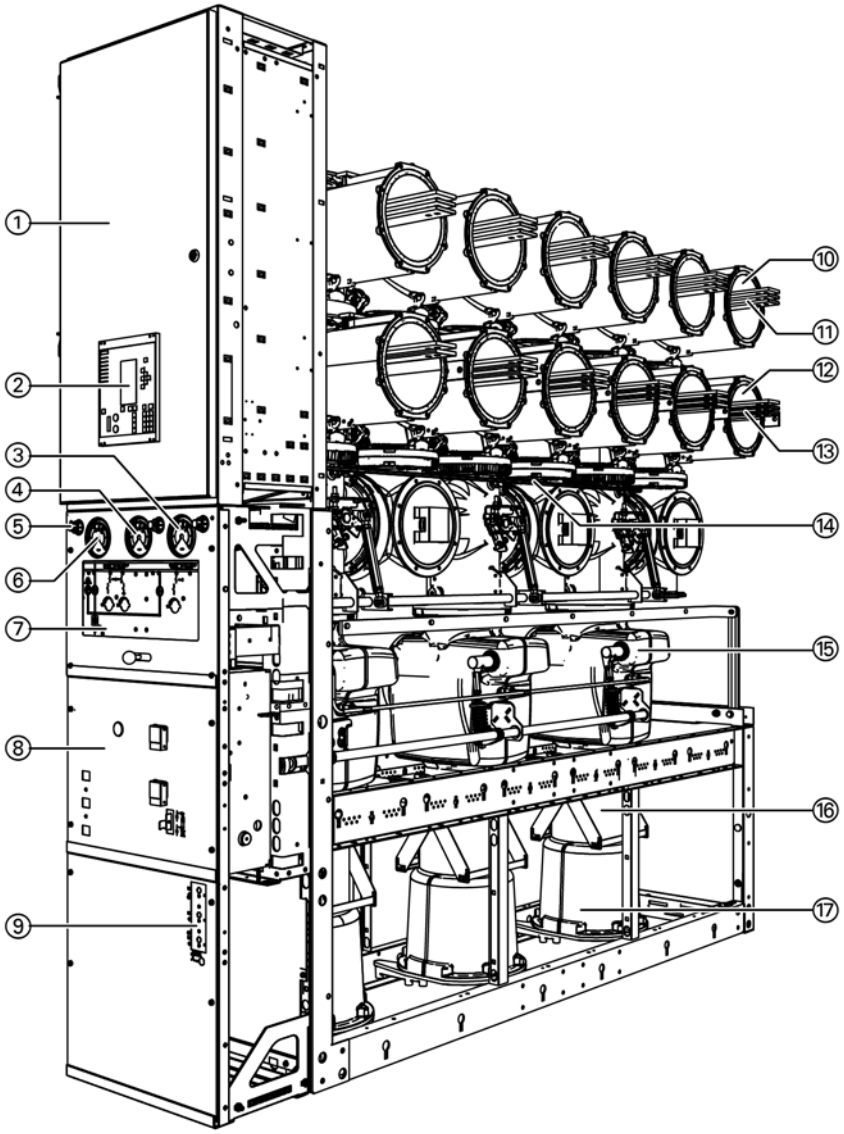
① Low-voltage compartment (standard heights: 850/1200 mm)
② Busbar housing
③ Busbars

Bus sectionalizer (2 panels) BS BB1



① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for switchpanel pole housing
④ Gas filling valve
⑤ Gas pressure manometer for three-position disconnector housing in system 1
⑥ Cover of operating mechanism for three-position disconnector
⑦ Dummy cover for circuit-breaker operating mechanism
⑧ Capacitive voltage detecting system
⑨ Busbar housing
⑩ Busbars
⑪ Gas pipe
⑫ Bus riser housing
⑬ 4MC4 current transformer
⑭ Bus sectionalizer

Circuit-breaker panel with 5000 A busbar



① Low-voltage compartment (standard height: 1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas pressure manometer for circuit-breaker housing
⑤ Gas filling valve
⑥ Gas pressure manometer for three-position disconnector housing in system 1
⑦ Operating mechanism of three-position disconnector
⑧ Circuit-breaker operating mechanism
⑨ Capacitive voltage detecting system
⑩ Busbar housing, upper busbar system
⑪ Busbars, upper busbar system
⑫ Busbar housing, lower busbar system
⑬ Busbars, lower busbar system
⑭ Gas pipe
⑮ Switchpanel pole housing with vacuum interrupter
⑯ 4MC4 current transformer
⑰ Panel connection housing with inside-cone bushings for cable plugs, voltage transformers and surge arresters, or for connection of bar systems

8 Panel design

8.1 Function

The circuit-breaker panel is the basic panel type of the 8DB10. The circuit-breaker panel can fulfil the function "incoming feeder" or "outgoing feeder". It can carry or switch all rated busbar and feeder currents as well as the short-circuit currents quoted on the respective rating plates.

8.2 Subframe

- Support for switchpanel poles and panel front
- Forms the cable compartment
- Subframe versions
  - Standard: Switchgear height 2350 mm
  - Higher version: Switchgear height 2570 mm

8.3 Low-voltage compartment

- For accommodation of protection, control, measuring and metering equipment
- With plug-in cables of the circuit-breaker and three-position disconnector operating mechanisms on top-hat rail for incoming and outgoing cables (e.g. bus wires)
- Devices can be optionally mounted in the door or on top-hat rail inside the low-voltage compartment
- Height of low-voltage compartment, optionally 850 mm (standard) or 1200 mm

8.4 Switchpanel pole

- Poles arranged one behind the other.

  One switchpanel pole consists of a vertically arranged housing with a vacuum interrupter inside.

  Over the switchpanel pole, there are the disconnector housings for busbar system 1 and 2, and above these the respective busbar housings in horizontal arrangement.

8.5 Switchgear panel

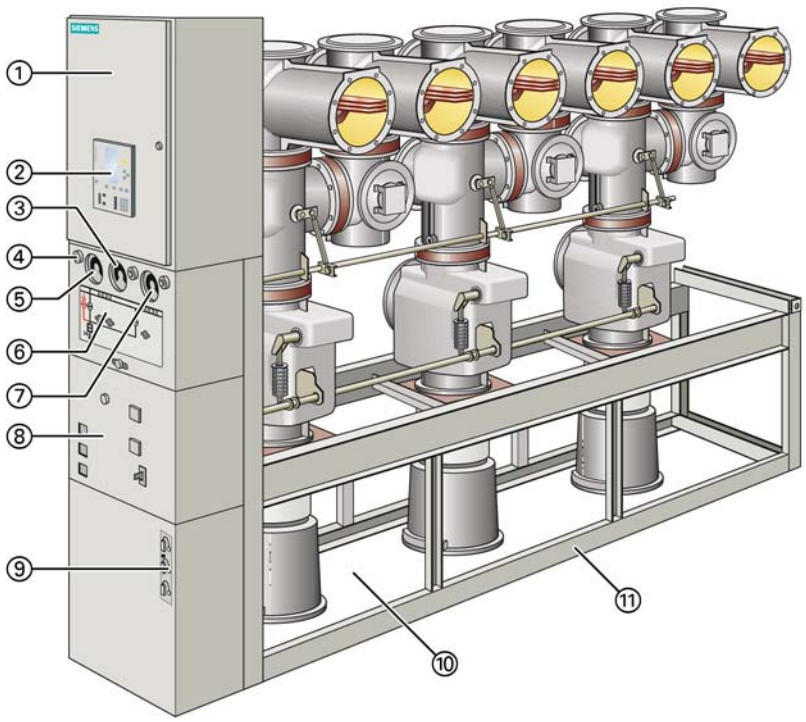


Fig. 4: 8DB10 circuit-breaker panel

① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Gas pressure manometer for circuit-breaker housing
④ Gas filling valve
⑤ Gas pressure manometer for three-position disconnector housing in system 1
⑥ Control and indication board for three-position disconnector with position indicator for circuit-breaker
⑦ Gas pressure manometer for three-position disconnector housing in system 2
⑧ Control and indication board for vacuum circuit-breaker
⑨ Capacitive voltage detecting system
⑩ Cable compartment
⑪ Frame

9 Circuit-breaker

9.1 Design

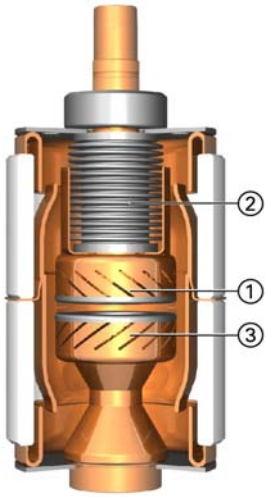
The vacuum circuit-breaker is an integral part of the switchgear panel and consists of the following components:

- Operating mechanism with stored-energy spring mechanism and control elements (3AH49)
- Operating linkage for contact operation
- 3 switchpanel poles with vacuum interrupters

Mechanical interlocking

The circuit-breaker and the three-position disconnector are mechanically interlocked against each other. During manual operation, the mechanical interlock prevents the circuit-breaker from being closed as long as the three-position disconnector is not in a defined end position (CLOSED/OPEN/EARTHED). Furthermore, the mechanical interlock prevents the three-position disconnector from being operated while the circuit-breaker is closed.

Vacuum interrupters



① Moving contact
② Metal bellows
③ Fixed contact

Fig. 5: Sectional view of a vacuum interrupter

9.2 Operating mechanism box

Design

The operating mechanism box is closed with a front plate. The front plate contains openings for the control elements and indicators. The operating mechanism box accommodates all components required to operate the circuit-breaker.

① Auxiliary switch (-S1)
② ON pushbutton
③ Closing solenoid (-Y9)
④ 1st shunt release (-Y1)
⑤ OFF pushbutton
⑥ Undervoltage release (-Y7)
⑦ Operating shaft for circuit-breaker
⑧ Opening spring
⑨ Operations counter
⑩ Position indicator for circuit-breaker
⑪ "Closing spring charged / not charged" indicator
⑫ Position switch
⑬ Closing spring
⑭ Gear with hand crank coupling
⑮ Rating plate

Fig. 6: Circuit-breaker operating mechanism without front plate

Function

Depending on its design, the circuit-breaker is closed electrically or mechanically with the ON pushbutton. The operating power is transmitted to the vacuum interrupters through an operating linkage. The closing spring is immediately recharged by the motor after closing.

If the motor supply voltage fails, the closing spring can be charged manually. To do this, there is an opening in the removable front plate with the hand crank coupling of the gear behind. The charging condition of the spring can be read on the indicator.

9.3 Equipment

Basic equipment

The basic version of the vacuum circuit-breaker is equipped as follows:

- Electrical operating mechanism (charging motor) with mechanical and electrical anti-pumping device (M1)
- Closing solenoid (Y9)
- 1st shunt release (Y1)
- Low-voltage plug connector with 10-pole wiring (Q0)
- Auxiliary switch, max. 2NO + 2NC + 2 changeover freely available (S1)
- Position switch for "closing spring charged" indication (S41, S42)
- Circuit-breaker tripping signal, cutout switches (S6, S7)
- Operations counter
- Feeder locking device

Additional equipment

- Extended auxiliary switch, max. 12NO + 12NC + 2 changeover freely available (S1)
- Shunt release (Y2)
- Undervoltage release (Y7)
- Interlocking between feeder locking device and three-position disconnector (circuit-breaker only lockable in earthed position)

Possible release combinations

Release	Type	Release combination			
		1	2	3	4
1st shunt release	3AY15 10	X	X	X	X
2nd shunt release	3AX1101	- - -	X	- - -	X
Undervoltage release	3AX1103	- - -	- - -	X	X

10 Disconnector and three-position disconnector

Function of three-position disconnector

Busbar system 1 is equipped with a the three-position disconnector which combines the functions of a disconnector and an earthing switch. It is designed for no-load operation only.

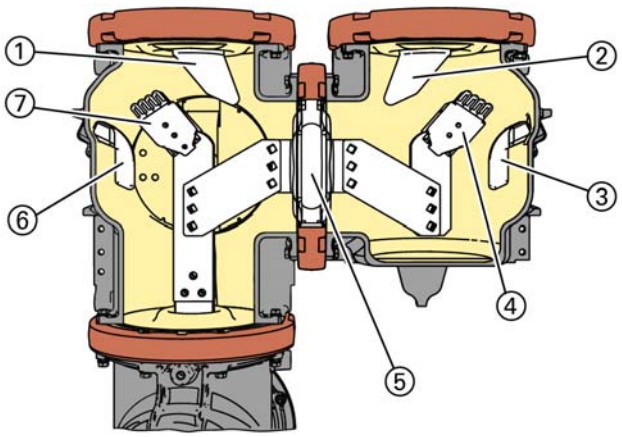
Function of disconnector

A disconnector is installed in busbar system 2. It is designed for no-load operation only. The disconnector has a work-in-progress earthing contact for maintenance work, which cannot be operated during normal operation.

ATTENTION

The work-in-progress earthing contact of the disconnector in busbar system 2 is designed for maintenance work at the three-position disconnector in busbar system 1 in de-energized condition only.

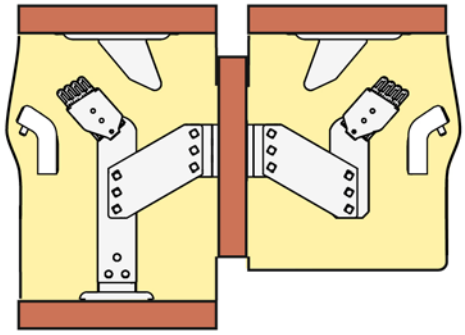
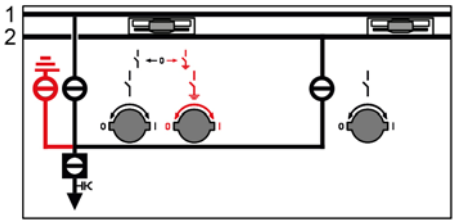
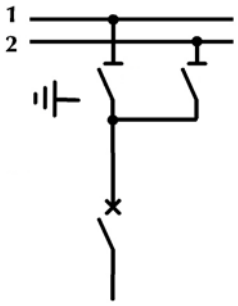
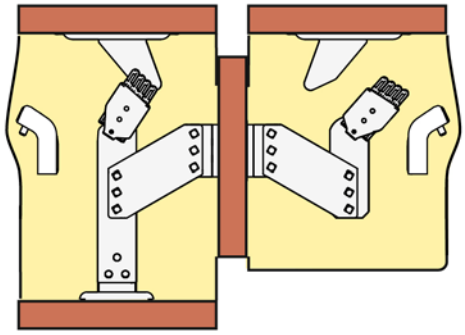
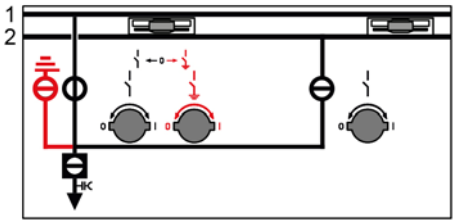
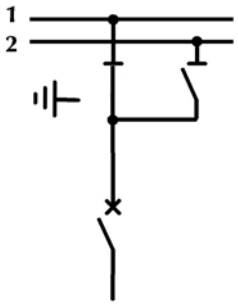
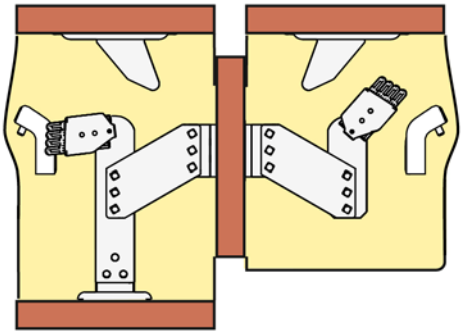
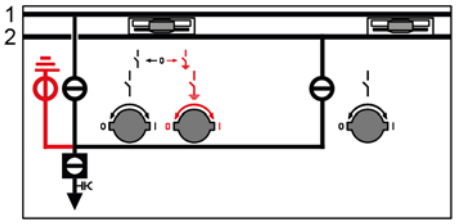
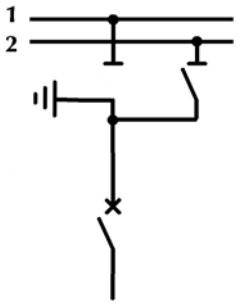
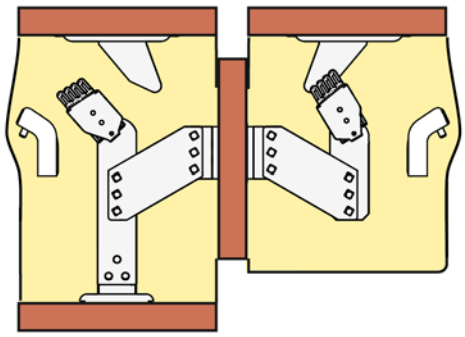
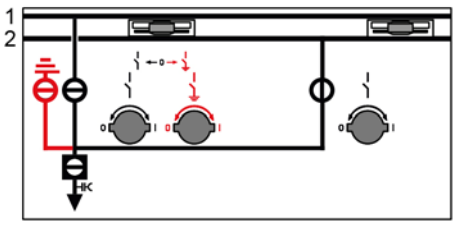
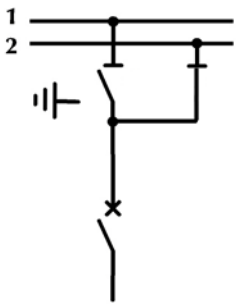
⇨ Before switching to the work-in-progress earthing contact, always contact your regional Siemens representative.



① Fixed contact of busbar, busbar system 1
② Fixed contact of busbar, busbar system 2
③ Work-in-progress earthing contact for system 2
④ Moving contact for system 2 in OPEN position
⑤ Bushing
⑥ Fixed contact for READY-TO-EARTH, system 1
⑦ Moving contact for system 1 in OPEN position

Fig. 7: 8DB three-position disconnector for busbar system 1 and three-position disconnector for busbar system 2

Switch positions

Switch positions	Position indicator	Basic scheme
 Three-position disconnector (system 1) in OPEN position Three-position disconnector (system 2) in OPEN position		
 Three-position disconnector (system 1) in CLOSED position Three-position disconnector (system 2) in OPEN position		
 Three-position disconnector (system 1) in READY-TO-EARTH position Three-position disconnector (system 2) in OPEN position		
 Three-position disconnector (system 1) in OPEN position Three-position disconnector (system 2) in CLOSED position		

Operating mechanism for three-position disconnector

The three-position disconnector is operated from the switchgear front.

- Auxiliary switch
  - Each operating mechanism is equipped with an auxiliary switch for the position indication.
- Motor operating mechanism
  - Remote operation (standard) applied to terminal
  - Local operation (option)
  - Manual operation possible by operating lever
- Wiring
  - Auxiliary switches and motor operating mechanisms are wired to terminal strips in the low-voltage compartment.

Interlocks for the three-position disconnector (option)

- The three-position switch is equipped with a mechanical interlock. This interlock prevents the circuit-breaker from being closed while the three-position switch is being operated. Furthermore the mechanical interlock prevents the possibility of operating the three-position switch while the circuit-breaker is closed.
- With single-busbar systems, the control gate can only be operated if the interrogation lever is pushed downwards. Thus, the corresponding operating shafts are only released at the operating front after actuation of the interrogation lever.
- The control gate of the switching gate of the three-position switch can be padlocked in three switch positions.

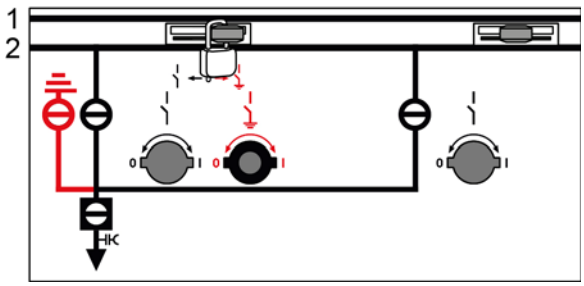


Fig. 8: Disconnecting function is blocked

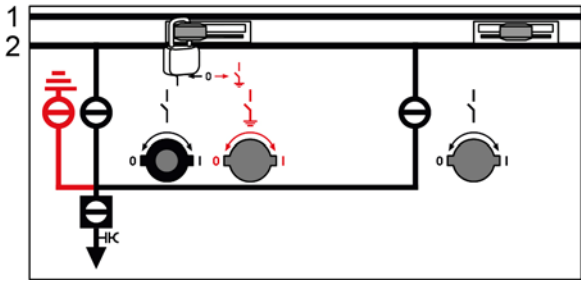


Fig. 9: Earthing function is blocked

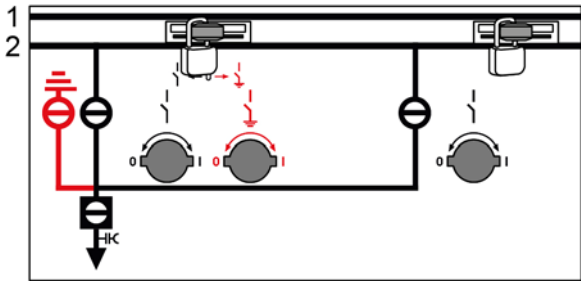


Fig. 10: Disconnecting and earthing functions are blocked (common function)

11 Make-proof busbar earthing switch

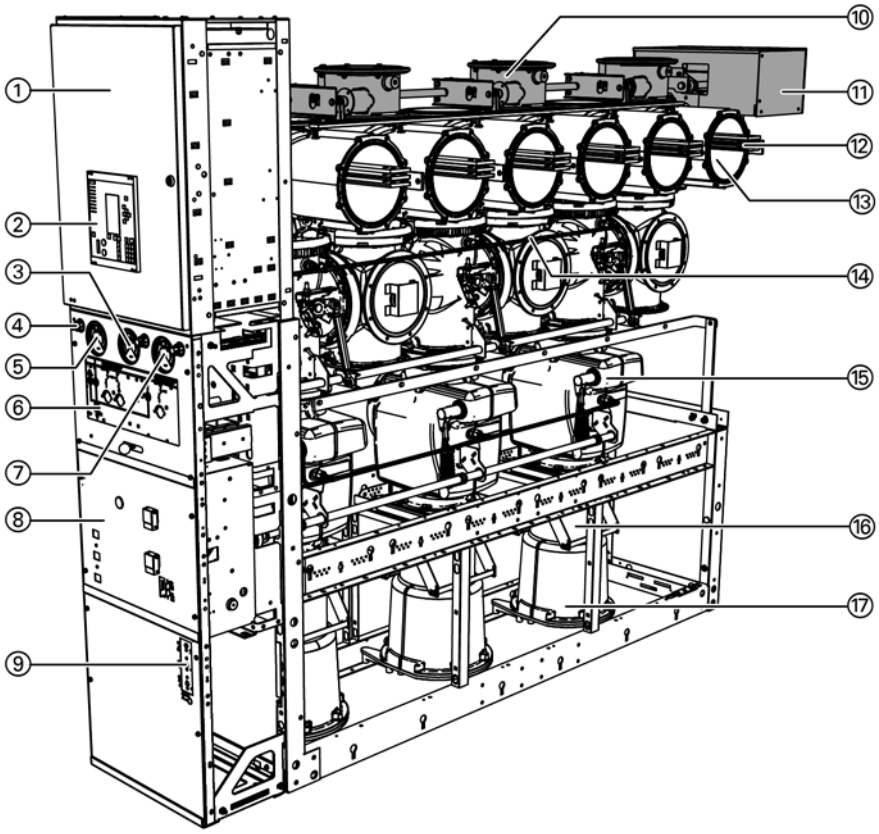


Fig. 11: Overview of busbar component: Busbar earthing switch

① Low-voltage compartment
② SIPROTEC bay controller (option)
③ Gas pressure manometer for circuit-breaker housing
④ Gas filling valve
⑤ Gas pressure manometer for three-position disconnector housing in system 1
⑥ Operating mechanism of three-position disconnector
⑦ Gas pressure manometer for three-position disconnector housing in system 2
⑧ Circuit-breaker operating mechanism
⑨ Capacitive voltage detecting system
⑩ Housing for busbar earthing switch
⑪ Operating unit
⑫ Busbars
⑬ Busbar housing
⑭ Gas pipe
⑮ Switchpanel pole housing with vacuum interrupter
⑯ 4MC4 current transformer
⑰ Panel connection housing with inside-cone bushings for cable plugs, voltage transformers and surge arresters, or for connection of bar systems

The busbar earthing switch is pre-assembled at the factory.

12 Current and voltage transformers

12.1 Voltage transformers

Features

- According to IEC 60044-2
- Cast-resin insulated
- Inductive type
- Safe-to-touch due to metal enclosure

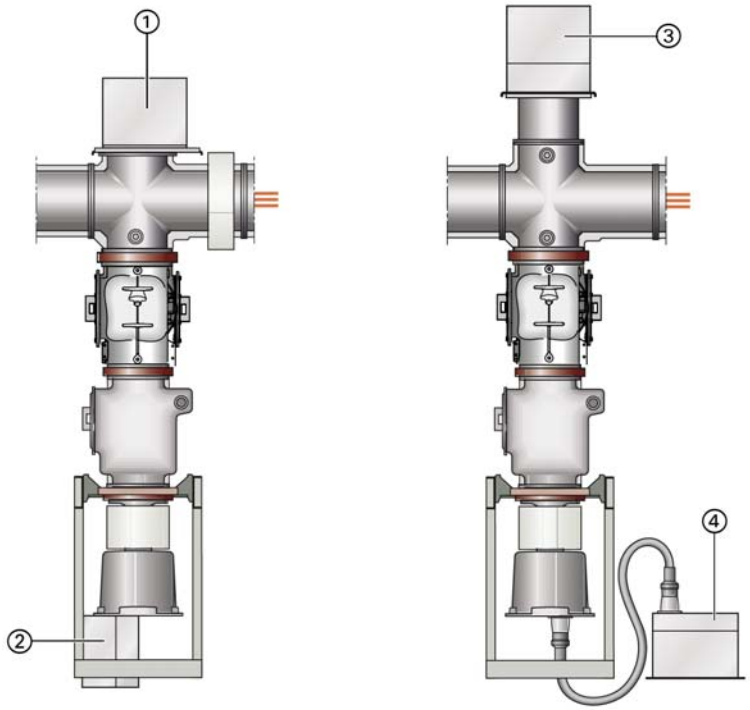


Fig. 12: Voltage transformer installation (basic scheme)

① Busbar voltage transformer 4MT3

② Feeder voltage transformer 4MT7 (connection at panel connection housing)

③ Voltage transformer 4MU4 with three-position disconnector

④ Feeder voltage transformer 4MU3 (not in the panel, connection via flexible cable with plug size S2 at the panel connection housing, and metal-enclosed voltage transformer)

Voltage transformer types

Mounting locations	Type	Comment
Busbar	4MT3	optionally with three-position disconnector
	4MU4	
Panel connection	4MU3	external
	4MT7	directly pluggable

Electrical data

Designation	4MT3	4MU4	4MT7	4MU3
Operating voltage kV	3.3 to 23.0	24.0 to 38.0	3.3 to 38.0	3.3 to 38.0
Rated voltage kV	24.0	40.5	40.5	40.5
Rated short-duration power-frequency withstand voltage kV	65.0	95.0	95.0	95.0
Rated lightning impulse withstand voltage kV	125.0	200.0	200.0	200.0
Rated voltage factor	Un / 8h = 1.9	Un / 8h = 1.9	Un / 8h = 1.9	Un / 8h = 1.9
	Un / continuous = 1.2	Un / continuous = 1.2	Un / continuous = 1.2	Un / continuous = 1.2
Standard	IEC	IEC	IEC	IEC
	GOST	GOST	GOST	GOST
	GB	GB	GB	GB

12.2 Current transformers

Features

- According to IEC 60044-1
- Designed as ring-core current transformers:
  - Ring core as carrier of secondary winding
  - Main circuit corresponds to primary winding
- Arranged outside the primary enclosure (switchgear vessel) due to single-pole design of the panel
- Free of dielectrically stressed cast-resin parts

Mounting locations

- On the busbar
- On the circuit-breaker housing
- On the panel connection
- On the cable

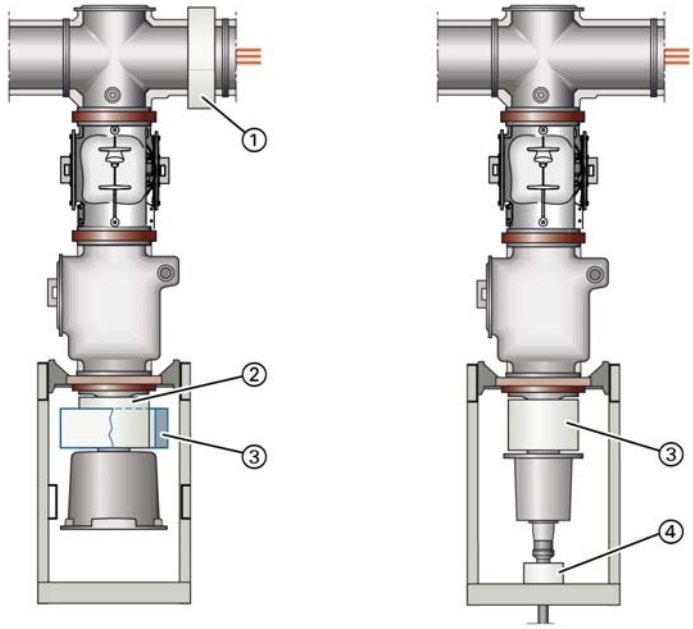


Fig. 13: Current transformer installation (basic scheme)

① Busbar current transformer (type 4MC4_40)
② Feeder current transformer (type 4MC4_90)
③ Feeder current transformer (type 4MC4_40)
④ Feeder current transformer (type 4MC4_10)

Electrical data

Designation		Type 4MC4
Operating voltage		max. 800 V
Rated short-duration power- frequency withstand voltage (winding test)		3 kV
Rated frequency		50/60 Hz
Rated continuous thermal current		max. 1.2 x rated current (primary)
Rated thermal short-time current, max. 3 s		max. 40 kA
Rated current	dynamic	unlimited
	primary	40 A to 2500 A
	secondary	1 A And 5 A
Multiratio (secondary)		200 A - 100 A to 2500 A - 1250 A
Core data according to rated primary current		max. 3 cores
Measuring core	Rating	2.5 VA to 30 VA
	Class	0.2 to 1
	Overcurrent factor	FS 5, FS 10
Protection core	Rating	2.5 VA to 30 VA
	Class	5 P or 10 P
	Overcurrent factor	10 to 30
Permissible ambient air temperature		max. 60 °C
Insulation class		E

13 Gas compartments

Function

The distribution of the gas compartments is decisive for working on the switchgear during operation and the resulting operational restrictions. Thus, in case of fault, the distribution of the gas compartments determines the extent of work.

The following example shows the distribution of the gas compartments in a switchgear with double busbar system with the associated item designations of the manometers. For more detailed data to other configurations, please contact your regional Siemens representative.

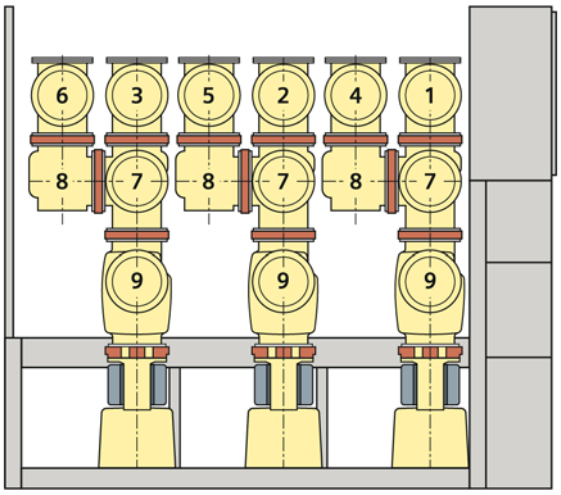


Fig. 14: Gas compartment distribution in a double-busbar panel 8DB10

① Busbar system 1, phase L1 (manometer B11)
② Busbar system 1, phase L2 (manometer B12)
③ Busbar system 1, phase L3 (manometer B13)
④ Busbar system 2, phase L1 (manometer B21)
⑤ Busbar system 2, phase L2 (manometer B22)
⑥ Busbar system 2, phase L3 (manometer B23)
⑦ Three-position disconnector, busbar system 1, phases L1, L2, L3 (manometer B1)
⑧ Disconnector, busbar system 2, phases L1, L2, L3 (manometer B2)
⑨ Circuit-breaker, phases L1, L2, L3 (manometer B0)
⑩ Top-mounted bus sectionalizer, busbar system 1, phases L1, L2, L3 (manometer B16)
⑪ Top-mounted bus sectionalizer, busbar system 2, phases L1, L2, L3 (manometer B26)

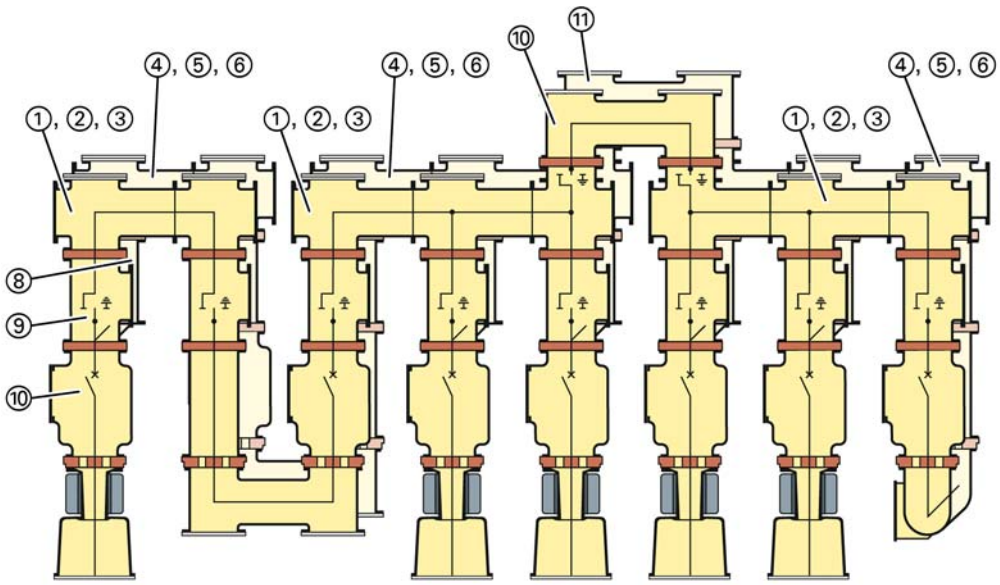
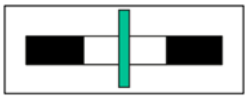


Fig. 15: Gas compartment distribution in 8DB10 switchgear with double-busbar panels

Bushings

	Symbol	Adhesive label
Gas-tight bushing		
Bushing pervious to gas		

Gas quantities 8DB10

The gas quantities of 8DB10 are determined in accordance with the project, and are indicated on the rating plates of the switchgear panels.

Examples for typicals (all data for three-phase operation)	**70 kPa** Gas quantity in kg (feeder and busbar)*	**120 kPa** Gas quantity in kg (feeder and busbar)*
Circuit-breaker panel 1250 A 1x panel connection S2	4.5	5.0
Circuit-breaker panel 1250 A 3x panel connection S3	5.2	5.7
Circuit-breaker panel 1250 A 4x panel connection S3	6.4	6.9
Circuit-breaker panel 2500 A 4x panel connection S3	-	6.9
Bus sectionalizer 1250 A (2 panels)	13.6	14.4
Bus sectionalizer 2500 A (2 panels)	-	14.4
Bus coupler 2500 A	-	7.5

* Values according to technical data, see page 44, "Insulating gas SF_6"

Examples for busbar shares	**70 kPa** Gas quantity in kg*	**120 kPa** Gas quantity in kg*
Busbar 2500 A, left end panel	1.8	2.2
Busbar 2500 A, right end panel	1.4	1.8
Busbar 2500 A, intermediate panel	1.8	2.2

* Values according to technical data, see page 44, "Insulating gas SF_6"

14 Panel connection

14.1 Features

- Bushings for plugs with inside-cone plug-in system according to EN 50181
- Single and multiple connections possible per phase
- Conection of several cables with different plug sizes possible per phase
- Connection of solid-insulated or gas-insulated bar possible
- Connection of 4MT7 voltage transformer plugged in at the panel connection housing version 3
- Connection of 4MU3 voltage transformer via flexible cable and plug size 2 at the panel connection housing
- For rated normal currents up to 2500 A

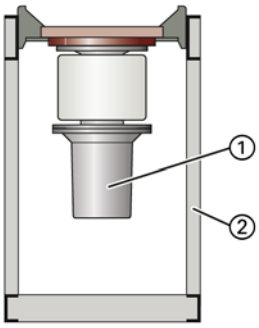
14.2 Panel connection versions for cable plugs

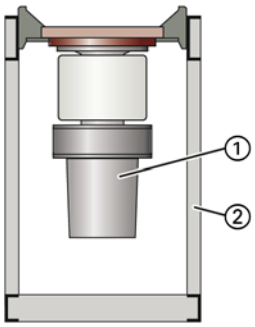
Selection table

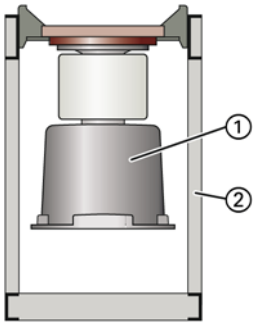
Cable plugs, inside cone

Plug size	**2**	**3**	**4**
Rated normal current (A)	800	1250	2500
Rated lightning impulse withstand voltage (kV)	200	200	200
Rated short-duration power-frequency withstand voltage (kV)	95	95	95
Min. cross-section (mm^2)	25	50	95
Min. core diameter (mm)	4.9	7.2	9.3
Max. cross-section (mm^2)	325	800	1200
Max. core diameter (mm)	22.3	34.6	45.4
Min. diameter across insulation (mm)	13.5	15.5	33
Max. diameter across insulation (mm)	40.0	51.0	66.0

Examples: Panel connection versions

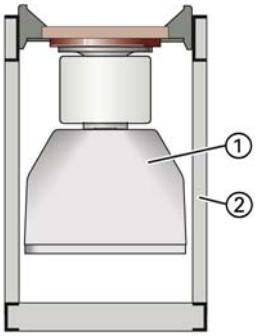
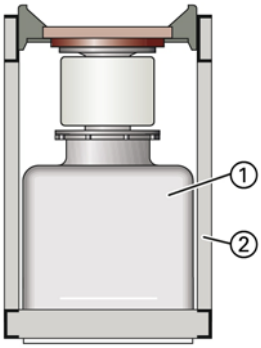
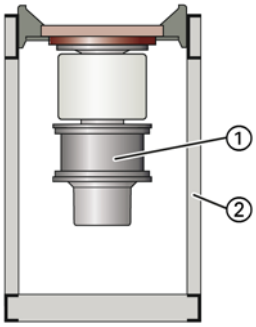
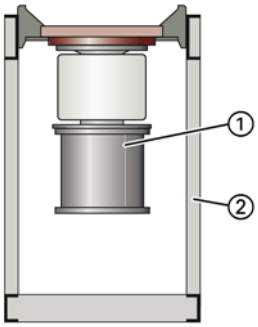






Version 1	**Version 2**	**Version 3**			
S2	S3	S2	S3	4MT7	Solid-insulated busbar connection
1	1	1	1	-	-
		2	-	-	-
		3	-	-	-
		-	2	-	-
		-	3	-	-
		1	2	-	-
		1	-	1	-
		2	-	1	-
		-	1	1	-
		1	1	1	-
		-	-	1	1
		1	-	-	1
		2	1	-	-

Legend:
① Panel connection housing
② Subframe

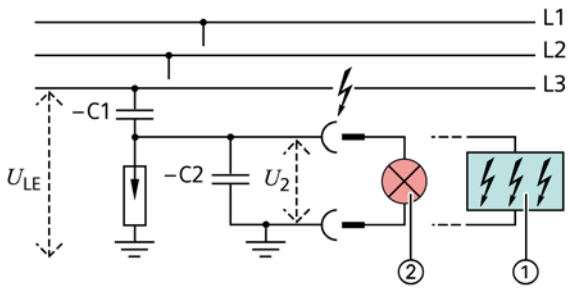
							
Version 4			**Version 5**			**Version 6**	**Version 7**
S2	S3	Solid-insulated busbar connection	S2	S3	S4	Solid-insulated busbar connection	Gas-insulated busbar connection
4	-	-	-	-	1	1	1
5	-	-	1	-	1		
6	-	-	2	-	1		
-	4	-	-	1	1		
1	3	-	1	1	1		
1	4	-	-	-	2		
2	2	-	-	2	1		
2	3	-					
3	1	-					
3	2	-					
4	1	-					
2	-	1					
-	1	1					
-	2	1					
1	1	1					

Legend: ① Panel connection housing
② Subframe

15 Voltage detecting systems

For voltage detection according to IEC 61243-5 and VDE 0682 Part 415 with the following voltage detecting systems:

- LRM plug-in sockets
- VOIS+, VOIS R+ (option)
- CAPDIS -S1/-S2+ (option)
- WEGA 1.2/2.2 (option)



① VOIS, WEGA, CAPDIS-S1+/S2+ fixed-mounted
② LRM indicator plugged in

Fig. 16: Voltage detecting system via capacitive voltage divider (principle)

- -C1: Capacitance integrated into bushing
- -C2: Capacitance 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

LRM system

Fig. 17: Verification of safe isolation from supply (LRM system)

Features of LRM plug-in sockets

- Verification of safe isolation from supply phase by phase through insertion of the voltage indicator in the corresponding plug-in sockets
- Voltage indicator suitable for continuous operation
- Safe-to-touch
- Routine-tested
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes if high voltage is present
- Fixed-mounted capacitive voltage dividers in the bushings

The marking for documentation of the repeat test of the interface condition is located next to the LRM plug-in sockets:

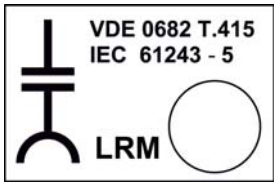


Fig. 18: Documentation to repeat test of interface condition

VOIS+, VOIS R+

Fig. 19: Voltage indicator type VOIS+

Features of VOIS+, VOIS R+

- Integrated display, without auxiliary power
- With indication "A1" to "A3" (see page 177, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- 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 54, 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

CAPDIS-S1+/S2+

Fig. 20: Voltage indicator type CAPDIS-S2+ (option)

Common features of CAPDIS -S1+/-S2+

- 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 "Test" button
- Adjustable to different operating voltage ranges
- 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 signal-lead test
- With overvoltage monitoring and signaling at 1.2 times operating voltage

DANGER

High voltage! Danger! Do only modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ after consultation with the regional Siemens representative!

⇨ If the setting of the C2 module was modified by mistake, re-establish the factory setting as follows:

- Pull out the C2 module ③ at the rear side of CAPDIS-S1+/S2+. **Caution:** Open printed circuit board may be energized.
- Plug the C2 module ③ into CAPDIS-S1+/S2+ so that the marked arrow ① on the housing points to the marking ② on the C2 module

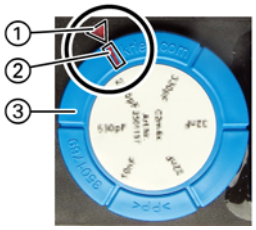


Fig. 21: Marking of the factory setting at the C2 module

Features of CAPDIS-S1+

- Without auxiliary power
- With indication "A1" to "A7" (see page 177, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- Without ready-for-service monitoring
- Without signaling relay (thus without auxiliary contacts)

Features of CAPDIS-S2+

- With indication "A0" to "A8" (see page 177, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- Only by pressing the "Test" pushbutton: "ERROR" indication (A8), e.g., in case of missing auxiliary voltage
- With ready-for-service monitoring (external auxiliary power required)
- With integrated signaling relays 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)

WEGA 1.2

Fig. 22: Voltage indicator type WEGA 1.2

Features of WEGA 1.2

- With indication "A1" to "A5" (see page 179, "Indications WEGA 1.2, WEGA 2.2")
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- Degree of protection IP 54, temperature range –25 °C to +55 °C
- Without integrated signaling relay
- Without auxiliary power

WEGA 2.2

Fig. 23: Voltage indicator type WEGA 2.2

Features of WEGA 2.2

- With indication "A0" to "A6" (see page 179, "Indications WEGA 1.2, WEGA 2.2")
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- Degree of protection IP 54, temperature range –25 °C to +55 °C
- With integrated signaling relay
- Auxiliary power required

16 Aseismic design (option)

Additional components for seismic design are pre-assembled at the factory.

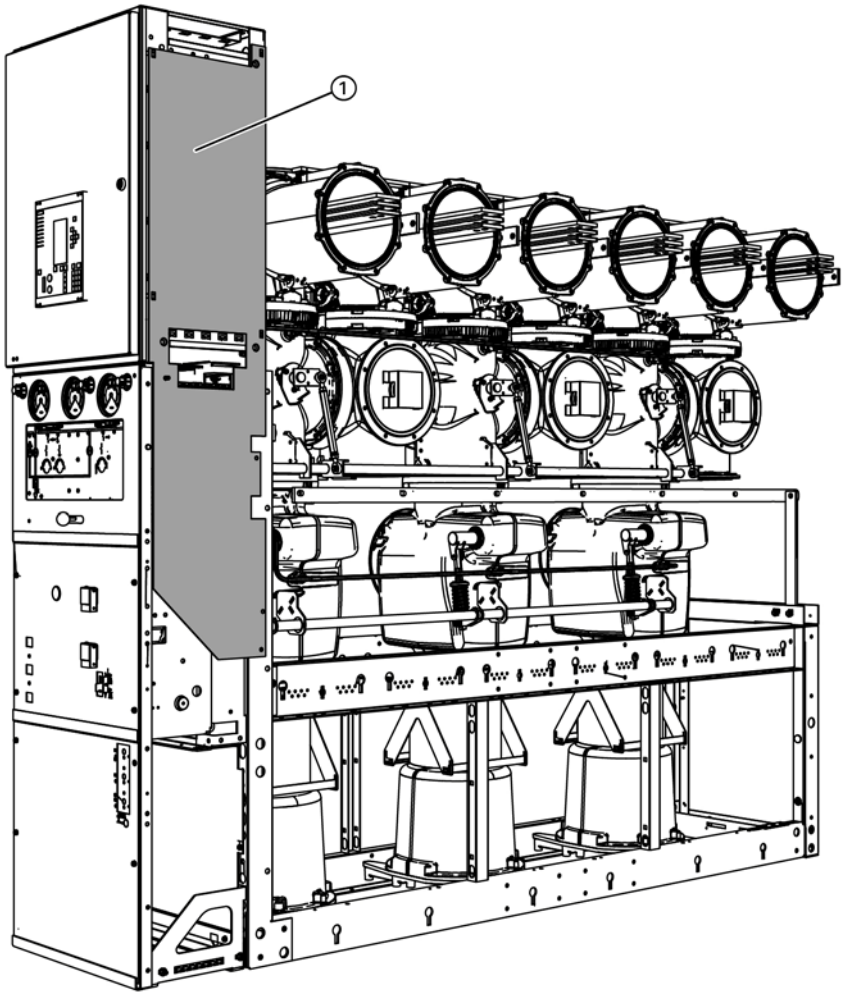


Fig. 24: Aseismic panel design (reinforced side plate ①)

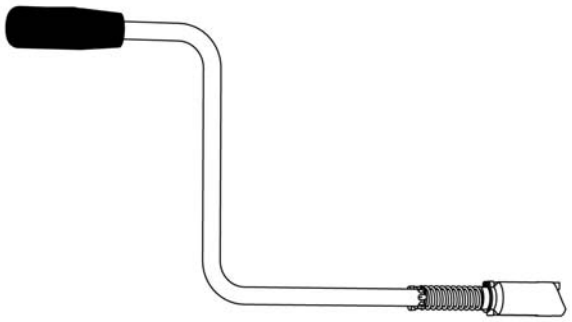
17 Accessories

17.1 Standard accessories

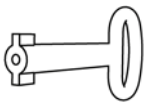
- Operating and installation instructions
- Operating lever for three-position disconnector: DISCONNECTING function

- Operating lever for three-position disconnector: EARTHING or READY-TO-EARTH function

- Hand crank for charging the circuit-breaker closing spring



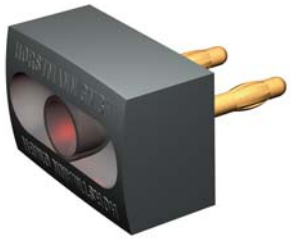
- Double-bit key with a diameter of 3 mm (for door of low-voltage compartment)



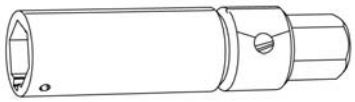
17.2 Other accessories

According to the order documents/purchase order (selection):

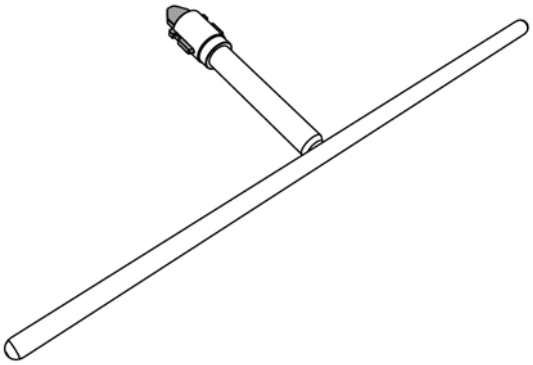
- Voltage detecting system (e.g. plug-in voltage indicator)
- Voltage indicators for LRM systems, pluggable (e.g. make Horstmann)



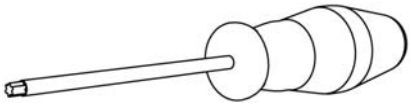
- Adapter for emergency operation of the three-position operating mechanism (to be used only with motor operating mechanism)



- Operating lever for the make-proof busbar earthing switch



- Torx screwdriver



- Test units to check the capacitive interface and the voltage indicators

- Phase comparison test units (e.g. make Pfisterer, type EPV)

Accessories box in the switchgear end wall to store the accessories.

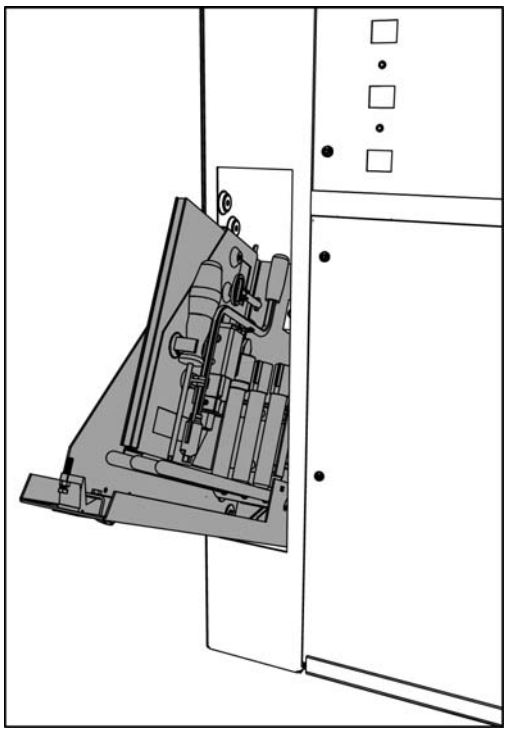


Fig. 25: Accessories box in the switchgear end wall (open)

18 Technical data

18.1 Electrical data

Complete switchgear

Rated						
voltage		kV	**12**	**24**	**36**	**40.5**
frequency		Hz	50/60			
General	Rated short-duration power-frequency withstand voltage	kV	28	50	70	85
	Rated lightning impulse withstand voltage	kV	75	125	170	185
Disconnector	Rated short-duration power-frequency withstand voltage	kV	32	60	80	90
	Rated lightning impulse withstand voltage	kV	85	145	195	220
short-circuit breaking current, max.		kA	40			
short-time withstand current 3s, max.		kA	40			
short-circuit making current, max.		kA	104			
peak withstand current, max.		kA	104			
normal current of busbar, max.		A	5000			
normal current of feeders, max.		A	2500			

18.2 Vacuum circuit-breaker

Operating times

Closing time		Closing solenoid	<95	ms
Opening time		1st shunt release	<65	ms
		2nd shunt release	<55	ms
		Undervoltage release	<55	ms
Arcing time	at 50 Hz		<15	ms
	at 60 Hz		<12	ms
Break time at 50 Hz		1st shunt release	<80	ms
		2nd shunt release	<70	ms
		Undervoltage release	<70	ms
Dead time			300	ms
Total charging time			<15	s

Number of operating cycles

Rated normal current	10000 operating cycles
	30000 operating cycles (option)
Short-circuit breaking current	50 operating cycles

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

The operating mechanisms of the 3AH49 vacuum circuit-breakers are suitable for auto-reclosing. For DC operation, the maximum power consumption is approx. 500 W. For AC operation, the maximum power consumption is approx. 650 VA.

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	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	
		Resistive load	Inductive load
dc	24	10	10
	48	10	9
	60	9	7
	110	5	4
	220	2,5	2

Closing solenoid (Y9)

The closing solenoid 3AY1510 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 different principles are used:

- The **shunt release (Y1)** 3AY15 10 is used as standard in the basic circuit-breaker version. With this design, the circuit-breaker is opened electrically. Power consumption: 140 W or 140 VA.
- The **shunt release (Y2)** 3AY11 01 with energy store is fitted if more than one shunt release is required. With this design, 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 (Y7) 3AX1103 are tripped automatically through an electromagnet or deliberately. The deliberate tripping of the undervoltage release generally takes place via an NC contact in the tripping circuit or via an 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 releases (Y6)

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

- The c.t.-operated release **3AX1102** consists of an energy store, an un latching 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.

Integrated varistor

ATTENTION

Switching overvoltages can damage electronic control devices.

⇨ Do not switch off inductive consumers in DC circuits.

With the varistor integrated in the motors, the inductances of the circuit-breaker operating mechanism and the circuit-breaker control system can be operated with DC. The integrated varistor limits the overvoltage to approx. 500 V and is available for all rated operating voltages.

18.3 Insulating gas SF_6

Sulphur hexafluoride SF_6 according to IEC 60 376 is used as insulating gas. SF_6 insulates live parts between each other and against earth potential.

Features

- Non-toxic
- Odorless
- Colorless
- Non-inflammable
- Chemically neutral
- Electronegative
- Heavier than air

Filling degree of compressed gas cylinders

1.04 kg SF_6 / liter cylinder volume (valid at a max. ambient air temperature of + 65 °C).

Vapor pressure over liquid SF_6

In the supplied cylinders, about 2/3 of the cylinder volume is liquid at + 20 °C, the rest is saturated SF_6 vapor.

Vapor pressure as a function of temperature

Temperature	Vapor pressure
+ 20 °C	2100 kPa
+ 30 °C	2700 kPa
+ 65 °C	7000 kPa (test pressure of cylinder)

Storage

Store the cylinders in vertical position in a cool place.

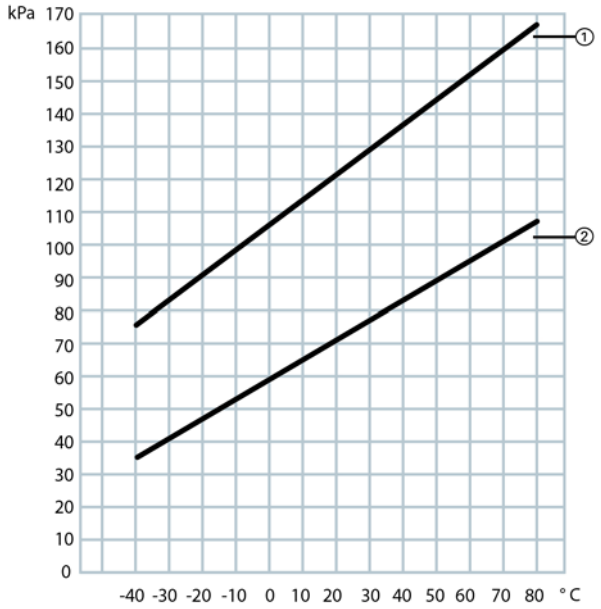
Secure the cylinders against accidents.

Gas pressures in kPa at 20°C

	Busbar housing				
Rated busbar current [A]	≤ 2500, 5000				3150, 4000
Rated voltage [kV]	≤ 40.5				
Rated lightning impulse withstand voltage [kV]	≤ 185	185	190	200	≤ 190
Rated short-duration power-frequency withstand voltage [kV]	≤ 85	95	85	80	≤ 85
Rated functional level [kPa]	**70**	**120**			
Signal "critical functional level"	40	90			
Min. functional level [kPa]	50	100			
Signal "pressure too low" [kPa]	50	100			
Max. functional level [kPa]	120	180			
Signal "pressure too high" [kPa]	120	180			

	Circuit-breaker/disconnector housing							
Rated feeder current [A] *	1250		≥ 1600	≤ 2500				
Rated voltage [kV]	≤ 36			40.5		36	38	40.5
Rated lightning impulse withstand voltage [kV]	≤ 170			185	190	200	200	200
Rated short-duration power-frequency withstand voltage [kV]	≤ 50	65 / 70	≤ 70	85	85	80	80	80
Rated functional level [kPa]	70	120						
Signal "critical functional level"	40	90						
Min. functional level [kPa]	50	100						
Signal "pressure too low" [kPa]	50	100						
Max. functional level [kPa]	120	180						
Signal "pressure too high" [kPa]	120	180						

Characteristics of gas pressure - temperature



① 120 kPa/20 °
② 70 kPa/20 °

Fig. 26: Characteristics of gas pressure as a function of temperature

The characteristics of the gas pressures as a function of temperature show the behavior of the SF_6 gas at different gas filling levels depending on the ambient air temperature.

Due to the different configurations of the gas compartments, installed switchgear assemblies may deviate from the above characteristics.

18.4 Classification of 8DB10 according to IEC 62 271-200

DANGER

Internal arc classification

⇨ With internal arc classification IAC A FL, the area behind the switchgear is not tested regarding the effects of internal faults. For this reason, access to this area must be prevented during switchgear operation.

Protect the area behind the switchgear, e.g. by means of a barrier in form of a chain, a tape or a beam.

Design and construction

Partition class	**PM (partition of metal)**	
Loss of service continuity category	LSC 2	
Accessibility to compartments	Busbar compartment	Tool-based
	Switching-device compartment	Tool-based
	Low-voltage compartment	Tool-based
	Cable compartment	Tool-based

Internal arc classification

Designation of the internal arc classification IAC		
IAC class for		
	- Wall-standing arrangement	IAC A FL 40 kA, 1 s
	- Free-standing arrangement	IAC A FLR 40 kA, 1 s
Type of accessibility A		Switchgear in closed electrical service location
		Access “for authorized personnel only” according to IEC 62 271-200
	- F	Front
	- L	Lateral
	- R	Rear (for free-standing arrangement)
Rated short-time withstand current		40 kA
Rated duration of short circuit		1 s

18.5 Standards, specifications, guidelines

Basic prescriptions and standards

The fixed-mounted circuit-breaker switchgear 8DB10 for indoor installation complies with the following prescriptions and standards:

		IEC/EN standard	VDE standard
Switchgear		62271-1	0671-1
		62271-200	0671-200
Devices	Circuit-breakers	62271-100	0671-100
	Disconnectors/earthing switches	62271-102	0671-102
	Voltage detecting systems	61243-5	0682-415
Surge arresters		60099	0675
Degree of protection	IP code	60529	0470-1
	IK code	62262	0470-100
Insulation		60071	0111
Instrument transformers	Current transformers	60044-1	0414-1
	Voltage transformers	60044-2	0414-2
Installation and earthing		61 936-1 / HD 637 -S1	0101
Insulating gas SF_6	**Use and handling**	62271-4	0671-4
	Specification for new SF_6	60376	0373-1
	Guidelines for the checking and treatment of SF_6 taken from electrical equipment	60480	0373-2
Environmental conditions		60721-3-3	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 - EMC Guide for Switchgear; A&D ATS SR/PTD M SP)

Protection against solid foreign objects, electric shock and water

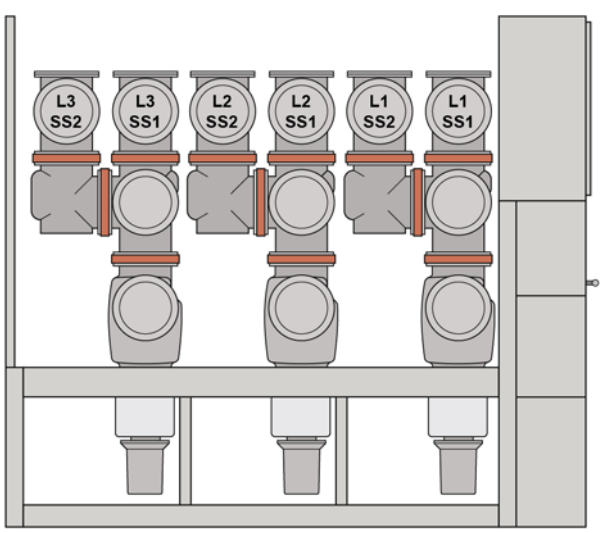
The fixed-mounted circuit-breaker switchgear of the series 8DB10 fulfills the following degrees of protection according to IEC 60 529:

- IP65 standard for parts under high voltage
- IP3XD standard for external enclosure
- IP31D option standard for external enclosure

Transport regulations

According to "Annex A of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)", Siemens gas-insulated medium-voltage switchgear does not belong to the category of dangerous goods in respect of transportation, and is exempted from special transport regulations according to ADR, Clause 1.1.3.1 b).

18.6 Phase sequence



L1 = Phase position 1
L2 = Phase position 2
L3 = Phase position 3
SS1 = Busbar system 1
SS2 = Busbar system 2

Fig. 27: Phase sequence in busbar compartment

18.7 Gas leakage rate

Gas leakage rate

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

18.8 Rating plates

Switchgear panel

The rating plate contains all information that is binding for the panel. It is provided on the inside of the door of the low-voltage compartment of each panel.

If the circuit-breaker class is specified as M2*, a maximum of 30,000 mechanical operating cycles are possible with the circuit-breaker.

① Switchgear type
② Serial number
③ Operating mechanism number
④ Year of manufacture
⑤ Panel number
⑥ Technical data
⑦ Internal arc classification
⑧ Pressure test mark of the SF_6 gas vessel
⑨ Number of operating instructions for the panel

Fig. 28: Rating plate of switchgear (example)

The IAC classification is referred to each panel. The data on the rating plate (see item ⑦) describes the areas classified for the corresponding panel.

18.9 Overview of busbar covers

	**ATTENTION**
	If covers are removed from the switchgear assembly, please ensure that the correct cover type is mounted again. ⇨ If necessary, mark cover type.

	**NOTE**
	Mounting direction of post insulator cover ⇨ The post insulator cover is marked with the designation "Front". The marking must always point towards the front of the switchgear when the cover is mounted. ⇨ Observe the mounting position of the post insulator cover.

Fig. 29: Standard cover (rear view)

Fig. 30: Desiccant cover (rear view)

Fig. 31: Post insulator cover (rear view)

Fig. 32: Post insulator cover with desiccant (rear view)

Fig. 33: Bursting disc (rear view)

Fig. 34: Bursting disc (front view)

Installation

19 Constructional stipulations

19.1 Switchgear room

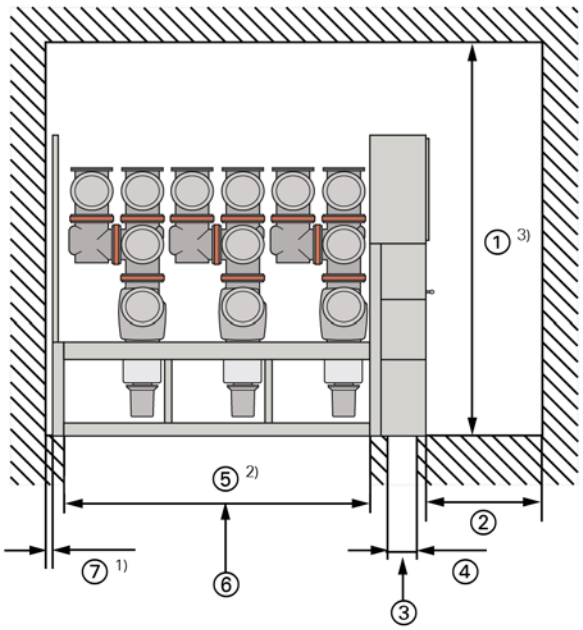
Please observe the following points while preparing the switchgear room:

- Base frame and switchgear dimensions
- Transport route to the switchgear room
- Distribution and intermediate storage spaces
- Size of the room and the doors
- Construction and load-bearing capacity of the floor
- Illumination, heating, power and water supply
- Dimensions of installation scaffoldings and foundation rails
- Installation of high-voltage cables
- Earthing system
- Cleanliness: Switchgear room free of dirt and dust

Floor openings

The panels can be bolted or welded to the foundation rails. Fasten each panel diagonally to the foundation rails at two points at least. Use M10 fixing bolts as a minimum.
Tightening torque: 60 Nm.

Dimensions of the switchgear room



① ≥ 2850 mm 3)
② ≥ 800 mm
③ Area for floor openings for control cables
④ 210 mm
⑤ ≥ 2185 mm 2)
⑥ Floor openings for high-voltage cables
⑦ ≥ 50 mm 1)

1) ≥ 500 mm for free-standing arrangement. ≥ 800 mm for free-standing arrangement and operation from the rear.

2) For large panel connection housings (versions 4 and 5) the dimension must not be smaller than 2185 mm.

3) I f there are any busbar components, the minimum room height may have to be higher.

Fig. 35: Room planning (data in mm)

Room dimensions and wall distances

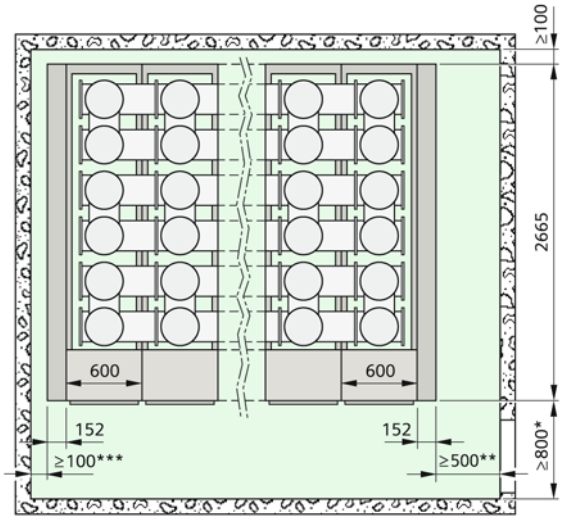


Fig. 36: Wall-standing arrangement

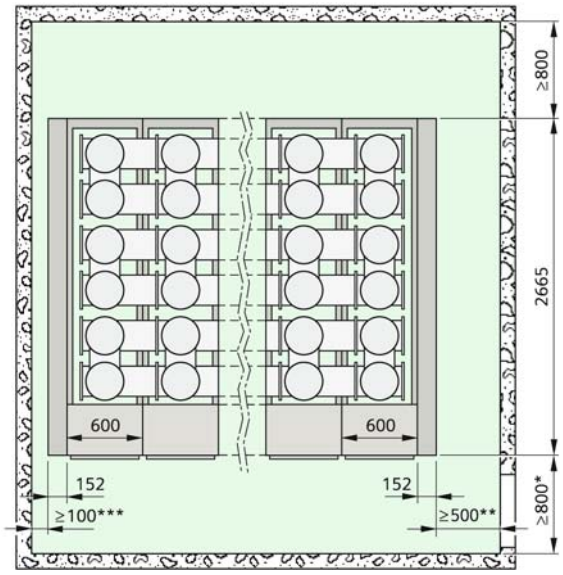


Fig. 37: Free-standing arrangement

* Depending on national requirements

** Lateral wall distance ≥ 500 mm optionally required on the left or on the right

*** Lateral minimum wall distance ≥ 100 mm optionally possible on the left or on the right

Load-bearing capacity of the floor

Load data and minimum distances		
Constant loads	Vertical single load	12 kN ****)
Not constant loads	Live load	9 kN/m^2
Minimum distances	Control aisle	800 mm *)
	Minimum lateral wall distance	100 mm **)
	Lateral wall distance	500 mm ***)
	Ceiling height	2900 mm
Minimum door opening	Height	2700 mm ****)
	Width	900 / 1900 mm *****)

*) Depending on national requirements.

**) Optionally possible on the left or on the right.

***) Optionally required on the left or on the right.

****) Without busbar components / height of low-voltage compartment 850 mm

*****) Individual panel without transport packing
(for group deliveries and bringing in with transport packing, see page 57, "Transport units "

Construction of the floor

The floor covering must be even, easy to clean, pressure-resistant, slip-resistant, abrasion-resistant and electrically discharging.

As floor construction, the following is possible:

Steel girder layer

Suitable for large and numerous floor openings, and advantageous for later modifications or extensions of the switchgear. The dimensions result from the constructional data of 8DB10 (see page 53, "Constructional data of the foundation").

Fig. 38: Frame construction with longitudinal girders

Fig. 39: Frame construction with longitudinal girders (cable basement)

Reinforced-concrete plate

Suitable for small room dimensions or spans, as well as for few and smaller floor openings.

Double floor

Suitable if neither a cable basement nor sufficient cable ducts can be installed; it consists of removable, flame-retardant floor plates mounted on a supporting structure. The supporting floor is about 60 to 100 cm lower depending on the cable routing (bending radius).

Earthing system

- Provide suitable earthing system for the substation building (e.g., foundation earth electrode, ring earth electrode, earth rod), and prepare the associated connection points inside the substation building.
- Connect components brought into the substation building - such as metallic constructions, floor reinforcement, doors, pressure relief systems, cable tracks, etc. - to the substation earth, and earth them.
- Dimension the cross-sections of the earth electrodes sufficiently (e.g., foundation earth electrode, ring earth electrode, earth rod).
- Always observe the associated national and international standards and building regulations.

Cable basement

	**ATTENTION** The cable basement must be sufficiently large to perform all work involved and to provide a clear arrangement of the cables. ⇨ The height and depth of the cable basement depends on the bending radii of the cables used.

The cable basement must have the following characteristics:

- Dry
- Accessible at any time
- Sufficiently illuminated

19.2 Constructional data of the foundation

Floor openings and fixing points

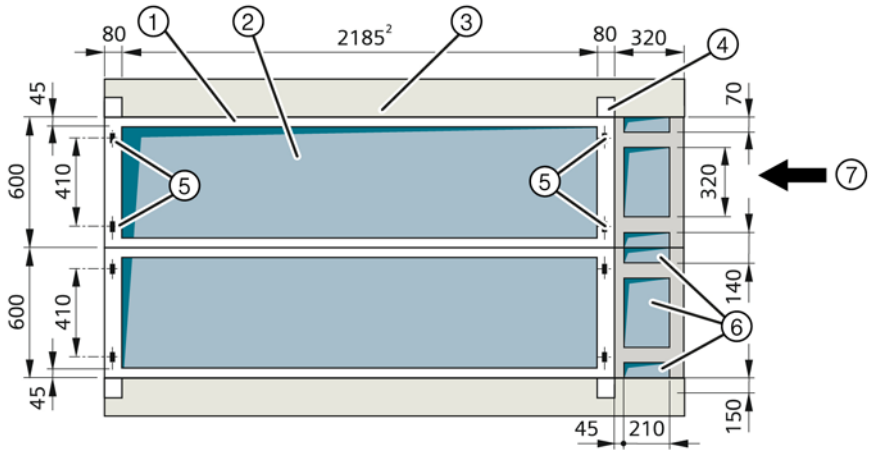


Fig. 40: Overview of floor openings and fixing points

①	Base frame	⑤	Fixing holes (26x45) for M10
②	Floor opening for high-voltage cables	⑥	Area for floor openings for control cables
③	Switchgear termination	⑦	Operating side of the panel
④	Foundation rails		
2)	For large panel connection housings, the dimension must not be smaller than 2185 mm		

Stipulations for the bolted joint of the standard design

The standard design must be bolted diagonally to the foundation rails at two points (use sheet EN10021, 4x40x60 mm).

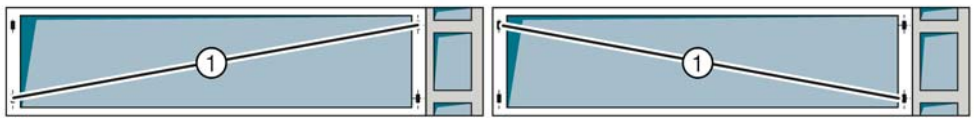


Fig. 41: Bolted joints of standard design

① Fixing points (26x45 mm) for M10

Stipulations for the bolted joint of the aseismic design

The aseismic design must be bolted to the foundation rails at all 4 points using a floor fixing profile. The floor fixing profile is included in the scope of supply. The fixing material is not included in the scope of supply. (Part number: 865-2944.0 without fixing material).

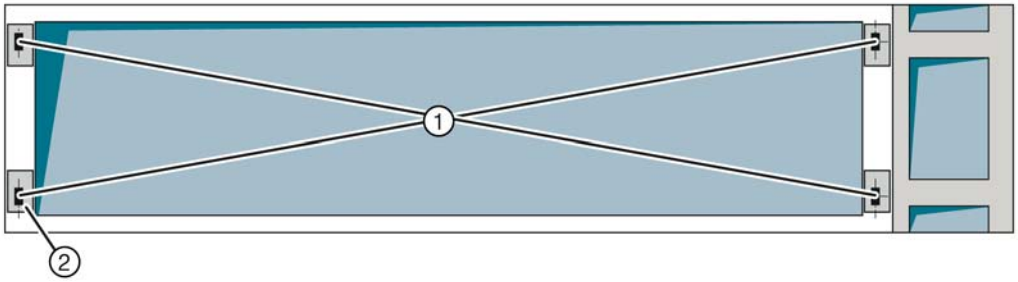


Fig. 42: Bolted joints of the aseismic design

① Fixing points (26x45 mm) for M10

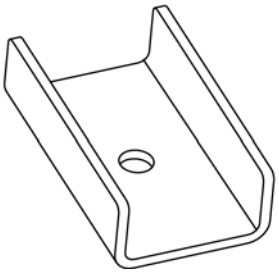


Fig. 43: Fixing profile

② Fixing profile

Stipulations for the welded joint of the standard design

The standard design must be welded diagonally to the foundation rails at two points.
A floor fixing profile is not necessary.

The welding seams are conform to the strength of the equivalent bolted joint with M10 bolts.

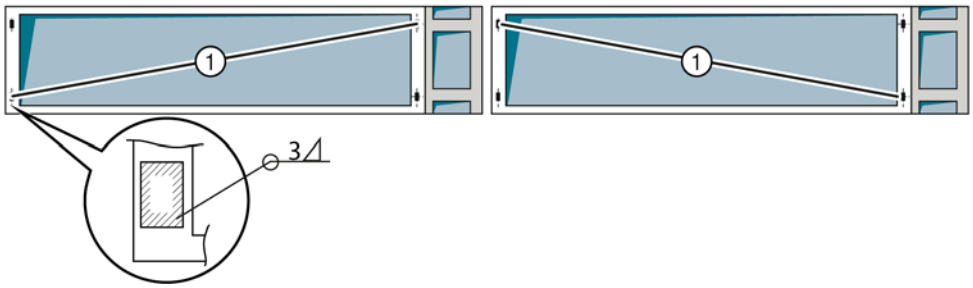


Fig. 44: Welding seams of the standard version

① Fixing points (26x45 mm)

Stipulations for the welded joint of the aseismic design

The aseismic design must be welded to the foundation rails at all 4 points.
A floor fixing profile is not necessary.

The welding seams must conform to the strength of the equivalent bolted joint with M10 bolts.

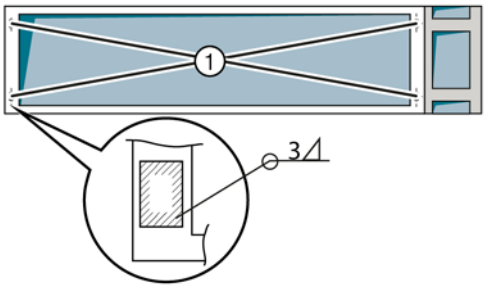
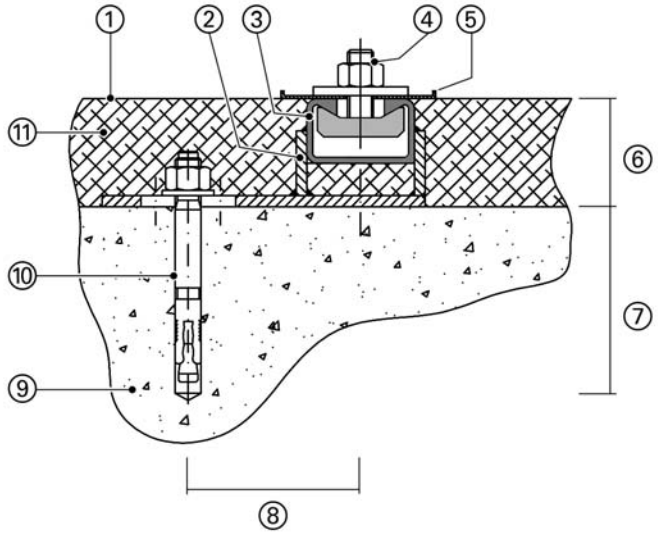


Fig. 45: Welding seams of the aseismic design

① Fixing points (26x45 mm)

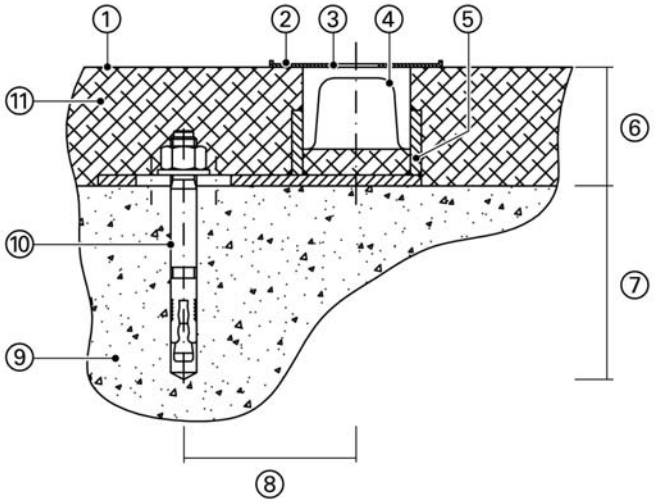
Siemens recommendation for the floor fixing



① Upper edge of finished floor
② Floor fixing plate (holder for profiles at a distance ≥ 1200 mm), see page 56, "Floor fixing plate"
③ C-profile CB 50 x 30, EN 10025, S235JR
④
- Hook-head bolt M16x35-4.6
- Washer R18, DIN 440/ISO 7094, S235JRG2C + L
- Hexagonal nut M16-8, DIN EN ISO 4032

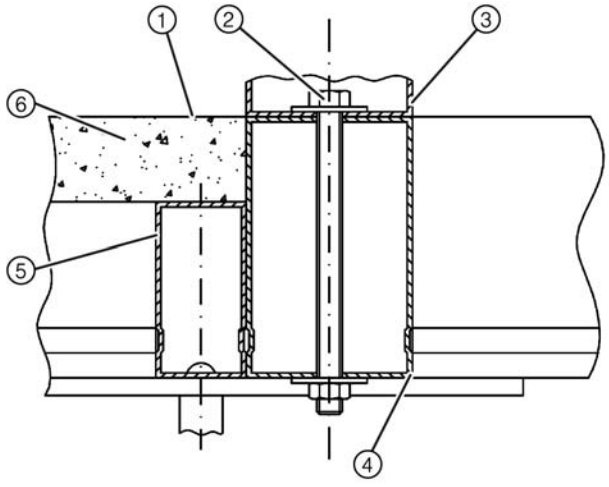
⑤ Base frame of the switchgear
⑥ Min. 50 mm
⑦ Min. 90 mm
⑧ 80 mm
⑨ Raw floor
⑩ Expansion dowel with hexagonal bolt and washer, FAN 12/10
⑪ Floor finish

Fig. 46: Screwed floor fixing



① Upper edge of finished floor
② Base frame of the switchgear
③ Welding in fixing opening of base frame
④ U-profile U80, DIN 1026
⑤ Floor fixing plate (holder for profiles at a distance ≥ 1200 mm), see page 56, "Floor fixing plate"
⑥ Min. 55 mm
⑦ Min. 90 mm
⑧ 80 mm
⑨ Raw floor
⑩ Expansion dowel with hexagonal bolt and washer, FAN 12/10
⑪ Floor finish

Fig. 47: Welded floor fixing



① Upper edge of double floor
②
- Hexagonal bolt M10-8, DIN 931/933
- Washer 10.5-St, EN ISO 7093-1
- Hexagonal nut M10-8, DIN EN ISO 4032

③ Base frame of the switchgear
④ Substructure
⑤ Supporting profile (e.g. profile 70 x 40 x 2)
⑥ Floor plate (approx. 36 mm thick)

Fig. 48: Fixing on double floor

Floor fixing plate

The floor fixing plate is not part of the scope of supply of the Switchgear Factory Frankfurt.

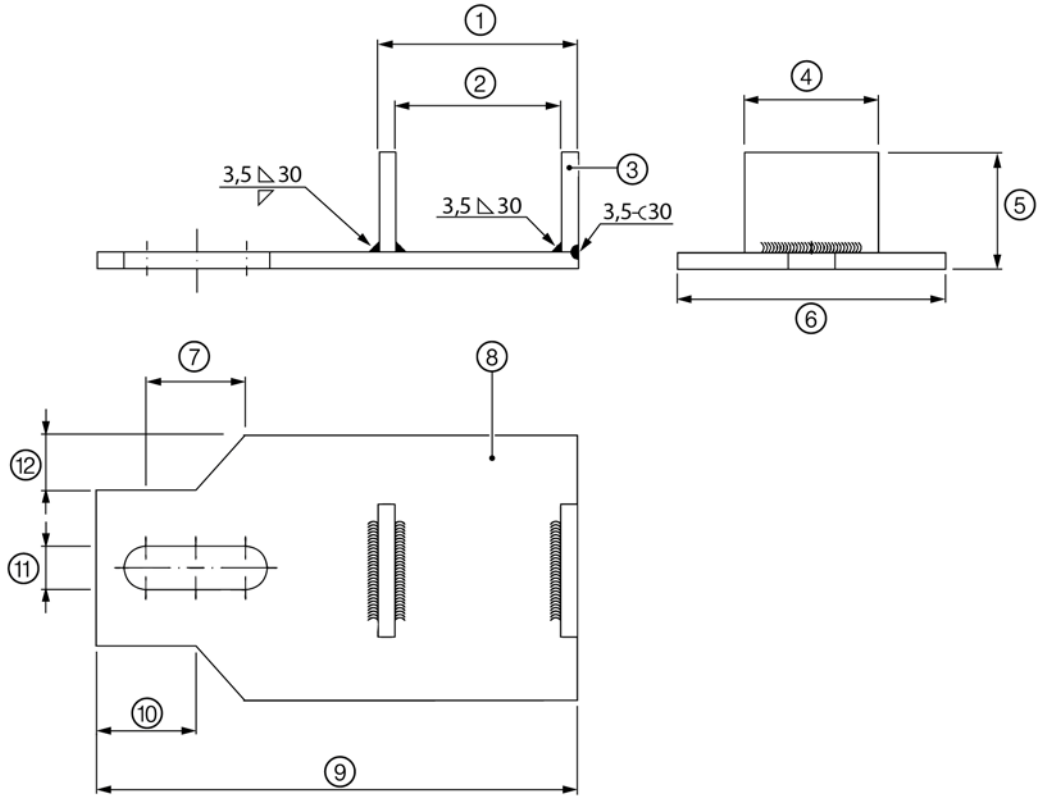


Fig. 49: Floor fixing plate

① 90^{+2} mm
② 80^{+2} mm[1)]
③ Plate 30 x 5 x 40 mm, DIN 1017/EN 10025, S235 JR, hot-dip galvanized
④ $40^{\pm1}$ mm
⑤ $35^{\pm2}$ mm
⑥ $80^{\pm1.5}$ mm
⑦ $30^{\pm1}$ mm
⑧ Plate 80 x 5 x 160 mm, DIN 1017/EN 10025, S235 JR, hot-dip galvanized
⑨ $160^{\pm2}$ mm
⑩ 30 mm
⑪ 13 mm
⑫ 15 mm

1) 50 mm when using C-profile CB 50

	**NOTE**
	The welded seams are susceptible to corrosion. ⇨ After welding, protect the welded seams professionally against corrosion.

Foundation

Please observe the following items when preparing the foundation:

- Dimensions of the floor opening and the fixing points of the switchgear frame (see page 53, "Constructional data of the foundation").
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate them with shims (0.5 - 1.0 mm).

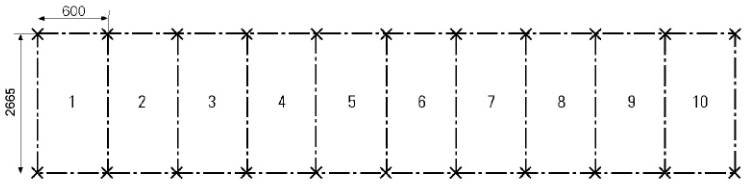


Fig. 50: Measuring sheet for the foundation

The measuring sheet for the foundation shows: Evenness/straightness tolerance according to DIN 4366: 1 mm for 1 m length, 2 mm for the total length.

Regulations and standards referred to foundation and switchgear room

The switchgear can be used as indoor installation according to IEC 61 936 (Power Installations exceeding 1 kV AC) and VDE 0101

- outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools
- in lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering

For more information, see page 46, "Standards, specifications, guidelines".

19.3 Transport units

Dimensions

Panel widths	Transport dimensions	Transport weight with packing[1)]	Transport weight without packing [1)]
mm	Width x Height x Depth mm x mm x mm	approx. kg	approx. kg
Transport inside Germany or to European countries			
1 x 600	1816 x 2550 x 3124	1300	1200
2 x 600	1816 x 2550 x 3124	2600	2400
3 x 600	2416 x 2550 x 3124	3900	3600
Transport to overseas			
1 x 600	1840 x 2850 x 3124	1300	1200
2 x 600	1840 x 2850 x 3124	2600	2400
3 x 600	2440 x 2850 x 3124	3900	3600
[1)] Average values depending on the degree to which panels are equipped			

Center of gravity

The position of the center of gravity can vary depending on the switchgear design.
In the following construction, the center of gravity is located at the marked position:

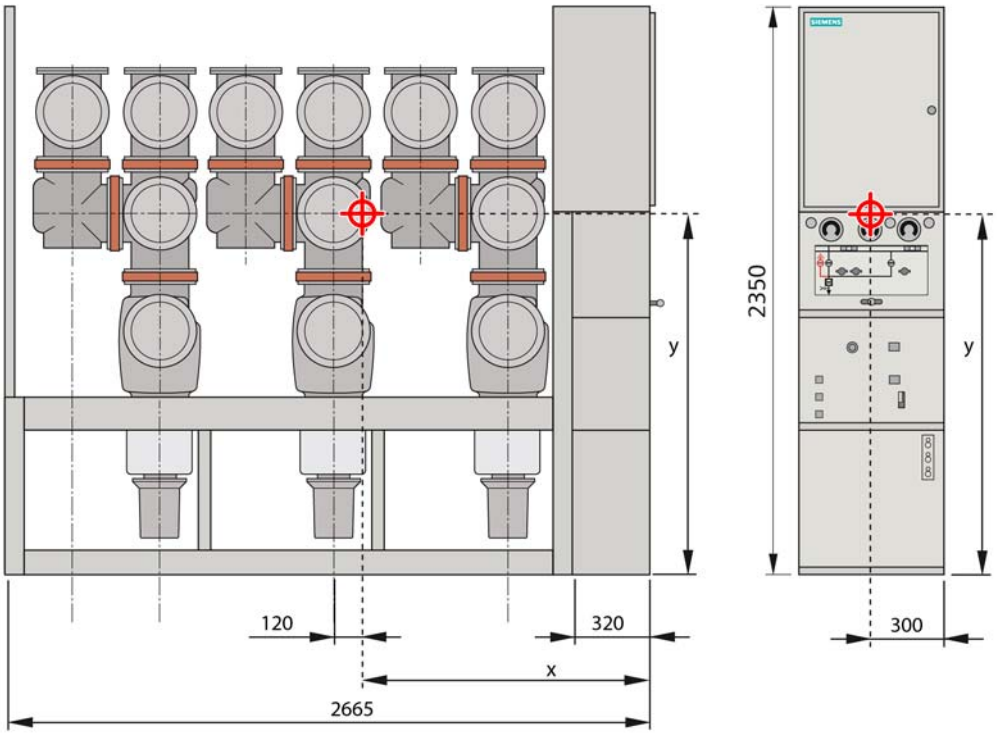


Fig. 51: Position of the center of gravity (depending on the switchgear version)

20 Before installation

20.1 Preliminary clarifications

In order to load the transport units in a suitable installation order, the responsible Siemens representative requires the following information from you several weeks before delivering the switchgear:

- Sketch of the installation room including the locations and numbers of the individual panels and the storage space for the accessories
- Sketch of the access route from the public road to the switchgear building and information concerning the condition thereof (meadows, arable soil, sand, gravel, etc.)
- Sketch of the transport route inside the switchgear building with the locations and dimensions of doors and other narrow points, as well as the floor number of the installation room
- Information about available lifting equipment, e.g., mobile crane, fork-lift truck, lifting truck, hydraulic jack, roller pads. If no lifting equipment is available, please notify this explicitly.

20.2 Intermediate storage

	**DANGER** Risk of injury and damage to the stored goods if the storage surface is overloaded or the transport units are stacked. ⇨ Observe the load-bearing capacity of the floor. ⇨ Do not stack the transport units.

	**DANGER** Fire risk! ⇨ No smoking. ⇨ Keep fire extinguishers in a weatherproof place. ⇨ Mark the location of the fire extinguisher.

	**ATTENTION** Supplied desiccant bags lose their effectivemess 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.

	**ATTENTION** The transport units may be damaged if they are stored outdoors without seaworthy packing (seaworthy crate). ⇨ Store transport units outdoors in seaworthy packing (seaworthy crate) only.

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
- Observe the permissible storage temperature from -25° C to +70° C in accordance with the installed secondary devices. In the individual case, the electronic components must be checked regarding the permissible limit temperature and the relevant temperatures for the application.
- In a weatherproof place
- Protected against damage
- Store transport units in such a way that they can be taken out later in the correct order for installation.

Storage in closed rooms

The following switchgear parts must be stored in closed rooms:

- Unpacked parts
- Transport units which are not packed in seaworthy crates

The storage room must have the following characteristics:

- Well-ventilated
- Free of dust
- Dry and protected against flooding
- Relative humidity should not exceed 50%
- Protected against vermin (e.g., insects, mice, rats)
- Even floor to enable stable storage
- Floor with adequate load-bearing capacity
- Sufficient size to enable clearly arranged storage

⇨ Do not unpack small parts to avoid corrosion and loss.

⇨ Store transport units in such a way that they can be taken out later in the correct order for installation.

⇨ Provide for sufficient ventilation in heated storage rooms.

⇨ Check transport units for condensation every 4 weeks.

⇨ If the inside of the packing or parts of the switchgear show condensation: Remove the packing, dry the switchgear and the packing. Refit the packing.

Outdoor storage

The storage place must have the following characteristics:

- Protected against rain water
- Protected against flooding as well as melting water from snow and ice
- Protected against pollution and vermin (e.g., insects, mice, rats)
- Even floor to enable stable storage
- Floor with adequate load-bearing capacity
- Sufficient size to enable clearly arranged storage

⇨ Place transport units on planks or square timber for protection against floor humidity.

⇨ Store transport units in such a way that they can be taken out later in the correct order for installation.

⇨ After 6 months (12 months with seaworthy long-time packing) of storage, unpack the transport units and store them in closed rooms, or regenerate the seaworthy packing (see below).

Regenerating the seaworthy packing

After 6 months (12 months with seaworthy long-time packing) of storage, the protection of the seaworthy packing is exhausted. If the transport units still need to be stored outdoors, the seaworthy packing must be regenerated.

⇨ If there is no sufficient knowledge about professional regeneration of the packing: Ask for expert personnel via the competent Siemens representative.

⇨ Open the packings.

⇨ Renew desiccant bags.

⇨ Refit the packings so as to reach full protection: Weld the PE protective foils hermetically tight and rebuild the seaworthy crates completely.

20.3 Tools/auxiliary means

Before starting to work on the switchgear, provide for the tools/auxiliary means required:

- Vacuum pump (e.g. DILO type B048R01), DN8 connection
- Portable hygrometer (e.g. DILO type 3-037-R001 or DILO type 3-038 SF_6 multimeter), DN8 connection
- Volume percentage meter (e.g. DILO type 3-027-R002 or DILO type 3-038 SF_6 multimeter), DN8 connection
- Gas leak detector (e.g. DILO type 3-033-R002)
- SF_6 gas filling device (e.g. DILO type 3-393-R001), DN8 connection
- Vacuum cleaner with flexible and thin tube
- 1 set roller pads
- Round-steel bars; diameter: 30 mm, length: 1600 mm for double panel + 600 mm for each additional panel
- Chain with transport shackles
- Roller crowbars
- Reinforcing bars
- Racks (crank winch)
- Hydraulic jack (2 to 3 t, for vertical and horizontal stroke)
- Emery paper (K 360)
- Step-ladder
- Cable drum
- Drill
- Torque wrench 8 – 20 Nm, 20 to 70 Nm
- Shim plates 0.5 to 1 mm
- Cleaning agent HAKU 1025/90
- Soft, lint-free cloths
- Torx reversing ratchet / screwdriver T10/80, T20/100, T25/100, T30/115
- Water level
- Guide string
- Rod magnet with flexible shaft
- Open spanners SW 13, 16, 17, 18, 19, 24, 27, 32 , 36
- Ring spanners SW 13, 16, 17, 18, 19, 22, 24, 27
- Various screwdrivers
- Vernier caliper
- Water pump pliers
- Mirror with flexible shaft (welding mirror)

20.4 Installation and fixing material

Before starting to install the individual components, provide for the required installation and fixing material.

20.5 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.

21 Unloading and erecting the transport units

21.1 Packing and transport unit

Packing

The transport units can be packed as follows:

- On pallets, covered with PE protective foil
- In a seaworthy crate with long-time packing (switchgear is sealed with desiccant bags in aluminum-coated PE foil)
- Other packings in special cases

	**NOTE**
	The packing materials of the switchgear can be disposed of as classified materials. ⇨ Please observe the local regulations for disposal and environmental protection.

Transport unit

Transport units consist of:

- Individual panels or panel groups consisting of up to 3 individual panels
- Accessories

21.2 Checking the delivery for completeness and transport damage

Before installation, the transport units must be checked for completeness and damage.

	**ATTENTION**
	Transport units may be damaged if stored without intact packing. ⇨ If the transport units are stored before installation, open packing for checks only if the packing is damaged so much that the content must be assumed to be damaged as well. ⇨ Refit the packing before installation. ⇨ Observe instructions to intermediate storage (see page 59, "Intermediate storage").

Checking for completeness

⇨ Check whether the delivery is complete and correct using the delivery notes and packing lists.

⇨ Compare the serial number of the switchgear panels on the delivery note with that on the packing and the rating plates of the panels.

⇨ Check whether the accessories are complete.

Checking for transport damage

⇨ Unpack the transport units. Do not unpack parts supplied with the switchgear in order to avoid loss and damage.

⇨ Inform the forwarding agent immediately about any defects or transport damages; if required, refuse to accept the delivery.

⇨ As far as possible, document larger defects and transport damages photographically; prepare a damage report and inform your regional Siemens representative immediately.

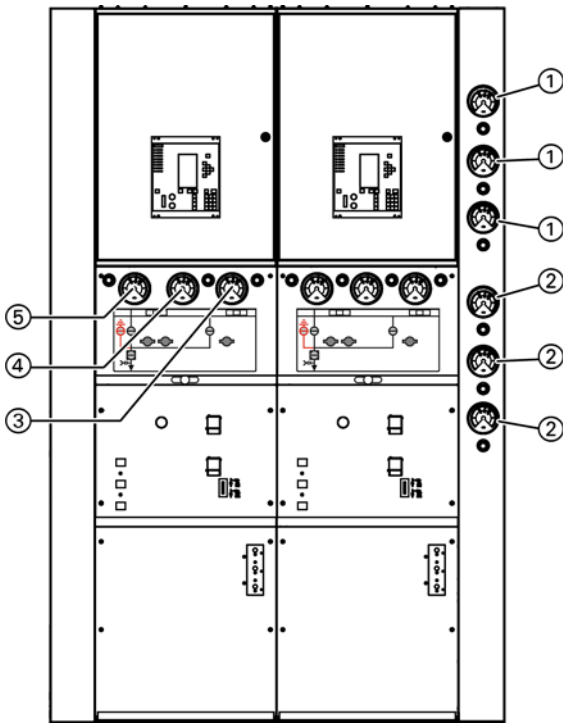
⇨ Have the transport damages repaired, otherwise you may not start installation.

⇨ Check the SF_6 gas pressure.

⇨ Refit the packing.

21.3 Checking the SF_6 gas pressure

To exclude any gas losses during transportation in the gas compartments filled at the factory, check the gas pressure indicators on the panels.



① Gas pressure manometers for the busbar compartments in system 1
② Gas pressure manometers for the busbar compartments in system 2
③ Gas pressure manometer for three-position disconnector housing in system 2
④ Gas pressure manometer for circuit-breaker housing
⑤ Gas pressure manometer for three-position disconnector housing in system 1
⑥ Critical gas pressure (signaling contact)
⑦ Minimum permissible gas pressure (signaling contact)
⑧ Actual gas pressure
⑨ Maximum permissible gas pressure (signaling contact)

Fig. 52: Gas pressure manometers at the panel

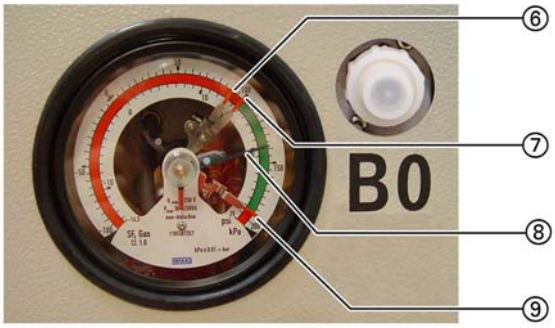


Fig. 53: Gas pressure manometer for the circuit-breaker housing at the panel

	**DANGER**
	Operation with incorrect SF_6 gas pressure can destroy parts of the switchgear. ⇨ Do not install or put the switchgear into operation with incorrect SF_6 gas pressures.

⇨ Check the gas pressure in the compartments pre-filled at the factory on the associated gas pressure indicators. The values must not drop below the temperature-dependent limit values.

⇨ If the filling pressure is too low: Do not assemble the part of the switchgear concerned and inform the regional Siemens representative.

21.4 Unloading transport units

	**DANGER** Risk of injury due to transport units falling down. The transport units can slip off the transport tackle due to the high position of the center of gravity. ⇨ Do not stay under suspended loads. ⇨ Avoid heavy movement of the load. ⇨ Secure the fixing points of the ropes against slipping off.

	**ATTENTION** Parts of the switchgear may be damaged by touching ropes or chains when lifted. ⇨ Use transport tackle / expander.

Lifting packed transport units with the crane

To avoid damage and pollution, the transport units should be transported as long as possible in their original packing. Packed transport units are always lifted with the wooden pallet.

⇨ Use transport tackle / spreader to prevent the transport units from being damaged by the ropes.

⇨ Sling the ropes around the ends of the wooden pallets.

⇨ Unload the transport units and set them down as close to the switchgear building as possible in order to avoid unnecessary moves.

⇨ 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.

Removing transport units from wooden pallets

Unpack transport units and remove from the pallets only if

- there are only short transportation ways left inside the switchgear building, or
- the transport units can be set down with the crane directly at the switchgear building.

The transport unit is screwed on the pallet. The fixing points for transport are located behind the front metal cover in the frame and at the rear cross member.

⇨ Remove the metal covers from the subframes of the panels.

⇨ Remove all fixing bolts that connect the transport unit with the transport pallet.

Lifting unpacked transport units with the crane

To lift the transport unit, two round steel bars with a diameter of 30 mm are required. Minimum length of the round steel bars: Width of transport unit plus 400 mm.

The transport holes for pushing the round bars in are marked on the transport units with a red symbol.

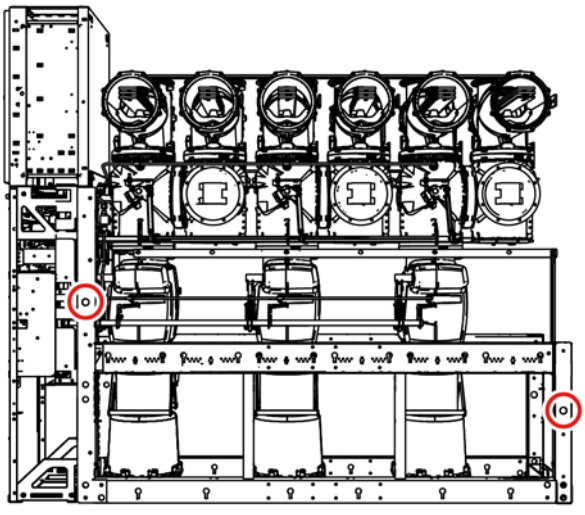


Fig. 54: Position of transport holes

Fig. 55: Marking of transport holes

- ⇨ Push the round steel bars into the transport holes at the front and at the rear.
- ⇨ Attach ropes or chains at the ends of the round steel bars.
- ⇨ Stretch the ropes or chains by lifting the transport tackle carefully.
- ⇨ If the ropes or chains are touching the transport unit, use transport tackle / expander.
- ⇨ Lift the transport unit carefully.

21.5 Transporting the units to the place of installation

Preparing the switchgear room

DANGER

Risk of falling down when crossing provisionally bridged floor openings with the transport units.

- ⇨ Observe sufficient load-bearing capacity of the bridges.
- ⇨ Support bridges adequately.
- ⇨ Secure bridges against displacement.

- ⇨ Bridge floor openings that have to be crossed and prop up with adjustable supports.
- ⇨ Fix the bridges to secure them against displacement.
- ⇨ Clean the switchgear room. Special cleanliness is required.
- ⇨ Draw a marking line at the place of installation in order to align the switchgear.
- ⇨ Unpack the transport units inside the switchgear building. Do not unpack parts supplied with the switchgear in order to avoid loss and damage.

Transporting the units with the pallets

ATTENTION

Sensitive parts of the switchgear may be damaged during transport.

- ⇨ Push the transport units only at the corners of the base frame.
- ⇨ While pushing, take care not to damage any sensitive parts of the switchgear such as gas pipes, bursting discs, shafts, etc.

- ⇨ Move the transport units as close as possible to the place of installation (switchgear room) by means of lifting trucks or fork-lift trucks.

Lifting the transport unit with hydraulic or lifting jacks

Two round steel bars with a diameter of 30 mm are required which are pushed into the transport holes at the transport unit, same as described for lifting with the crane (see page 65, "Unloading transport units").

DANGER

If they are lifted unevenly, the transport units can fall over due to their high center of gravity.

- ⇨ Lift the transport units slowly and evenly.

- ⇨ Push the round steel bars into the transport holes at the front and at the rear.
- ⇨ Support the hydraulic or lifting jacks with robust and stable platforms so that they will reach the bars in lowered condition.
- ⇨ Lift the transport unit carefully.

Further transport without wooden pallets

⇨ Before lifting the transport unit with a fork-lift truck, knock the boards marked at the front out of the wooden pallet.

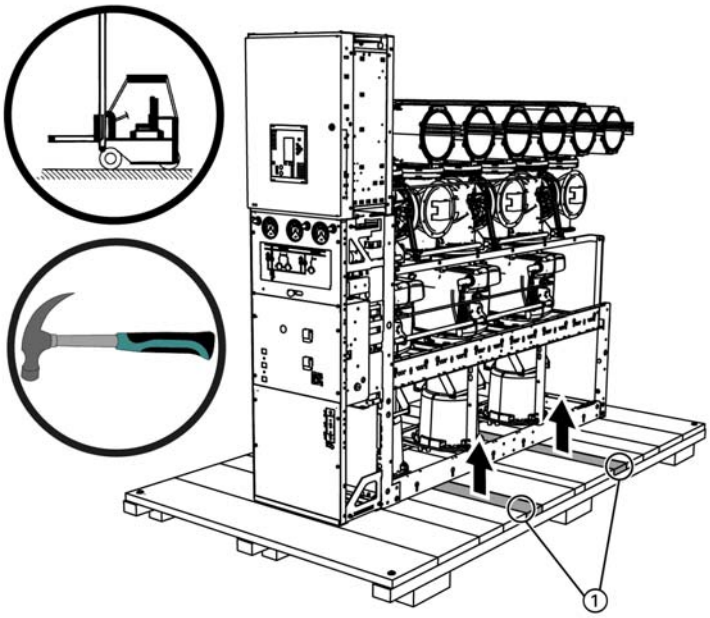


Fig. 56: Lifting the transport unit with the fork-lift truck

① Boards marked at the front

⇨ Lift the transport unit with a crane, hydraulic jacks or a fork-lift truck.

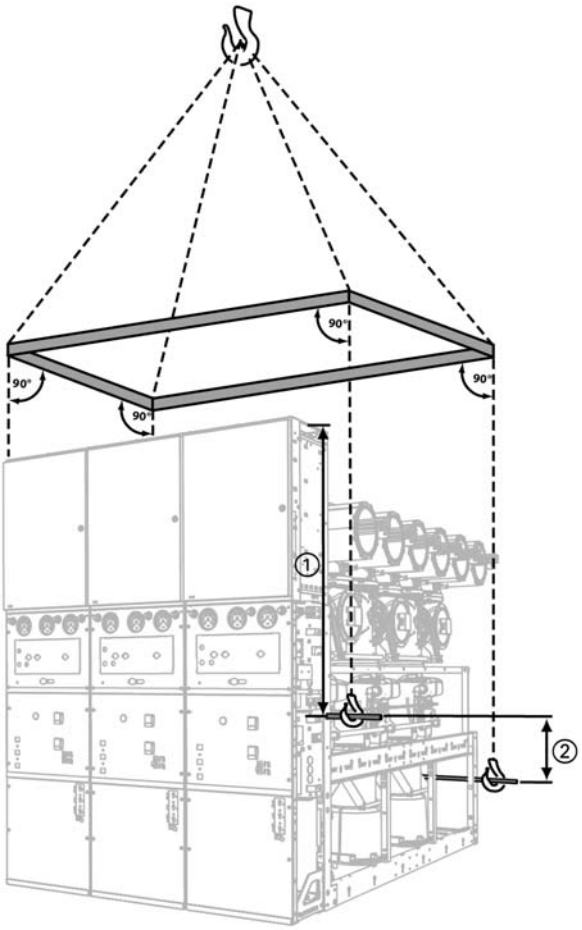


Fig. 57: Example for craning the transport unit

① 1037 mm (height of switchgear dependent on built-on components)

② 622 mm

⇨ Lower the transport unit onto roller pads (reinforced rollers), or tubes (approx. 30 mm diameter). Distribute the roller pads so as to support the transport unit at the outer edges and at the joints between the panels.

⇨ Lift one side, then the other side of the transport unit with roller crowbars and slowly lower it on the mounting position. Apply the roller crowbars only at the corners of the transport units.

Transporting the unit on roller pads/bars

⇨ Prepare four roller pads (reinforced rollers) or two bars.

⇨ Lift the transport unit as described above.

⇨ Place the roller pads in position at the external corners of the base frame under the vertical frame supports, or lay the bars crosswise under the base frame of the transport unit.

⇨ Lower the transport unit slowly and evenly onto the roller pads/bars.

	NOTE
	A transport unit standing on roller pads can only be moved straight ahead. ⇨ To change the direction, the position of the roller pads must be changed.

21.6 Setting down the transport units at the place of installation

Depending on the constructional facts in the switchgear room, there are two basic possibilities for setting down the transport units at the place of installation:

1. Setting down from the narrow side of the floor opening	The transport units are moved over the floor opening to the cable basement coming from the narrow side of the floor opening, and are set down side by side
2. Setting down from the long side of the floor opening	The transport units are set down in front of the long side of the floor opening to the cable basement, and are pushed over the floor opening

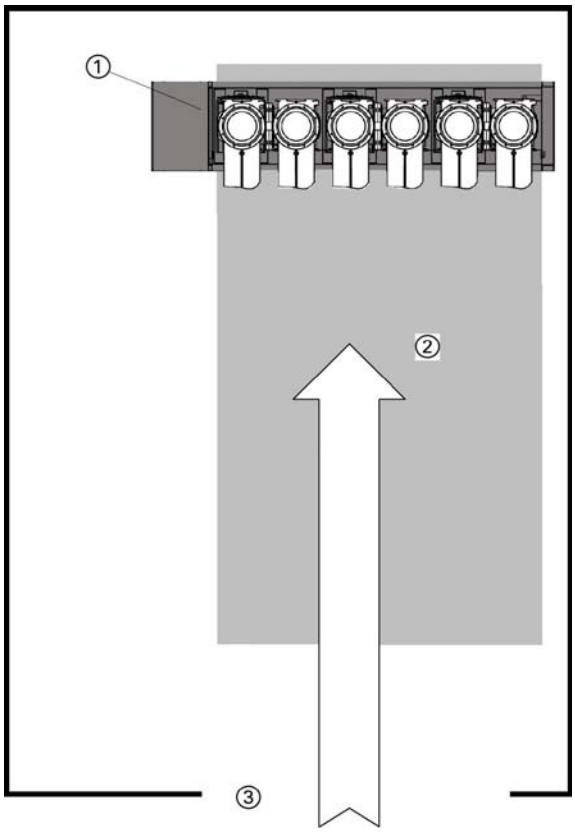


Fig. 58: Setting down from the narrow side of the floor opening

① Transport unit

② Floor opening

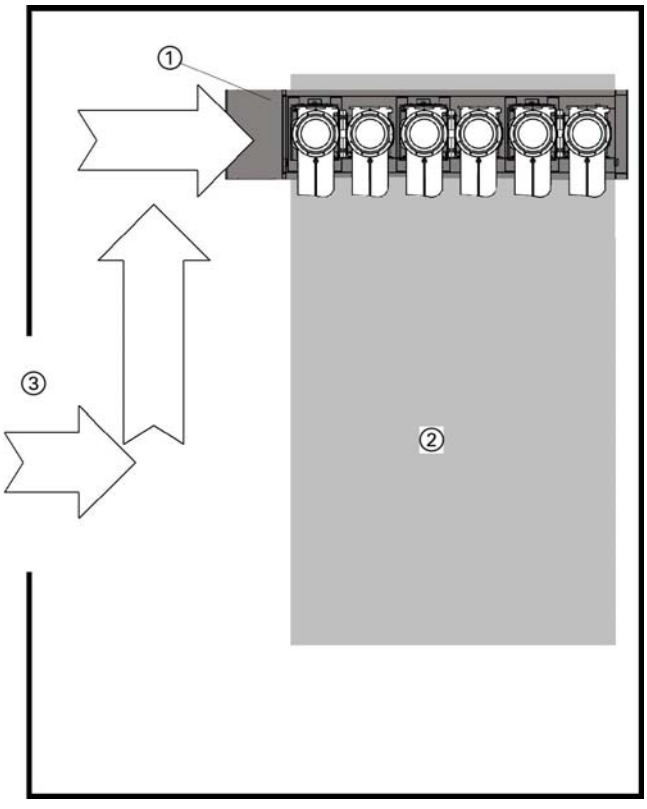


Fig. 59: Setting down from the long side of the floor opening

③ Door to the switchgear room

Setting down the transport units from the narrow side of the floor opening

Precondition:
The transport units must be standing on the roller pads / bars without pallet.

DANGER

The transport units can fall down when they are moved over the floor opening.

⇨ When moving the transport unit on the floor opening, take care that the roller pads / bars are always touching the foundation completely.

⇨ Check the moving direction of the transport unit all the time.

ATTENTION

Without roller pads / bars underneath, the transport units are moved using hydraulic or lifting jacks. The transport units may be damaged.

⇨ Apply auxiliary devices at floor level and only at the base frame of the transport units.

⇨ Place boards under the points where auxiliary devices are applied.

⇨ Roll the first transport unit (end panel) along the floor opening up to its final position.

⇨ Lift the transport unit.

⇨ Remove the roller pads / bars from underneath the transport unit.

⇨ Set down the transport unit carefully.

⇨ Shift the transport unit with hydraulic jacks, lifting equipment or lifting jacks until it is exactly aligned on its mounting position. Prop the hydraulic equipment or jacks up at the surrounding walls.

⇨ Roll the next transport unit along the floor opening, place it at a distance of 500 mm from the first transport unit and align it roughly.

⇨ Lift the transport unit, remove the roller pads / bars and set down the transport unit carefully.

⇨ Proceed in the same way with the other transport units, keeping a distance of 500 mm between them.

Setting down the transport units from the long side of the floor opening

Precondition:
The transport units must be standing on the roller pads / bars without pallet.

DANGER

The transport units can fall down when they are moved over the floor opening.

⇨ When moving the transport unit on the floor opening, take care that the roller pads / bars are always touching the foundation completely.

⇨ Check the moving direction of the transport unit all the time.

ATTENTION

Without roller pads / bars underneath, the transport units are moved using hydraulic or lifting jacks. The transport units may be damaged.

⇨ Apply auxiliary devices at floor level and only at the base frame of the transport units.

⇨ Place boards under the points where auxiliary devices are applied.

⇨ Roll the first transport unit up to the final position in parallel to the floor opening.

⇨ Lift the transport unit.

⇨ Remove the roller pads / bars from underneath the transport unit.

⇨ To shift the transport unit easily and to protect the floor, shims can be laid under as a sliding aid.

⇨ Set down the transport unit carefully.

⇨ Shift the transport unit with hydraulic jacks, lifting equipment or lifting jacks until it is exactly aligned on its mounting position. Prop the hydraulic equipment or jacks up at the surrounding walls.

⇨ If the transport unit is still partly or totally standing on the shims, remove the shims and carefully set down the transport unit again.

⇨ Roll the next transport unit in front of the floor opening and place it beside the first transport unit at a distance of 500 mm.

⇨ Lift the transport unit.

⇨ Remove the roller pads / bars from underneath the transport unit and lay shims under, if required.

⇨ Set down the transport unit carefully and push it over the floor opening as described above.

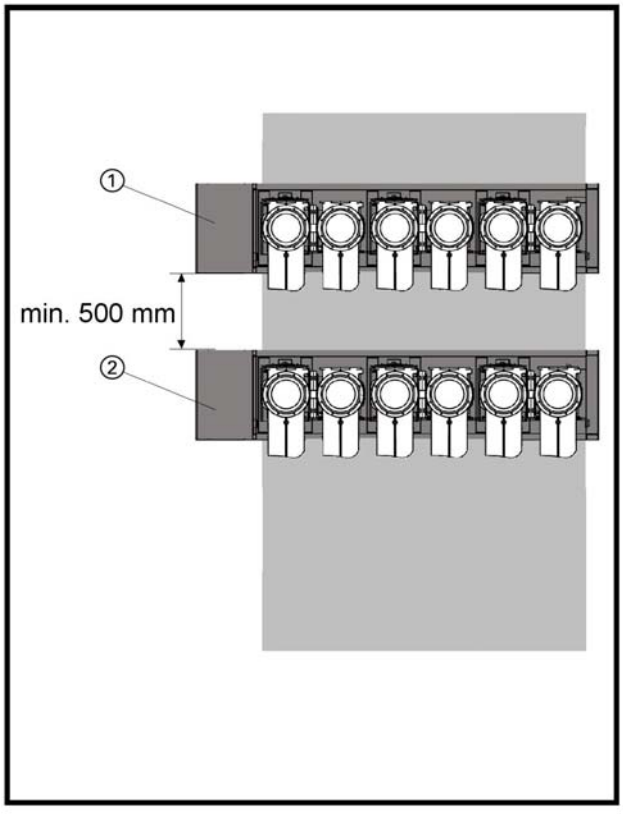
⇨ Align the transport unit roughly, observing a side distance of at least 500 mm.

⇨ Remove the shims from underneath the transport unit as described above.

⇨ Proceed in the same way with all other transport units.

21.7 Aligning the switchgear

To align the switchgear, please follow the illustration below:



① First transport unit, completely aligned

② Other transport units, roughly aligned

Fig. 60: Position of the transport units after erection

⇨ Align the first transport unit (end panel) completely and bolt it to the foundation (see page 53, "Constructional data of the foundation").

⇨ Just align the other transport units (panels) roughly first.

⇨ Keep a distance of at least 500 mm between the transport units for the following installation work.

If not all parts of the switchgear can be brought into the switchgear room before installation due to the little space available, proceed as follows:

⇨ Place as many transport units as possible side by side.

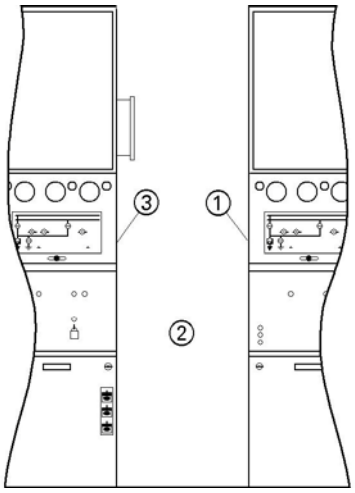
⇨ Mount these transport units.

⇨ Put other transport units on the free space left, etc.

22 Assembling the switchgear

	NOTE
	The activities described hereafter must be carried out by certified personnel who is familiar with installation of switchgear type 8DB10. ⇨ The switchgear must be assembled by certified personnel only.

The points the transport units are interconnected at are called **panel joints** hereafter.



① Transport unit on the right of the panel joint
② Panel joint
③ Transport unit on the left of the panel joint

Fig. 61: Term "panel joint"

Precondition: The transport units are standing in the switchgear room and are aligned for assembly (see page 70, "Aligning the switchgear").

Procedure: Repeat the following operations for all transport units until final assembly.

22.1 Preparing busbar assembly

Removing the transport blocks

During transport, fixing brackets retain the busbars at the open flange connections of the busbar housings. The fixing brackets are bolted together with the flanges of the busbar housings and the busbar ends.

	ATTENTION
	If the switchgear is transported without transport blocks (fixing brackets), parts of the switchgear may be damaged. ⇨ Do not remove the transport blocks until right before assembly. ⇨ Do not move the transport units over longer distances without transport blocks.

⇨ Switch all three-position disconnectors of the transport units located on the right ③ and on the left ② of the panel joint to READY-TO-EARTH position.

⇨ If there are any make-proof busbar earthing switches: Switch the make-proof busbar earthing switches to OPEN position.

⇨ Remove the fixing brackets from all flanges at the panel joint.

Preparing busbar assembly on the panel located on the right of the panel joint

This operation is **only** performed if there is a horizontal flange cover available on the busbar housing of the panel located on the right of the panel joint.

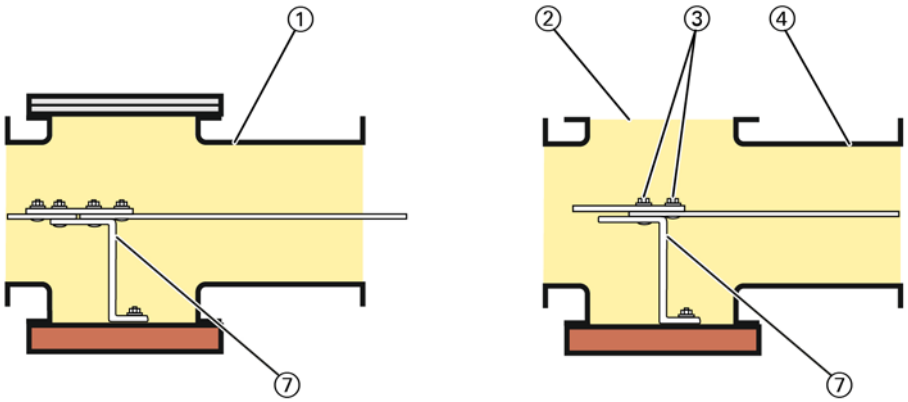


Fig. 62: Preparing busbar assembly on the panel located on the right of the panel joint (example with elbow coupling)

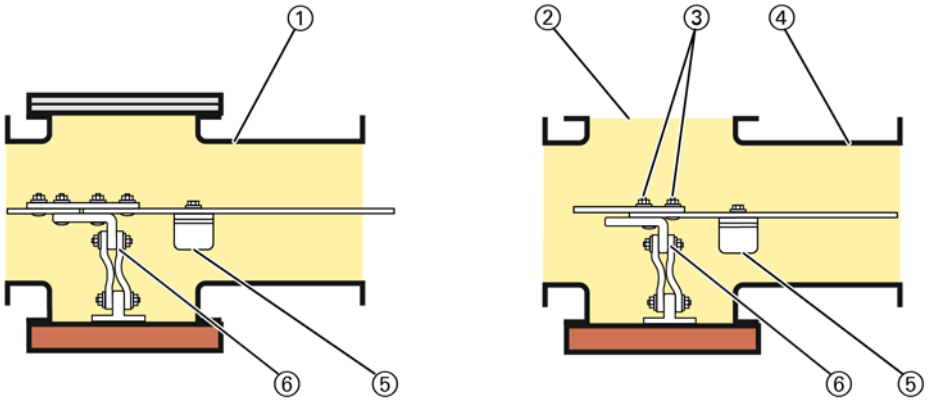


Fig. 63: Preparing busbar assembly on the panel located on the right of the panel joint (example with flexible connectors)

① Busbar housing of the panel located on the left of the panel joint
② Assembly openings (horizontal flanges) in the busbar housings of the panel located on the right of the panel joint
③ Fixing bolts
④ Busbar housing of the panel located on the right of the panel joint
⑤ Busbar support
⑥ Flexible connectors
⑦ Elbow coupling

⇨ Remove all horizontal flange covers from the assembly openings ② on the busbar housings ④ of the panel located on the right of the panel joint.

⇨ Mark the cover type, and re-assemble later (see page 49, "Overview of busbar covers").

⇨ Loosen the fixing bolts ③ at the busbar ends.

Re-assembling the busbars

This operation is **only** performed if one of the following devices is mounted on the busbar housings of the panel located on the right of the panel joint:

- Disconnectable busbar connection
- Disconnectable busbar voltage transformer
- Make-proof busbar earthing switch
- Top-mounted busbar sectionalizer

In these cases, the busbar joints are not accessible anymore after the transport units have been interconnected.

For this reason, the busbar sections must be re-assembled from the panel on the left of the panel joint to the panel on the right before starting the assembly. The illustration below shows the final position after re-assembling.

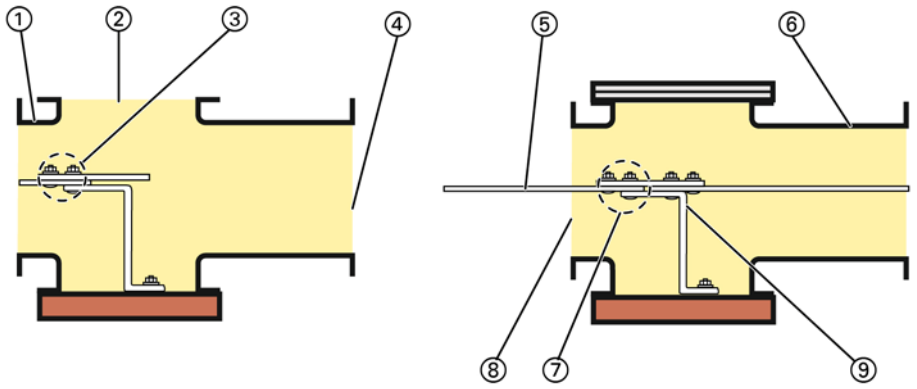


Fig. 64: Re-assembling the busbars (example with elbow coupling)

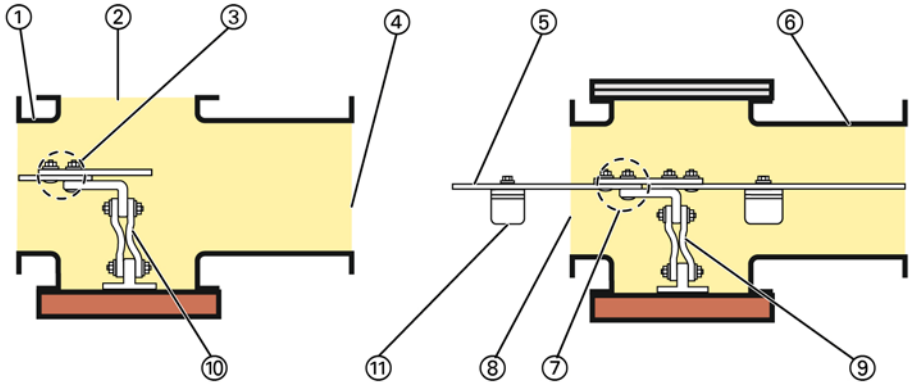


Fig. 65: Re-assembling the busbars (example with flexible connectors)

① Busbar housing of the panel located on the left of the panel joint
② Assembly openings (horizontal flanges)
③ Joints of the panel located on the left of the panel joint
④ Vertical flanges of the panel located on the left of the panel joint
⑤ Busbar sections
⑥ Busbar housing of the panel located on the right of the panel joint
⑦ Joints of the panel located on the right of the panel joint
⑧ Vertical flanges of the panel located on the right of the panel joint
⑨ Elbow coupling
⑩ Flexible connectors
⑪ Busbar support

⇨ Clear the assembly opening ② : Remove all horizontal flange covers on the busbar housings ① of the panel located on the left of the panel joint.

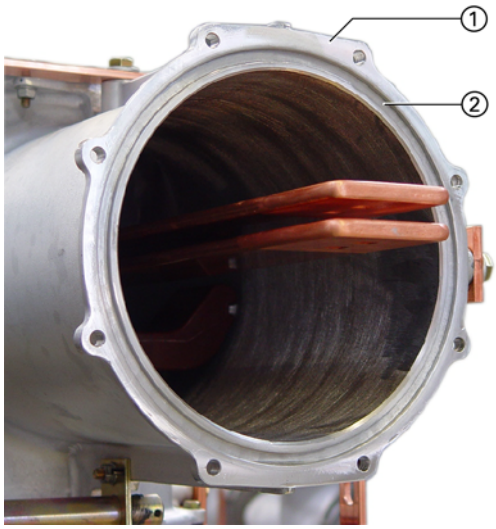
⇨ Undo the busbar sections ⑤ at the joints ③ in the busbar housing through the assembly opening ② . The busbar supports ⑨ remain on the disassembled busbar sections.

⇨ Take the busbar sections ⑤ out of the housings together with the associated busbar supports ⑨ through the vertical flange ④ .

⇨ Mount the busbar sections at the joints ⑦ in the busbar housings ⑥ of the panel located on the right of the panel joint. Assembly takes place through the vertical flanges ⑧ .

⇨ Check alignment and parallel position of the assembled busbar sections and correct if required.

Preparing the flanges of the busbar housings



① External contact surface of the flange
② Groove for toroidal sealing ring

Fig. 66: Flange on the busbar housing

- ⇨ Clean all vertical flanges of the busbar housings at the panel joint and the grooves for the sealing rings carefully with lint-free paper.
- ⇨ Carefully check the external contact surfaces ① of the flanges and the grooves ② for scratches, other damages or pollution. Damages and pollution will cause leaks.
- ⇨ If any external contact surfaces or grooves are damaged: Inform the regional Siemens representative and co-ordinate the elimination of damages.
- ⇨ Apply a thin film of the supplied mounting paste (e.g. Polylub GLY 801, 0.40 kg) on the external contact surfaces of the flanges and the O-rings (sealing rings). To do this, apply a grease strip of approx. 3 mm thickness on the external contact surfaces of the flanges.
- ⇨ Put the O-rings into the grooves of the flanges.

22.2 Installing transport units

Positioning the transport unit

The transport unit to be attached is moved evenly by two people, if possible, using hydraulic hoisting cylinders, hydraulic jacks or lifting jacks. A third person acts as an **observer** and corrects the joining of the busbar sections and the flanges during the process.

	**ATTENTION** When joining the transport units, the busbar supports may be damaged. ⇨ Join the transport units carefully. ⇨ Observe the position of the busbar supports.

	**ATTENTION** Without roller pads / bars underneath, the transport units are moved using hydraulic equipment or lifting jacks. The transport units may be damaged. ⇨ Apply auxiliary devices at floor level and only at the base frame of the transport units. ⇨ Place boards under the points where auxiliary devices are applied.

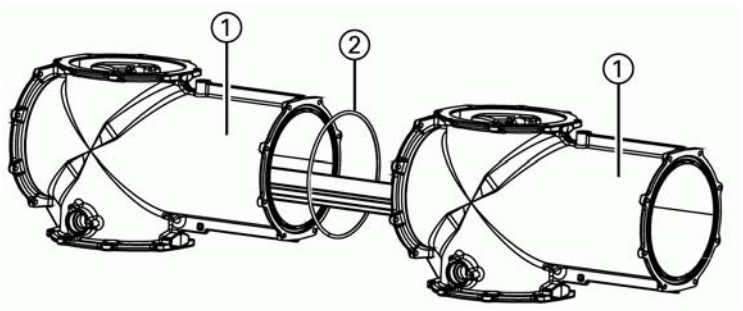
	**ATTENTION** Sensitive parts of the switchgear may be damaged during installation work at the busbar and the busbar housings. ⇨ While working at the busbars or the busbar housings, prop up only on the base frame of the transport unit. ⇨ Do not prop up on sensitive parts of the switchgear like gas pipes, bursting discs, shafts, etc.

- ⇨ Apply one lifting gear each at the rear and at the front of the base frame of the transport unit to be shifted. Prop the lifting gear up at the surrounding walls.
- ⇨ Place one person in observer position at the already mounted transport unit. The observer must watch the movement of the flanges and the busbars and must be able to reach the busbar sections by hand through the assembly openings.
- ⇨ If the flange connections are equipped with a compensator or insulating joint: Fix the associated insulating rings / insulating plates provisionally at the flange side of the already fixed-mounted transport unit.
- ⇨ On the observer´s command, push the transport unit to be attached towards the already mounted one using the lifting gear. The observer checks and corrects the approach of the busbar sections.
- ⇨ Continue approaching the transport units until the flanges touch evenly.
- ⇨ In case of deviations, correct the position of the transport unit, compensating any floor unevenness with shims under the corners (same points as for roller pads / bars).

Bolting the flanges of the busbar housings together

	ATTENTION
	Sensitive parts of the switchgear may be damaged during installation work at the busbar and the busbar housings. ⇨ While working at the busbars or the busbar housings, prop up only on the base frame of the transport unit. ⇨ Do not prop up on sensitive parts of the switchgear like gas pipes, bursting discs, shafts, etc.

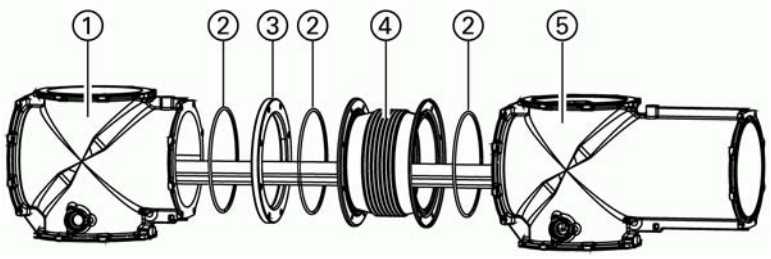
- ⇨ **Flange-to-flange connections:** Tighten M8x40 bolts crosswise. Tightening torque: 20 Nm.



① Busbar housing
② Toroidal sealing ring

Fig. 67: Flange-to-flange connection

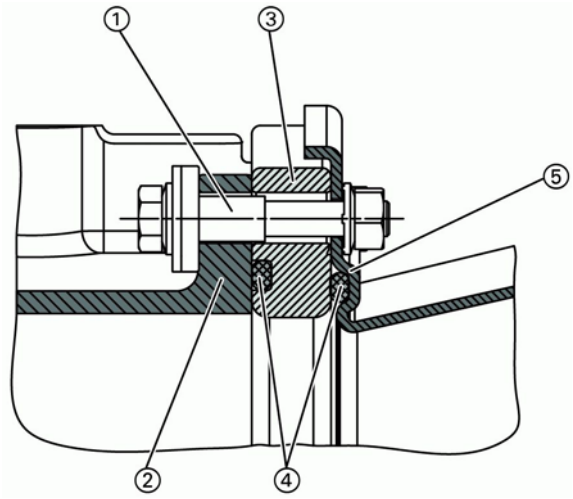
- ⇨ **Flange connections with compensator:** Push insulating ring between the flanges. Fasten M8x55 bolts crosswise with one insulating sleeve each. Tightening torque: 20 Nm.



① Busbar housing (bolts M8x55)
② Toroidal sealing ring
③ Insulating ring (thickness: 18 mm)
④ Compensator
⑤ Busbar housing (bolts M8x35)

Fig. 68: Short busbar housing with compensator

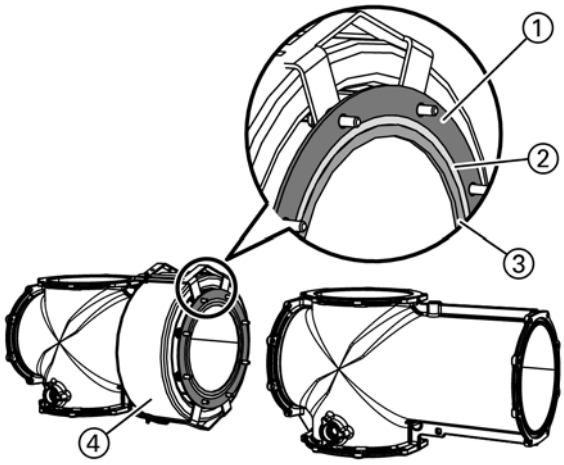
➩ For flange connections with compensator, insulating sleeves must be inserted at the bolted joints.



① Insulating sleeve
② Busbar housing
③ Insulating ring (thickness: 18 mm)
④ Toroidal sealing rings
⑤ Compensator

Fig. 69: Flange connection with compensator and insulating sleeve

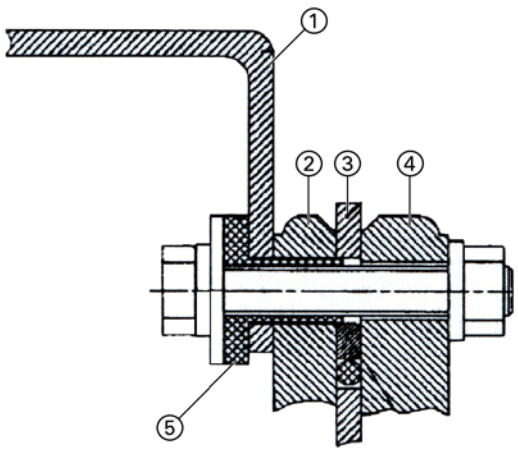
➩ **Flange connections with insulating joint:** Push insulating ring between the flanges. Fasten M8x45 bolts crosswise with one insulating sleeve each. Tightening torque: 20 Nm.



① Busbar housing
② Toroidal sealing ring
③ Insulating ring (thickness: 4 mm) with sealing ring ④

Fig. 70: Long busbar housing with insulating joint

➩ If there are e. g. busbar current transformers or expansion joints available, the flange connections must be equipped with insulating sleeves.



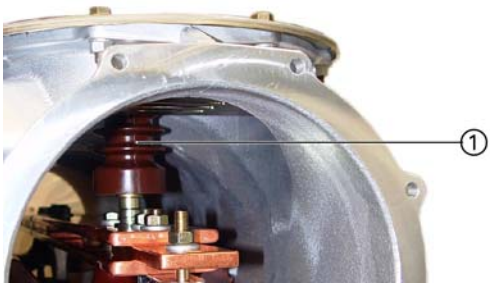
① Current transformer mounting plate
② Flange
③ Insulating ring
④ Compensator
⑤ Insulating sleeve

Fig. 71: Flange connections with insulating sleeve

Bolting busbars together

The busbars are accessed through the horizontal flanges of the busbar housings (assembly openings).

⇨ Check whether the busbar has been pre-assembled with a post insulator ① .



⇨ Align busbar and post insulator horizontally with each other using the clearance of the busbar hole.

⇨ Align the busbars and the links so that the busbar sections are in line and the fixing bolts will fit through the holes.

⇨ Tighten the fixing bolts just a little. The busbar sections must still be able to move.

22.3 Installing further transport units

⇨ Repeat the work operations (see page 71, "Preparing busbar assembly") until all transport units are installed.

22.4 Completing switchgear installation

As a precondition for this work, the switchgear must have been completely assembled as described above (see page 77, "Installing further transport units").

Tightening the busbar fixing bolts

⇨ Tighten the fixing bolts of all busbars and fixed contacts at all panel joints of the switchgear. Tightening torque: 40 Nm.

⇨ Finally fit the protective caps on the bolted busbar joints.

Checking the contact overlapping of the disconnector contacts

In CLOSED position, the contact fingers must rest exactly on the fixed contact of the disconnector. Check the contact overlapping with suitable means. For open housing covers, a welding mirror and a pocket lamp are suitable. For badly visible points, a stick-mounted camera with a flex handle is suitable.

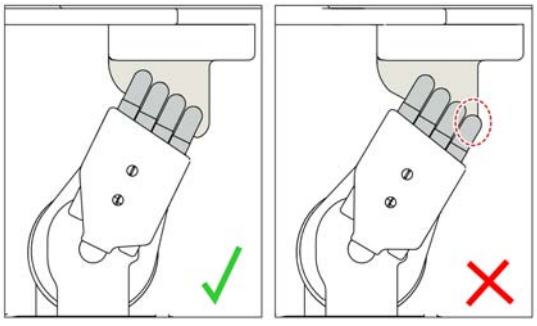
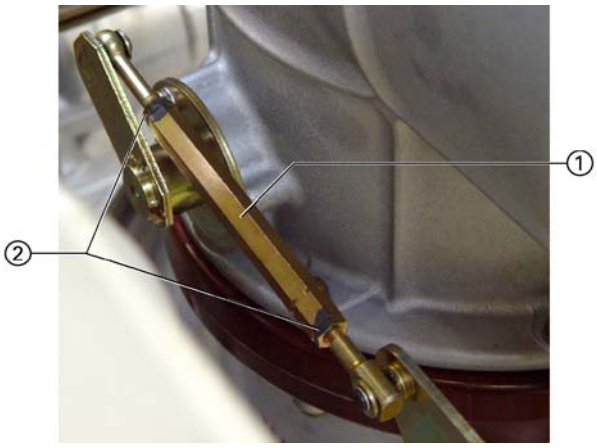


Fig. 72: Example for correct and incorrect position of the contact fingers on the fixed contact

Correcting contact overlapping of disconnector contacts



① Hexagonal sleeve of disconnector coupling rod
② Locknuts

Fig. 73: Disconnector coupling rod

⇨ Undo the locknuts ② at the hexagonal sleeve of the disconnector coupling rod ① .

⇨ Modify the length of the disconnector coupling rod by turning the hexagonal sleeve ① , so that the contact fingers are resting exactly on the fixed contact of the disconnector in CLOSED position.

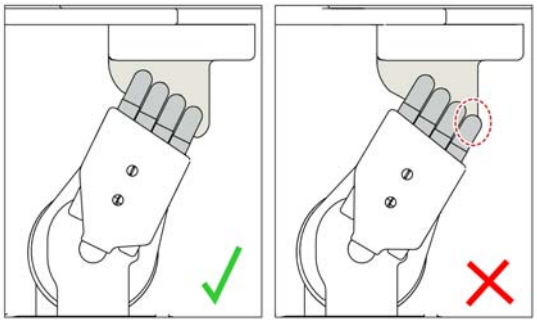


Fig. 74: Example for correct and incorrect position of the contact fingers on the fixed contact

⇨ Verify proper contact overlapping after several switching operations with the operating mechanism of the three-position disconnector.

⇨ Tighten the locknuts ② again with a tightening torque of 20 Nm.

Mounting busbar housing covers without desiccant bag holders

	**ATTENTION**
	In the ambient air, the desiccant bags lose their effectiveness rapidly and cannot be used anymore. ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**. ⇨ Do **not** use desiccant bags if the humidity indicators are **pink**. ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes and close the gas compartment hermetically.

For this reason, the busbar housing covers **without** a holder for desiccant bags are mounted first (cover **without** "Filter" inscription).

⇨ Remove tools, clean the inside of the housings with a hand vacuum cleaner, and clean the bushing plates with a rag.

⇨ Prepare the flanges of the cleaned busbar housings for assembly.

⇨ Clean the contact surfaces of the busbar housing covers with a lint-free paper, and apply a thin film of grease (e.g. Polylub GLY 801, 0.40 kg).

⇨ Put the covers on the prepared flanges and bolt them tight crosswise.
Tightening torque: 20 Nm.

Bolting the subframes together

The subframes of the transport units are bolted together at the panel joints using connecting links at the front and a connecting plate at the rear.

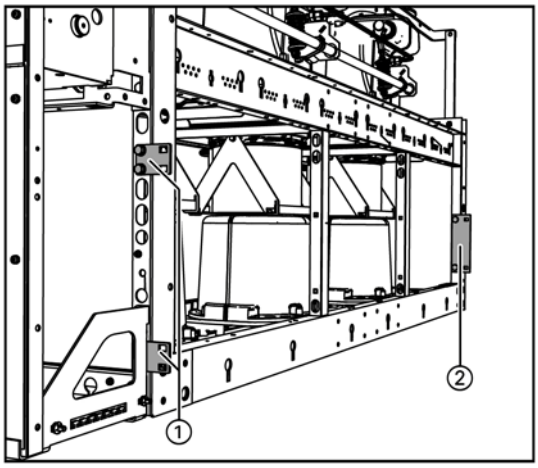


Fig. 75: Bolting the subframe together (representation with 4MC4 current transformer)

① Connecting plate (rear)
② Connecting links (front)

⇨ Align adjacent connecting links at the subframes. The holes must be in line.

⇨ Bolt the transport units together at the front connecting links using four bolts M10 x 20 (tightening torque 40 Nm), and at the rear connecting plate using two coach bolts M10 x 20 (tightening torque 40 Nm).

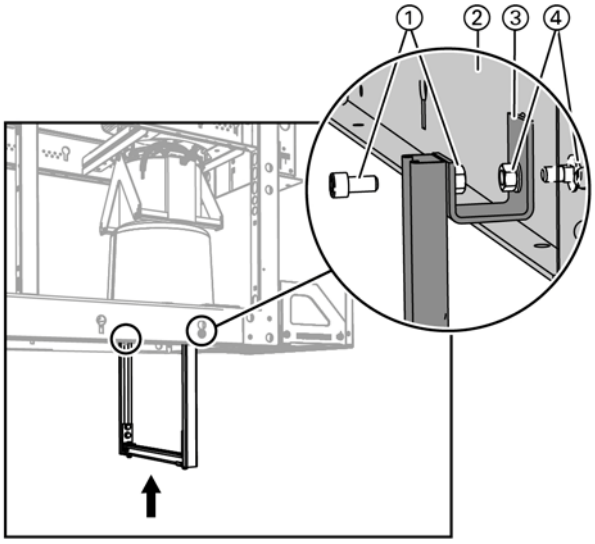
Fastening the panels to the foundation

⇨ Fasten the panels to the foundation (see page 53, "Constructional data of the foundation").

Mounting the cable bracket

Standard version for round panel connection housing

⇨ Mount the cable bracket at the cross members down at the subframe.

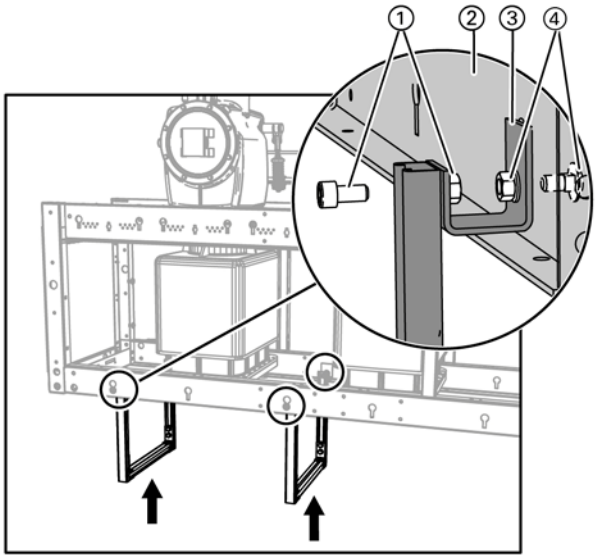


① Hexagon socket-head bolt M10 x 20 with nut
② Subframe
③ Bracket at the cable bracket
④ Hexagonal bolt M10 x 20 with nut

Fig. 76: Round panel connection housing: Mounting the cable bracket (representation with 4MC4 current transformer)

Standard version for square panel connection housing

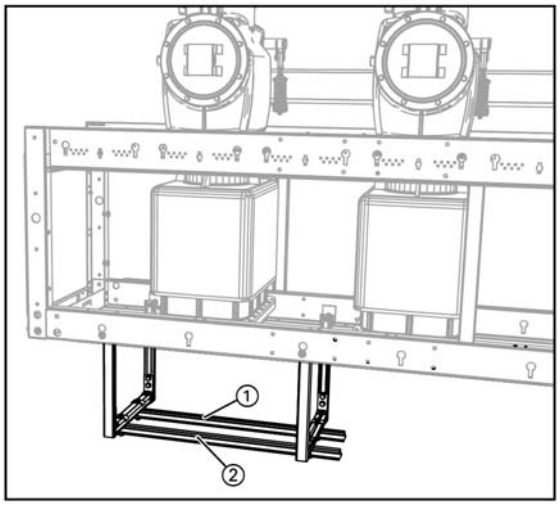
⇨ Mount the cable bracket at the cross members down at the subframe.



① Hexagon socket-head bolt M10 x 20 with nut
② Subframe
③ Bracket at the cable bracket
④ Hexagonal bolt M10 x 20 with nut

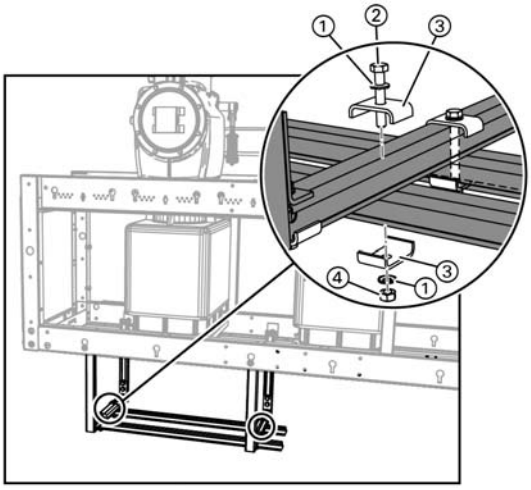
Fig. 77: Square panel connection housing: Mounting the cable bracket (representation without 4MC4 current transformer)

⇨ Bolt C-rails to the cable brackets.



① C-rail at the rear
② C-rail at the front

Fig. 78: Mounting the C-rails at the cable brackets
(representation without 4MC4 current transformer)

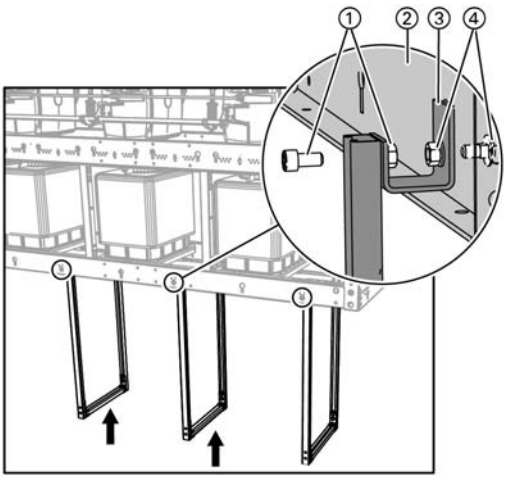


① Lock washer M8
② Hexagonal bolt M8 x 50
③ Bracket
④ Hexagonal nut M8

Fig. 79: Mounting the C-rails at the cable brackets
(representation without 4MC4 current transformer)

Extended version for square panel connection housing

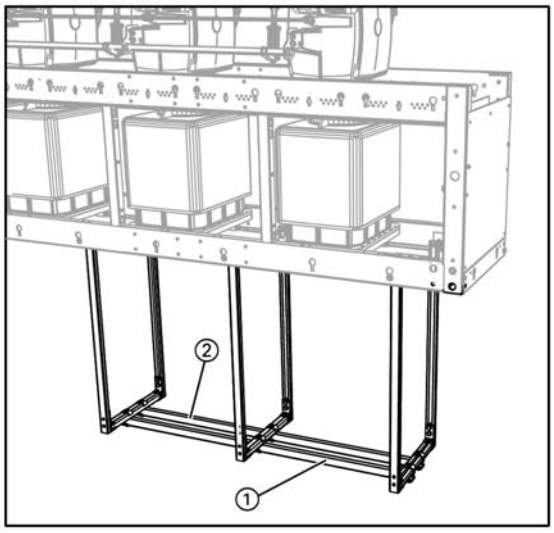
⇨ Mount the cable bracket at the cross members down at the subframe.



① Hexagon socket-head bolt
M10 x 20 with nut
② Subframe
③ Bracket at the cable bracket
④ Hexagonal bolt
M10 x 20 with nut

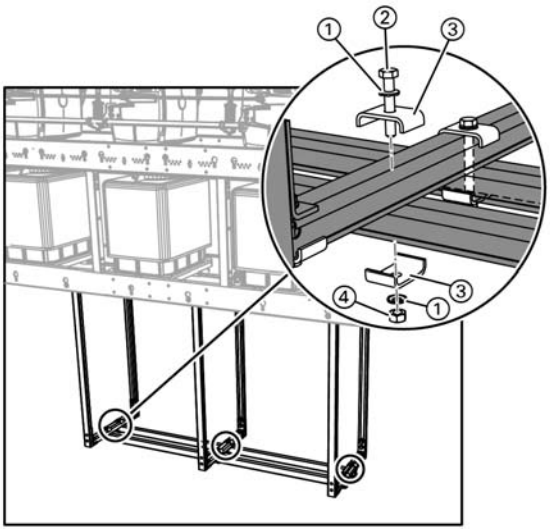
Fig. 80: Square panel connection housing:
Mounting the extended cable bracket
(representation without 4MC4 current transformer)

⇨ Bolt C-rails to the cable brackets.



① C-rail at the front
② C-rail at the rear

Fig. 81: Mounting the C-rails at the cable brackets
(representation without 4MC4 current transformer)

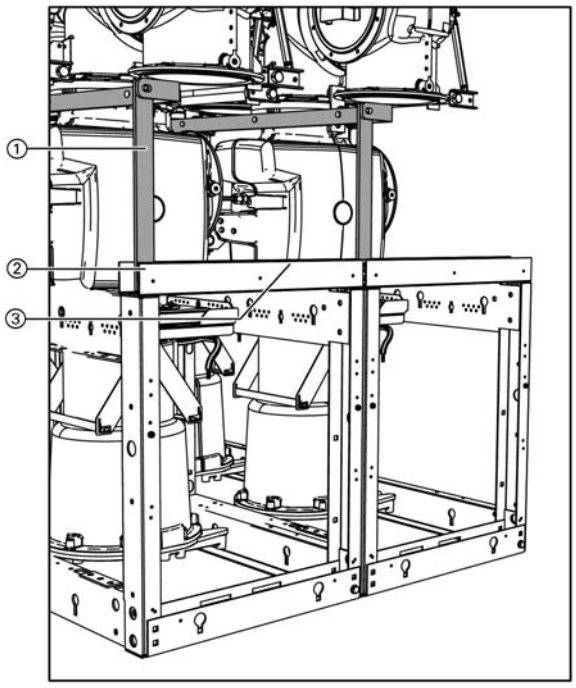


① Lock washer M8
② Hexagonal bolt M8 x 50
③ Bracket
④ Hexagonal nut M8

Fig. 82: Fixing points of the C-rails at the cable brackets
(representation without 4MC4 current transformer)

Bolting earthing busbars together

The earthing busbar runs at the rear of the subframes. The units overlap and are interconnected with two bolts M12 x 45 and a tightening torque of 70 Nm each.



① Earthign busbar section folded up (as-delivered condition)
② Joint
③ Pre-assembled earthing busbar section

Fig. 83: Bolting earthing busbars together

⇨ Remove the left-hand bolt at the joint ② .

⇨ Undo the right-hand bolt at the joint ② and fold the earthing busbar section ① to the left into horizontal position.

⇨ Bolt the earthing busbar section ① together with the earthing busbar of the next transport unit using 2 bolts. Tightening torque: 70 Nm.

⇨ Refit the removed bolt at the joint ② and tighten the two bolts at the joint. Tightening torque: 70 Nm.

⇨ Proceed in the same way with all other transport units until all earthing busbar ends of the switchgear are interconnected.

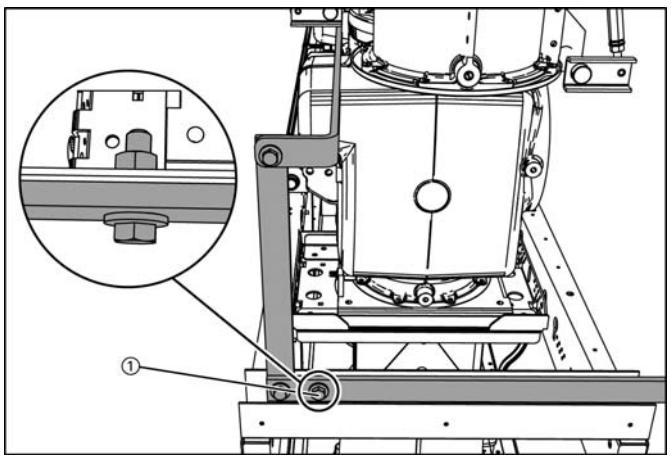
Earthing the panels

The cross-sections and materials of the earthing conductors are specified in the DIN/VDE 0101 standard or in the IEC 61936-1 and in the relevant country-specific standards.

⇨ Connect the earthing busbar to the substation earth.

Recommendation: In case of panel groups, earth the end panels (M12 bolts) and every fifth panel at least.

⇨ Mount an earthing cable or an earthing bar to the earthing bolt ① of the earthing busbar.



① Earthing bolt (earthing point)

Fig. 84: Earthing bolt of earthing busbar, example: right end panel

23 Installation work with SF_6 gas before commissioning

If a rated short-duration power-frequency withstand voltage test has to be carried out at site, the work with insulating sulphur hexafluoride gas (SF_6) described in this section must be performed in advance.

DANGER

Danger of suffocation! SF_6 gas is heavier than air and concentrates first near to the floor and in floor openings.

- ⇨ Do not let SF_6 gas get into the environment.
- ⇨ While working with SF_6 gas, provide for sufficient ventilation.
- ⇨ After working with SF_6 gas, vent the cable basement and any hollows in the floors with special care.
- ⇨ Observe the safety data sheet for SF_6 gas.
- ⇨ Please observe IEC 62271-303 and -304.

23.1 Completing busbar assembly and filling with SF_6 gas

The individual phases and sections of the busbar (called **busbar runs** hereafter) must be filled with SF6 gas at site. Each busbar run forms one gas compartment.

Busbar runs within one transport unit that are already filled and closed hermetically at the factory **are not refilled with SF6 gas on site**.

All parts of the switchgear that have to be filled with gas are equipped with desiccant bags in order to eliminate residual humidity in the gas filling. In ambient air, the desiccant agent loses its effectiveness rapidly.

To expose the desiccant bags as briefly as possible to the ambient air, the following installation and gas work is performed completely **on one busbar run**, and is then continued on the next busbar run, etc.

Preparing the busbar run for filling gas

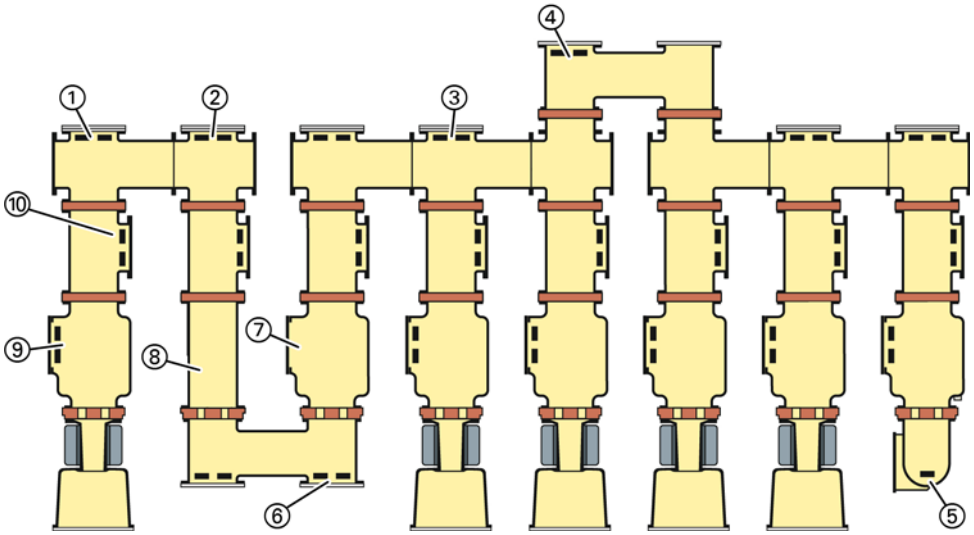


Fig. 85: Desiccant bags in the gas compartments, design example (position identified in the illustration by black squares; on the switchgear, with the inscription "Filter" on the outside)

Item no.	Designation	Desiccant bags
①	Busbar housing, left end panel	2 x 250 g
②	Busbar housing, right end panel	2 x 250 g
③	Busbar housing, general type with "Filter" inscription on the cover	2 x 250 g
④	Top-mounted bus sectionalizer	2 x 250 g
⑤	Bus coupler	1 x 250 g
⑥	Interconnection housing of bus sectionalizer	4 x 250 g
⑦	Circuit-breaker housing, right-hand panel of bus sectionalizer	
⑧	Bus riser housing	
⑨	Circuit-breaker housing, general type	2 x 250 g
⑩	Three-position disconnector housing, general	2 x 250 g

NOTE

Observe the mounting location of circuit-breaker and bus riser housing in the bus sectionalizer.

⇨ If the circuit-breaker housing of a bus sectionalizer is mounted in the right-hand panel, the bus riser housing is located in the left-hand panel.

ATTENTION

In the ambient air, the desiccant bags lose their effectiveness rapidly and cannot be used anymore.

⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**.

⇨ Do **not** use desiccant bags if the humidity indicators are **pink**.

⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes and close the gas compartment hermetically.

⇨ Remove all covers with the **"Filter"** inscription from the housings of one busbar run.

⇨ Clean busbar housings that are dirty inside with a hand vacuum cleaner. In this case, clean the bushing plates too with a rag.

⇨ Prepare the flanges of the busbar housings for assembly.

⇨ Clean the contact surfaces of the busbar housing covers with a lint-free paper, and apply a thin film of grease (e.g. Polylub GLY 801, 0.40 kg).

⇨ Determine the size of the desiccant bags required for each busbar housing and place the originally packed desiccant bags at the corresponding covers.

⇨ Take the desiccant bags out of the packings and lay them completely into the associated holder in the covers.

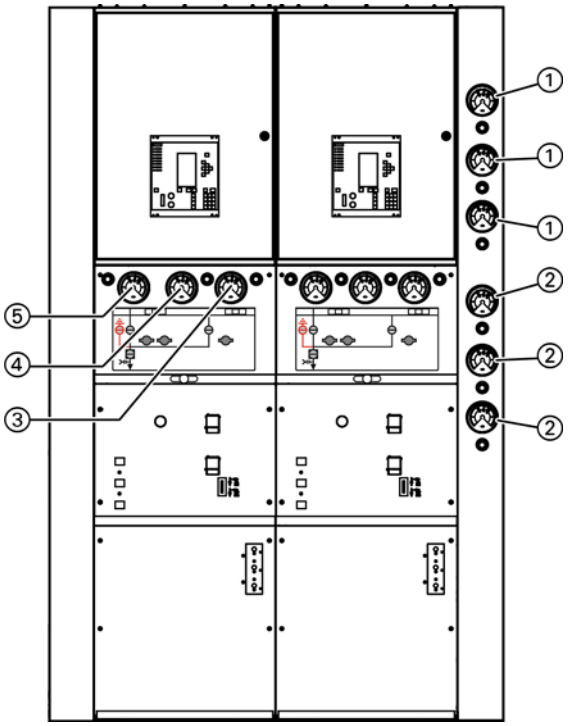
⇨ Put the busbar covers with the bags into position. Observe that no part of the bags is jammed in the contact surfaces in order to prevent leaks.

⇨ Bolt the covers tight crosswise. Tightening torque: 20 Nm.

Evacuating the busbar run with the vacuum pump

Before filling SF_6 gas in, the air must be removed from the busbar run to be filled with gas (evacuation). One of the covers next to the right and left end panel of the switchgear contains the pressure indicators and gas filling valves for all busbar runs.

Evacuating a five-panel busbar run takes about 30 to 40 minutes.



① Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 1
② Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 2
③ Manometer for three-position disconnector housing in busbar system 2
④ Manometer for circuit-breaker housing
⑤ Manometer for three-position disconnector housing in busbar system 1

Fig. 86: Gas pressure manometers and gas filling valves at the switchgear front

⇨ Undo the locking cap of the gas filling valve ② for the completely closed busbar run.

⇨ Connect the vacuum pump to the valve of the busbar run ② . Use short tubes with the largest inside diameter possible.

⇨ Evacuate the housings down to a pressure of less than 2 kPa.
Manometer indication: -100 kPa. Measure the pressure with the vacuum pump locked.

⇨ Depending on the inside diameter and length of the vacuum pump tube, let the pump operate for another 5 to 15 minutes.

⇨ Remove the pump tube. The valve in the gas filling valve closes automatically.

Filling the busbar run with an SF_6 gas cyclinder

⇨ Determine the filling pressure required according to the rating plate (see page 48, "Rating plates") and the data given in Section "Insulating gas SF_6" (see page 44, "Insulating gas SF_6"). The pressure depends on the gas temperature.

⇨ Connect the SF_6 gas cylinder to the gas filling valve of the evacuated busbar run.

⇨ Fill SF_6 into the busbar run until the necessary pressure is reached. Check the filling pressure on the pressure indicator of the busbar run and on the pressure indicator of the gas filling equipment.

⇨ Remove the connecting tube of the gas cylinder from the gas filling valve.
The gas filling valve closes automatically.

⇨ Refit the locking cap of the gas filling valve.

⇨ The limit value indicators on the pressure indicator of the busbar run have been pre-adjusted at the factory. Check the limit pressures according to the table and the graphics (see page 44, "Insulating gas SF_6"), and correct with the supplied square socket spanner in case of deviations.

Completing the assembly of further busbar runs and filling with SF_6 gas

⇨ Fill all other busbar runs as described above (see page 84, "Completing busbar assembly and filling with SF_6 gas").

23.2 Installing the panel connections supplied in the accessories, and filling the circuit-breaker housing with SF_6 gas

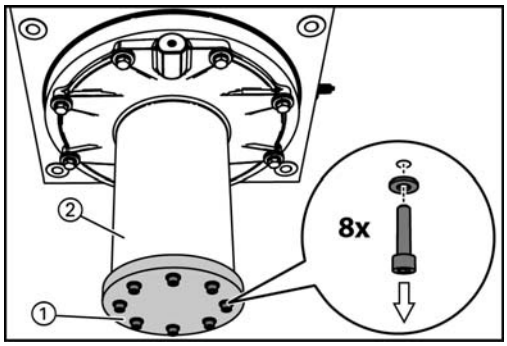
For the installation of panel connections that are supplied separately, the circuit-breaker housing is not filled with SF_6 gas at the factory.

To expose the desiccant bags as briefly as possible to the ambient air, the installation work described hereafter is performed **completely on one circuit-breaker housing in one panel**.

	**ATTENTION**
	Desiccant bags that have been fitted in the circuit-breaker housings at the factory are not effective anymore if the housings remain open for more than half an hour. ⇨ Replace desiccant bags in circuit-breaker housings that have been open for more than half an hour.

Assembling panel connections supplied separately

⇨ Remove 8 pan-head bolts and 8 strain washers from the cover of the transformer housing ① .

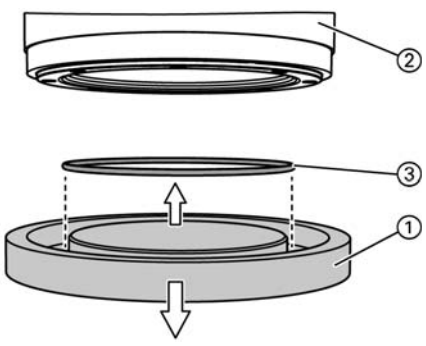


① Cover of transformer housing
② Transformer housing

Fig. 87: Removing the cover of the transformer housing

	**NOTE**
	Do **not** reuse the removed pan-head bolts, strain washers and the toroidal sealing ring. ⇨ Dispose of the pan-head bolts, strain washers and the toroidal sealing ring in an environmentally compatible way.

⇨ Remove the cover of the transformer housing ① and the toroidal sealing ring ③ .



① Cover of transformer housing
② Transformer housing
③ Toroidal sealing ring

Fig. 88: Removing the cover of the transformer housing and the seal

⇨ Undo 11 bolt-and-washer assemblies M8x40 and 1 hexagonal bolt (with plain washer and spring washer) at the cover of the panel connection housing ④ .

④ Cover of panel connection housing

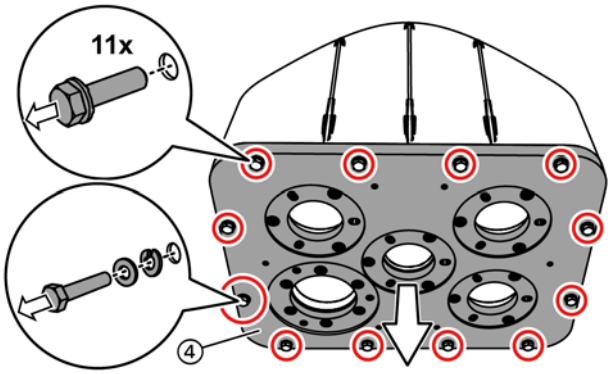


Fig. 89: Removing the cover with the plug sockets

⇨ Remove the panel connection housing ⑤ .

⇨ Take the sealing ring ⑥ out of the groove in the cover of the panel connection housing.

④ Cover of panel connection housing
⑤ Panel connection housing
⑥ Sealing ring

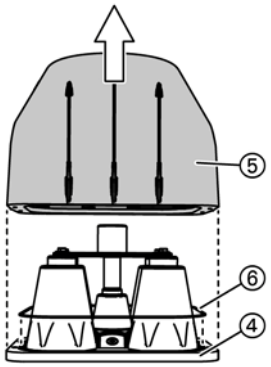


Fig. 90: Removing the panel connection housing

⇨ Remove 4 pan-head bolts, 4 nuts and 4 strain washers from the cover of the panel connection housing ⑦ .

	NOTE
	Do **not** reuse the removed pan-head bolts, strain washers and nuts. ⇨ Dispose of the pan-head bolts, strain washers and nuts in an environmentally compatible way.

⇨ Remove the cover of the panel connection housing ⑦ .

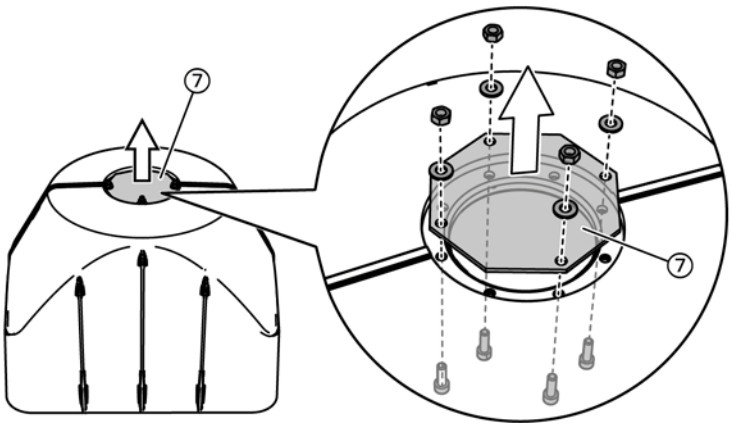
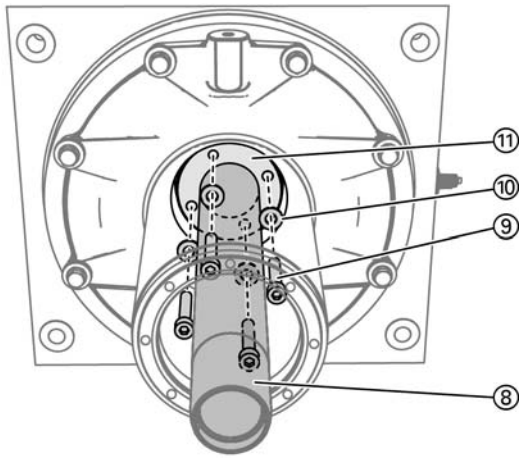


Fig. 91: Removing the cover of the panel connection housing

	NOTE
	Depending on the panel connection version, the feeder current and whether there are voltage transformers available, the panel connection stud is delivered in different lengths. ➪ Before assembling the panel connection stud, verify the correct length according to the supplied overview (861-9582.9).

➪ Bolt the panel connection stud ⑧ to the bushing terminal ⑪ using 4 pan-head bolts M8x50 ⑨ and 4 strain washers ⑩ from the accessories (tightening torque: 20 Nm).



⑧ Panel connection stud
⑨ Pan-head bolt M8x50 (4x)
⑩ Strain washer (4x)
⑪ Bushing terminal

Fig. 92: Fastening the panel connection stud

➪ Grease the toroidal sealing ring ③ uniformly with the supplied mounting paste (e.g. Polylub GLY 801, 0.40 kg).

➪ Insert the toroidal sealing ring ③ in the panel connection housing ⑤ .

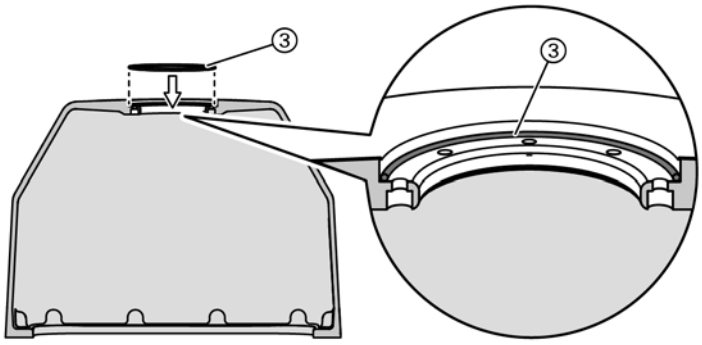
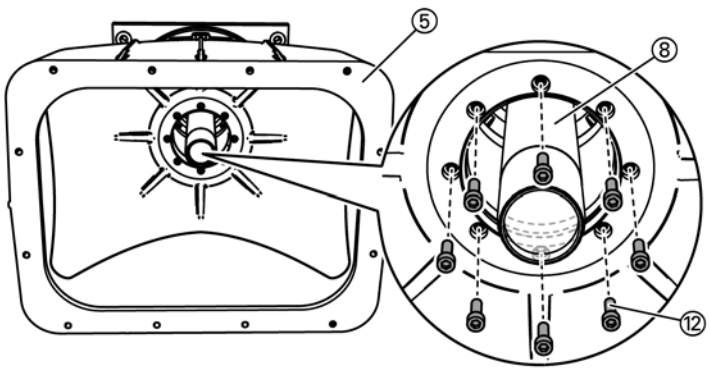


Fig. 93: Inserting the toroidal sealing ring

➪ Bolt the panel connection housing ⑤ to the transformer housing ② using 8 pan-head bolts M6x20 (with Polylok coating) ⑫ from the accessories (tightening torque: 10 Nm).



⑤ Panel connection housing
⑧ Panel connection stud
⑫ Pan-head bolt M6x20 with Polylok coating (8x)

Fig. 94: Fastening the panel connection housing (view from below)

➪ Clean the sealing ring ⑥ removed from the panel connection housing, and grease it uniformly with the supplied mounting paste (e.g. Polylub GLY 801, 0.40 kg).

➪ Insert the sealing ring ⑥ in the groove of the cover of the panel connection housing ④ .

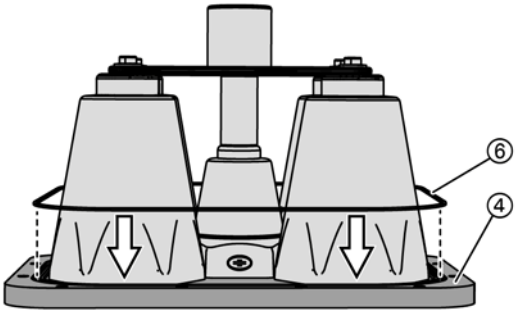


Fig. 95: Inserting the sealing ring

➪ Grease the contact laminations ⑬ with mounting paste Vaseline 8422 DAB 8 (order number: 8BX2091).

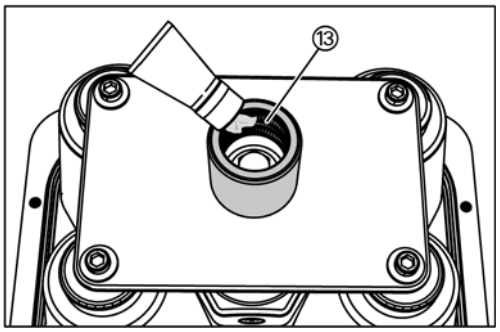


Fig. 96: Greasing the socket

	NOTE
	In other panel connection versions, the plug sockets may be arranged asymmetrically. ➪ If the plug sockets are arranged asymmetrically, observe the mounting direction of the cover of the panel connection housing.

➪ Push the cover of panel connection housing ④ into the panel connection housing ⑤ .

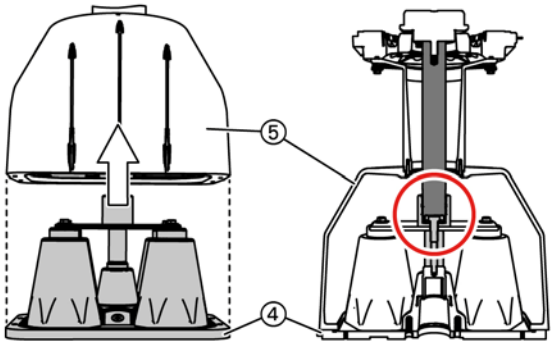


Fig. 97: Inserting the cover of the panel connection housing

⇨ Refasten the cover of the panel connection housing ④ with 11 bolt-and-washer assemblies M8x40 (tightening torque: 20 Nm).

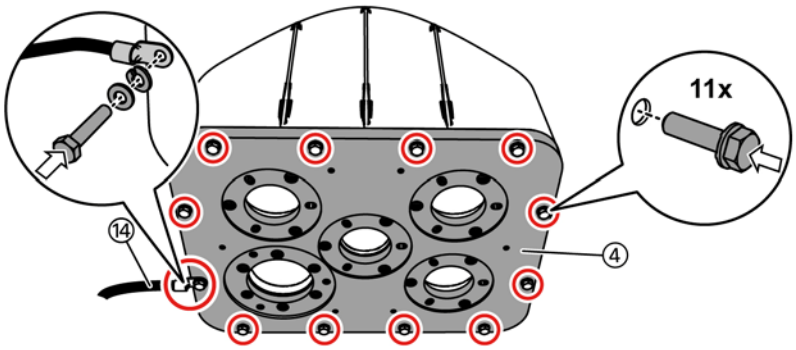


Fig. 98: Fastening the cover with the plug sockets

The earthing cable is either pre-assembled at the subframe, or fastened to the subframe with cable straps.

⇨ Bolt the earthing cable to the subframe if the earthing cable is not pre-assembled.

⇨ Bolt the earthing cable ⑭ with an hexagonal bolt M8x40 (with plain washer and spring washer) to the cover of the panel connection housing (tightening torque: 20 Nm).

⇨ Repeat the above work operations for all other panel connections in the same panel.

✔ The panel connections are assembled.

Replacing desiccant bags in the circuit-breaker housings

The desiccant bags are located behind the cover of the bursting disc at the side of the circuit-breaker housing. The cover has the inscription "Filter".

① Cover of bursting disc

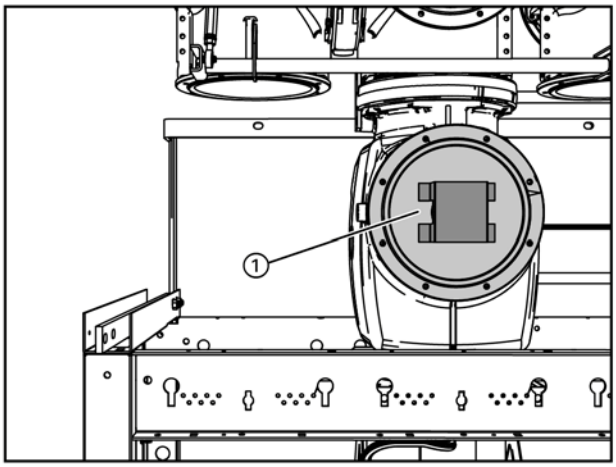


Fig. 99: Cover of bursting disc on circuit-breaker housing

	ATTENTION
	In the ambient air, the desiccant bags lose their effectiveness rapidly and cannot be used anymore. ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**. ⇨ Do **not** use desiccant bags if the humidity indicators are **pink**. ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes and close the gas compartment hermetically.

⇨ Remove the lateral cover of the bursting disc with the **"Filter"** inscription on **one** circuit-breaker housing.

⇨ Unpack two new desiccant bags of 250 g each per pole, and put them completely into the holder.

⇨ Clean the sealing surfaces of the cover of the bursting disc with a lint-free paper, and apply a thin film of grease.

⇨ Put the covers the bursting disc with the bags into position. Observe that no part of the bags is jammed in the sealing surfaces in order to prevent leaks.

⇨ Bolt the covers tight crosswise. Tightening torque: 20 Nm.

⇨ Repeat the above work operations for all circuit-breaker housings on the same panel where the desiccant bags must also be fitted.

⇨ After completing the replacement of desiccant agent in the panel, evacuate the circuit-breaker housings and fill them with SF_6 gas (see below).

Evacuating the circuit-breaker housings with the vacuum pump

The circuit-breaker housings of one panel form a common gas compartment. Before filling SF_6 gas in, the air must be removed from the circuit-breaker housings (evacuation).

The pressure indicator and the gas filling valve for the circuit-breaker housings of one panel are located on the right side of the housing front.

⇨ Undo the locking cap of the gas filling valve for the circuit-breaker housings.

⇨ Connect the vacuum pump to the valve. Use short tubes with the largest inside diameter possible.

⇨ Evacuate the housings down to a pressure of less than 2 kPa.
Manometer indication: -100 kPa. Measure the pressure with the vacuum pump locked.

⇨ Depending on the inside diameter and length of the vacuum pump tube, let the pump operate for another 5 to 15 minutes.

⇨ Remove the pump tube. The gas filling valve closes automatically.

Filling the circuit-breaker housings with SF_6 gas

⇨ Determine the filling pressure required according to the rating plate and the data given in Section "Technical data" (see page 42, "Technical data"). The pressure depends on the gas temperature.

⇨ Connect the SF_6 gas cylinder to the gas filling valve of the evacuated circuit-breaker housings.

⇨ Fill SF_6 into the circuit-breaker housings until the necessary pressure is reached. Check the filling pressure on the pressure indicator of the circuit-breaker housings and on the pressure indicator of the gas filling equipment.

⇨ Remove the connecting tube of the gas cylinder from the gas filling valve. The gas filling valve closes automatically.

⇨ Refit the locking cap of the gas filling valve.

⇨ Adjust the limit pressures on the pressure indicator for the circuit-breaker housings with the supplied square socket spanner (see page 44, "Insulating gas SF_6").

Evacuating and filling the circuit-breaker housings with the maintenance unit

The procedure to be followed corresponds to the work operations described above for evacuating and filling without maintenance unit. As against working with vacuum pump and gas cylinder, the maintenance unit offers better environmental protection due to reduced SF_6 losses.

The same gas pressure data apply as for filling with gas cylinder. Observe the operating instructions of the maintenance unit!

24 Performing the power- frequency voltage test

The transport units are already tested at the factory at rated short-duration power-frequency withstand voltage. On the customer´s request, the dielectric strength of the switchgear can be tested on site. This is a repeat test at 80% of the values according to IEC 62271-1 and -200.

Preparing the power-frequency voltage test

DANGER

High voltage! Danger! If the panel feeders are included in the rated short-duration power-frequency withstand voltage test, the panel connections are live during the test.

⇨ Keep a minimum distance of 3 m to the panel connections.

ATTENTION

If the rated short-duration power-frequency withstand voltage test is performed incorrectly, the switchgear may be damaged.

⇨ Do not perform a rated short-duration power-frequency withstand voltage test without the manufacturer´s assistance.

ATTENTION

Already mounted non-disconnectable inductive voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200 will be damaged during the rated short-duration power-frequency withstand voltage test.

⇨ Remove already mounted non-disconnectable inductive voltage transformers.

⇨ Do not install non-disconnectable inductive voltage transformers until the rated short-duration power-frequency withstand voltage test has been completed.

Due to the interlocking condition, busbar system 1 and busbar system 2 must be tested separately from each other.

⇨ Check the SF_6 gas filling (see page 128, "Checking the SF_6 gas filling").

⇨ Before the test, remove non-disconnectable voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200.

⇨ Cover the bushings at the panel with surge-proof caps.

Testing busbar system 1

⇨ Switch the three-position disconnector of busbar system 1 and the circuit-breaker in the incoming panel to CLOSED position for the rated short-duration power-frequency voltage test.

⇨ Fit dummy plugs on all free sockets of the incoming panel.

⇨ While testing circuit-breaker panels: Fit dummy plugs on all sockets of the panel to be tested.

⇨ Earth and short-circuit all test sockets of the voltage detecting system.

⇨ Switch all other three-position disconnectors to READY-TO-EARTH position.

⇨ Apply the power-frequency test voltage in a surge-proof way at the cable connection bushing via test adapters.

✔ The rated short-duration power-frequency withstand voltage test can now be performed.

Testing busbar system 2

⇨ Switch the circuit-breaker and the three-position disconnector of busbar system 1 in the incoming panel to OPEN position.

⇨ Switch the disconnector of busbar system 2 and the circuit-breaker in the incoming panel to CLOSED position for the rated short-duration power-frequency voltage test.

⇨ Fit dummy plugs on all free sockets of the incoming panel.

⇨ While testing circuit-breaker panels: Fit dummy plugs on all sockets of the panel to be tested.

⇨ Earth and short-circuit all test sockets of the voltage detecting system.

⇨ Switch all other three-position disconnectors to READY-TO-EARTH position.

⇨ Apply the power-frequency test voltage in a surge-proof way at the cable connection bushing via test adapters.

✔ The rated short-duration power-frequency withstand voltage test can now be performed.

Performing the power-frequency voltage test

⇨ Apply 80 % of the rated short-duration power-frequency withstand voltage consecutively to phases L1, L2 and L3 for 60 seconds each.

Completing the power-frequency voltage test

⇨ Switch the voltage transformer disconnector of the disconnectable voltage transformers to CLOSED position.

⇨ After the test, mount non-disconnectable voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200.

25 Installation work with SF_6 gas after the power-frequency voltage test

If a rated short-duration power-frequency withstand voltage test has to be carried out at site, the work with sulphur hexafluoride gas (SF_6) described in this section must be performed after the test.

DANGER

Danger of suffocation! SF_6 gas is heavier than air and concentrates first near to the floor and in floor openings.

- ⇨ Do not let SF_6 gas get into the environment.
- ⇨ While working with SF_6 gas, provide for sufficient ventilation.
- ⇨ After working with SF_6 gas, vent the cable basement and any hollows in the floors with special care.
- ⇨ Observe the safety data sheet for SF_6 gas.

25.1 Installing solid-insulated bars at the panel connection, and filling the circuit-breaker housings with SF_6 gas

When solid-insulated bars are installed, the circuit-breaker housings are ventilated. The circuit-breaker housings are already equipped with desiccant bags at the factory in order to eliminate the residual humidity in the gas filling. In ambient air, the desiccant agent loses its effectiveness rapidly.

To expose the desiccant bags as briefly as possible to the ambient air, the following work operations are performed **completely for one bar connection on one panel**.

ATTENTION

Desiccant bags that have been fitted in the circuit-breaker housings at the factory are not effective anymore if the housings remain open for more than half an hour.

- ⇨ Replace desiccant bags in circuit-breaker housings that have been open for more than half an hour.

Mounting solid-insulated bars

- ⇨ Remove provisional cover from one of the circuit-breaker housings.
- ⇨ Write down the beginning of the ventilation time of the circuit-breaker housing.
- ⇨ Prepare the flange of the solid-insulated bar and the connection flange of the circuit-breaker housing for assembly.
- ⇨ Mount solid-insulated bar. Tightening torque at the flange: 20 Nm.
- ⇨ If the circuit-breaker housing was ventilated for more than half an hour, replace the desiccant bags (see page 87, "Installing the panel connections supplied in the accessories, and filling the circuit-breaker housing with SF_6 gas").
- ⇨ Evacuate the circuit-breaker housings and fill with SF_6 gas (see page 87, "Installing the panel connections supplied in the accessories, and filling the circuit-breaker housing with SF_6 gas").
- ⇨ Repeat the above work operations for all other panel connections in the same panel.

26 Installing voltage transformers

DANGER

The voltage transformer can explode!

⇨ If the voltage transformer is short-circuited, there is risk of explosion!
Check the voltage transformer circuits up to the m.c.b. or the fuse for short-circuits.

DANGER

High voltage! Danger! Before starting installation work at the voltage transformers, the busbar must have been isolated and earthed.

⇨ Isolate and earth the busbar.
Verify safe isolation from supply.

ATTENTION

Sensitive parts of the switchgear may be damaged during installation work at the busbar and the busbar housings.

⇨ While working at the busbars or the busbar housings, prop up only on the aluminum housings and the frame.

⇨ Do not prop up on sensitive parts of the switchgear like gas pipes, bursting discs, shafts, etc.

ATTENTION

While working on metal-coated voltage transformers, the coating may be scratched or damaged. Then, the voltage transformers cannot be touched anymore.

⇨ Work carefully while mounting metal-coated voltage transformers.

⇨ Take care not to scratch or damage the metal coating.

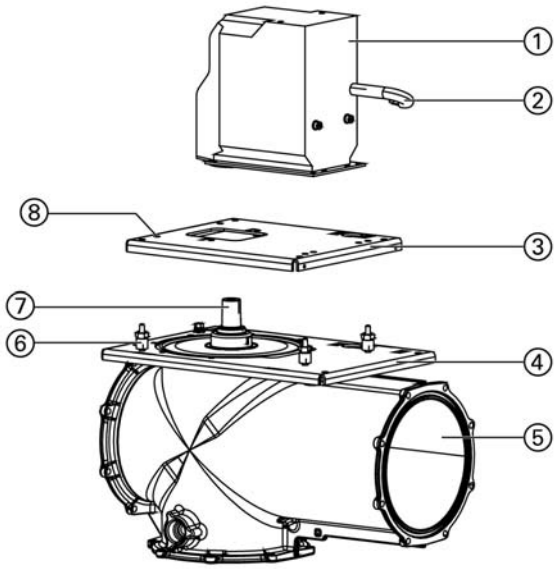
ATTENTION

Risk of partial discharges at the voltage transformer bushings due to pollution.

⇨ Clean all bushings at the panel at the voltage transformer carefully before starting installation work.

⇨ Observe extreme cleanliness while working.

26.1 Installation of voltage transformers type 4MT3 on the busbar



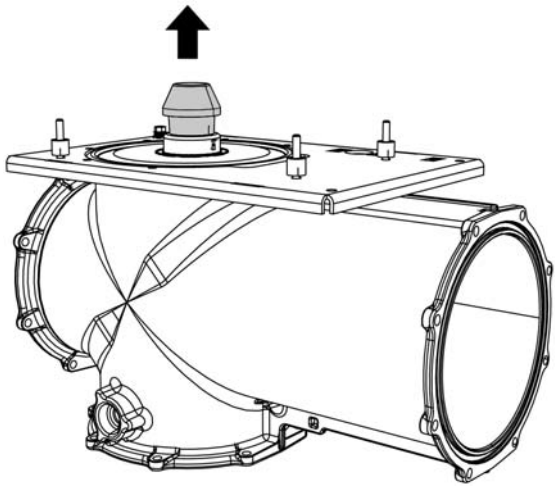
① 4MT3 voltage transformer
② Low-voltage plug connector
③ Adapter plate
④ Voltage transformer mounting plate
⑤ Busbar housing
⑥ Distance sleeves
⑦ Outside-cone bushing
⑧ Hole with setnut for press-out bolt

Fig. 100: 4MT3 busbar voltage transformer (shown without cover)

⇨ Isolate and earth the busbar.

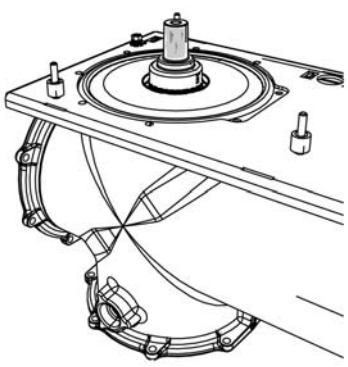
⇨ Verify safe isolation from supply.

⇨ For first installation: Remove protective cap.
If available: Disassemble surge-proof caps of the outside-cone bushing.



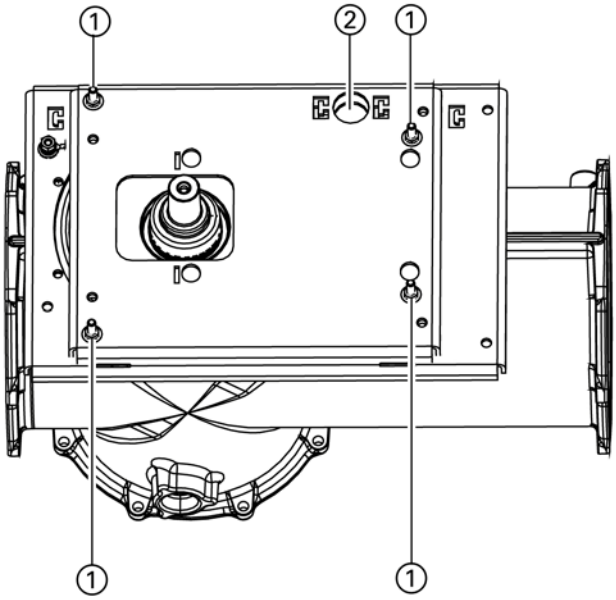
⇨ Clean the silicone adapter of the voltage transformer and the outside-cone bushing carefully. Use a cleaning agent without solvents and a lint-free cloth.

⇨ Grease the silicone adapter of the voltage transformer and the outside-cone bushing of the voltage transformer mounting plate uniformly with mounting paste for cable sets.



⇨ If not yet pre-assembled, mount the adapter plate on the voltage transformer.

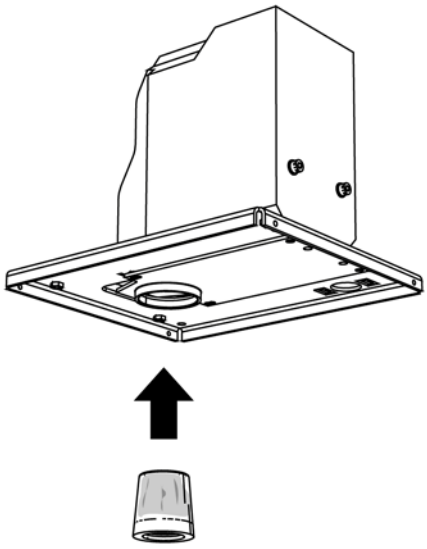
	NOTE
	The already assembled adapter plate can be displaced due to vibrations during transport. To position the adapter plate correctly: ⇨ Loosen the M8 bolts of the adapter plate a little bit. ⇨ Bolt the adapter plate uniformly together with the voltage transformer mounting plate. Tightening torque: 30 Nm.



① M8 bolts for fixing the adapter plate on the voltage transformer mounting plate

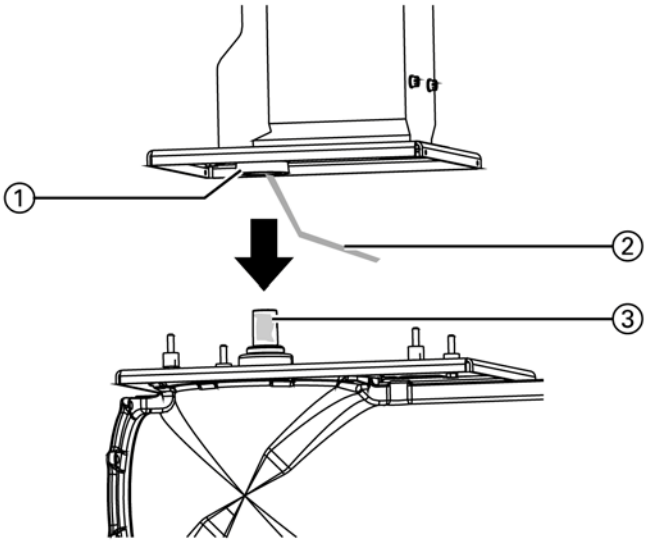
② Bushing for low-voltage plug connector

⇨ Insert the silicone adapter in the voltage transformer.



	ATTENTION
	Risk of partial discharges at the outside-cone bushing. ⇨ Make sure that the connecting lug of the capacitive connecting point of the outside-cone bushing is earthed.

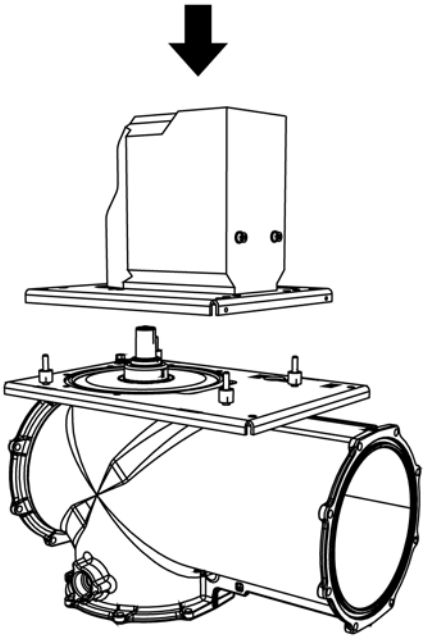
⇨ To let excess air out of the plug connection while mounting the voltage transformer, fit a nylon thread or a cable strap into the inside cone of the silicone adapter in the voltage transformer.



① Silicone adapter
② Cable strap
③ Outside-cone bushing

	**DANGER**
	Risk of injury! The voltage transformer type 4MT3 has a weight of approx. 30 kg. ⇨ Secure the voltage transformer against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

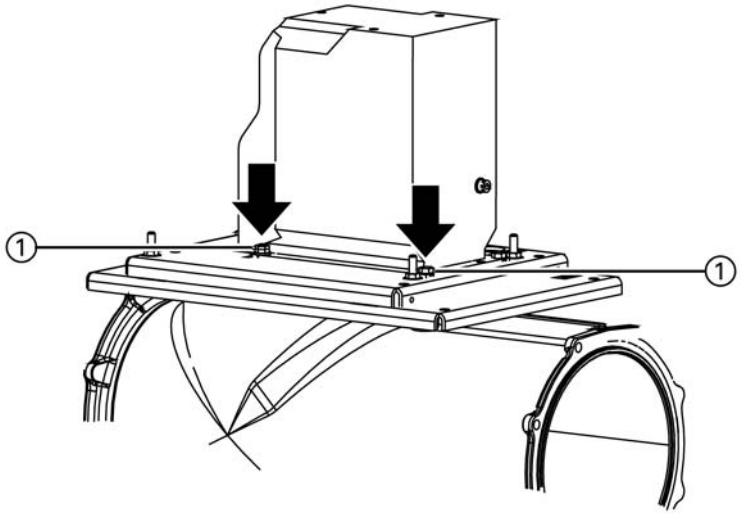
⇨ Lower the voltage transformer slowly onto the bushing, pulling the cable strap out of the inside cone of the voltage transformer at the same time.



⇨ Connect the low-voltage plug connector to the voltage transformer.

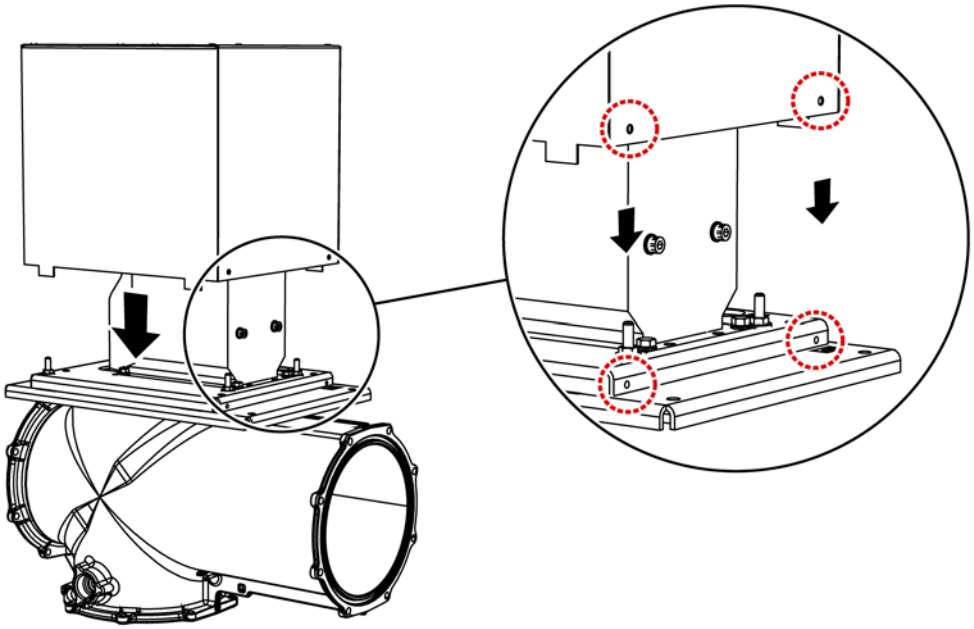
⇨ Fasten the voltage transformer at the panel. To do this, bolt the voltage transformer uniformly together with the voltage transformer mounting plate using four M8 bolts. Tightening torque: 30 Nm.

	NOTE
	To have the voltage transformer correctly seated on the voltage transformer mounting plate: ⇨ Prevent the voltage transformer from canting during installation.

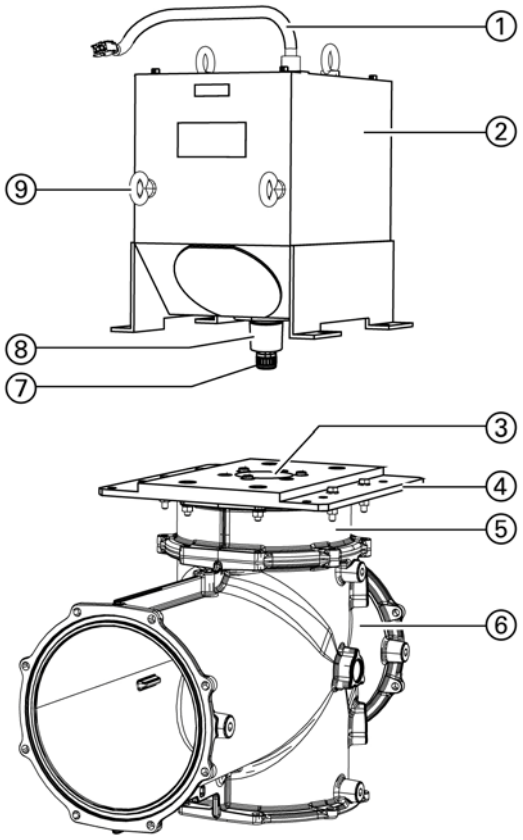


① Fixing bolts to connect the voltage transformer with the voltage transformer mounting plate

⇨ Mount the cover of the voltage transformer using four bolts M6 x 12 and contact washers. Tightening torque: 8 Nm.



26.2 Installation of voltage transformers type 4MU4 on the busbar



① Low-voltage plug connector
② 4MU4 voltage transformer
③ Inside-cone bushing
④ Voltage transformer mounting plate
⑤ Intermediate ring
⑥ Busbar housing
⑦ Primary terminal at the voltage transformer
⑧ Silicone adapter
⑨ Crane eye

Fig. 101: 4MU4 busbar voltage transformer

- ⇨ Isolate and earth the busbar.
- ⇨ Verify safe isolation from supply.
- ⇨ Only for first installation: Remove protective cap.
- ⇨ Remove the surge-proof dummy plug from the inside-cone bushing. To do this, undo the three M8 hexagon socket-head bolts and remove the dummy plug.

① M8 bolts

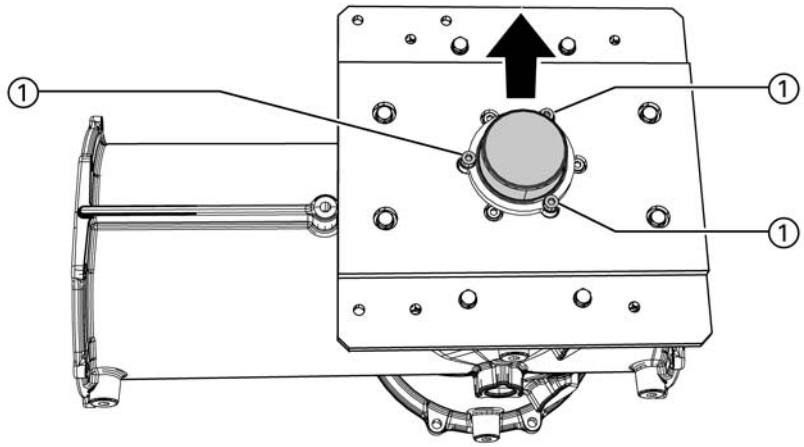


Fig. 102: Removing the dummy plug

⇨ Insert one hexagon socket-head bolt M8x25 (with pan head) each into the now free holes.

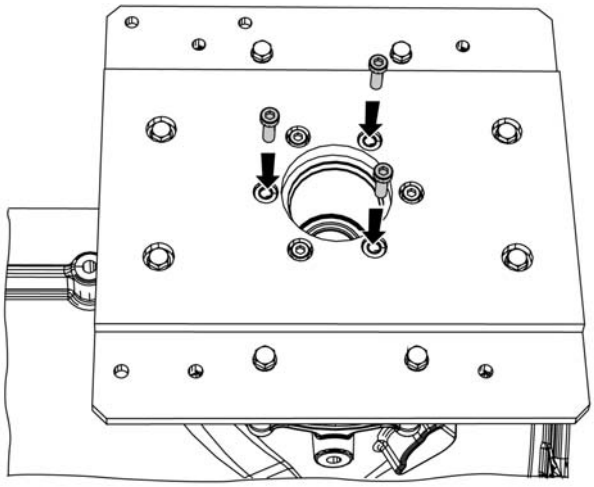


Fig. 103: Inserting hexagon socket-head bolts

⇨ Clean the silicone adapter and the inside-cone cast-resin socket carefully. Use a cleaning agent without solvents and a lint-free cloth.

⇨ Grease the silicone adapter and the inside-cone cast-resin socket uniformly with mounting paste for cables sets.

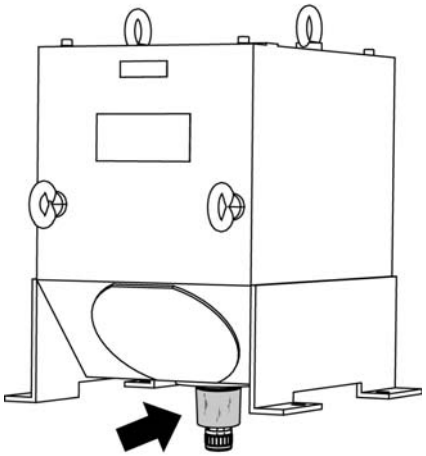


Fig. 104: Cleaning and greasing the silicone adapter

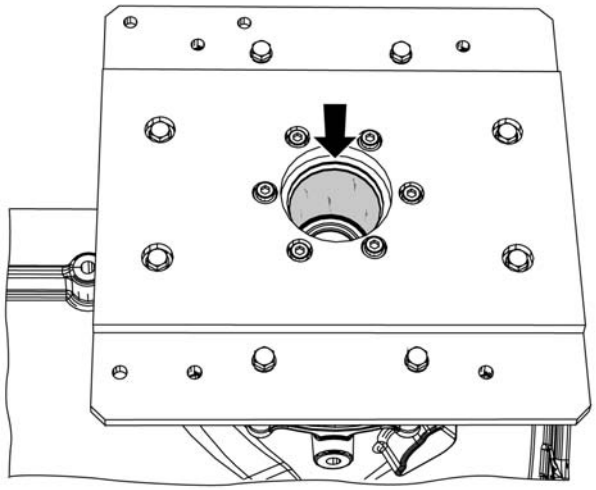


Fig. 105: Greasing and cleaning the inside-cone cast-resin socket

	ATTENTION
	Risk of injury! The voltage transformer type 4MU4 has a weight of approx. 60 kg. ⇨ Secure the voltage transformer against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids (e.g. a supporting rod).

⇨ Lower the voltage transformer slowly onto the busbar housing.

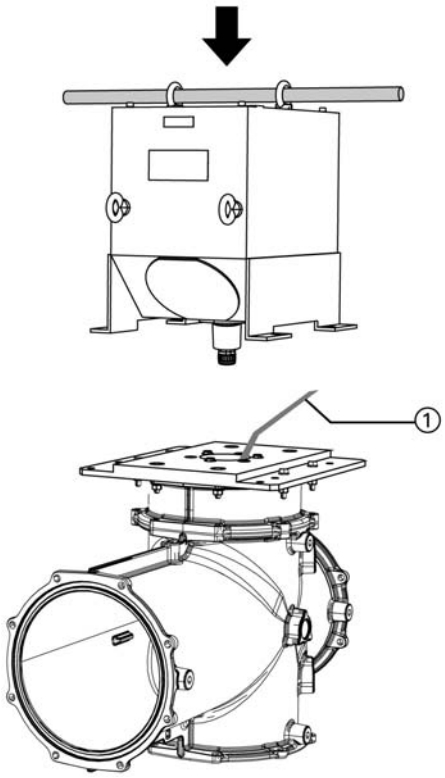


Fig. 106: Mounting the voltage transformer

⇨ To let excess air out of the plug connection while mounting the voltage transformer, fit a nylon thread or a cable strap into the inside cone of the voltage transformer mounting plate.

⇨ Insert the primary terminal of the voltage transformer slowly into the inside cone of the mounting plate, pulling the cable strap out at the same time.

⇨ Connect the low-voltage plug connector to the voltage transformer.

⇨ Fasten the voltage transformer at the panel. To do this, bolt the voltage transformer uniformly together with the voltage transformer mounting plate using four M8 bolts. Tightening torque: 30 Nm.

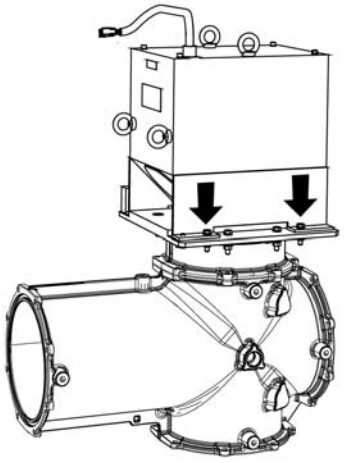
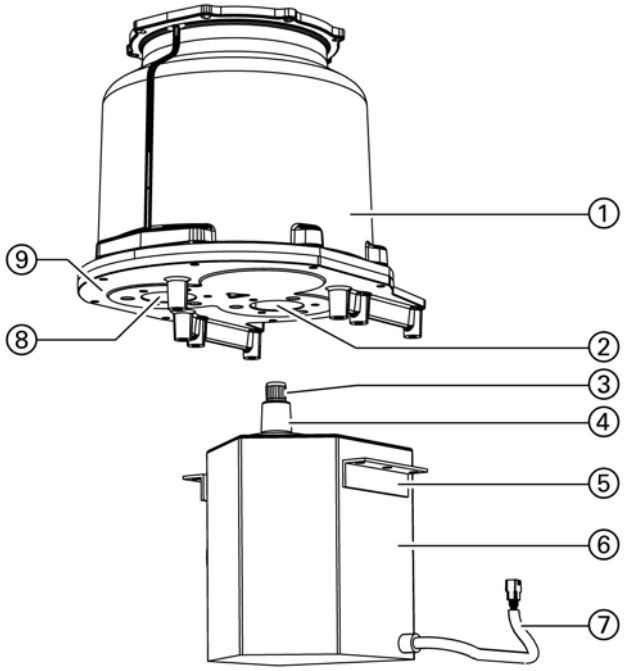


Fig. 107: Fixing the voltage transformer

26.3 Installation of voltage transformers type 4MT7 at the cable feeder



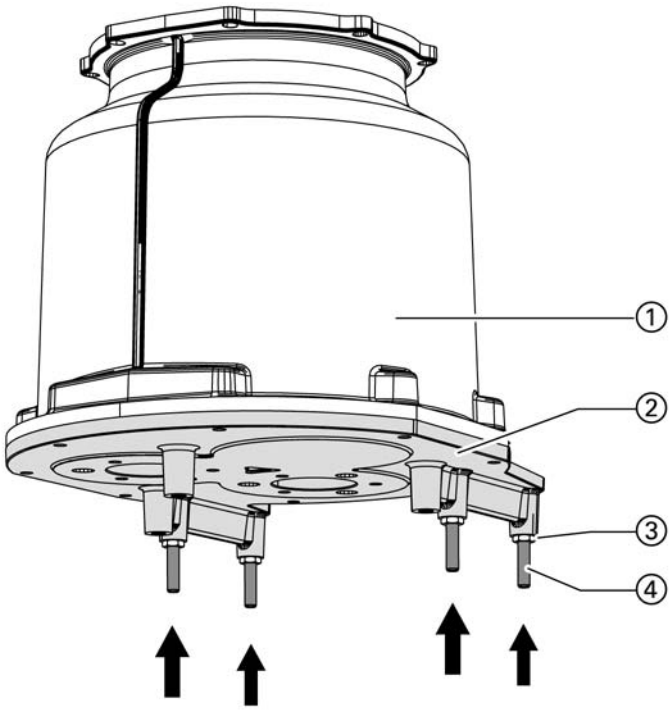
① Panel connection housing
② Inside-cone bushing for primary terminal of transformer
③ Primary terminal at the voltage transformer
④ Silicone adapter
⑤ Fixing bracket (fastened to the voltage transformer housing)
⑥ 4MT7 voltage transformer
⑦ Low-voltage plug connector
⑧ Inside-cone bushing for cable
⑨ Panel connection cover

Fig. 108: 4MT7 voltage transformer

⇨ Isolate and earth the cable feeder.

⇨ Verify safe isolation from supply.

⇨ For first installation of the voltage transformer, mount the threaded rods M10 with low-design nuts (flat nuts) according to DIN 4035 on the panel connection cover (installation instruction enclosed with the supplementary equipment).



① Panel connection housing
② Panel connection cover
③ M10 nuts acc. to DIN 4035
④ Threaded rods M10

Note: Nuts ③ and threaded rods ④ are included in the supplementary equipment

Fig. 109: Mounting the threaded rods

⇨ For first installation: Remove protective cap.
If available: Disassemble surge-proof dummy plugs of the inside-cone bushings.
To do this, undo the two sets of three M8 bolts.

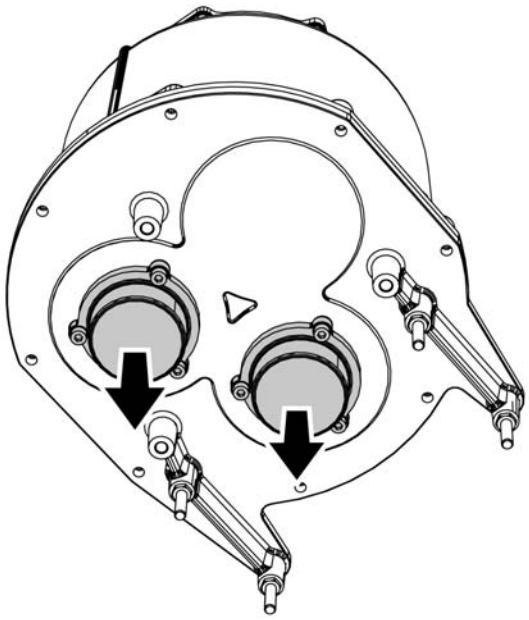


Fig. 110: Removing surge-proof dummy plugs

⇨ Clean the silicone adapter and the inside-cone cast-resin socket carefully. Use a cleaning agent without solvents and a lint-free cloth.

⇨ Grease the silicone adapter and the inside-cone cast-resin socket uniformly with mounting paste for cables sets.

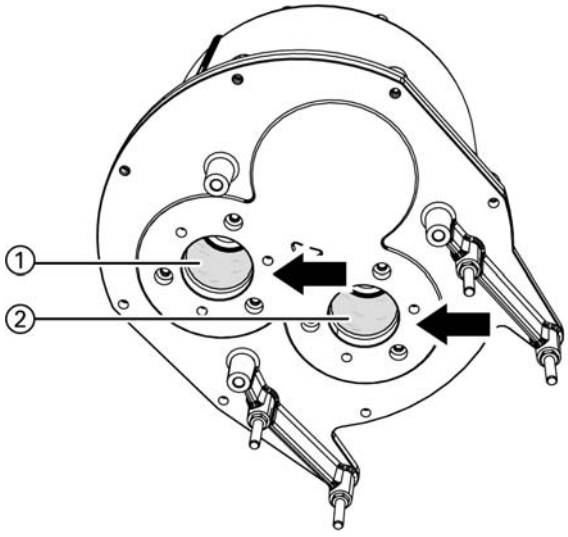


Fig. 111: Greasing the silicone adapter

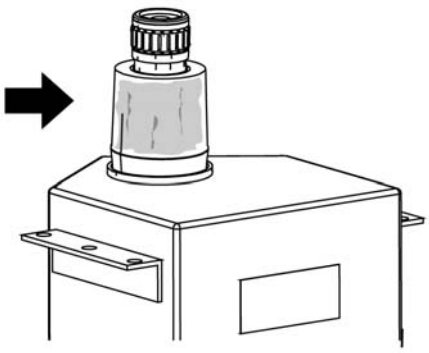


Fig. 112: Greasing the inside-cone cast-resin socket

① Inside-cone bushing for plug-in cable connection
② Inside-cone bushing for primary terminal of transformer

	**DANGER**
	Risk of injury! The voltage transformer type 4MT7 has a weight of approx. 35 kg. ⇨ Secure the voltage transformer from below against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids. ⇨ If necessary, support the voltage transformer with a suitable facility.

➩ Lower the primary terminal of the voltage transformer slowly onto the panel connection housing.

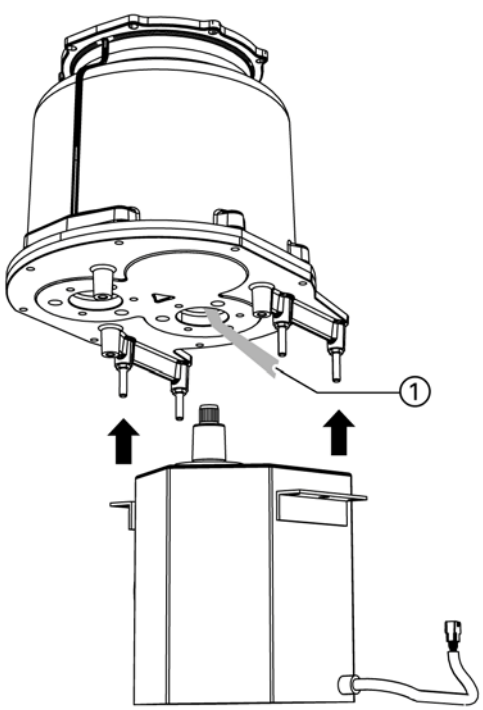


Fig. 113: Mounting the voltage transformer

➩ To let excess air out of the plug connection while mounting the voltage transformer, fit a nylon thread or a cable strap into the inside cone of the panel connection cover.

➩ Insert the primary terminal of the voltage transformer slowly into the inside cone of the panel connection cover, pulling the cable strap out at the same time.

➩ Fit plain washers on the threaded rods of the fixing bracket stecken. Bolt the voltage transformer uniformly together with the panel connection cover using the M10 nuts. Tightening torque: 30 Nm.

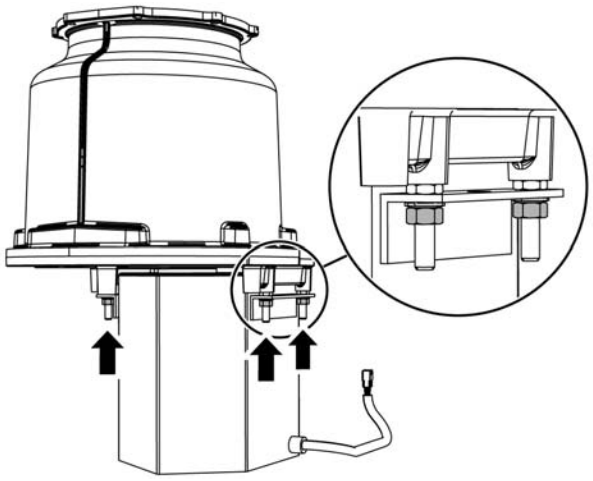


Fig. 114: Bolting the voltage transformer together

➩ Connect the low-voltage plug connector to the voltage transformer.

27 Removal of voltage transformers

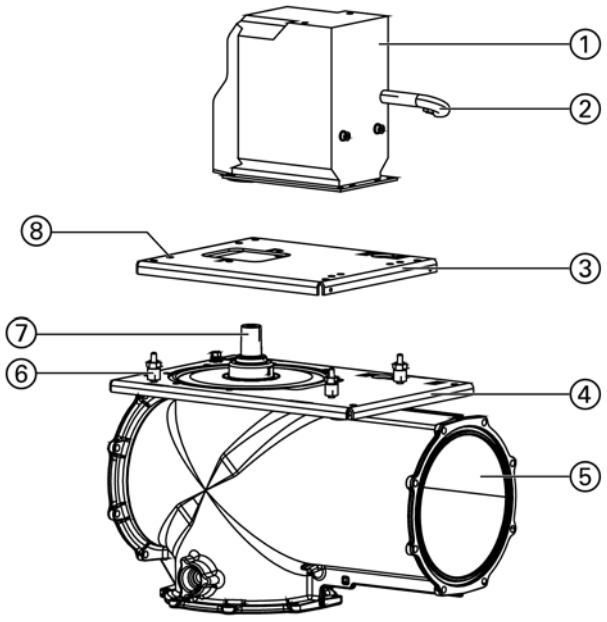
	DANGER
	High voltage! Danger! Before starting installation work at the busbar voltage transformers, the busbar must have been isolated and earthed. ⇨ Isolate and earth the busbar.

	ATTENTION
	If a power-frequency voltage test has to performed before putting the switchgear into operation, ⇨ already mounted **non-disconnectable** busbar voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200 must be removed.

	ATTENTION
	Sensitive parts of the switchgear may be damaged during installation work at the busbar and the busbar housings. ⇨ While working at the busbars or the busbar housings, prop up only on the aluminum housings and the frame. ⇨ Do not prop up on sensitive parts of the switchgear like gas pipes, bursting discs, shafts, etc.

	ATTENTION
	While working on metal-coated voltage transformers, the coating may be scratched or damaged. Then, the voltage transformers cannot be touched anymore. ⇨ Work carefully while mounting metal-coated voltage transformers. ⇨ Take care not to scratch or damage the metal coating.

27.1 Removal of voltage transformers type 4MT3 from the busbar



① 4MT3 voltage transformer
② Low-voltage plug connector
③ Adapter plate
④ Voltage transformer mounting plate
⑤ Busbar housing
⑥ Distance sleeves
⑦ Outside-cone bushing
⑧ Hole with setnut for press-out bolts

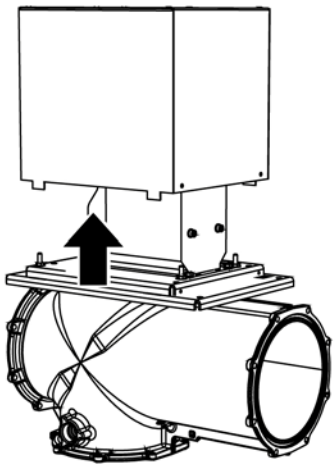
Fig. 115: 4MT3 busbar voltage transformer (shown without cover)

⇨ Isolate and earth the busbar.

⇨ Verify safe isolation from supply.

⇨ Remove the low-voltage plug connector at the voltage transformer.

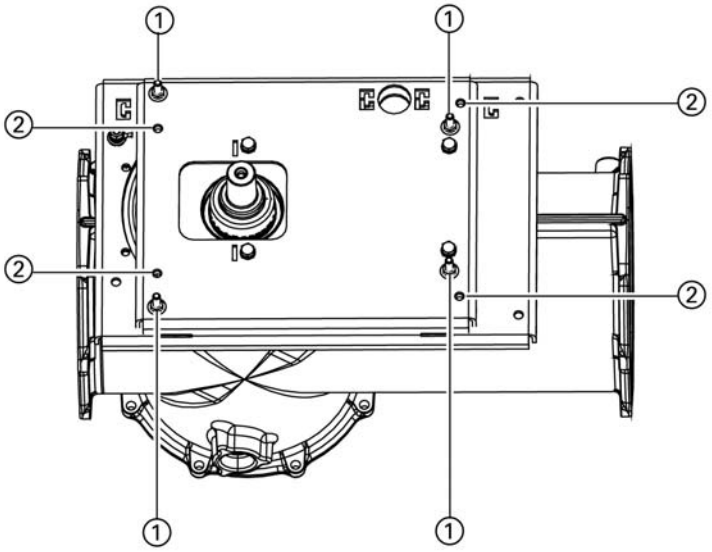
⇨ Remove the cover of the voltage transformer.



⇨ Remove the fixing bolts of the adapter plate.

⇨ Screw four press-out bolts into the holes provided for this purpose in the adapter plate.

⇨ Press the voltage transformer out of the bushing together with the adapter plate with the help of the press-out bolts. While doing so, screw the press-out bolts in uniformly, so that the transformer is not canted.



① Fixing bolts at the adapter plate

② Holes with setnut for press-out bolts

	**ATTENTION**
	Risk of injury! While being removed from the bushing, the voltage transformer can detach suddenly. ⇨ Remove the voltage transformer upwards as uniformly as possible. ⇨ Do not use excessive force.

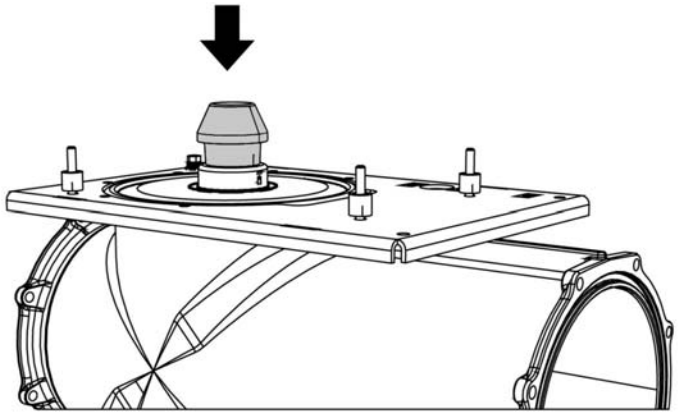
	**ATTENTION**
	Risk of injury! The voltage transformer type 4MT3 has a weight of approx. 30 kg. ⇨ Secure the voltage transformer against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

	NOTE
	If you remove the voltage transformer, the silicone adapter may fall out of the voltage transformer. ⇨ Keep the silicone adapter carefully for later use.

⇨ Clean the silicone adapter and the outside-cone bushing carefully using a cleaning agent without solvents and a lint-free cloth.

⇨ Protect the connection socket of the voltage transformer against damages and pollution using a suitable cover.

⇨ For voltage tests: Close the outside-cone bushing at the busbar housing with a surge-proof cap and protect it against damages and pollution.



27.2 Removal of voltage transformers type 4MU4 from the busbar

⇨ Isolate and earth the busbar.

⇨ Verify safe isolation from supply.

⇨ Remove the low-voltage plug connection.

⇨ Remove the 4 fixing bolts M8x35 of the fixing brackets at the voltage transformer mounting plate.

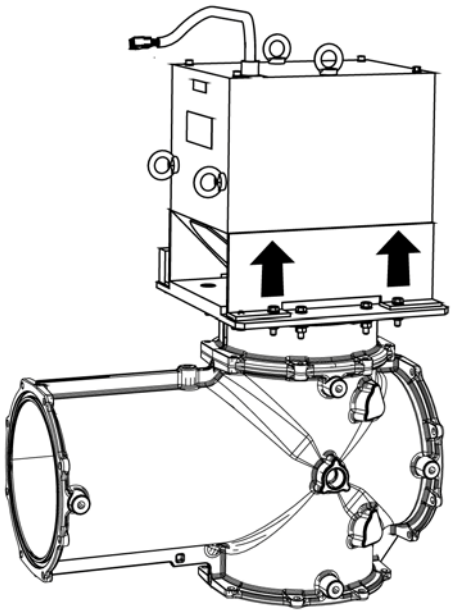


Fig. 116: Removing the fixing bolts at the voltage transformer mounting plate

⇨ Lift the voltage transformer at the upper crane eyes using a suitable rod (e.g. steel rod).

	**ATTENTION** Risk of injury! While being removed from the bushing, the voltage transformer can detach suddenly. ⇨ Remove the voltage transformer upwards as uniformly as possible. ⇨ Do not use excessive force.

	**ATTENTION** Risk of injury! The voltage transformer type 4MU4 has a weight of approx. 60 kg. ⇨ Secure the voltage transformer against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids (e.g. a supporting rod).

⇨ Remove the voltage transformer slowly upwards by means of the steel rods.

⇨ Lower the transformer so that it does not lie on the primary terminal, and protect it against damages and pollution using a suitable cover.

⇨ **For voltage tests:** Close the inside-cone bushing at the panel with a surge-proof dummy plug size 2.

To do this, remove the 3 bolts M8x25. Store these bolts carefully. Fit the dummy plug and bolt together with 3 bolts M8.

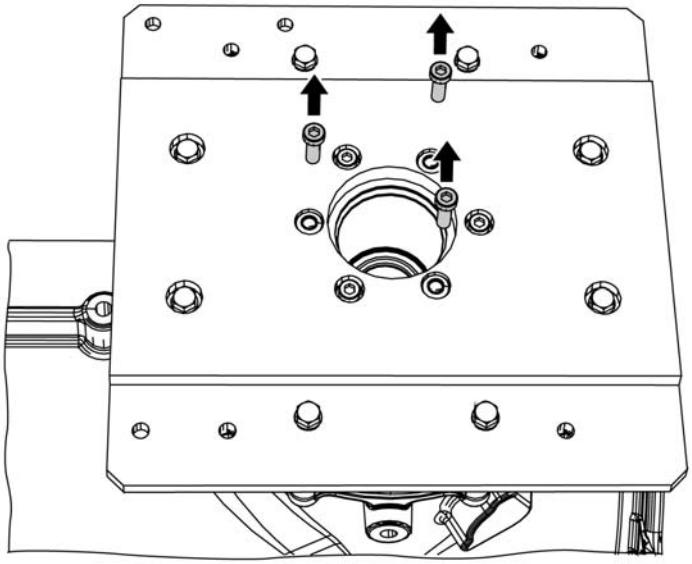
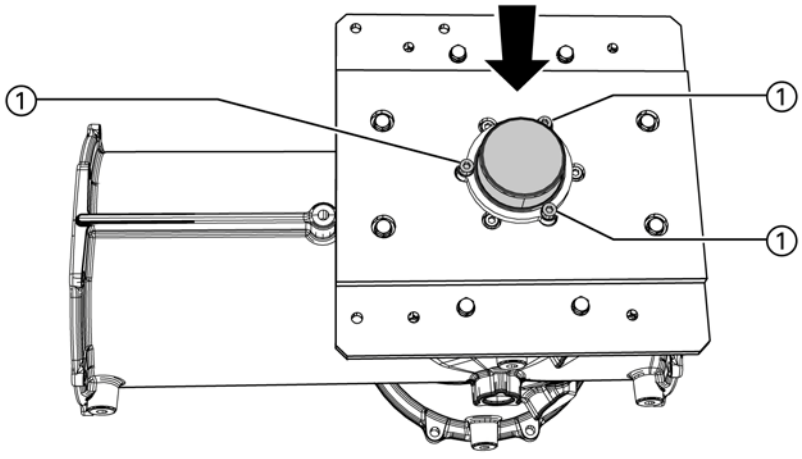


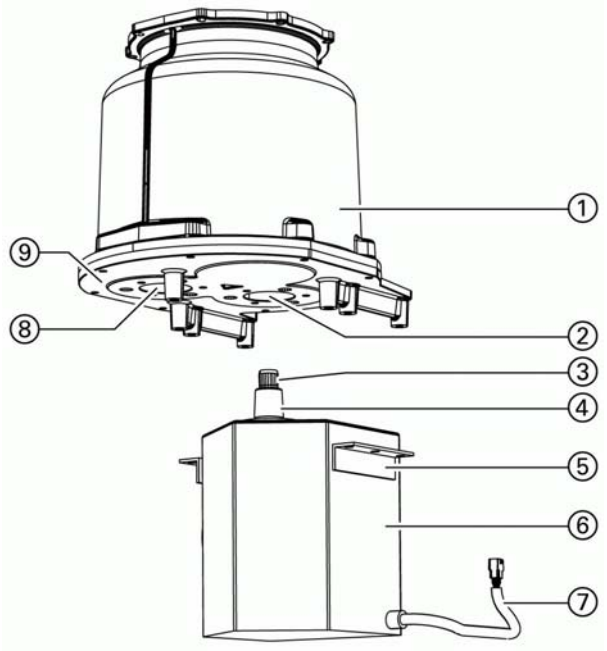
Fig. 117: Removing bolts M8x25



① M8 bolts

Fig. 118: Inserting the dummy plug

27.3 Removal of voltage transformers type 4MT7 from the cable feeder



① Panel connection housing
② Inside-cone bushing for primary terminal of transformer
③ Primary terminal at the voltage transformer
④ Silicone adapter
⑤ Fixing bracket (fixed at the voltage transformer housing)
⑥ 4MT7 voltage transformer
⑦ Low-voltage plug connection
⑧ Inside-cone bushing for cable
⑨ Panel connection cover

Fig. 119: 4MT7 voltage transformer

⇨ Isolate and earth the cable feeder.

⇨ Verify safe isolation from supply.

⇨ Remove the voltage transformer. To do this, remove the 4 bolts of the fixing brackets at the panel connection cover, bolt size M10.

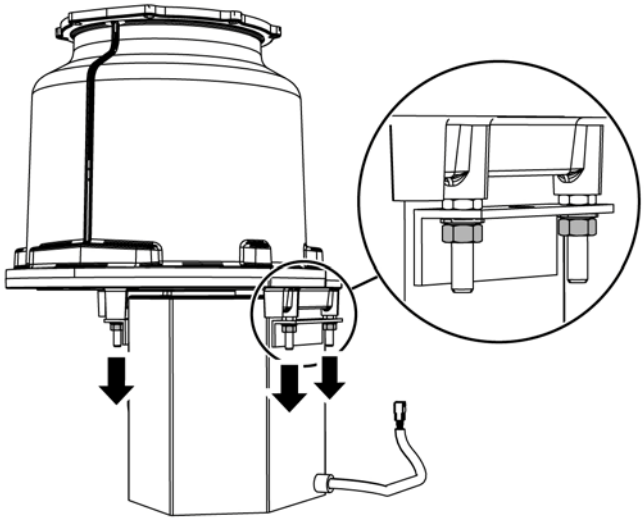


Fig. 120: Removing the voltage transformer

	**ATTENTION**
	Risk of injury! While being removed from the bushing, the voltage transformer can detach suddenly. ⇨ Remove the voltage transformer uniformly downwards. ⇨ Do not use excessive force.

	**ATTENTION** Risk of injury! The voltage transformer type 4MT7 has a weight of approx. 35 kg. ⇨ Secure the voltage transformer against falling down. ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids. ⇨ If necessary, support the voltage transformer with a suitable facility.

⇨ Remove the voltage transformer slowly downwards.

⇨ Lower the voltage transformer so that it does not lie on the primary terminal, and protect it against damages and pollution using a suitable cover.

⇨ **For voltage tests:** Close the inside-cone bushings at the switchpanel pole with surge-proof dummy plugs size 2 (3), and bolt tight using 3 bolts M8 each.

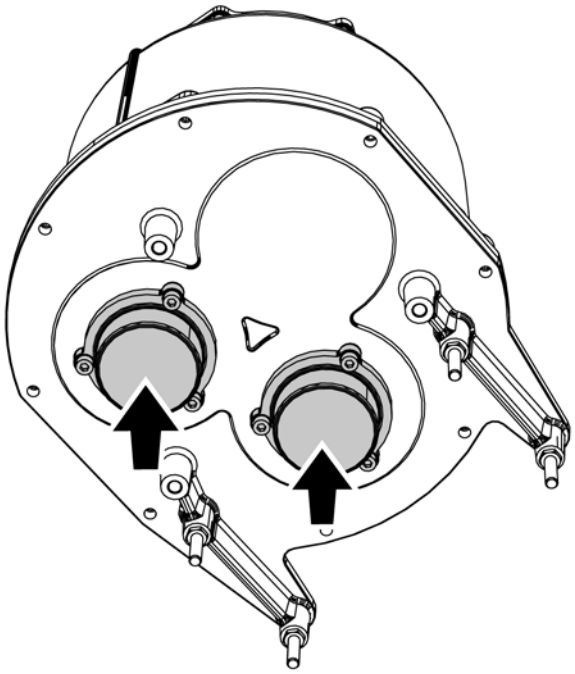


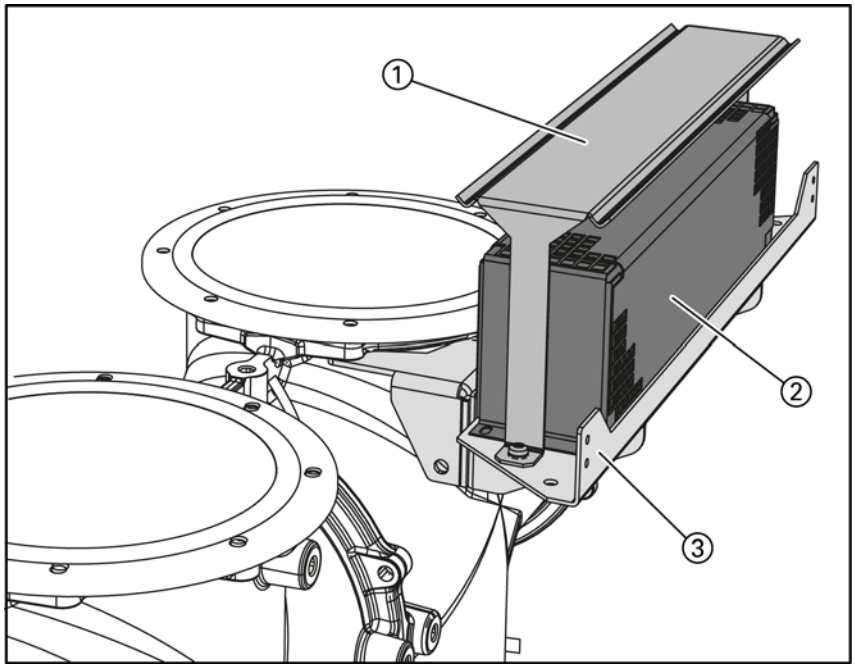
Fig. 121: Mounting surge-proof dummy plugs

28 Busbar components

28.1 Voltage transformer damping resistor

The damping resistor of the voltage transformer is pre-assembled at the factory.

➪ Do not damage the damping resistor while working at the busbar.



① Fixing bracket of damping resistor
② Damping resistor
③ Voltage transformer mounting plate

28.2 Voltage transformer with or without three-position disconnector

Voltage transformer with three-position disconnector (for example, 4MU4 voltage transformer)

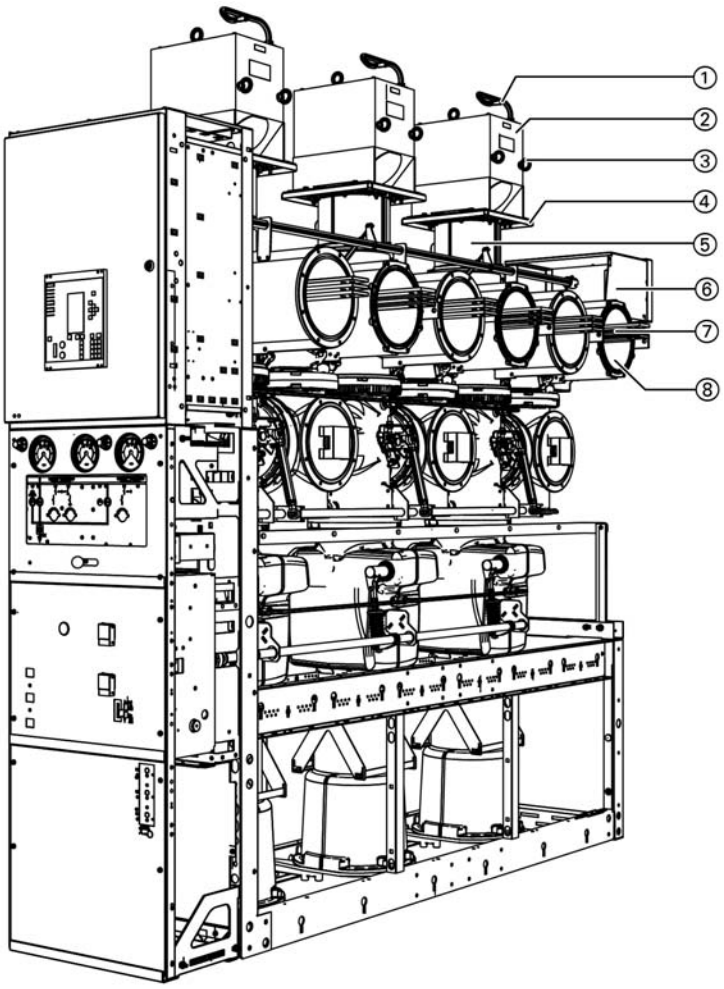


Fig. 122: Overview of busbar component: 4MU4 voltage transformer with three-position disconnector

① Low-voltage plug connector
② 4MU4 voltage transformer
③ Crane eyes
④ Voltage transformer mounting plate
⑤ Intermediate ring
⑥ Operating unit
⑦ Busbars
⑧ Busbar housing

For assembly operations for 4MU4 voltage transformer, see page 101, "Installation of voltage transformers type 4MU4 on the busbar".

Voltage transformer without three-position disconnector (for example, 4MU4 voltage transformer)

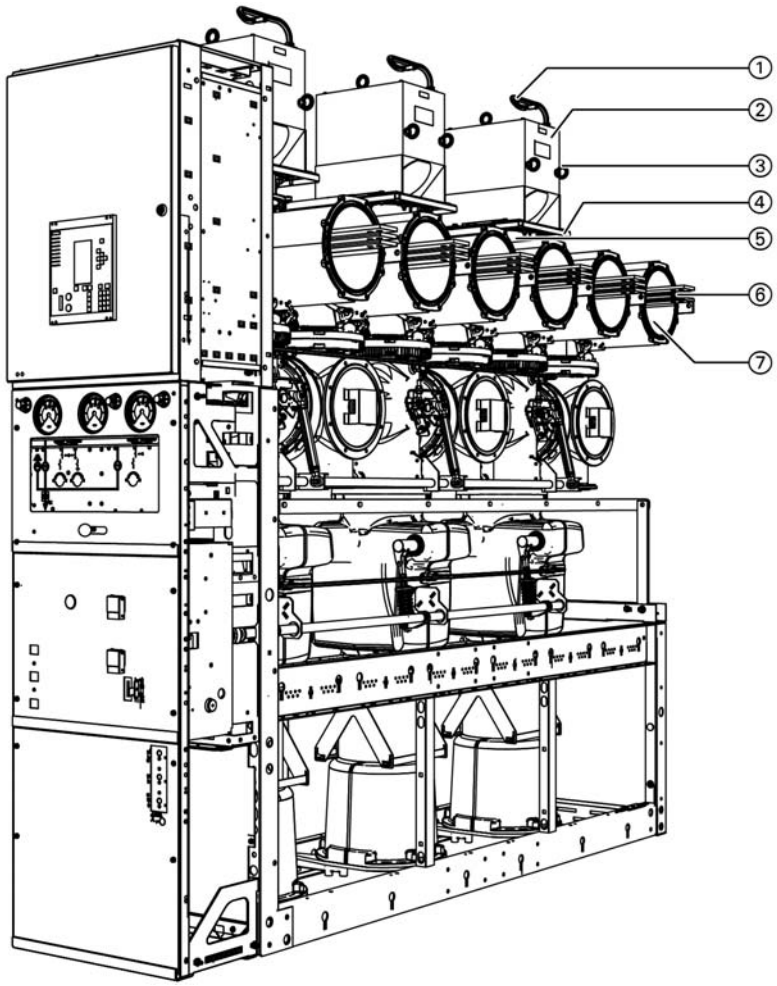


Fig. 123: Overview of busbar component: 4MU4 voltage transformer without three-position disconnector

① Low-voltage plug connector
② 4MU4 voltage transformer
③ Crane eyes
④ Voltage transformer mounting plate
⑤ Intermediate ring
⑥ Busbars
⑦ Busbar housing

For assembly operations for 4MU4 voltage transformer, see page 101, "Installation of voltage transformers type 4MU4 on the busbar".

28.3 Solid-insulated bar (V-type bar)

Solid-insulated bar with three-position disconnector

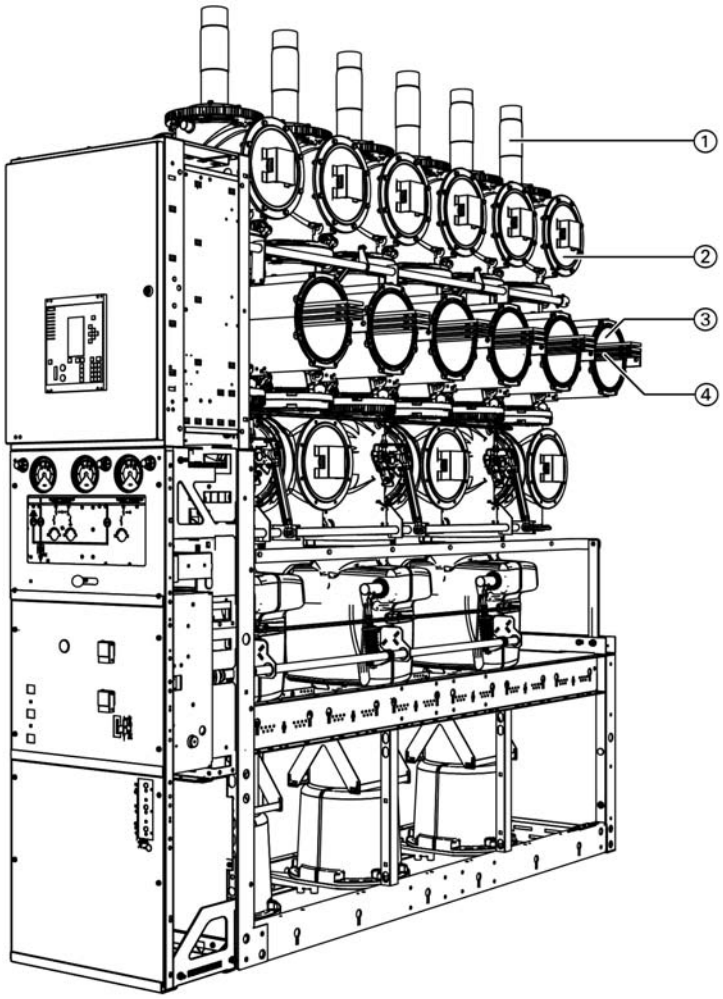


Fig. 124: Overview of busbar component: Solid-insulated bar with three-position disconnector

①	Solid-insulated bar with integrated pressure ring
②	Connection housing for solid-insulated bar
③	Busbar housing
④	Busbars

⇨ Remove the covers ① and sealing rings. To do this, remove the 6 bolts M8 x 45 (including washer and spring washer) and the M10 nuts.

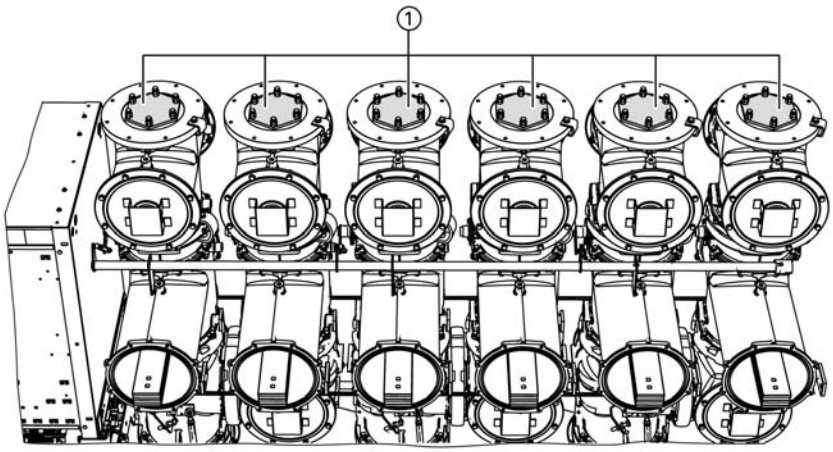
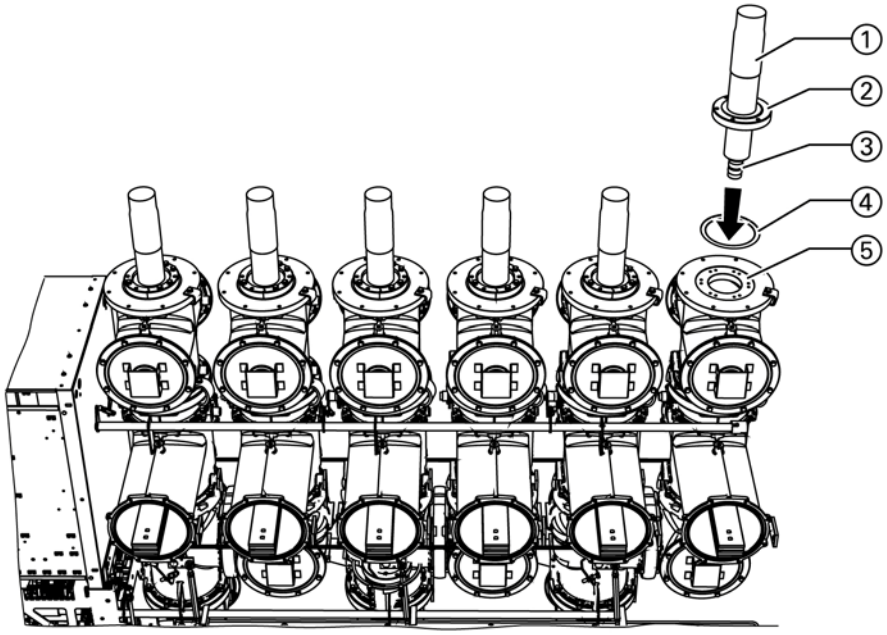


Fig. 125: Removing the covers ① and sealing rings

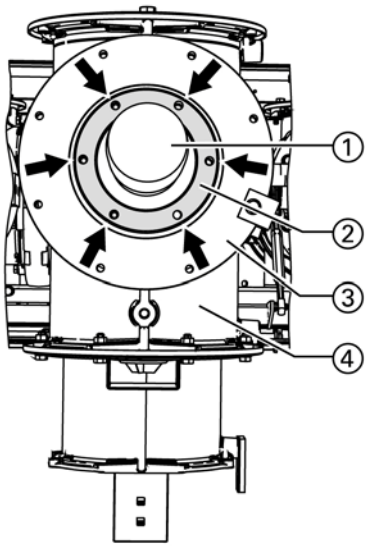
⇨ Mount solid-insulated bar.



① Solid-insulated bar with integrated pressure ring (②)
② Pressure ring
③ Contact bolt
④ Sealing ring
⑤ Connection cover for solid-insulated bar

Fig. 126: Solid-insulated bar

⇨ Bolt the pressure ring of the solid-insulated bar together with the busbar housing using 6 bolts M8 x 45 (including washer and spring washer). Tightening torque: 20 Nm.



① Solid-insulated bar
② Pressure ring
③ Connection cover for solid-insulated bar
④ Busbar housing

Fig. 127: Fixing points for the pressure ring of the solid-insulated bar

⇨ The solid-insulated bar is disassembled in reverse order: Remove the bolts at the pressure ring of the solid-insulated bar. Remove the solid-insulated bar and bolt the cover onto the connection housing.

Solid-insulated bar without three-position disconnector

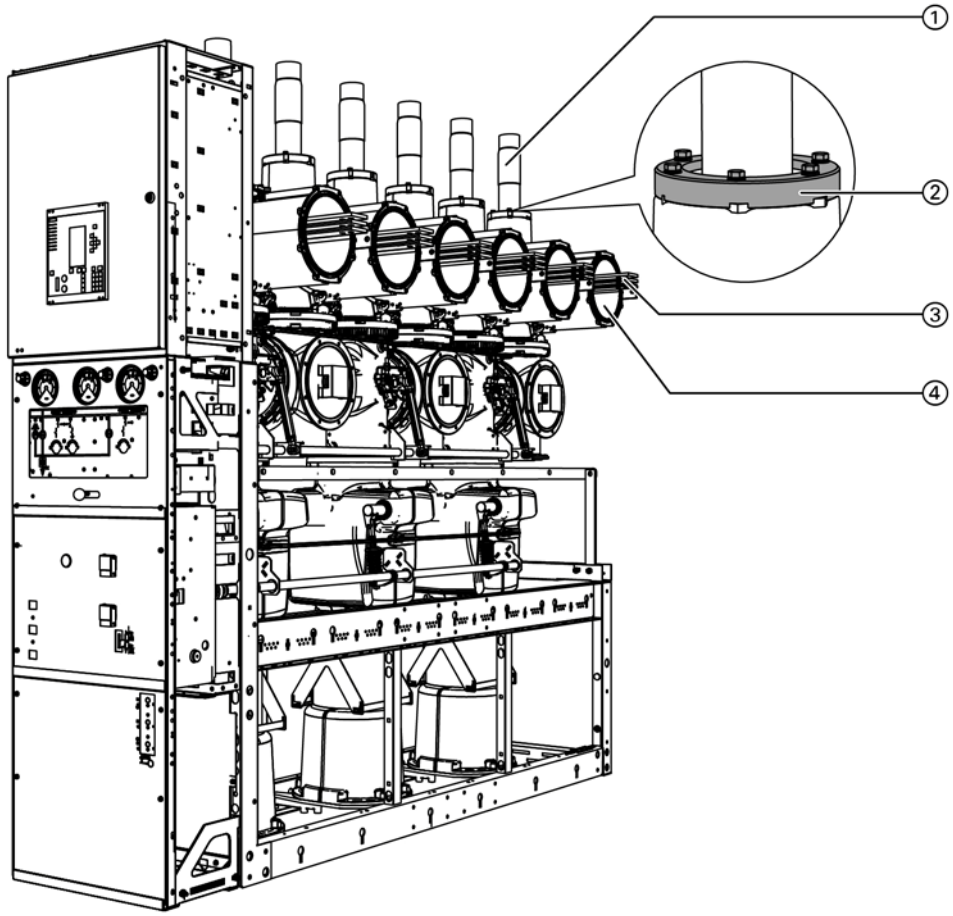


Fig. 128: Overview of busbar component: Solid-insulated bar without three-position disconnector

① Solid-insulated bar with integrated pressure ring (②)

② Pressure ring

③ Busbars

④ Busbar housing

⇨ Remove the covers ① . To do this, remove the 6 bolts M8 x 45 (including washer and spring washer) and nuts M10.

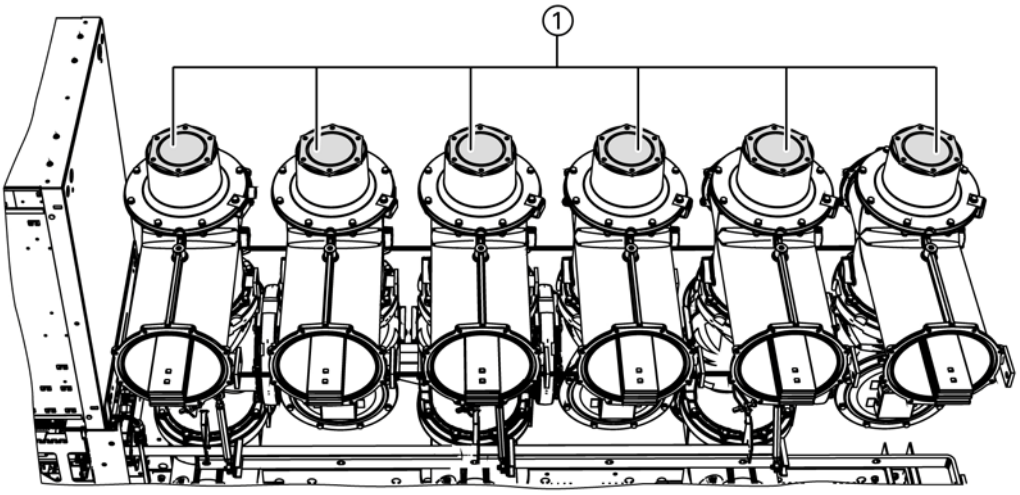
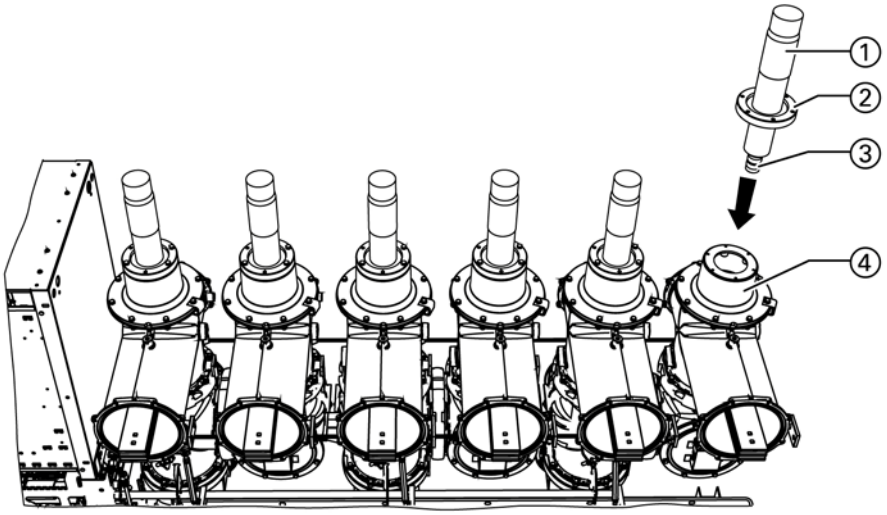


Fig. 129: Removing the covers ①

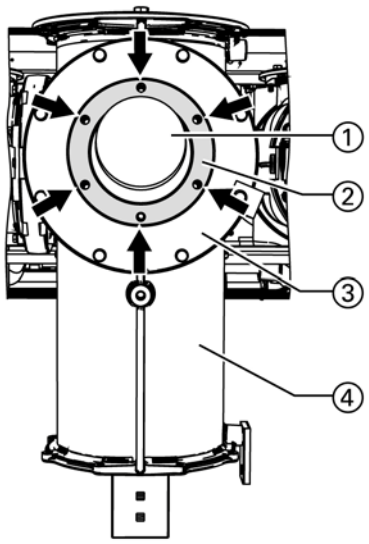
➩ Mount solid-insulated bar.



① Solid-insulated bar with integrated pressure ring
② Pressure ring
③ Contact bolt
④ Connection cover for solid-insulated bar

Fig. 130: Mounting solid-insulated bars

➩ Bolt the pressure ring of the solid-insulated bar together with the busbar housing using 6 bolts M8 x 45 (including washer and spring washer). Tightening torque: 20 Nm.



① Solid-insulated bar
② Pressure ring
③ Connection cover for solid-insulated bar
④ Busbar housing

Fig. 131: Fixing points for the pressure ring of the solid-insulated bar

➩ The solid-insulated bar is disassembled in reverse order: Remove the bolts at the pressure ring of the solid-insulated bar. Remove the solid-insulated bar and bolt the cover onto the connection cover.

28.4 Gas-insulated bar

Gas-insulated bar with three-position disconnector

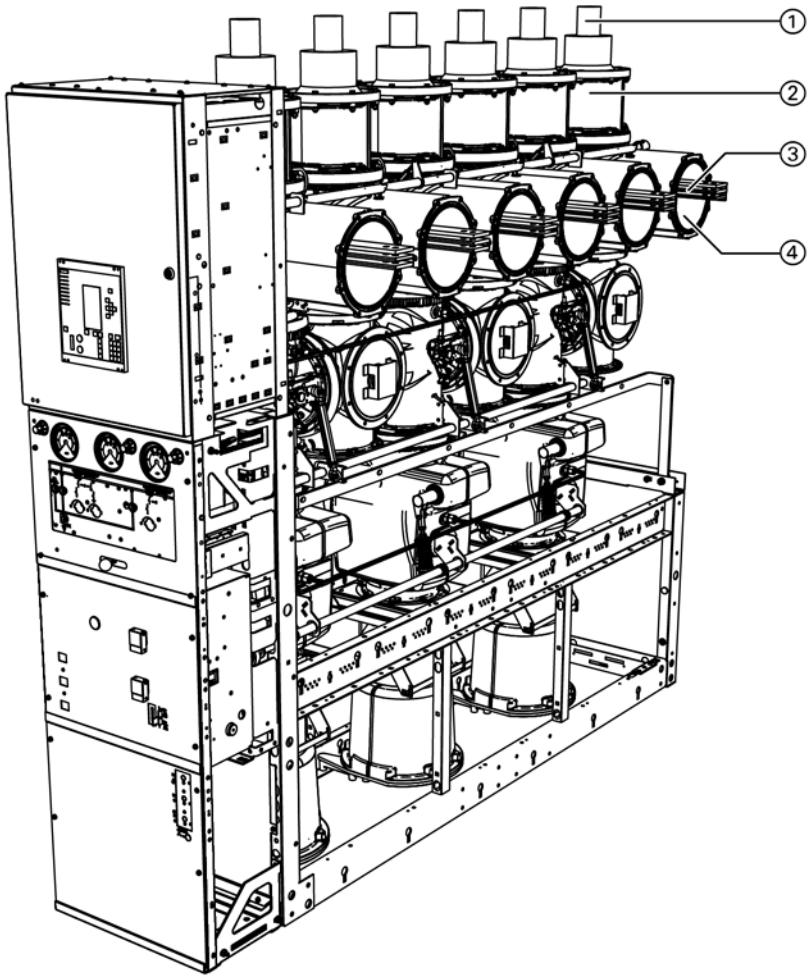


Fig. 132: Overview of busbar component: Gas-insulated bar with three-position disconnector

① Gas-insulated bar with integrated pressure ring

② Connection housing for gas-insulated bar

③ Busbars

④ Busbar housing

➪ Remove the covers ① . To do this, remove the 8 bolts M8 x 20 and the nuts. Reuse the bolts for fixing the gas-insulated bar.

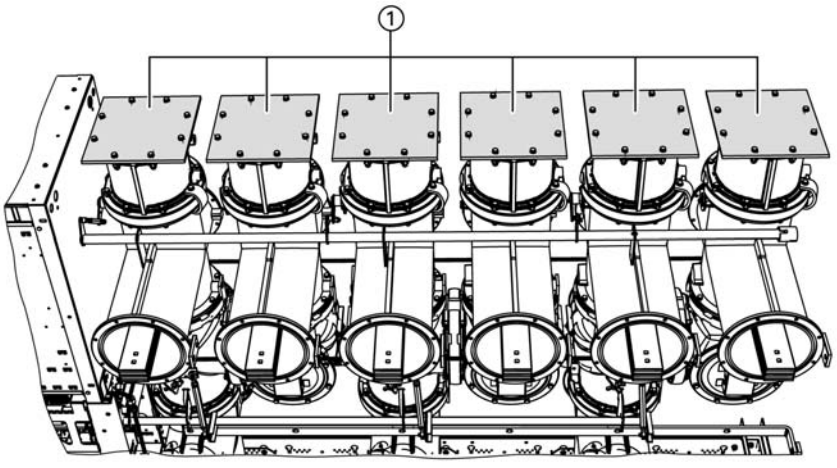
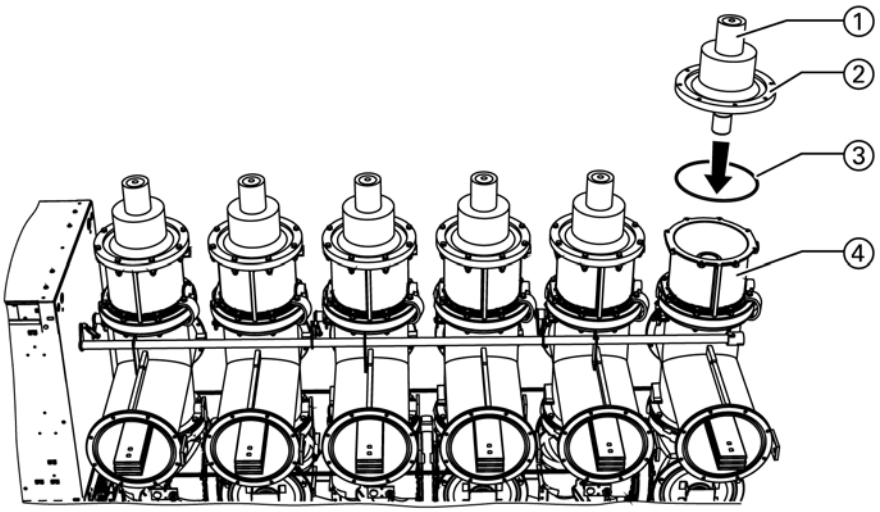


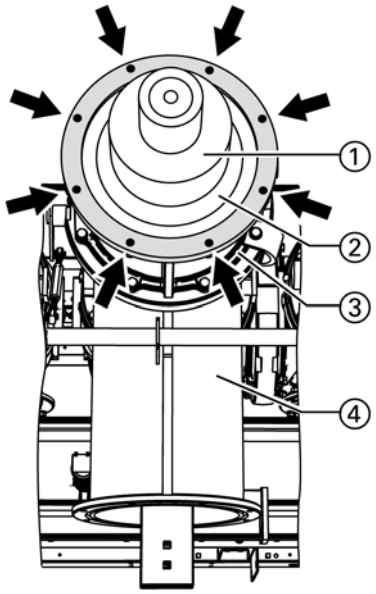
Fig. 133: Removing the covers ①

➩ Mount the gas-insulated bar.



① Gas-insulated bar (with integrated pressure ring ②)
② Pressure ring
③ Sealing ring
④ Connection housing

➩ Bolt the pressure ring of the gas-insulated bar together with the busbar housing using 8 bolts M8 x 20. Tightening torque: 20 Nm.



① Gas-insulated bar
② Pressure ring
③ Connection housing
④ Busbar housing

Fig. 134: Fixing points for the pressure ring of the gas-insulated bar

➩ The gas-insulated bar is disassembled in reverse order: Remove the bolts at the pressure ring of the gas-insulated bar. Remove the gas-insulated bar and bolt the cover onto the connection housing.

Gas-insulated bar without three-position disconnector

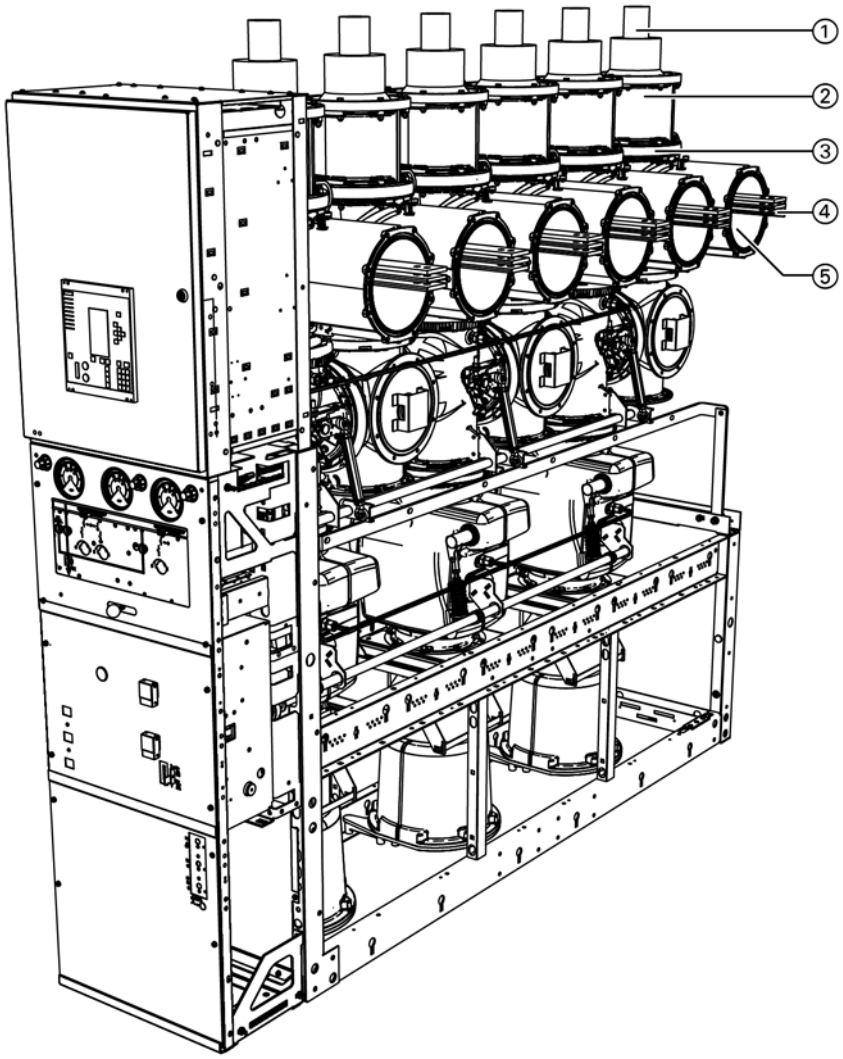


Fig. 135: Overview of busbar component: Gas-insulated bar without three-position disconnector

① Gas-insulated bar with integrated pressure ring (②)
② Connection housing for gas-insulated bar
③ Intermediate ring
④ Busbars
⑤ Busbar housing

⇨ Remove the covers ① . To do this, remove the 8 bolts M8 x 20 and the nuts. Reuse the bolts for fixing the gas-insulated bar.

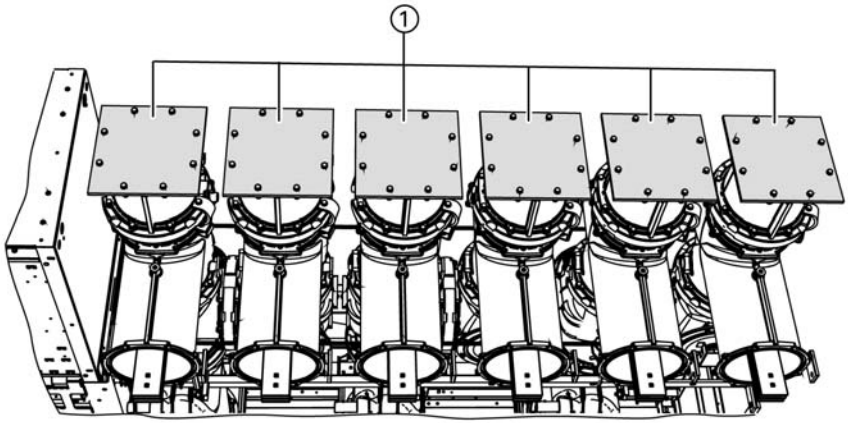
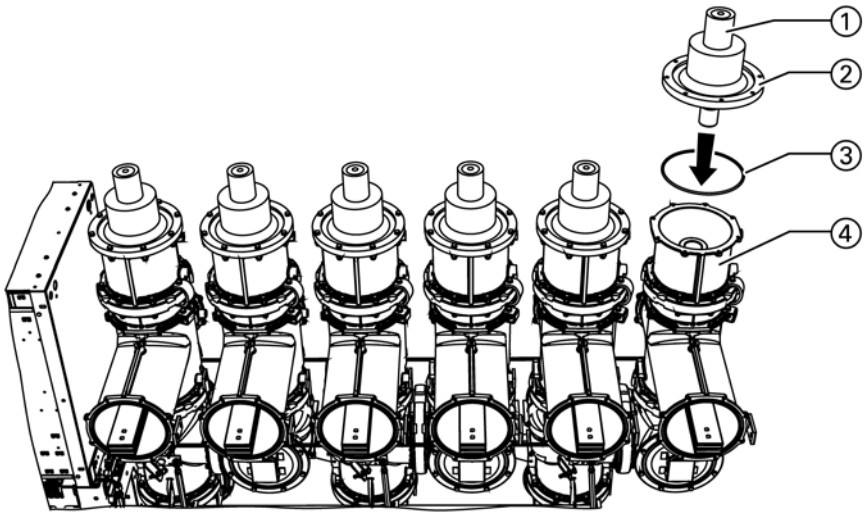


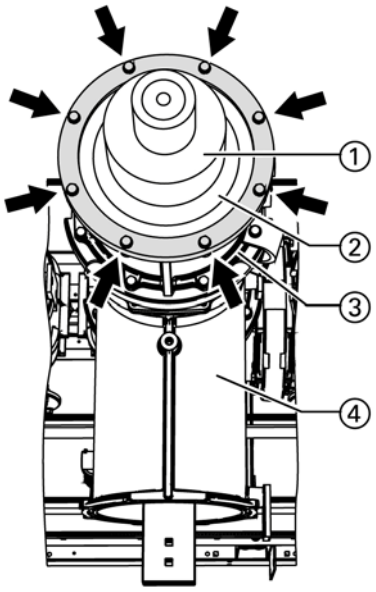
Fig. 136: Removing the covers ①

➪ Mount the gas-insulated bar.



① Gas-insulated bar (with integrated pressure ring ②)
② Pressure ring
③ Sealing ring
④ Connection housing

➪ Bolt the pressure ring of the gas-insulated bar together with the busbar housing using 8 bolts M8 x 20. Tightening torque: 20 Nm.



① Gas-insulated bar
② Pressure ring
③ Connection housing
④ Busbar housing

Fig. 137: Fixing points for the pressure ring of the gas-insulated bar

➪ The gas-insulated bar is disassembled in reverse order: Remove the bolts at the pressure ring of the gas-insulated bar. Remove the gas-insulated bar and bolt the cover onto the connection housing.

28.5 Busbar connection S2 and S3

Busbar connection with plug size S2 or S3 and with three-position disconnector

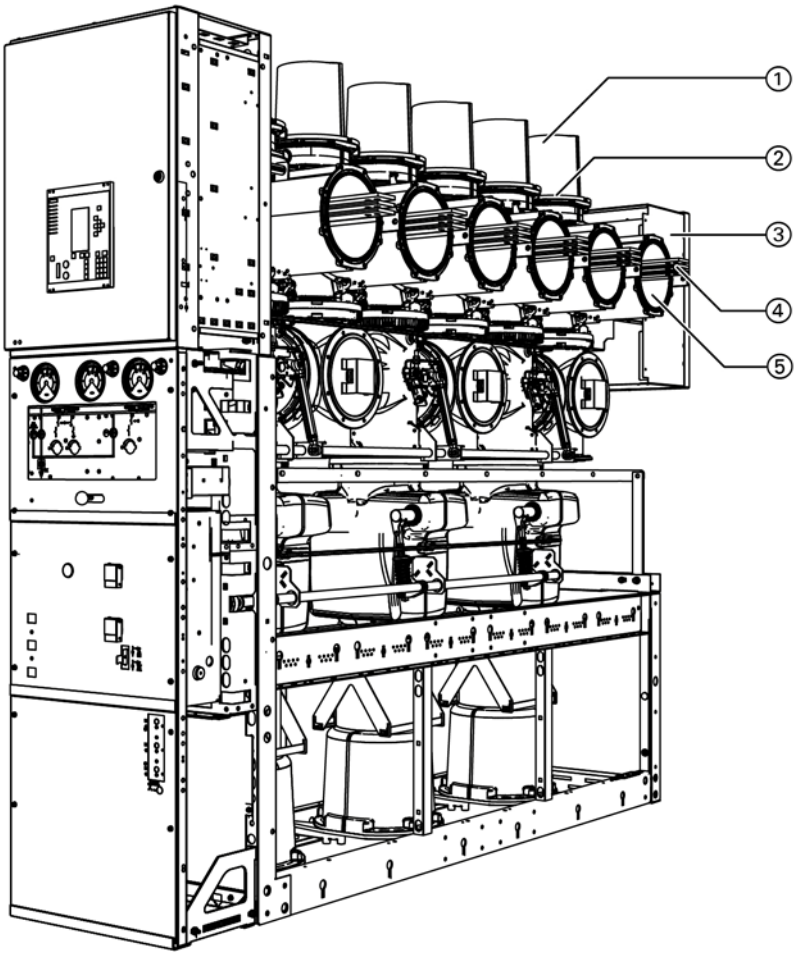


Fig. 138: Overview of busbar component:
Busbar connection with plug size S2 or S3 and with three-position disconnector

① Busbar connection with plug size 2 or 3
② Intermediate ring
③ Operating unit for busbar systems 1 and 2
④ Busbars
⑤ Busbar housing

The busbar connection S2 or S3 with three-position disconnector is pre-assembled at the factory.

Busbar connection with plug size S2 or S3 without three-position disconnector

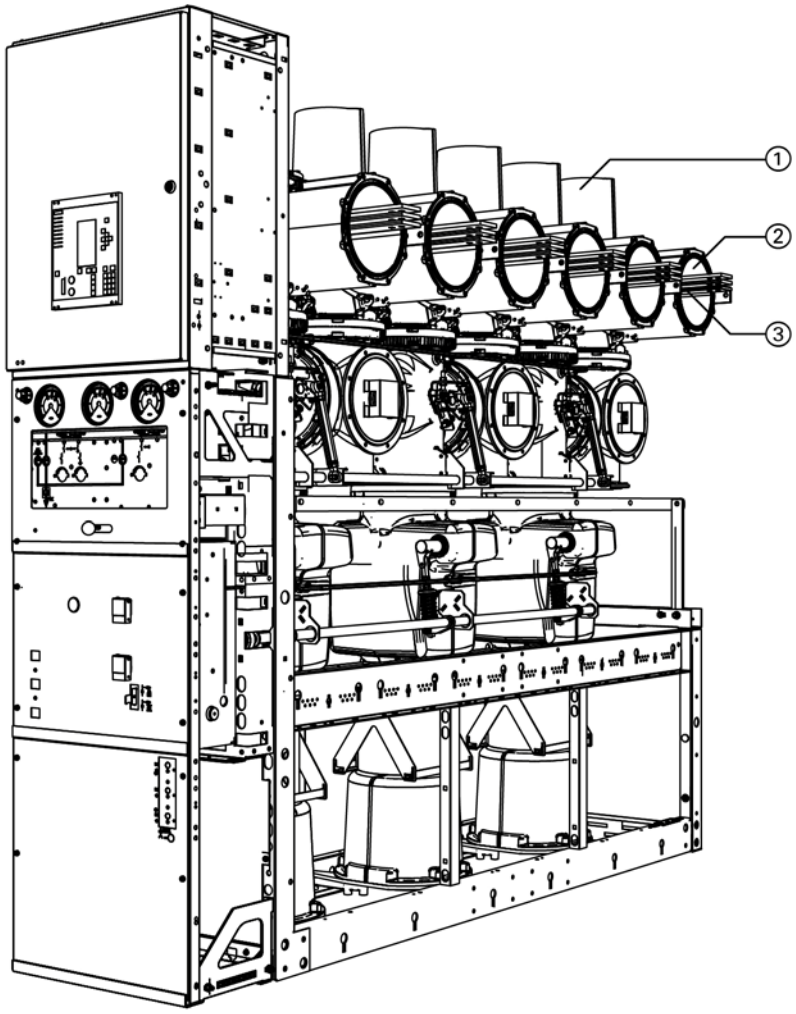


Fig. 139: Overview of busbar component:
Busbar connection with plug size S2 or S3 without three-position disconnector

① Busbar connection with plug size S2 or S3

② Busbar housing

③ Busbars

The busbar connection S2 or S3 is pre-assembled at the factory.

28.6 Busbar earthing switch

Busbar earthing switch

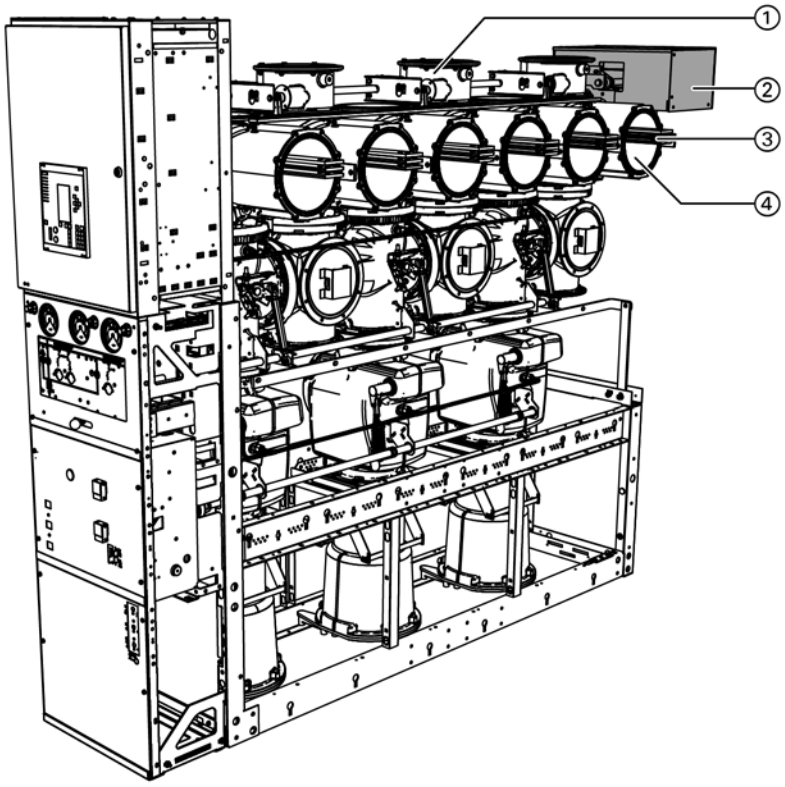


Fig. 140: Overview of busbar component: Busbar earthing switch

① Housing for busbar earthing switch

② Additional compartment for operating mechanism of busbar earthing switch

③ Busbars

④ Busbar housing

The busbar earthing switch is pre-assembled at the factory.

28.7 Capacitive voltage tap at the busbar

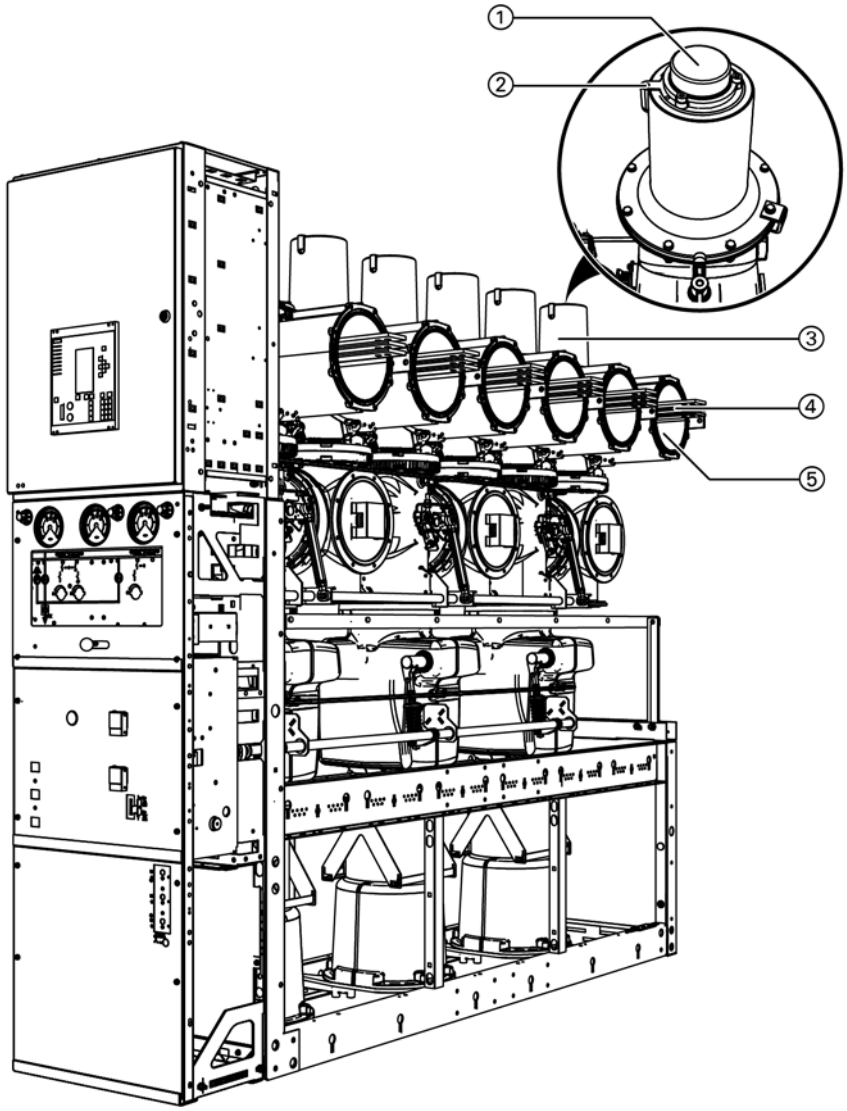


Fig. 141: Overview of busbar component: Capacitive voltage tap

① Dummy plug
② Capacitive voltage tap
③ Panel connection housing
④ Busbars
⑤ Busbar housing

The capacitive voltage tap at the panel connection housing is pre-assembled at the factory.

	NOTE
	Visual inspection of the dummy plugs ⇨ Verify that all dummy plugs (①) are properly inserted in the capacitive voltage taps.

29 Tests

29.1 Checking the SF_6 gas filling

DANGER

Operation with an incorrect SF_6 gas pressure can destroy parts of the switchgear.

⇨ Do not put the switchgear into operation with too high or too low SF_6 gas pressures.

Checking the gas pressure

Before commissioning or a rated short-duration power-frequency withstand voltage test, the gas pressures of **all** gas compartments must be checked.

⇨ On all gas compartments filled at site: After having filled the gas compartments, observe a temperature compensation time of **24 hours**. Do not check the gas pressure before that time.

⇨ Check the gas pressure in all gas compartments filled at site. If the limit values adjusted on the indicators are underflown or exceeded, correct the gas pressure.

Leakage test

⇨ **24 hours** after having filled the gas compartments, check all flange connections mounted at site and all SF_6 pipes for leaks.

⇨ For leak detection, use an SF_6 leak detector.

⇨ In case of gas leaks, these points must be disassembled and sealed again.

Checking the gas quality

⇨ Check the gas quality **24 hours** after filling the gas compartments.

⇨ Determine the maximum dew point with a gas hygrometer.
Dew-point temperature: -15°C.

⇨ Check the air content in the SF_6 gas with a gas-percentage meter.
Maximum air content: 5%.

⇨ If the gas quality is not achieved, the gas filling must be cleaned with the maintenance unit.

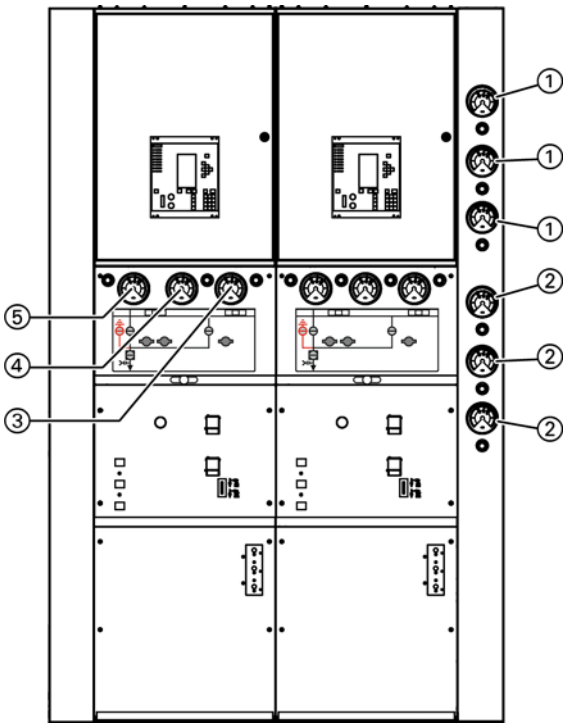
Monitoring the gas pressure

⇨ After commissioning, check the gas pressures daily for a period of two weeks. If the gas pressures drop within this period of time, please inform the Siemens representative.

⇨ After this period of time, check the gas pressures according to the maintenance instructions.

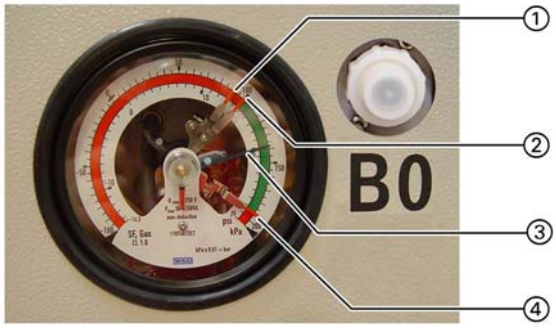
29.2 Monitoring the gas pressure

The perfect functioning of the switchgear is only guaranteed if the gas pressure indication is between the minimum and the maximum functional level (see page 44, "Insulating gas SF_6").



① Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 1
② Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 2
③ Manometer for three-position disconnector housing in busbar system 2
④ Manometer for circuit-breaker housing
⑤ Manometer for three-position disconnector housing in busbar system 1

Fig. 142: Gas pressure manometers at the panel



① Minimum permissible functional level (signaling contact)
② Critical gas pressure (signaling contact)
③ Actual gas pressure
④ Maximum permissible functional level (signaling contact)

Fig. 143: Gas pressure manometer for the circuit-breaker housing at the panel

	**DANGER**
	If gas pressure is beyond the minimum or maximum functional level: ⇨ Contact the regional Siemens representative immediately. ⇨ Shut down the circuit-breaker panel if required.

29.3 Checking the circuits of the low-voltage equipment

DANGER

The voltage transformer can explode!

⇨ If the voltage transformer is short-circuited, there is risk of explosion.
Check the voltage transformer circuits up to the m.c.b. or the fuse for short-circuits.

⇨ Check the current transformer circuits according to the circuit diagrams.

⇨ Check the functions of all protection devices with a secondary test unit for relays.

29.4 Checking high-voltage connections

⇨ Check the tightening torque of the fixing bolts of the cable plugs according to the manufacturer's instructions.

⇨ Check the earthing of the cable termination on all high-voltage cables.

29.5 Checking electrical connections

Checking device connections

⇨ Check the screw-type connections of the devices in the low-voltage compartment at random with the torque wrench.

⇨ Check the plug-in connections of the devices in the low-voltage compartment at random.

Checking auxiliary cable connections

⇨ Check auxiliary cable connections on devices and terminal blocks at random.

⇨ Check all auxiliary cable connections on current transformer terminals including slides and jumpers in the low-voltage compartment.

⇨ Check the designation labels on the terminal blocks.

⇨ Replace missing labels using the information given in the circuit diagrams.

29.6 Checking protection against environmental influences

For touching up doors and front parts there is a paint pen available.

⇨ Touch up surface damages.

30 Final installation work

30.1 Mounting cables with plugs

	**ATTENTION** The dust-proof caps supplied on the sockets of the multiple panel connections do not provide sufficient shock protection. ⇨ Close unused sockets of multiple panel connections with dummy plugs.

⇨ Proceed according to the installation instructions of the corresponding plug manufacturer.

⇨ Mount the cable bracket (option). Distance between lower edge of panel connection housing and cable bracket: Minimum 450 mm.

	**ATTENTION** Do **not** bolt cable shields onto panel connection housings in order to avoid damage to the switchgear. ⇨ Connect cable shields to the cable bracket or to the switchgear earth.

30.2 Connecting low-voltage cables

Connect low-voltage cables of customer (option):

⇨ Remove the metal covers from the frames.

⇨ Open the doors of the low-voltage compartments.

⇨ Fix the low-voltage cables at the holders provided for this purpose.

⇨ Connect the ends of the cables to the terminals in the low-voltage compartment according to the circuit diagram.

⇨ Close the doors of the low-voltage compartments.

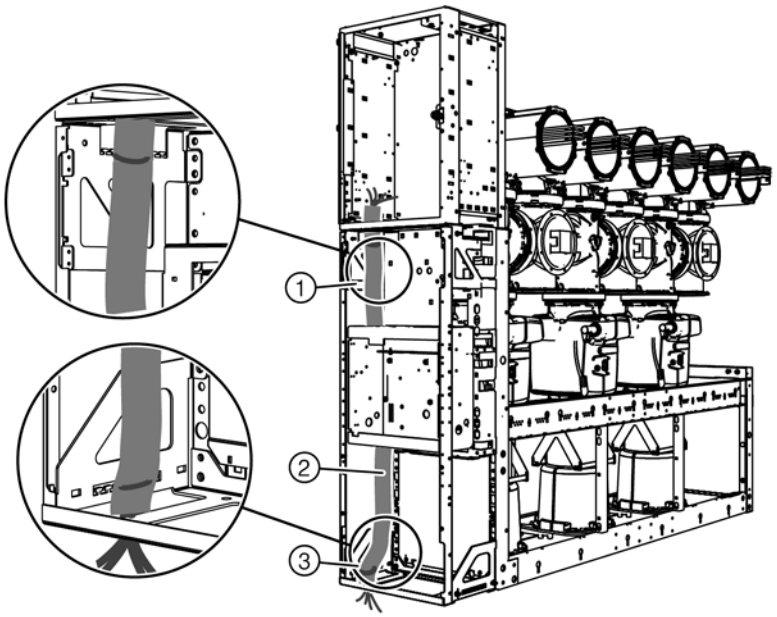


Fig. 144: Fixing of low-voltage cables

① Fixing of low-voltage cables at the upper front support

② Fixing of low-voltage cables at the lower front support

③ Low-voltage cables

Connecting the STG plug with the VBSTB4 modular terminal

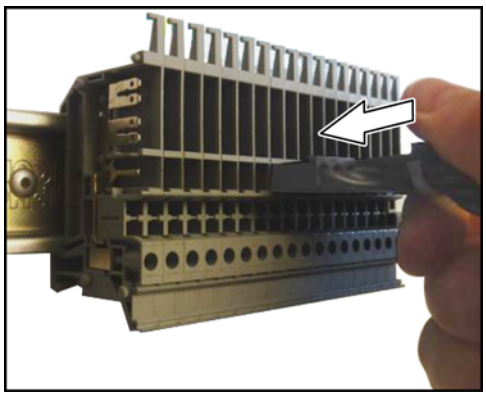
For 2-, 4- and 10-pole STG plugs make PHOENIX CONTACT, observe the instructions for installation and removal described hereafter.

	NOTE
	The information stated herein refer to the user instructions of PHOENIX CONTACT. The user is obliged to inform himself about the latest state of the instructions for installation or removal of the STG plugs, and to observe the manufacturer's instructions. ⇨ Manufacturer's site: https://www.phoenixcontact.com

Mounting the STG plug

⇨ Hold the STG plug horizontally over the plug shaft of the VBSTB4 modular terminal.

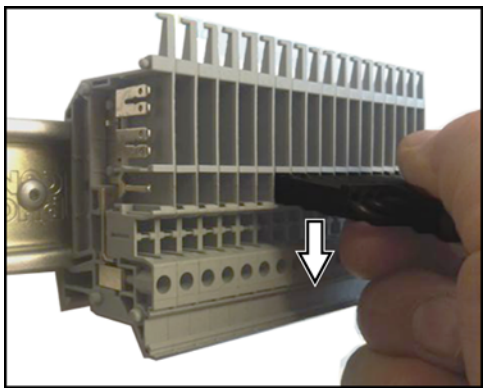
⇨ Push the STG plug horizontally into the modular terminal until the STG plug latches in.



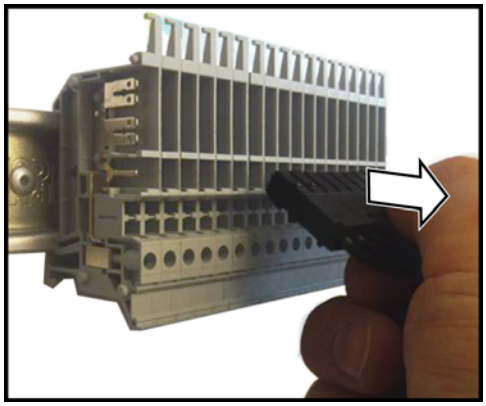
✔ The STG plug is latched into the modular terminal and mounted.

Removing the STG plug

⇨ Push the STG plug slightly to the screwing side until the latching noses come out of the latching slots of the modular terminal.



⇨ Pull the STG plug horizontally out of the VBSTB4 modular terminal.

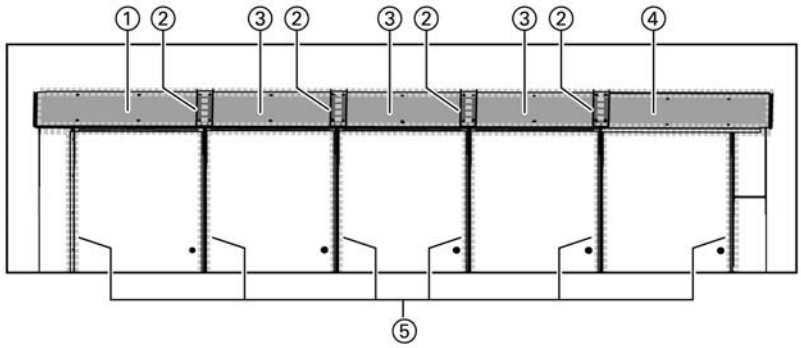


✔ The STG plug is removed.

30.3 Mounting the metal covers

⇨ Screw all metal covers to the frames again.

31 Installation of degree of protection version IP31D



① Protection plate for left end panel
② Sealing strip for intermediate panels
③ Protection plate for intermediate panels
④ Protection plate for right end panel
⑤ Sealing tape between the individual panels, and between roof plate and protection plate

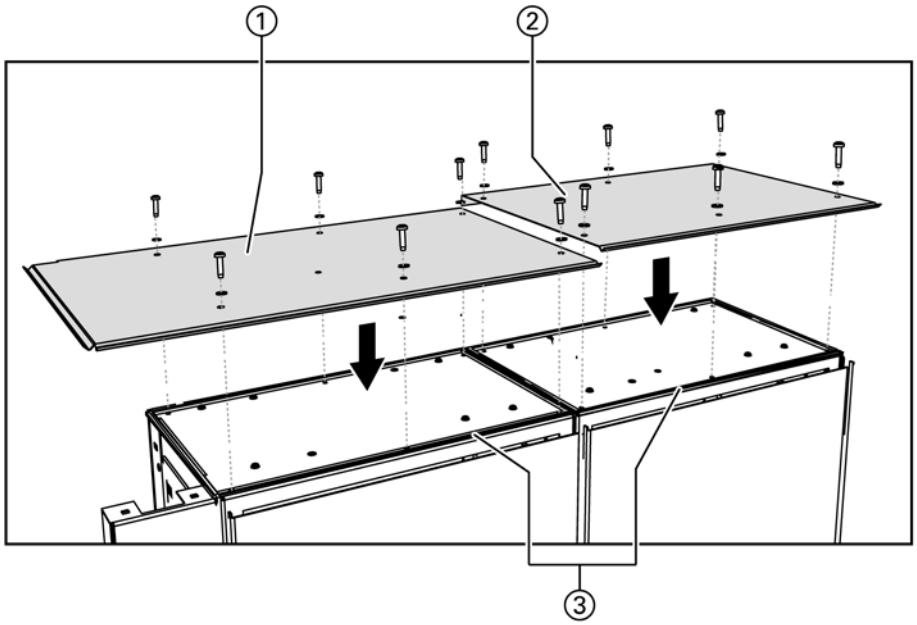
Fig. 145: Overview: Degree of protection version IP31 for panels

31.1 IP31D - protection against vertically falling water drops

Mounting protection plates (if not pre-assembled at the factory)

⇨ On the roof plates of the panels, the sealing tape was pre-assembled at the factory.

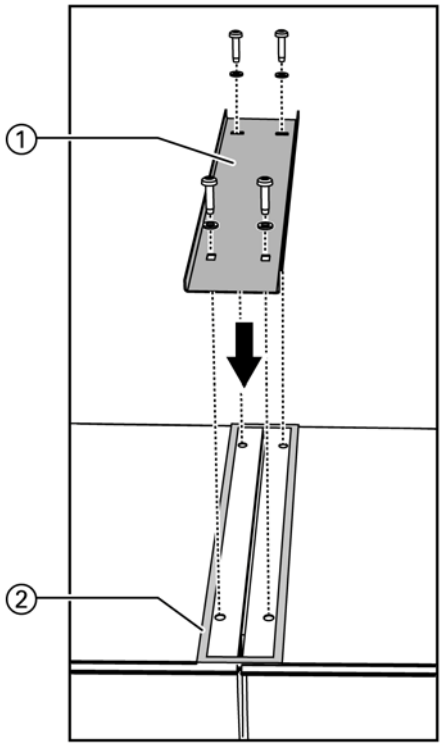
⇨ Mount protection plates for intermediate and end panels. To do this, use bolts M6 x 25.



① Protection plate for left end panels (6 bolts M6 x 25)
② Protection plate for intermediate panels (6 bolts M6 x 25)
③ Sealing tape

Fig. 146: Example: Fastening protection plate for end panel and intermediate panel

⇨ Protect the junction edges of panels with additional sealing strips .
Attach a sealing tape under the sealing strip.



① Sealing strip (4 bolts M6 x 25)
② Sealing tape

Fig. 147: Example: Fastening the sealing strip
on the junction edge between two panels

32 Installation of rear walls of switchgear

⇨ Fasten the fixing cross members at the retainers and the busbar housings using 2 bolts M8 x 30 each. Tightening torque: 20 Nm.

	**ATTENTION**
	If higher busbar housings with disconnectable feeders to the top are mounted on intermediate and end panels: ⇨ Turn the fixing cross member for installation by 180°.

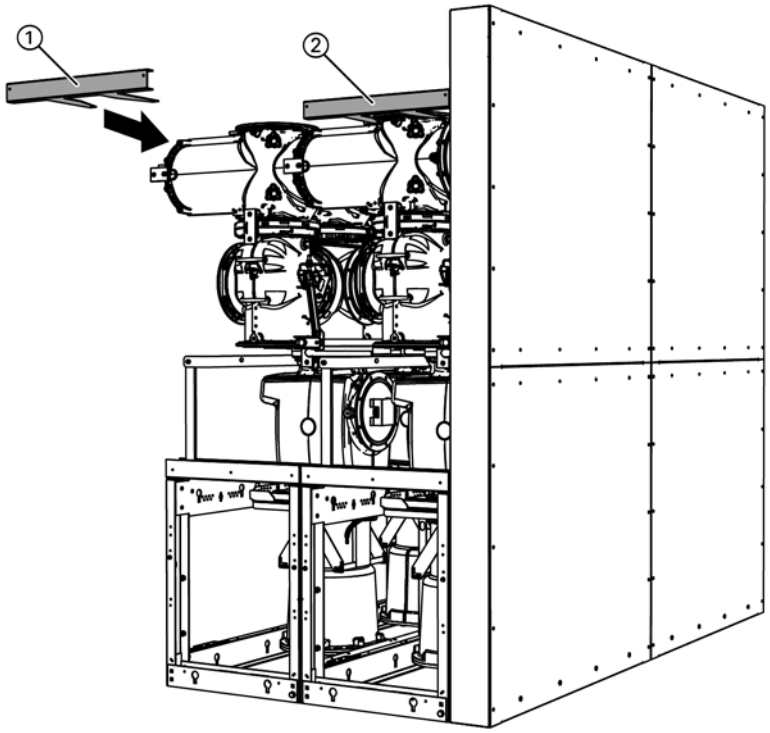


Fig. 148: Mounting fixing cross members on busbar housings

① Fixing cross members for right and left end panels

② The fixing cross member for intermediate panels is identical with the fixing cross member for end panels. However, the fixing cross member is turned by 180° if a higher busbar housing with a disconnectable feeder to the top was mounted.

⇨ Mount the retainers for the rear walls. To do this, use 24 bolts M6 x 12. Tightening torque: 12 Nm.

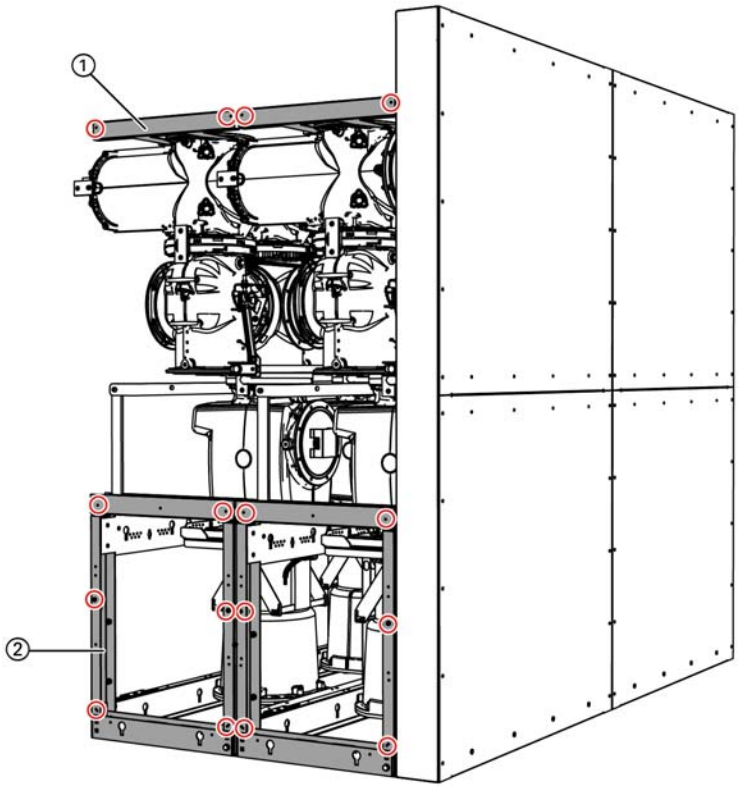


Fig. 149: Bolting points for the retainers

① Fixing cross members

② Subframe

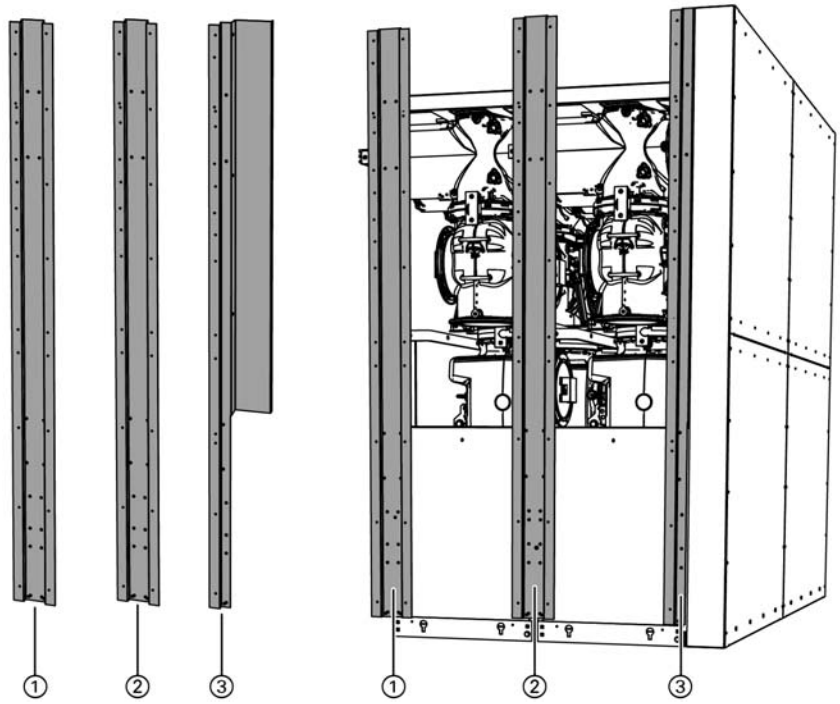


Fig. 150: Retainers for the rear walls

①, ② Retainer for intermediate panels

③ Retainer for left end panels (retainer for right end panels is not shown here)

⇨ Bolt the lower rear walls together with the retainers. Use 8 bolts M6 x 12 for each rear wall. Tightening torque: 12 Nm.

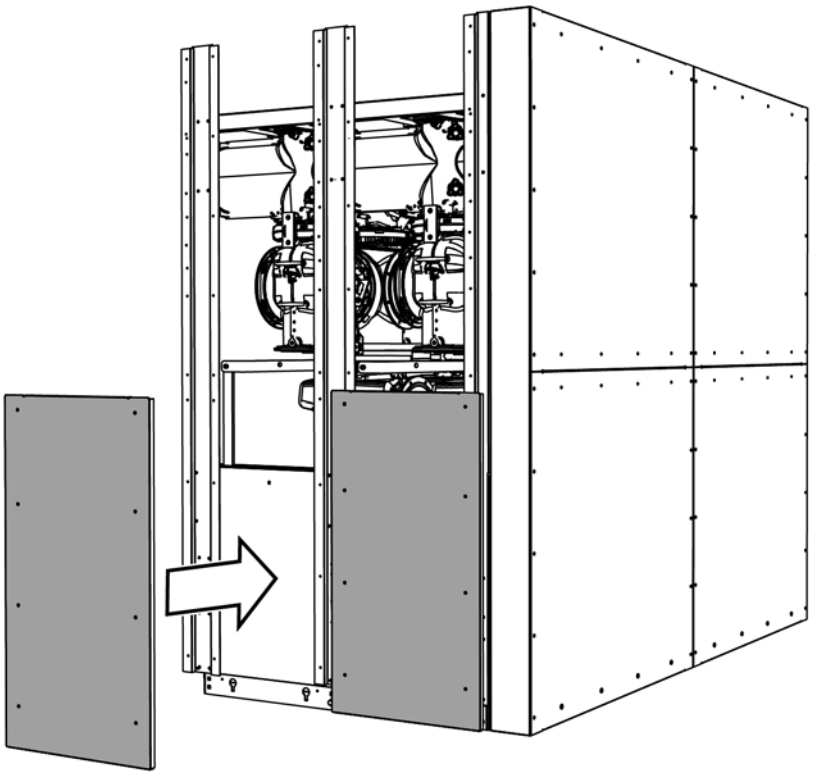


Fig. 151: Mounting lower rear walls

⇨ Bolt the upper rear walls together with the retainers.
Use 10 bolts M6 x 12 for each rear wall. Tightening torque: 12 Nm.

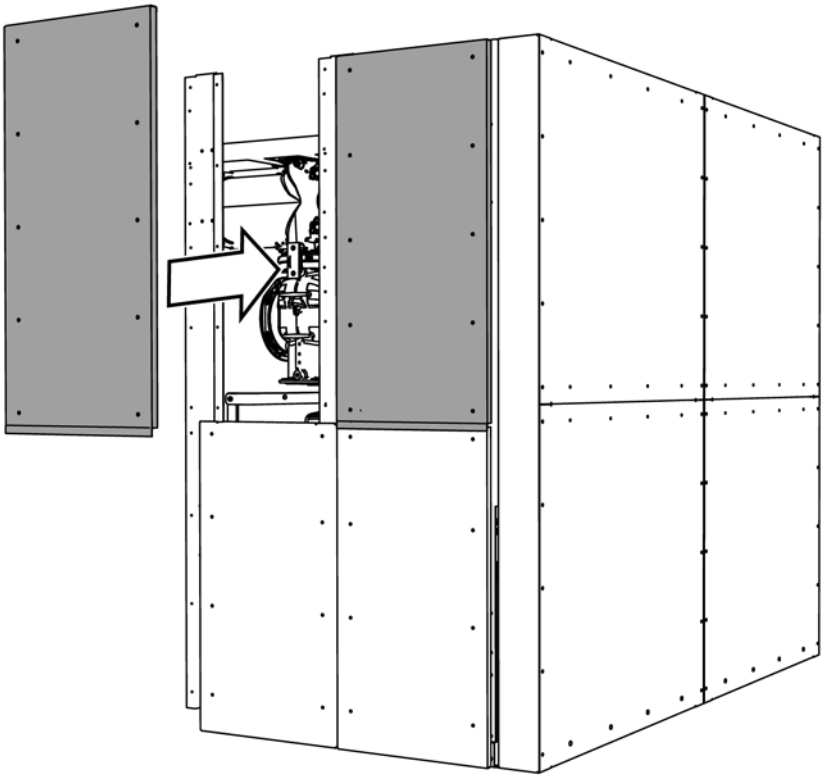


Fig. 152: Mounting upper rear walls

33 Installation of end walls

As-delivered condition of panel:

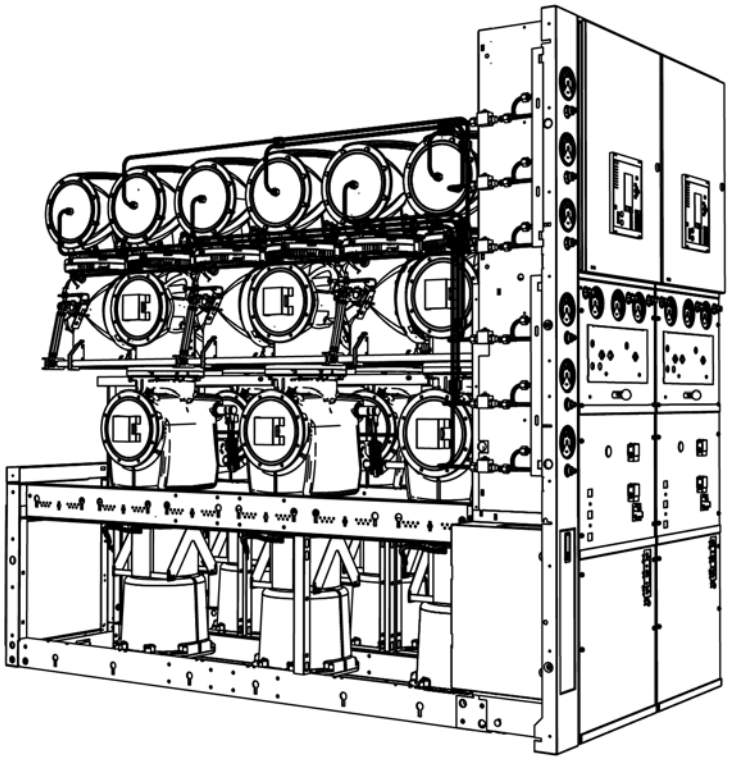


Fig. 153: As-delivered condition

⇨ Tighten rear end cover.

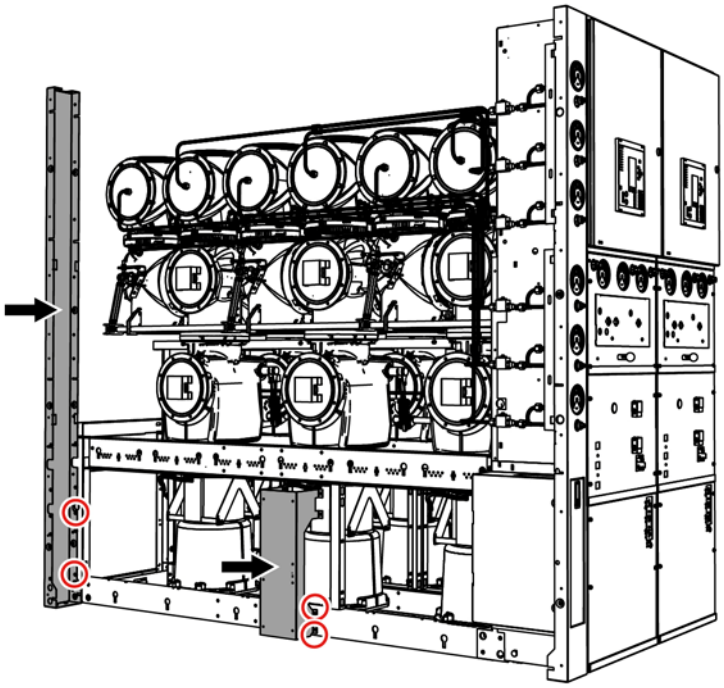


Fig. 154: Fixing points of rear end cover

⇨ Hang in the lower arc-resistant protection walls, and fix loosely using bolts.

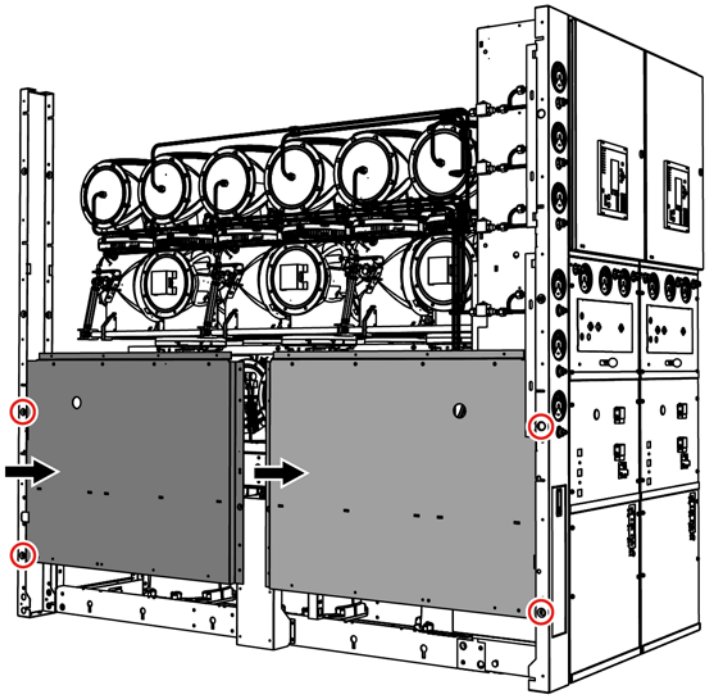


Fig. 155: Fixing points for lower arc-resistant protection walls, at the frame connection

⇨ Hang in the upper arc-resistant protection walls, and fix loosely using bolts.

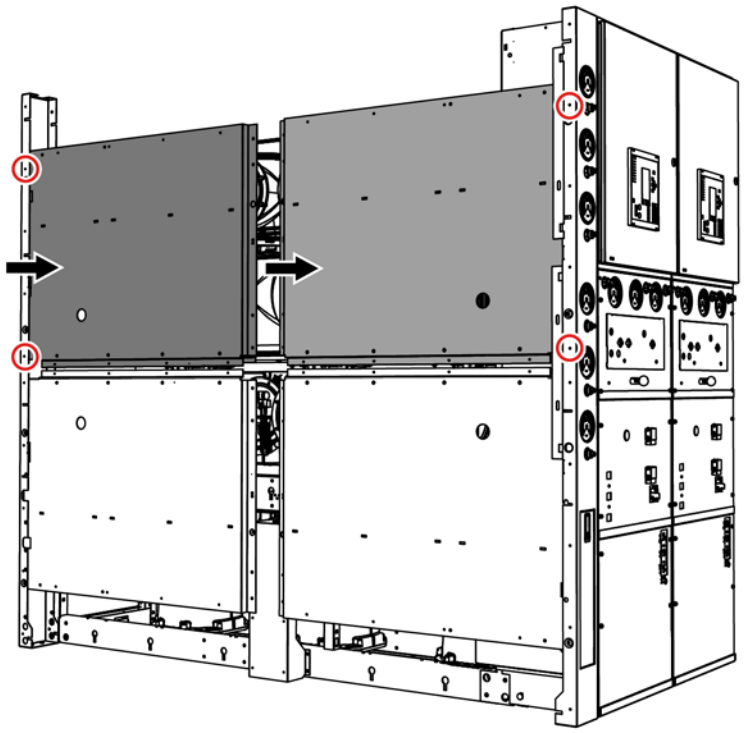


Fig. 156: Fixing points for upper arc-resistant protection walls

⇨ Slide the cross bracing between the end covers and the arc-resistant protection walls, and tighten it.

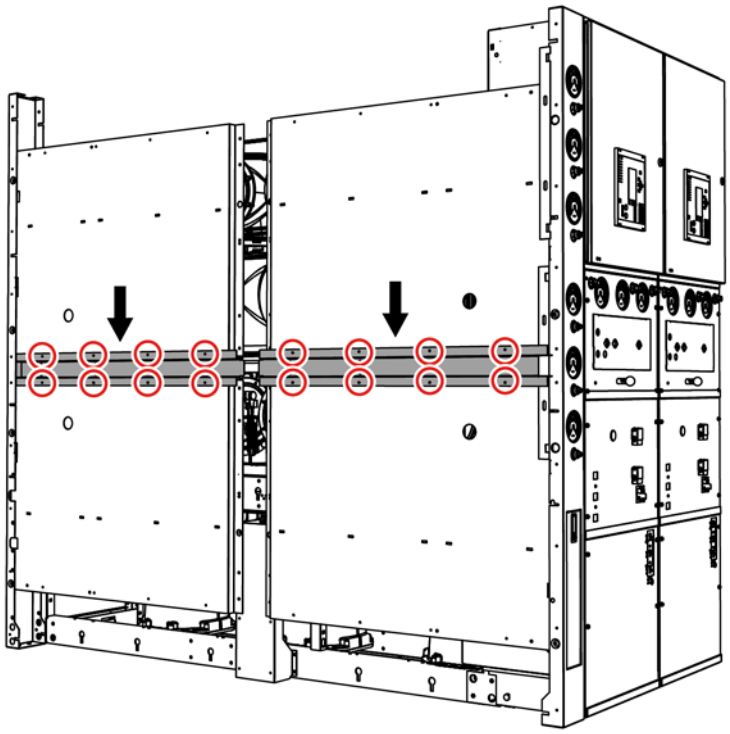


Fig. 157: Fixing points for cross bracing

⇨ Tighten the bolted joints of the upper and lower arc-resistant protection walls.

⇨ Fasten short air guide from inside and long air guide from outside.

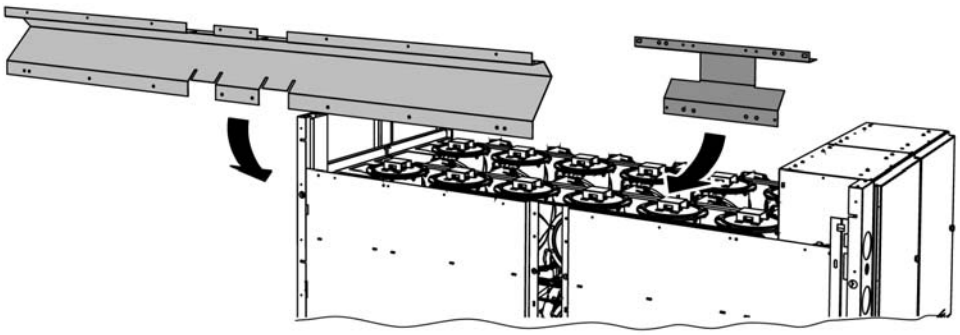


Fig. 158: Mounting direction for short air guide and long air guide

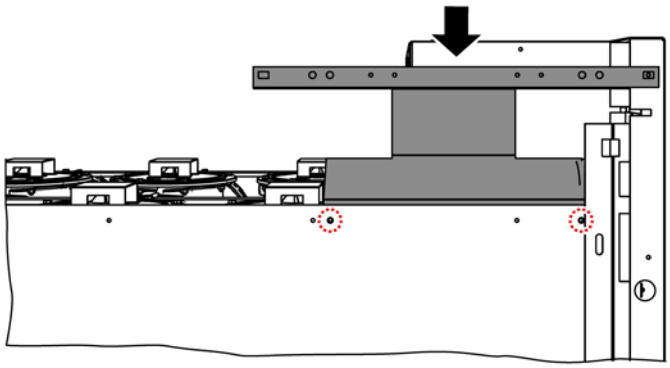


Fig. 159: Fixing points for short air guide

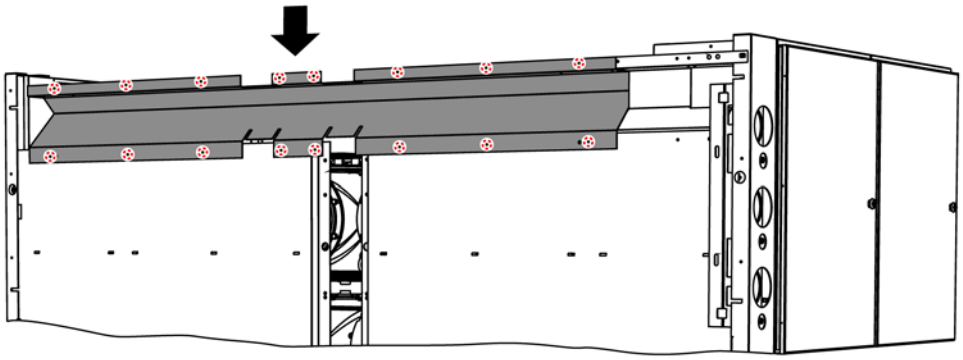


Fig. 160: Fixing points for long air guide

⇨ Mount central support.

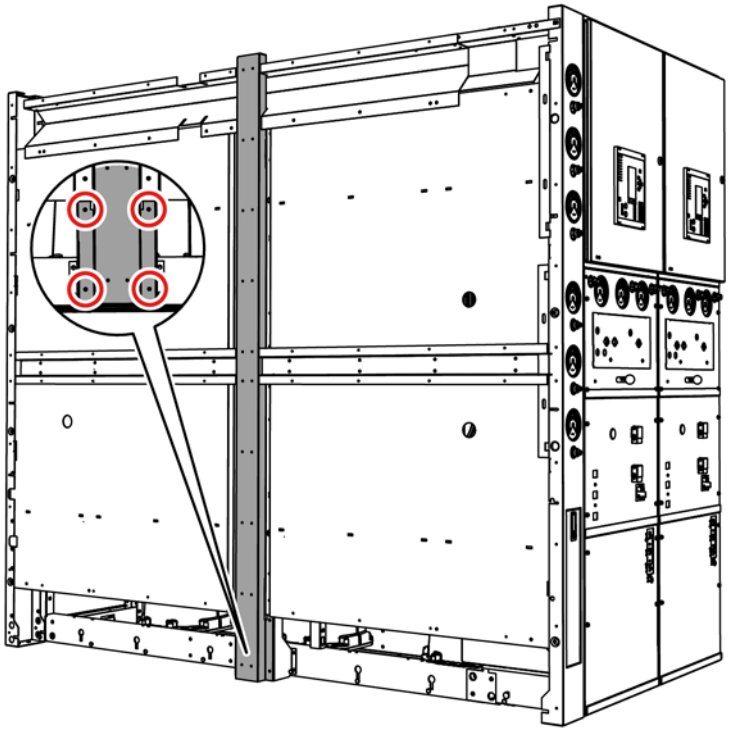


Fig. 161: Fixing points of central support

⇨ Mount lower end wall.

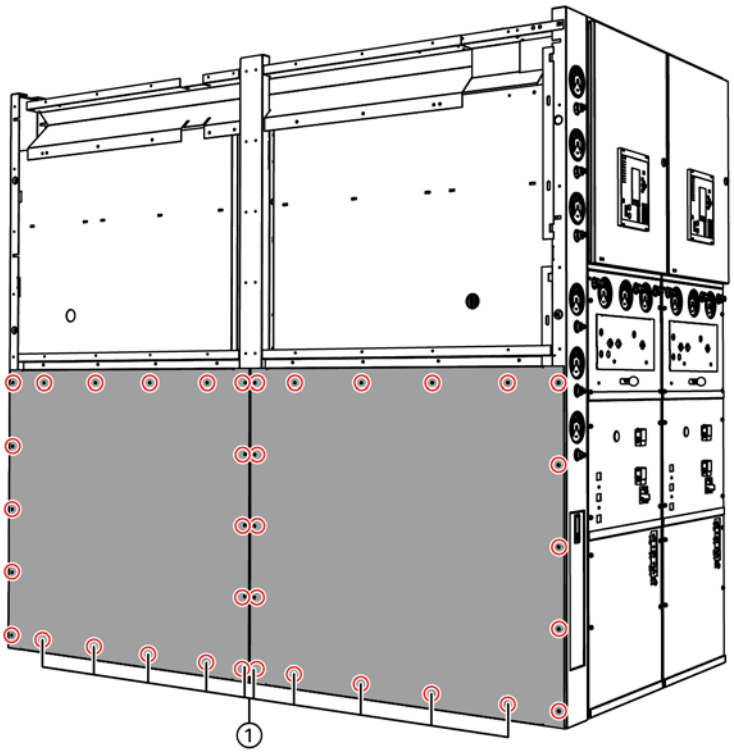


Fig. 162: Fixing points of lower end wall (close the drill holes identified with ① using stoppers)

⇨ Mount upper end wall.

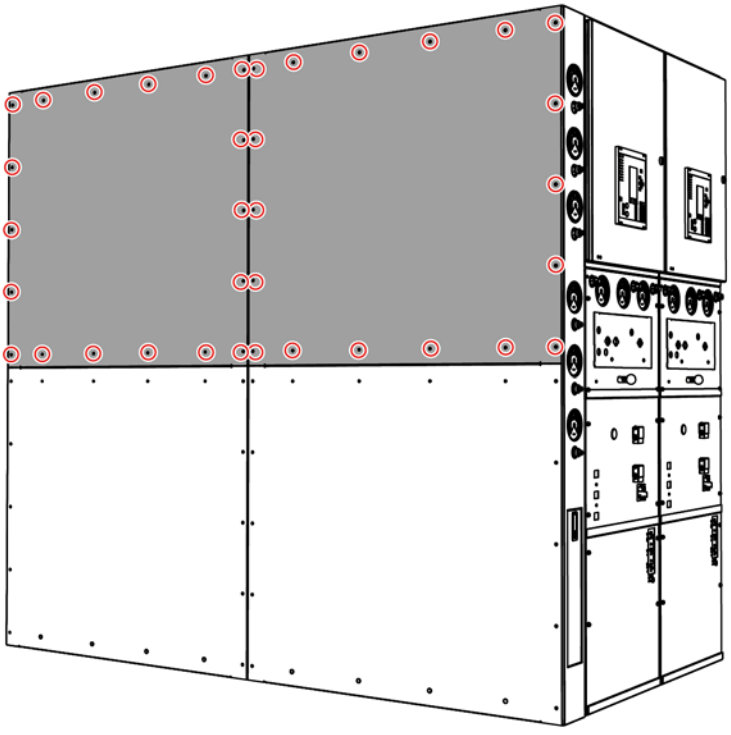


Fig. 163: Fixing points for upper end wall

34 Commissioning

34.1 Checking the installation work

⇨ Carry out a final check to make sure that all installation work has been performed according to these installation instructions (see page 50, "Installation").

34.2 Test operation

Read the operating instructions before the test operation. Test operation helps you to verify the perfect operation of the switchgear **without high voltage**.

The work described below must be performed on each panel.

	**DANGER** Operating the switchgear under high voltage for test can destroy the switchgear and cause personal injuries. ⇨ Switch off high voltage before test operation.

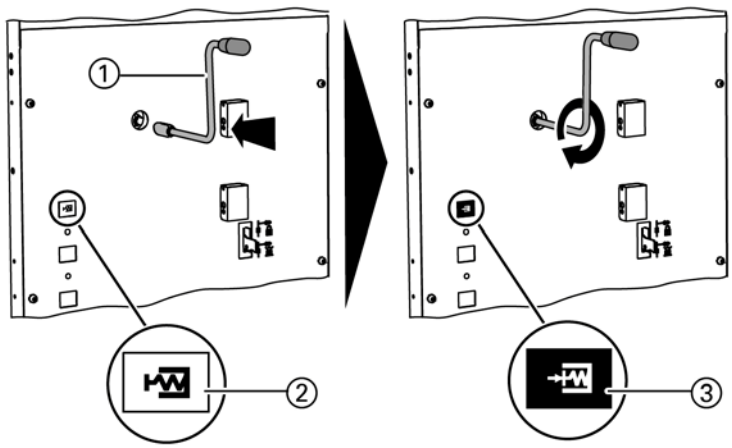
	**ATTENTION** If defective or incorrectly assembled switchgear is put into operation, this can damage or destroy parts of the switchgear. ⇨ Never put switchgear into operation if you notice during test operation that a part of it does not work as described in here.

Mechanical operation of switching devices

	**DANGER** Charging the circuit-breaker operating mechanism by hand can cause injuries due to the suddenly starting motor operating mechanism. ⇨ Charge the circuit-breaker mechanism with the supplied original hand crank with freewheel only.

⇨ All auxiliary and control voltages are switched off.

⇨ Charge the circuit-breaker operating mechanism by hand.



① Hand crank

② "Closing spring not charged" indication

③ "Closing spring charged" indication

⇨ Close and open the circuit-breaker.

⇨ Close and open the busbar earthing switch several times.

Electrical operation of switching devices

⇨ Switch on all auxiliary and control voltages. The motor must start up automatically immediately after, in order to charge the closing spring in the circuit-breaker operating mechanism.

⇨ Close and open the circuit-breaker several times. The motor charges the closing spring automatically after every closing operation.

⇨ Close and open the disconnectors and earthing switches several times.

Checking interlocks and indicators

All circuit-breakers, disconnectors and earthing switches are closed and opened, checking the interlocks and indicators at the same time.

⇨ Operate all switching devices for test to verify the perfect operation of all mechanical and electromechanical interlocks. Do not use force.

⇨ Check correct indication on position indicators at the front of the panels and in the control room.

Completing test operation

⇨ Switch the circuit-breakers, disconnectors and earthing switches to OPEN position.

Activating undervoltage release

The undervoltage releases mounted in the circuit-breaker must be activated.

The circuit-breaker operating mechanism is located in the central part of the panel behind the ON/OFF pushbuttons.

DANGER

Risk of injury by release of charged operating springs when the front plate of the operating mechanism is removed! Bruises or cuts at the hands can be the consequence.

⇨ To avoid impermissible switching operations, switch off auxiliary voltage.

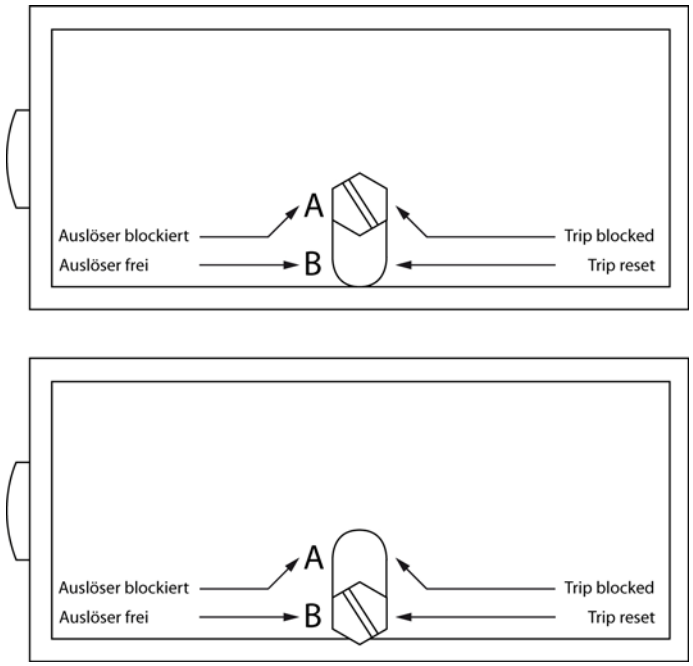
⇨ To discharge the spring energy store in the operating mechanism, perform the following operations before removing the cover:

- Trip the miniature circuit-breaker.
- Actuate the OFF pushbutton.
- Actuate the ON pushbutton.
- Actuate the OFF pushbutton.
- Disconnect the control cables from the low-voltage compartment.

⇨ The spring energy store indicator must show "spring not charged".

⇨ Remove the circuit-breaker front cover.

⇨ Shift the retaining screw of the striker from position A to position B to activate the undervoltage release.



⇨ Close the operating mechanism box and refit the cover.

✔ The circuit-breaker operating mechanism is now ready for operation with undervoltage release.

34.3 Checking the accessories

The switchgear accessories comprise:

- Operating levers
- Keys to operate the switching devices
- Single-line diagrams
- Operating instructions
- Warning signs
- Customer-specific consignments.

⇨ Make the switchgear accessories available in the switchgear room or in a neighboring room clearly and ready to hand.

⇨ Check the accessories in the service flap (option).

34.4 Correcting circuit diagrams

⇨ Note any modifications which may have been made during installation or commissioning in the supplied circuit diagrams.

⇨ After completion of the installation work, ask the regional Siemens representative for correction of the original circuit diagrams.

34.5 Instructing the operating personnel

⇨ Hand over the operating instructions to the operating personnel before commissioning.

⇨ Make the operating personnel familiar with all technical details and operation of the switchgear before switchgear acceptance.

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 48, "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 operator.

35 Control elements and indicators

Overview

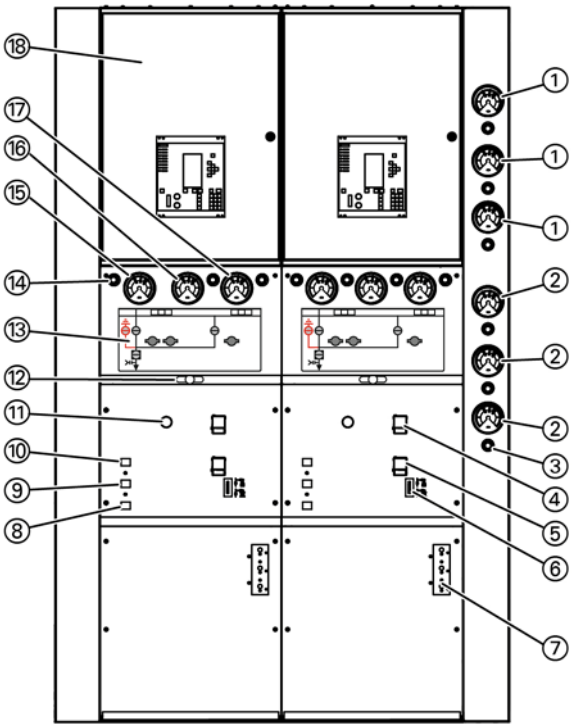


Fig. 164: Switchgear front

① Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 1
② Manometers of the SF_6 gas compartments for busbars L1, L2, L3 of busbar system 2
③ Gas filling valve
④ "ON" pushbutton (mechanical), sealable and lockable by the customer
⑤ "OFF" pushbutton (mechanical), sealable and lockable by the customer
⑥ Locking device
⑦ Sockets for voltage detecting system
⑧ Counter for operating cycles
⑨ Position indicator for circuit-breaker "CLOSED"/"OPEN"
⑩ "Closing spring charged / not charged" indicator
⑪ Opening for hand crank for charging the circuit-breaker closing spring
⑫ Selector gate for busbar system
⑬ Control and indication board for three-position disconnector operating mechanism
⑭ Gas filling valve
⑮ Manometer for three-position disconnector housing in busbar system 1
⑯ Manometer for circuit-breaker housing
⑰ Manometer for three-position disconnector housing in busbar system 2
⑱ Low-voltage compartment

Operating tools

The operating levers for the three-position disconnector functions DISCONNECTING and READY-TO-EARTH have a slot and a nose, which are arranged in such a way that the levers can only be used for their respective function. The emergency operating lever only has a slot and may exclusively be used as described (see page 159, "Emergency operation of the three-position disconnector") .

Fig. 165: Operating lever for DISCONNECTING function

Fig. 166: Operating lever for READY-TO-EARTH function (cross bar marked red)

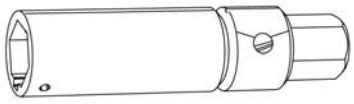


Fig. 167: Adapter for emergency operation (to be used only with motor operating mechanism)

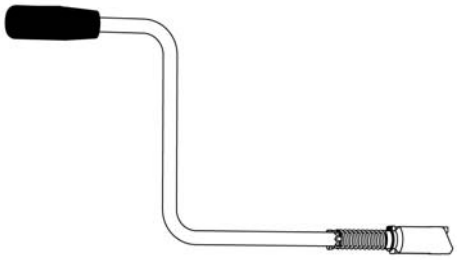


Fig. 168: Hand crank for charging the closing spring

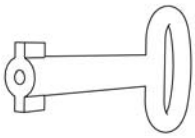
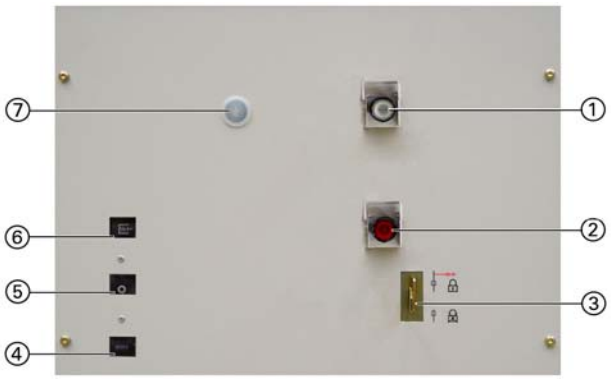


Fig. 169: Double-bit key 3 mm (door of low-voltage compartment

36 Circuit-breaker operation

	ATTENTION
	Operating the circuit-breaker locking device in the OPEN or CLOSED positions can damage the switchgear. ⇨ Operate the circuit-breaker locking device only in the EARTHED position, and padlock it.

Circuit-breaker control board



① ON pushbutton
② OFF pushbutton
③ "Feeder earthed" locking device
④ Operations counter
⑤ Position indicator for circuit-breaker
⑥ "Closing spring charged / not charged" indicator
⑦ Opening to charge the closing spring manuallly

Fig. 170: Circuit-breaker control board

36.1 Closing the circuit-breaker manually

Preconditions
- "Feeder earthed" locking device is open
- Closing spring is charged

⇨ Operate the ON pushbutton in the circuit-breaker control board.
✔ The position indicator changes to "I" position. The circuit-breaker is closed.

36.2 Opening the circuit-breaker manually

If the control voltage fails, the circuit-breaker can only be opened mechanically by hand.

	NOTE
	OFF signals ineffective ⇨ If the feeder is earthed through the three-position disconnector and the circuit-breaker, all electrical OFF signals are ineffective.

Preconditions
- "Feeder earthed" locking device is open

	DANGER
	If the "feeder earthed" locking device is padlocked, the circuit-breaker cannot be opened, neither electrically nor mechanically. ⇨ Fit the padlock only if the feeder is earthed.

⇨ Operate the OFF pushbutton in the circuit-breaker control board.
✔ The circuit-breaker is open.

36.3 Emergency release of the circuit-breaker

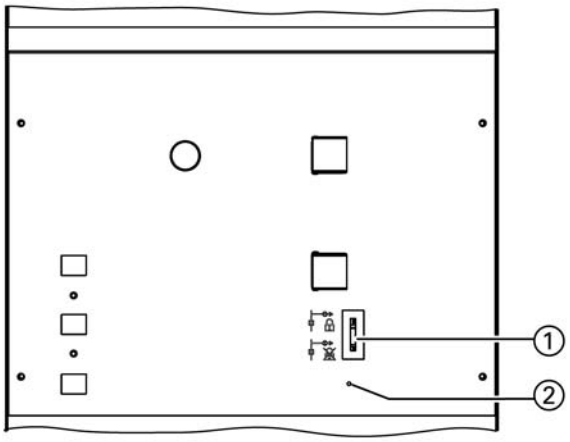
Interlocking of the "feeder earthed" function between circuit-breaker and three-position disconnector:

- Possible in all switch positions of the three-position disconnector.

Or:

- Only possible in three-position disconnector OPEN position.

	**ATTENTION**
	If the auxiliary voltage fails, the "feeder earthed" locking device is blocked. ⇨ Operate emergency release.



① "Feeder earthed" locking device
② Opening for emergency release

Fig. 171: Position of opening for emergency release at the circuit-breaker front

⇨ Insert a suitable auxiliary means (e.g. a very small screwdriver) in the release opening as far as it will go, and push softly to the left. Push the lever of the locking device upwards and remove the auxiliary means.

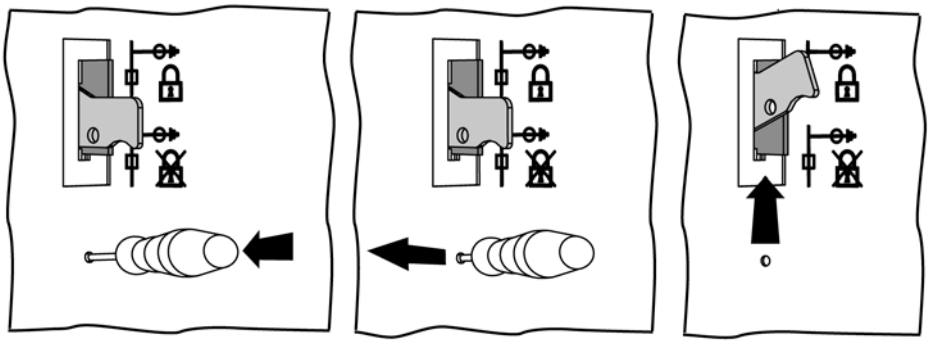


Fig. 172: Operating the emergency release

36.4 Recommendation for sealing the pushbuttons

	**ATTENTION** If you close manually, all electrical and mechanical interlocks are ineffective. ⇨ To guarantee safe operation of the interlocks: Seal/lock the pushbuttons (see table below).

Recommendation for sealing/locking

Panel types	Sealing
Incoming or outgoing feeder panels	ON pushbutton
Bus sectionalizer panels	ON pushbutton and OFF pushbutton

36.5 Test operation without auxiliary voltage

On circuit-breakers with undervoltage release 3AX1103:

	**ATTENTION** If the retaining screw of the striker is not shifted back from position A to position B after the test operation without auxiliary voltage, the undervoltage release will not function. ⇨ After the test operation without auxiliary voltage, shift the retaining screw of the striker back from position A to position B.

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

⇨ Charge the closing spring (see page 151, "Charging the closing spring manually").

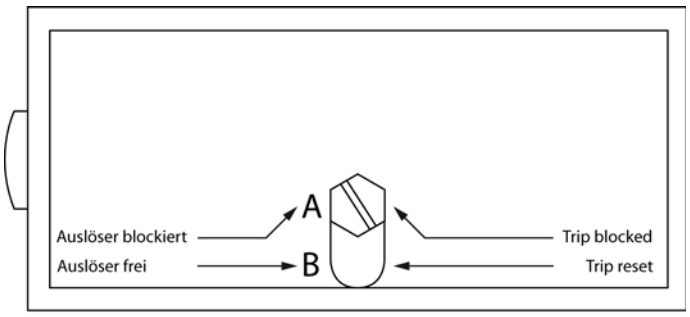
⇨ Operate the ON pushbutton in the circuit-breaker control board.

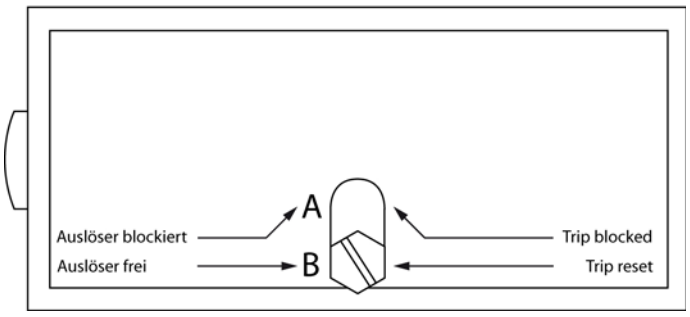
✔ The circuit-breaker is closed.

⇨ Operate the OFF pushbutton in the circuit-breaker control board.

✔ The circuit-breaker is open.

⇨ Shift the retaining screw of the striker from position A to B to activate the undervoltage release.



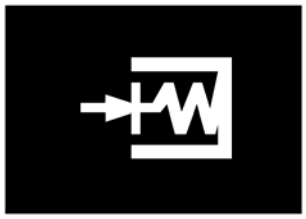


36.6 Test operation with auxiliary voltage (motor operating mechanism)

⇨ Switch on the supply voltage.

✔ The motor operating mechanism starts up and charges the closing spring.

⇨ Check whether the "closing spring charged" indication appears.



⇨ Operate the ON pushbutton in the circuit-breaker control board.

✔ The closing spring is charged by the motor.

⇨ Check whether the position indication "circuit-breaker CLOSED" appears.

⇨ Operate the OFF pushbutton in the circuit-breaker control board.

⇨ Check whether the position indication "circuit-breaker OPEN" appears.

36.7 Charging the closing spring manually

The closing spring is charged by the motor after applying control voltage. The energy required for the operating sequence OPEN-CLOSED-OPEN (auto-reclosing) is stored in the closing spring about 15 seconds after closing the circuit-breaker.

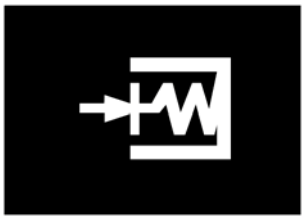


Fig. 173: "Closing spring charged" indication

Fig. 174: "Closing spring not charged" indication

The hand crank is required to charge the closing spring manually if the control voltage fails.

DANGER

Risk of injury by sudden rotation of hand crank. If you use a hand crank **without a freewheel** to charge the spring, the hand crank will rotate when the control voltage is switched on again (motor starts up) and can lead to injury.

⇨ Use special hand crank **with freewheel** from the accessories.

⇨ Remove cover from cutout.

⇨ Insert hand crank.

⇨ Turn hand crank clockwise approx. 30 turns until the indication "closing spring charged" appears.

⇨ Remove hand crank.

⇨ Close cutout with cover.

37 Operating the three-position disconnector

The procedures described in this section apply to:

- Disconnectable voltage transformers or disconnectable busbar connections
- Top-mounted bus sectionalizer
- Switching operations on circuit-breaker panels
- Switching operations on bus sectionalizer panels
- Switching operations on bus coupler panels

37.1 Control elements and indicators

Control board on the switchgear front

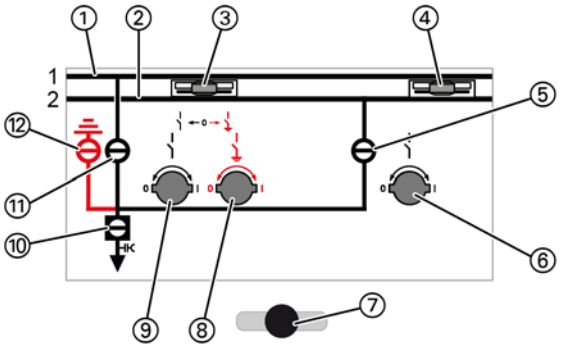


Fig. 175: Control board on the switchgear front

① Busbar system 1
② Busbar system 2
③ Control gate (three-position disconnector in busbar system 1)
④ Control gate (disconnector in busbar system 2)
⑤ Position indicator for disconnector in busbar system 2 (DISCONNECTING function)
⑥ Actuating opening for disconnector in busbar system 2 (DISCONNECTING function)
⑦ Selector gate for busbar system
⑧ Actuating opening for three-position disconnector in busbar system 1 (READY-TO-EARTH function)
⑨ Actuating opening for three-position disconnector in busbar system 1 (DISCONNECTING function)
⑩ Position indicator for circuit-breaker
⑪ Position indicator for three-position disconnector in busbar system 1 (DISCONNECTING function)
⑫ Position indicator for three-position disconnector in busbar system 1 (READY-TO-EARTH function)

The manual switching operations DISCONNECTING or READY-TO-EARTH must be pre-selected with the interrogation lever. The interrogation lever can only be operated if the associated switching operation is permissible.

Position indicator at the rear

The position of the three-position disconnector is indicated both at the front and at the rear of the switchgear. The rear position indicator for busbar systems 1 and 2 is located at the side of the disconnector housing.

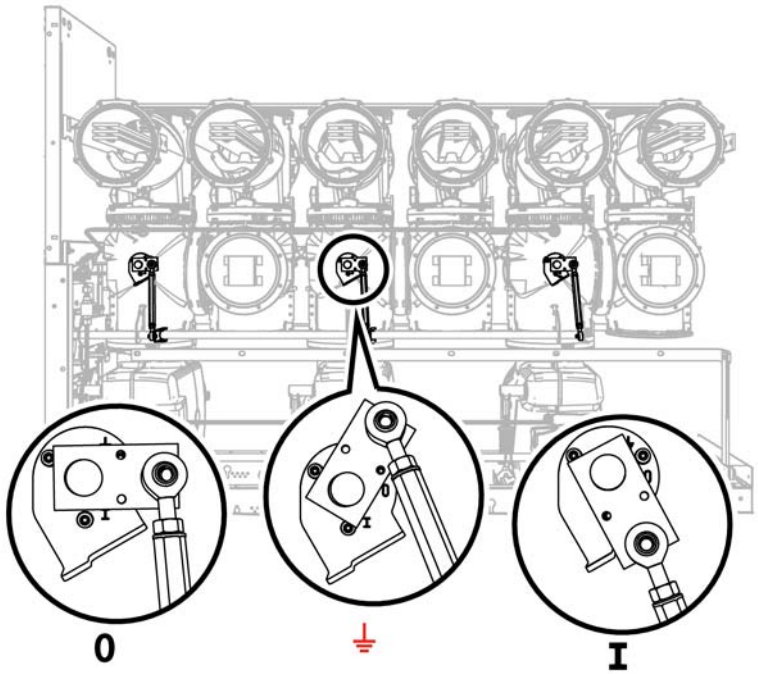


Fig. 176: Rear position indicator at the disconnector housing for busbar system 1

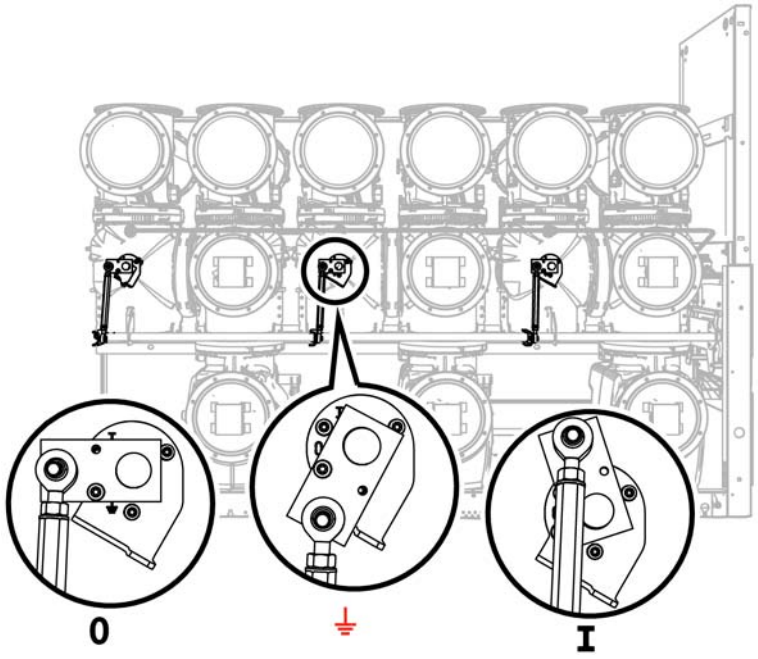


Fig. 177: Rear position indicator at the disconnector housing for busbar system 2

37.2 Closing the three-position disconnector manually

	**ATTENTION** In circuit-breaker panels, a mechanical interlock prevents the three-position disconnector from being operated when the circuit-breaker is closed. ⇨ Open the circuit-breaker (see page 148, "Opening the circuit-breaker manually").

	**ATTENTION** In disconnector panels without electromechanical/mechanical interlock, maloperation of the three-position disconnector is possible. Here, the three-position disconnector can be operated under load. Operating under load will destroy the three-position disconnector! ⇨ Do not operate the three-position disconnector under load.

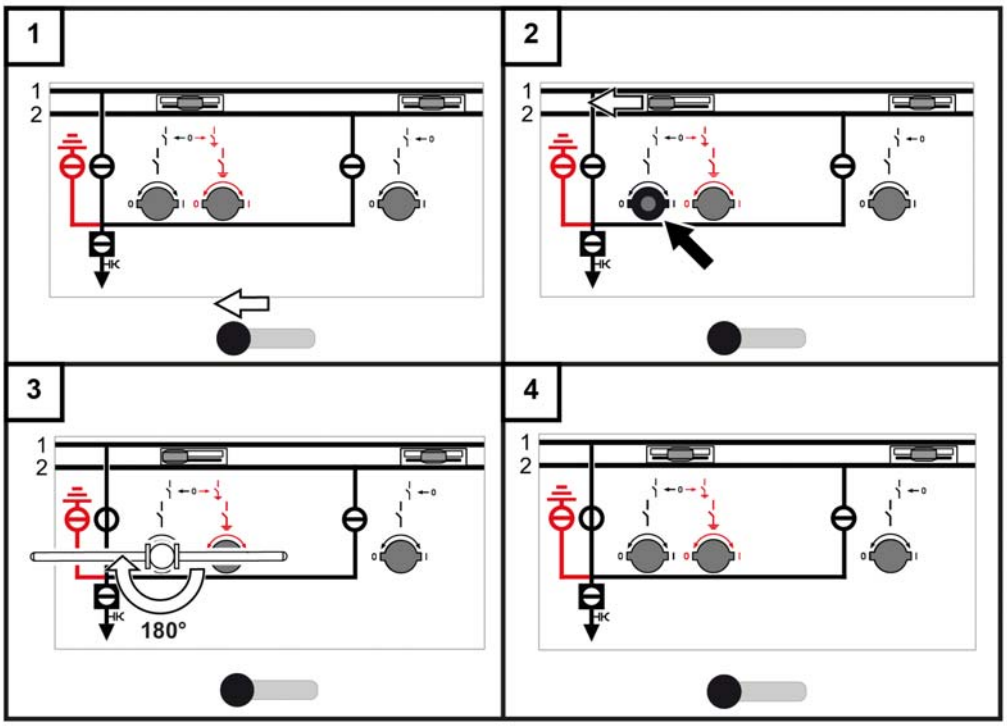


Fig. 178: Closing the three-position disconnector

⇨ Pre-select busbar system for switching operation.
Selector gate to the left: Busbar system 1. Selector gate to the right: Busbar system 2.

⇨ Push the left-hand control gate to the left.

✔ The opening for the DISCONNECTING function is free.

⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° **clockwise**).

✔ The three-position disconnector is closed.

✔ The position indicator changes to CLOSED position.

⇨ Remove the operating lever for the DISCONNECTING function.

✔ The left-hand control gate returns to its initial position.

✔ The opening for the DISCONNECTING function is closed.

37.3 Opening the three-position disconnector manually

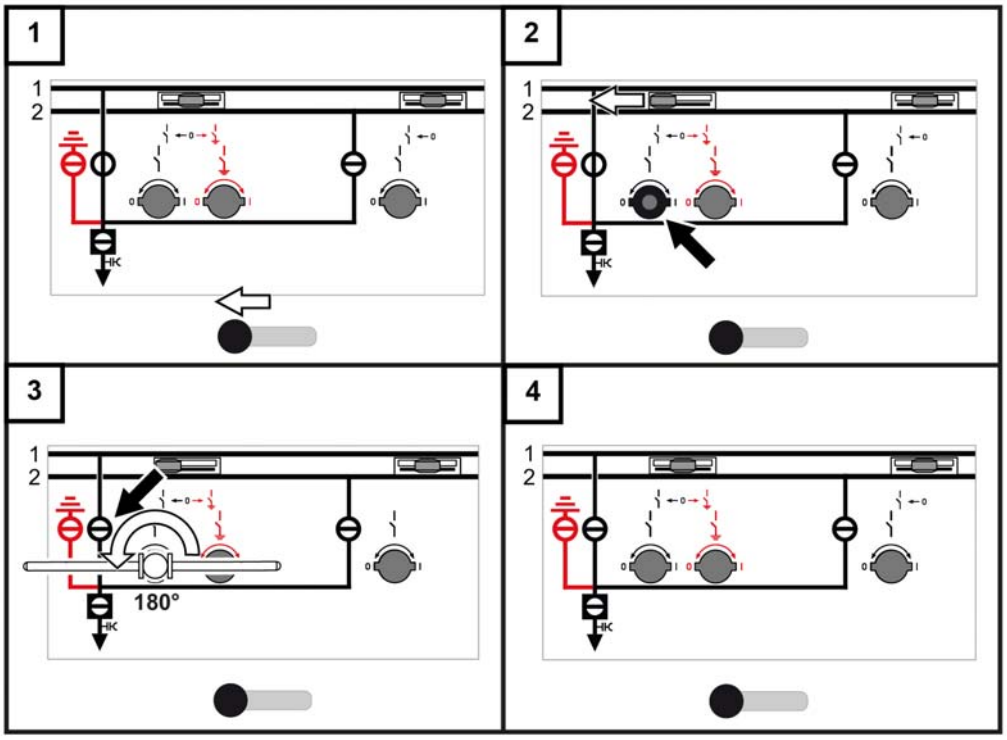


Fig. 179: Opening the three-position disconnector

⇨ Pre-select busbar system for switching operation.
Selector gate to the left: Busbar system 1. Selector gate to the right: Busbar system 2.

⇨ Push the left-hand control gate to the left.

✔ The opening for the DISCONNECTING function is free.

⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° **counter-clockwise**).

✔ The three-position disconnector is open.

✔ The position indicator changes to OPEN position.

⇨ Remove the operating lever for the DISCONNECTING function.

✔ The left-hand control gate returns to its initial position.

✔ The opening for the DISCONNECTING function is closed.

37.4 Activating the ready-to-earth function manually

	**ATTENTION**
	In circuit-breaker panels, a mechanical interlock prevents the three-position disconnector from being operated when the circuit-breaker is closed. ⇨ Open the circuit-breaker (see page 148, "Opening the circuit-breaker manually").

	**ATTENTION**
	In disconnector panels without electromechanical/mechanical interlock, maloperation of the three-position disconnector is possible. Here, the three-position disconnector can be operated under load. Operating under load will destroy the three-position disconnector! ⇨ Do not operate the three-position disconnector under load.

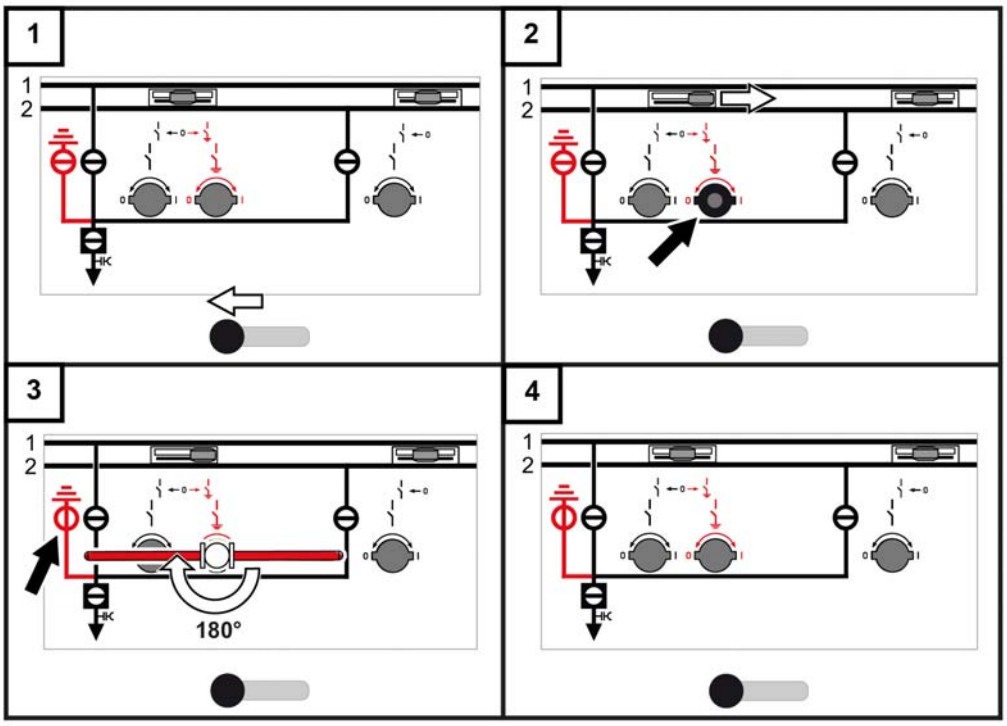


Fig. 180: Operating the three-position disconnector for the READY-TO-EARTH function

⇨ Pre-select busbar system for switching operation.
Selector gate to the left: Busbar system 1. Selector gate to the right: Busbar system 2 .

⇨ Push the left-hand control gate to the right.

✔ The opening for the READY-TO-EARTH function is free.

⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° **clockwise**).

✔ The earthing switch is closed.

✔ The position indicator changes to READY-TO-EARTH position.

⇨ Remove the operating lever for the READY-TO-EARTH function.

✔ The left-hand control gate returns to its initial position.

✔ The opening for the READY-TO-EARTH function is closed.

	**DANGER** Danger! High voltage! The earthing process is **not** completed until the circuit-breaker is closed. ⇨ Close the circuit-breaker after having switched the three-position disconnector to READY-TO-EARTH position.

⇨ Close the circuit-breaker (see page 148, "Circuit-breaker operation").

37.5 Deactivating the ready-to-earth function manually

⇨ Open the circuit-breaker (see page 148, "Opening the circuit-breaker manually").

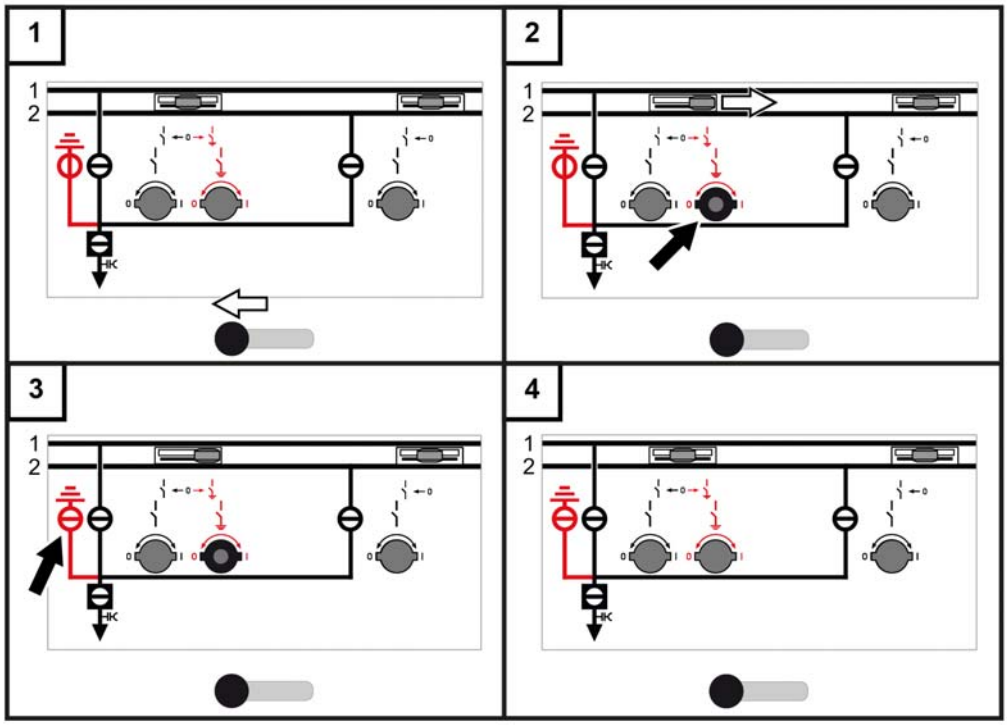


Fig. 181: Deactivating the READY-TO-EARTH function of the three-position disconnector

⇨ Preselect busbar system for switching operation.
Selector gate to the left: Busbar system 1. Selector gate to the right: Busbar system 2.

⇨ Push the left-hand control gate to the right.

✔ The opening for the READY-TO-EARTH function is free.

⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° **counter-clockwise**).

✔ The earthing switch is open.

✔ The position indicator changes to OPEN position.

⇨ Remove the operating lever for the READY-TO-EARTH function.

✔ The left-hand control gate returns to its initial position.

✔ The opening for the READY-TO-EARTH function is closed.

37.6 Three-position disconnector with auxiliary voltage (motor operating mechanism)

Three-position disconnectors with motor operating mechanism can also be controlled from remote according to their design.

37.7 Emergency release of the interlock with solenoids at the three-position disconnector

If the switchgear is equipped with a solenoid interlocking, the control gate is blocked if there is no auxiliary voltage available. In case of emergency, this interlock can be bypassed as follows:

	**DANGER** If the interlocking provided by the control gate is eliminated, switching operations are possible that can cause an arc fault which will endanger the life of the people present and damage the switchgear. ⇨ Do only eliminate the interlocking of the control gate to push the control gate to the center position. ⇨ Do not perform switching operations. ⇨ Use a screwdriver that fits the hole diameter of the solenoid openings.

To push the control gate from center position to right position:

⇨ Remove the left-hand plastic split rivet.

⇨ Insert the screwdriver through the left-hand opening and push the solenoid back.

⇨ Push the control gate to the right.

✔ The left-hand solenoid is released again, blocking further movements.

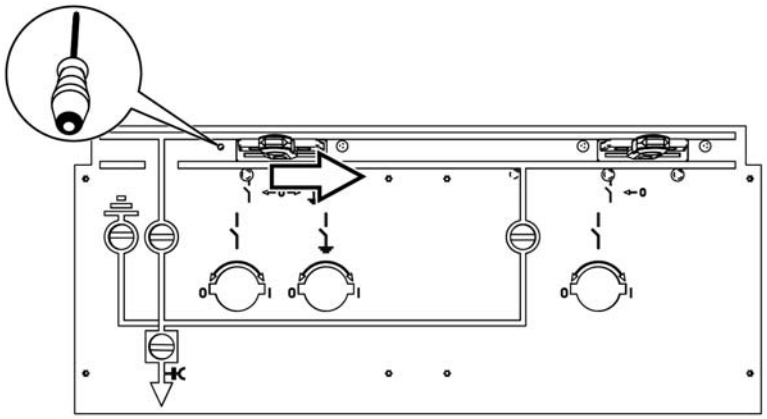


Fig. 182: Pushing the control gate to the right position

To push the control gate from center position to left position:

⇨ Remove the right-hand dummy plug.

⇨ Insert the screwdriver through the right-hand opening and push the solenoid back.

⇨ Push the control gate to the left.

✔ The right-hand solenoid is released again, blocking further movements.

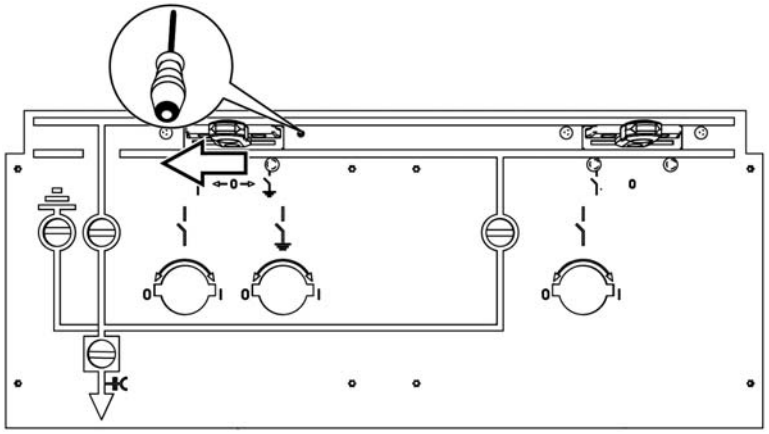


Fig. 183: Pushing the control gate to the left position

To push the control gate from the right or left position to the center position again:

⇨ Remove the plug (according to the position of the control gate) and push the solenoid back with the screwdriver.

⇨ Push the control gate to the center position.

⇨ After work completion, pull the screwdriver out and refit the stopper.

✔ The solenoid is released again, blocking further movements.

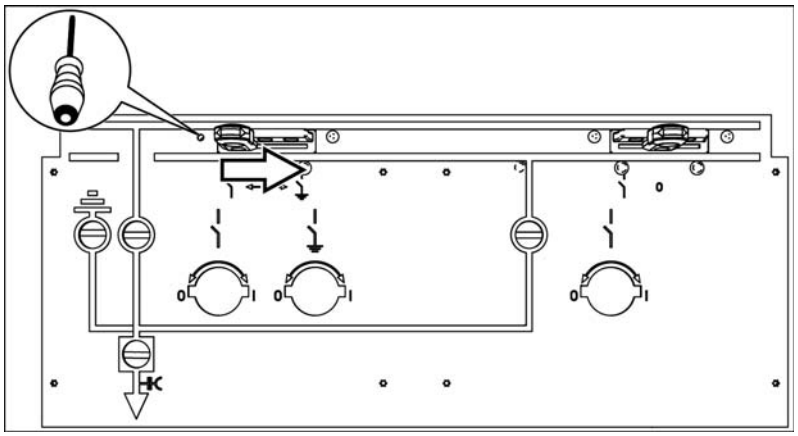


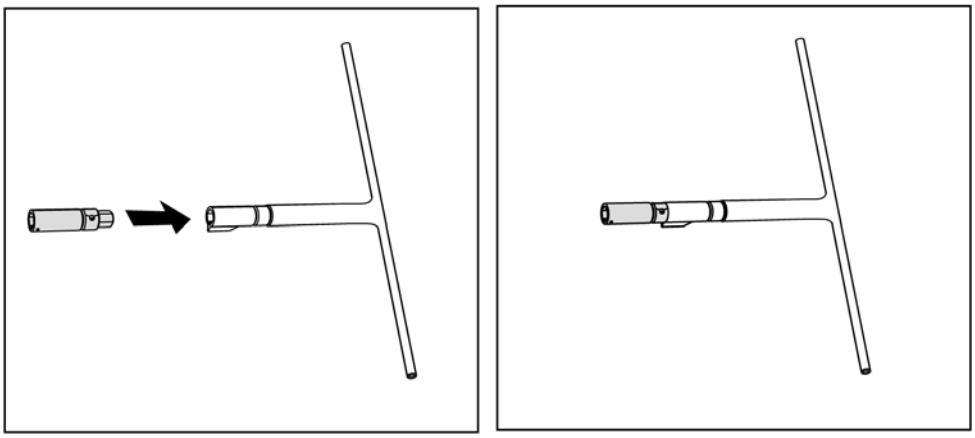
Fig. 184: Pushing the control gate to the center position

37.8 Emergency operation of the three-position disconnector

If the motor voltage of the three-position disconnector with motor operating mechanism fails and the three-position disconnector is in no defined end position, the three-position disconnector must be operated manually.

Adapter for emergency operation

⇨ Push emergency operation adapter on operating lever for three-position disconnector.



	**ATTENTION**
	If the operating lever with pushed-on adapter is incorrectly used, the indicator or even the operating mechanism of the three-position disconnector can be damaged. ⇨ The operating lever with pushed-on adapter is not aligned according to the noses of the standard operating lever, but according to the adapter slots.

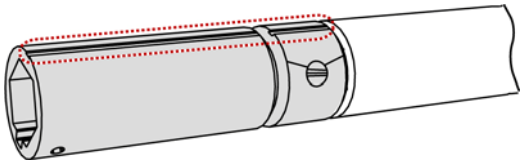


Fig. 185: Marking (long slot) on operating lever with pushed-on adapter

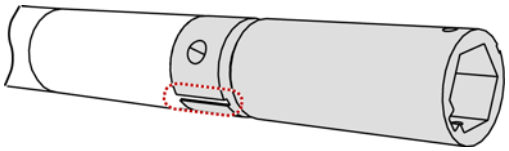


Fig. 186: Marking (short slot) on operating lever with pushed-on adapter

The noses of the operating lever are not significant for evaluating the position of the operating mechanism.

End positions of the three-position switch while switching with the operating lever with pushed-on adapter

	**ATTENTION**
	The operating lever does not have a stop. Switching beyond the end position of the three-position switch with the operating lever with pushed-on adapter will damage the three-position switch. ⇨ Do always observe the markings on the adapter of the operating lever.

Insert the operating lever with pushed-on adapter in such a way that the inner slot of the adapter fits on the pin of the operating shaft.

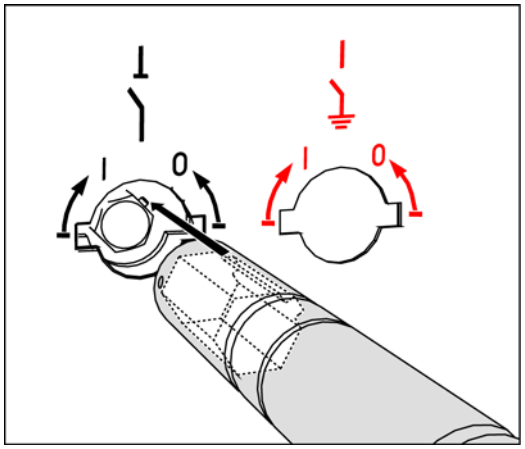
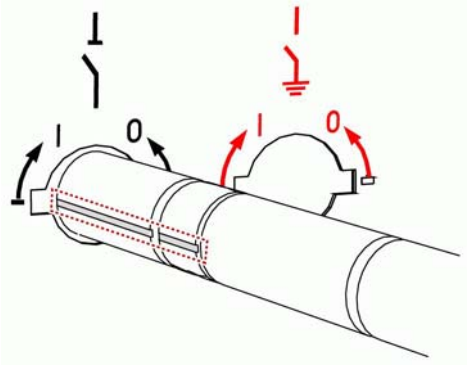
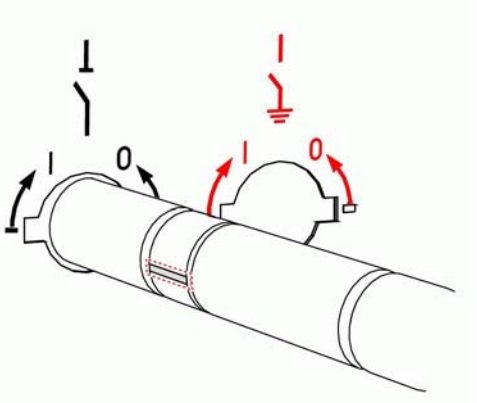
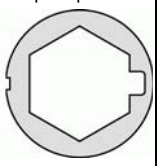
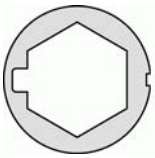
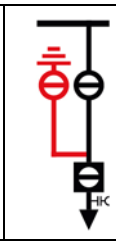
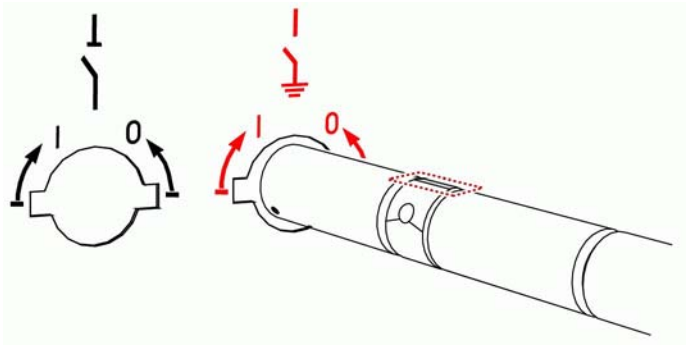


Fig. 187: Inserting the operating lever with pushed-on adapter

End positions of DISCONNECTOR

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>Adapter position   Position of long slot: left
Position of short slot: right</td>
<td>Adapter position   Position of long slot: right
Position of short slot: left</td>
</tr>
<tr>
<td>The disconnector is in CLOSED position.</td>
<td>The disconnector is in OPEN position.</td>
</tr>
</table>

End positions of EARTHING SWITCH

<table>
<tr>
<td> 
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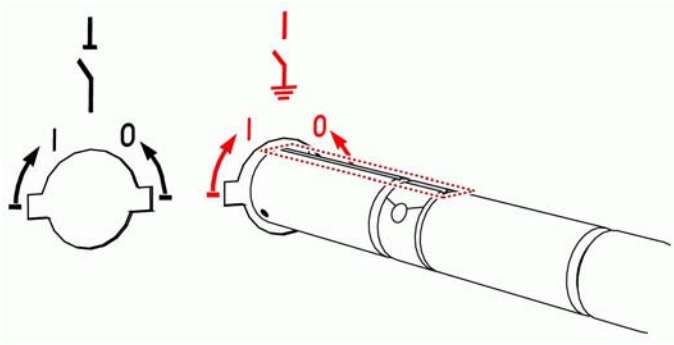
<td> 
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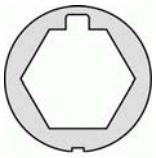
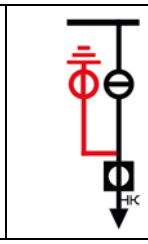
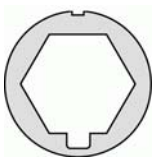
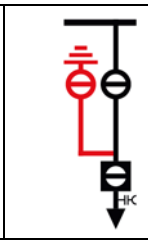
<td>Adapter position   Position of long slot: bottom
Position of short slot: top</td>
<td>Adapter position   Position of long slot: top
Position of short slot: bottom</td>
</tr>
<tr>
<td>The earthing switch is in CLOSED position.</td>
<td>The earthing switch is in OPEN position.</td>
</tr>
</table>

Emergency operation of the DISCONNECTING function

If the switch does not reach its end position, e.g., due to a failure of the auxiliary voltage during disconnector operation, push the operating lever with pushed-on adapter onto the hexagonal shaft for the DISCONNECTING function in such a way that the pin of the hexagonal shaft fits in the inner slot of the operating adapter.

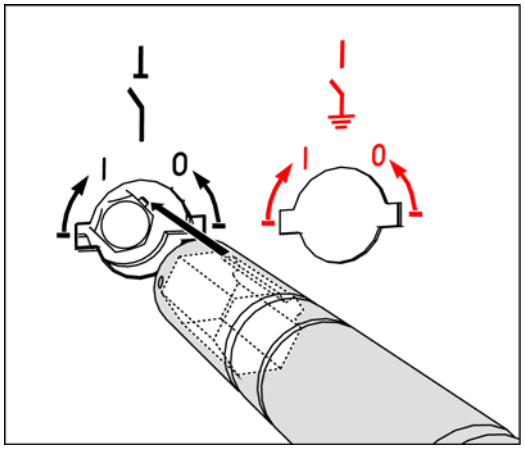


Fig. 188: Inserting the operating lever with pushed-on adapter (DISCONNECTING function)

	**DANGER** Danger of personal damage due to short-circuit. When switching with the emergency operating lever with adapter, there is a risk of switching a live busbar system straight to EARTHED position. ⇨ Turn the emergency operating lever with adapter carefully into the required end position. ⇨ When switching with the emergency operating lever with adapter, check the current switch position continuously at the position indicator.

	**ATTENTION** The work-in-progress earthing contact of the disconnector in busbar system 2 is designed for maintenance work at the three-position disconnector in busbar system 1 in de-energized condition only. ⇨ Before switching to the work-in-progress earthing contact, always contact the regional Siemens representative.

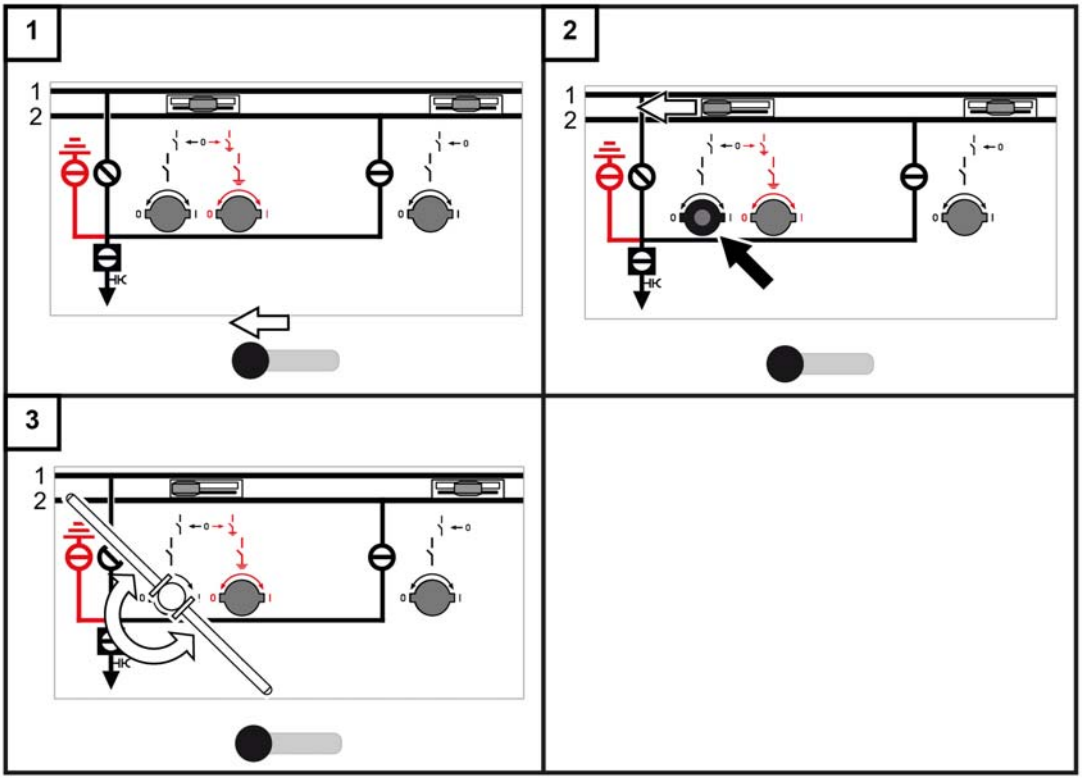


Fig. 189: Emergency operation of the DISCONNECTING function of the three-position disconnector

⇨ Push the control gate to the left.

⇨ Push the control gate to the left.

✔ The opening for the DISCONNECTING function is free.

To switch the DISCONNECTING function of three-position disconnector to the desired end position (CLOSED or OPEN), perform the following actions:

⇨ Turn the emergency operating lever until the position indicator changes to CLOSED or OPEN position.

Position of emergency operating lever	Marking of slot	Position of three-position disconnector
horizontal	at the bottom	CLOSED
	at the top	OPEN

⇨ Remove the emergency operating lever again.

✔ The control gate returns to its initial position.

✔ The opening for the DISCONNECTING function is closed.

Emergency operation of the READY-TO-EARTH function

If the switch does not reach its end position, e.g., due to a failure of the auxiliary voltage during earthing switch operation, push the operating lever with pushed-on adapter onto the hexagonal shaft for the READY-TO-EARTH function in such a way that the pin of the hexagonal shaft fits in the inner slot of the operating adapter.

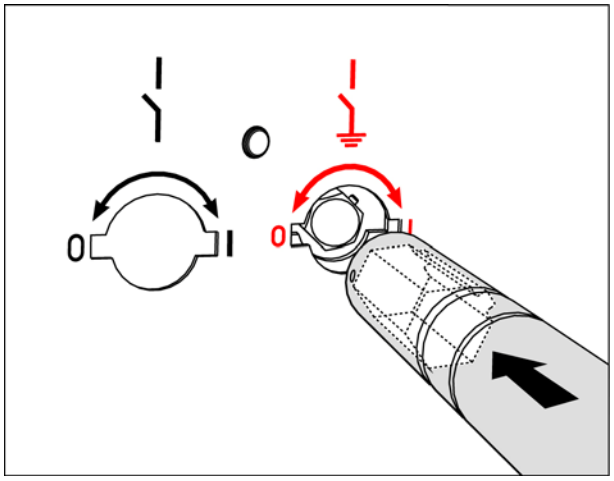


Fig. 190: Inserting the operating lever with pushed-on adapter (READY-TO-EARTH function)

	ATTENTION
	The emergency operating lever with adapter does not have a stop. Switching with the emergency operating lever beyond the end position of the DISCONNECTING function of the three-position disconnector will damage the three-position disconnector. ⇨ Do not turn the emergency operating lever with adapter beyond the horizontal position.

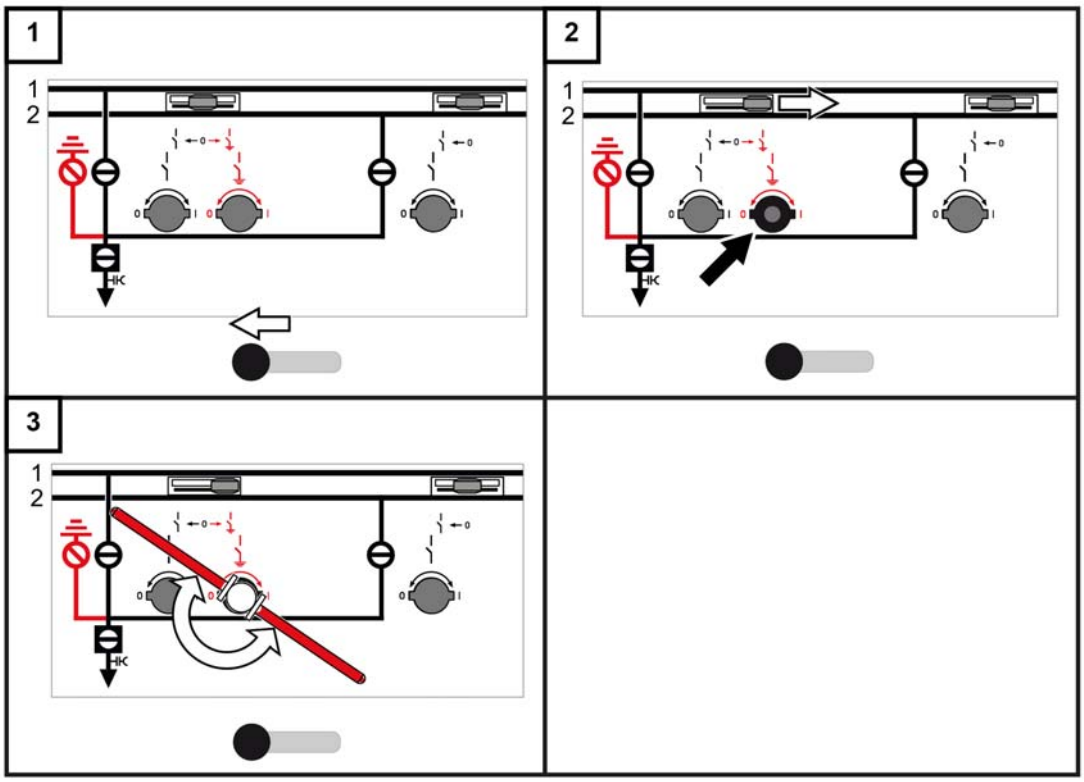


Fig. 191: Emergency operation of the READY-TO-EARTH function of the three-position disconnector

⇨ Push the control gate to the left.

⇨ Push the control gate to the right.

✔ The opening for the READY-TO-EARTH function is free.

⇨ Push the emergency operating lever onto the hexagonal shaft for the READY-TO-EARTH function so that the pin of the hexagonal shaft fits in the slot of the emergency operating lever.

To switch the the READY-TO-EARTH function of the three-position disconnector to the desired end position (READY-TO-EARTH or OPEN), perform the following actions:

⇨ Turn the emergency operating lever until the position indicator changes to READY-TO-EARTH or OPEN position.

Position of emergency operating lever	Marking of slot	Position of three-position disconnector
vertical	left	READY-TO-EARTH
	right	OPEN

⇨ Remove the emergency operating lever again.

✔ The control gate returns to its initial position.

✔ The opening for the READY-TO-EARTH function is closed.

Switching operations after emergency operation

⇨ Perform further manual switching operations only with the associated operating levers for the DISCONNECTING or READY-TO-EARTH functions.

38 Feeder earthing and de-earthing

DANGER

High voltage! Danger! Do always observe the Five Safety Rules

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

DANGER

Danger! High voltage! The earthing process is **not** completed until the circuit-breaker is closed.

- ⇨ Close the circuit-breaker after having switched the three-position disconnector to READY-TO-EARTH position.

ATTENTION

Earthing under load will destroy the three-position disconnector.

- ⇨ For circuit-breaker panels: Circuit-breaker panels cannot be operated when the disconnecting function is mechanically interlocked (see page 148, "Opening the circuit-breaker manually").
- ⇨ For disconnector panels: Make sure that the feeder is isolated from supply.

38.1 Feeder earthing

ATTENTION

If the "feeder earthed" locking device is activated and padlocked, the circuit-breaker cannot be opened, neither electrically nor mechanically. Operating the circuit-breaker locking device with the disconnector in OPEN or CLOSED position can damage the switchgear.

⇨ Operate the circuit-breaker locking device only in the EARTHED position, and secure it with a padlock.

⇨ Switch the three-position disconnector to READY-TO-EARTH position
(see page 155, "Activating the ready-to-earth function manually").

⇨ Close the circuit-breaker (see page 148, "Closing the circuit-breaker manually").

⇨ Pull the moving part of the "feeder earthed" locking device upwards.

⇨ Padlock the locking device.

38.2 Feeder de-earthing

⇨ Remove the padlock at the “feeder earthed” locking device.

✔ The moving part of the locking device folds downwards.

NOTE

In circuit-breaker operating mechanisms with undervoltage release, the circuit-breaker trips automatically after removing the padlock if

⇨ the panel is earthed and

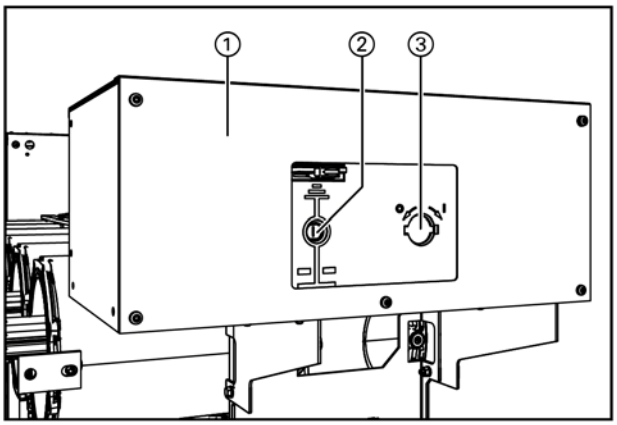
⇨ auxiliary voltage is available.

⇨ Open the circuit-breaker (see page 148, "Opening the circuit-breaker manually").

⇨ Switch the three-position disconnector to OPEN position
(see page 157, "Deactivating the ready-to-earth function manually").

39 Operating the busbar make-proof earthing switch

39.1 Control elements and indicators



① Additional compartment for operating mechanism of busbar earthing switch
② Position indicator
③ Actuating opening
④ Operating spindle at the operating lever

Fig. 192: Manual operating mechanism for busbar earthing switch (basic scheme)

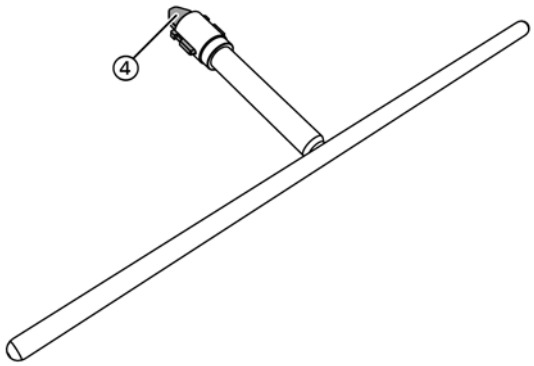


Fig. 193: Operating lever for busbar earthing switch (basic scheme)

The busbar earthing switch is equipped with a manual high-speed closing facility for make-proof earthing of the busbar.

The cover of the actuating opening is interlocked electromechanically.
Optionally, the control gate can be padlocked in one of the two switch positions.

	**DANGER**
	High voltage! Danger! By no means may the busbar make-proof earthing switch be operated under load, as it will be destroyed in case of repetition. ⇨ Observe the Five Safety Rules. ⇨ Disconnect the incoming and outgoing feeders in all panels.

	**NOTE**
	Once started, a switching operation is totally completed by the motor operating mechanism control to prevent intermediate positions. Starting another switching operation or switching back in the course a switching operation is not possible. ⇨ Wait for completion of a started switching operation before starting another switching operation.

39.2 Closing

	**ATTENTION** The control gate can only be moved to a position that is permissible at this moment. ⇨ Observe the position indicator at the busbar earthing switch.

	**ATTENTION** Once you have started a switching operation, you must complete it totally; turning back is blocked. The operating lever cannot be removed at intermediate positions. ⇨ Do not remove the operating lever at intermediate positions.

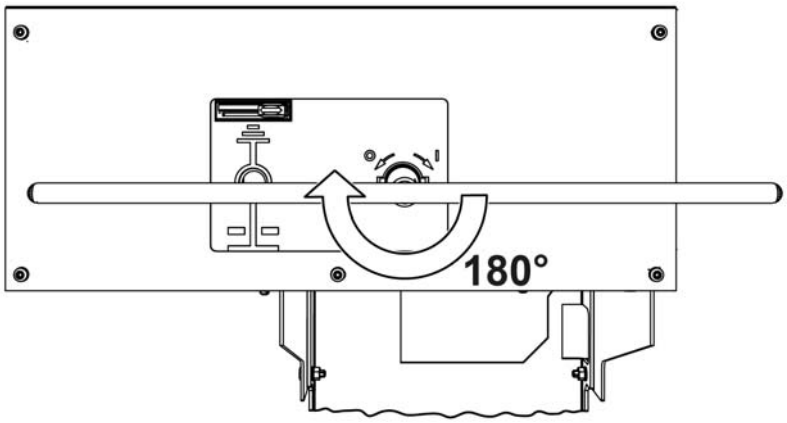


Fig. 194: Closing the busbar earthing switch (basic scheme)

⇨ Push the control gate to the right.
The position indicator changes to faulty position.

⇨ Hold the operating lever in horizontal position.

⇨ Insert the operating lever in the actuating opening as far as it will go. Observe the position of the operating spindle.

⇨ Turn the operating lever 180° clockwise.

⇨ Remove the operating lever.

✔ The control gate is in its initial position again.
The position indicator changes from faulty position to CLOSED position.

⇨ Optionally: Padlock the control gate.

✔ The busbar earthing switch is closed.

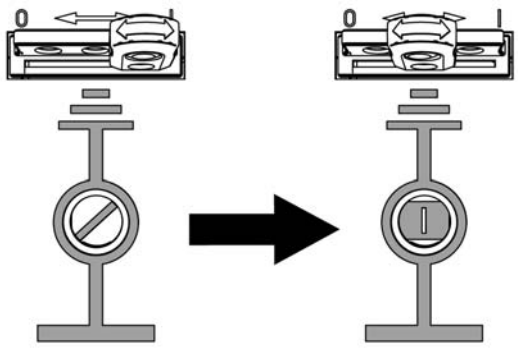


Fig. 195: Position indicator at the busbar earthing switch (basic scheme)

39.3 Opening

	**ATTENTION** The control gate can only be moved to a position that is permissible at this moment. ⇨ Observe the position indicator at the busbar earthing switch.

	**ATTENTION** Once you have started a switching operation, you must complete it totally; turning back is blocked. The operating lever cannot be removed at intermediate positions. ⇨ Do not remove the operating lever at intermediate positions.

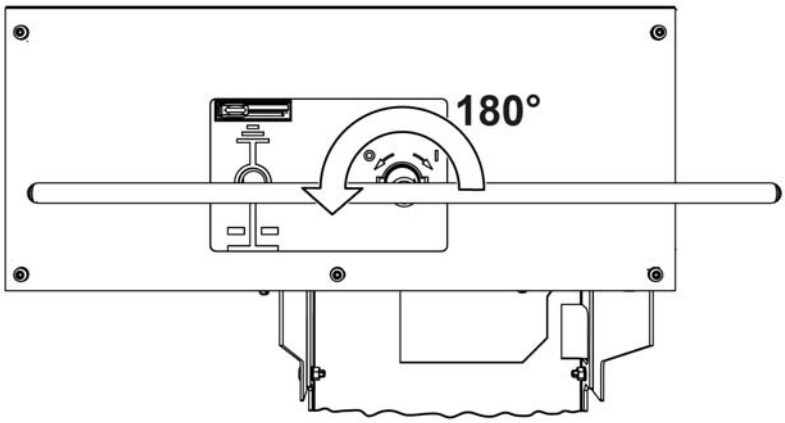


Fig. 196: Opening the busbar earthing switch (basic scheme)

⇨ Push the control gate to the left.
The position indicator changes to faulty position.

⇨ Hold the operating lever in horizontal position.

⇨ Insert the operating lever in the actuating opening as far as it will go.
Observe the position of the operating spindle.

⇨ Turn the operating lever 180° counter-clockwise.

⇨ Remove the operating lever.

✔ The control gate is in its initial position again.
The position indicator changes from faulty position to OPEN position.

⇨ Optionally: Padlock the control gate.

✔ The busbar earthing switch is open.

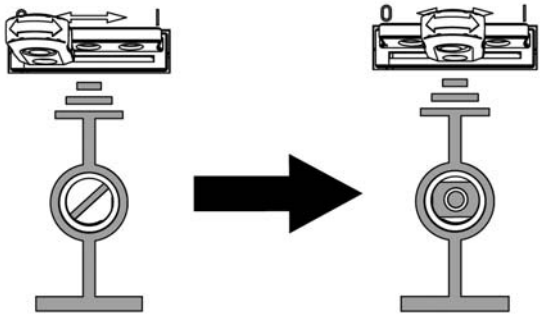


Fig. 197: Position indicator at the busbar earthing switch (basic scheme)

39.4 Emergency release of the interlock with solenoids at the busbar earthing switch

	**DANGER**
	If the interlocking of the control gate is eliminated, switching operations are possible that can cause an arc fault which will endanger the life of the people present and damage the switchgear. ⇨ Do only eliminate the interlocking of the control gate to push the control gate to the center position. ⇨ Do not perform switching operations. ⇨ Use a screwdriver that fits the hole diameter of the solenoid openings.

To push the control gate from center position to right position:

⇨ Remove the left-hand plastic split rivet.

⇨ Insert the screwdriver through the left-hand opening and push the solenoid back.

⇨ Push the control gate to the right.

✔ The left-hand solenoid is released again, blocking further movements.

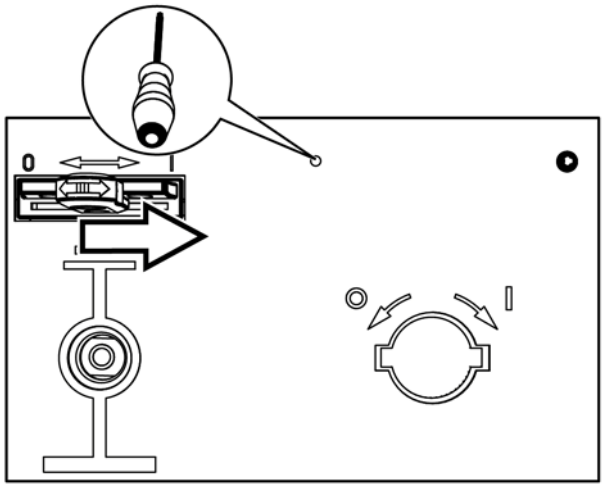


Fig. 198: Pushing the control gate to the right position (basic scheme)

To push the control gate from center position to left position:

⇨ Remove the right-hand dummy plug.

⇨ Insert the screwdriver through the right-hand opening and push the solenoid back.

⇨ Push the control gate to the left.

✔ The right-hand solenoid is released again, blocking further movements.

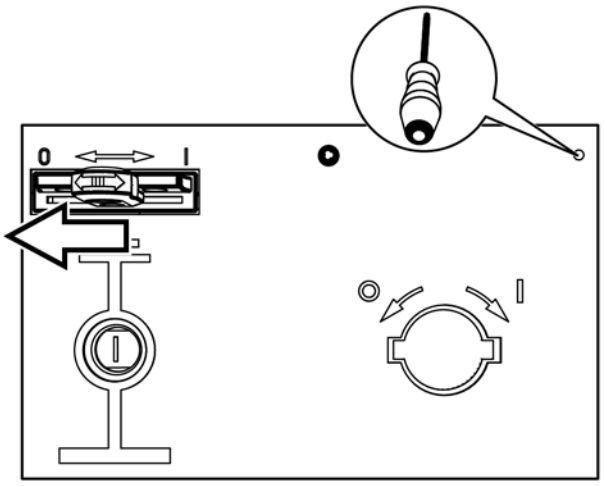


Fig. 199: Pushing the control gate to the left position (basic scheme)

To push the control gate from the right or left position to the center position again:

⇨ Remove the plug (according to the position of the control gate) and push the solenoid back with the screwdriver.

⇨ Push the control gate to the center position.

⇨ After work completion, pull the screwdriver out and refit the stopper.

✔ The solenoid is released again, blocking further movements.

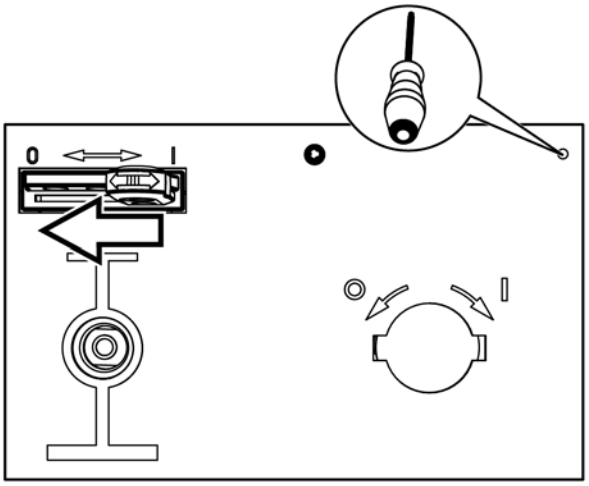


Fig. 200: Pushing the control gate to the center position (basic scheme)

40 Interlocks

Switching devices may only be controlled and operated in logical dependence on the switch position of other devices. Unpermissible switching operations must be locked in order to

- provide full protection for the personnel
- prevent switchgear damages and power failures.

The interlocks are mainly of the mechanical type. For dependencies, see the following tables:

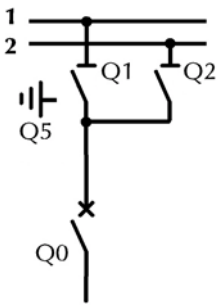


Fig. 201: Circuit-breaker panel

Switching operation	Switching is operation only possible if	Type
Q1 CLOSED / OPEN	Q0 OPEN, Q2 OPEN, Q5 OPEN	mechanical
Q2 CLOSED/OPEN	Q0 OPEN, Q1 OPEN, Q5 OPEN	mechanical
Q5 CLOSED/OPEN	Q0 OPEN, Q1 and Q2 OPEN	mechanical
Q0 CLOSED (mechanically)	Q1, Q2, as well as Q5 not in intermediate position	mechanically (for manual operation of Q1, Q2)
Q0 CLOSED (electrically)	Q1, Q2, or Q5 not in intermediate position	electrical
Q0 OPEN	it is not interlocked by a locking device when the feeder is earthed	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

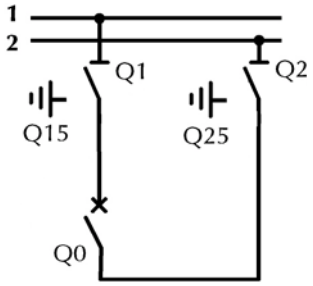


Fig. 202: Bus coupler (system 1 described, system 2 applies accordingly)

Switching operation	Switching operation is only possible if	Type
Q1 CLOSED/OPEN	Q0 OPEN, Q15 OPEN	mechanical
Q25 CLOSED/OPEN	Q0 OPEN, Q2 OPEN	mechanical
Q0 CLOSED (mechanically)	Q1, Q2, Q15, as well as Q25 not in intermediate position	mechanically (for manual operation of Q1, Q2, Q15, or Q25)
Q0 CLOSED (electrically)	Q1, Q2, as well as Q5 not in intermediate position	electrical
Q0 OPEN (electrically)	- being released by a bus coupler lock-in - it is not interlocked by a locking device when the busbar system is earthed	electrical / mechanical
Q0 OPEN (mechanically)	it is not interlocked by a locking device when the busbar system is earthed	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

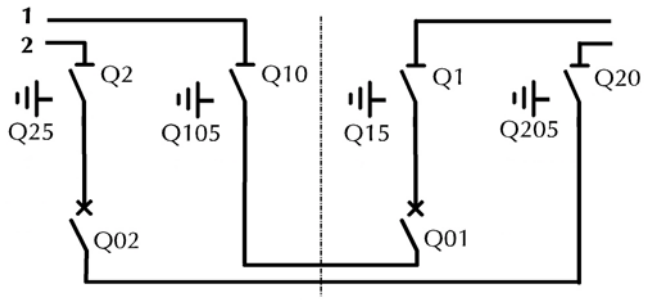


Fig. 203: Bus sectionalizer (system 2 described, system 1 applies accordingly)

Switching operation	Switching operation is only possible if	Type
Q2 CLOSED/OPEN	Q02 OPEN, Q25 OPEN	mechanical
Q20 CLOSED/OPEN	Q02 OPEN, Q205 OPEN	electromechanically / mechanically
Q25 CLOSED/OPEN	Q02 OPEN, Q2 OPEN	mechanical
Q205 CLOSED/OPEN	Q02 OPEN, Q20 OPEN	electromechanically / mechanically
Q02 CLOSED (mechanically)		
Q02 CLOSED (electrically)	Q2, Q20, Q25, as well as Q205 not in intermediate position	electrical
Q02 OPEN (electrically)	- being released by a bus coupler lock-in - it is not interlocked by a locking device when the busbar system is earthed	electrically / mechanically
Q02 OPEN (mechanically)	it is not interlocked by a locking device when the busbar system is earthed	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

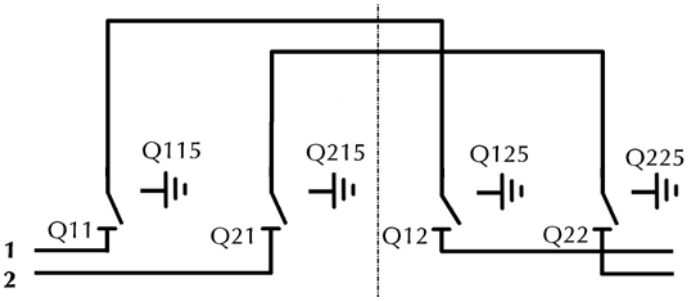


Fig. 204: Top-mounted bus sectionalizer (system 2 described, system 1 applies accordingly)

Switching operation	Switching operation is only possible if	Type
Q21 CLOSED/OPEN	Q215 OPEN	mechanical
Q22 CLOSED/OPEN	Q225 OPEN	mechanical
Q215 CLOSED/OPEN	Q21 OPEN	mechanical
Q225 CLOSED/OPEN	Q22 OPEN	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

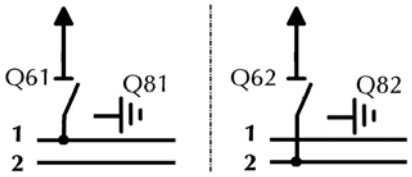


Fig. 205: Disconnectable busbar connection

Switching operation	Switching operation is only possible if	Type
Q61 or Q62 CLOSED/OPEN	permitted by internal or external switchgear interlocks, Q81 or Q82 OPEN	electromechanical / mechanical
Q81 or Q82 CLOSED/OPEN	permitted by internal or external switchgear interlocks, Q61 or Q62 OPEN	electromechanical / mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

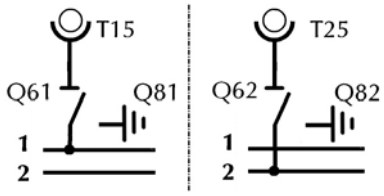


Fig. 206: Disconnectable busbar voltage transformer

Switching operation	Switching operation is only possible if	Type
Q61 or Q62 CLOSED/OPEN	Q81 or Q82 OPEN	mechanical
Q81 or Q82 CLOSED/OPEN	Q61 or Q62 OPEN	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

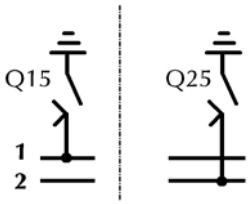


Fig. 207: Busbar earthing switch

Switching operation	Switching operation is only possible if	Type
Q15 or Q25 CLOSED/OPEN	opening for operating lever is open	optionally mechanical with locking device or electromechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

41 Verification of safe isolation from supply

41.1 LRM plug-in sockets

DANGER

High voltage! Danger! Verify safe isolation from supply without any doubt!

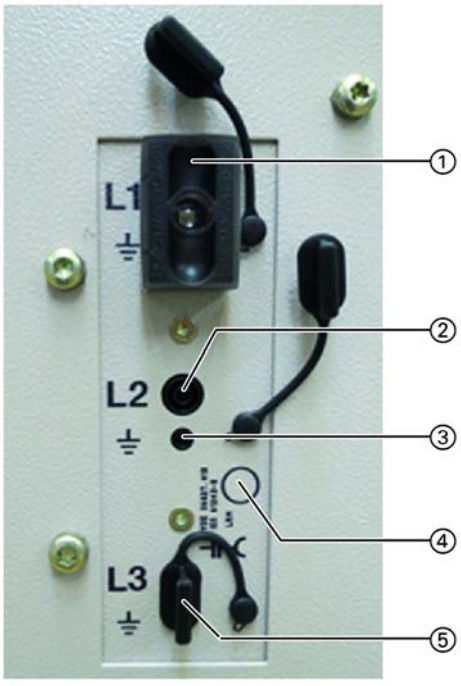
⇨ Possible sources of failure:
- Defective voltage indicator (or device for function testing of the coupling section)
- Maloperation of the voltage indicator (or device for function testing of the coupling section)

⇨ Test the perfect function of the voltage indicator and the coupling section in accordance with national standards:
- On a live panel
- With a test unit according to IEC 61243-5/EN 61243-5
- On all phases

⇨ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)

⇨ 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 34, "Voltage detecting systems").



1 Voltage indicator type LRM
2 Interface (capacitive test socket) for L2
3 Earth socket
4 Documentation to repeat test of interface condition
5 Cover for test sockets

Fig. 208: Verification of safe isolation from supply

⇨ Remove covers from plug-in sockets (capacitive test sockets L1, L2, L3).

⇨ Plug voltage indicator in all three phases L1, L2, L3 of the plug-in sockets.

✔ If the indicator does **not** flash or light up in any of the three phases, the phases are not live.

⇨ Replace the covers on the plug-in sockets.

Indication	LRM system	
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	Indication does not light up or flash	Phase isolated from supply

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

DANGER

High voltage! Danger! Verify safe isolation from supply without any doubt!

⇨ Possible sources of failure:

- Defective voltage indicator (or device for function testing of the coupling section)
- Maloperation of the voltage indicator (or device for function testing of the coupling section)

⇨ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)

DANGER

High voltage! Danger! Do only modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ after consultation with the regional Siemens representative!

⇨ If the setting of the C2 module was modified by mistake, re-establish the factory setting as follows:

- Pull out the C2 module ③ at the rear side of CAPDIS-S1+/S2+.
  Caution: Open printed circuit board may be energized.
- Plug the C2 module ③ into CAPDIS-S1+/S2+ so that the marked arrow ① on the housing points to the marking ② on the C2 module

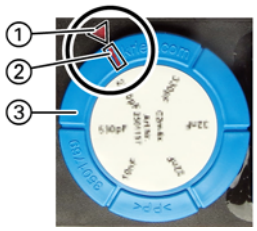


Fig. 209: Marking of the factory setting at the C2 module

Fig. 210: CAPDIS-S2+: Cover closed

Fig. 211: CAPDIS-S2+: Cover opened

① "Test" button
② Cover
③ LC display
④ Duct for signaling cables CAPDIS-M
⑤ Test socket L2
⑥ Earth socket
⑦ Test socket L3
⑧ Test socket L1
⑨ Short instructions

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	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Operating voltage present
A2										• Operating voltage not present • Auxiliary power not present (CAPDIS-S2+)
A3		ϟ	ϟ		ϟ	ϟ		ϟ	ϟ	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4				ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Voltage (**not** operating voltage) present
A5				ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Indication: "Test" passed (lights up shortly)
A6				ϟ ERROR	ϟ	ϟ	ϟ ERROR	ϟ	ϟ	Indication: "Test" not passed (lights up shortly)
A7				ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	Overvoltage present (lights up permanently)
A8							ϟ ERROR			Indication: "ERROR" e.g., in case of missing auxiliary voltage

41.3 Indications WEGA 1.2, WEGA 2.2

	**DANGER** High voltage! Danger! Verify safe isolation from supply without any doubt! ⇨ Possible sources of failure: - Defective voltage indicator (or device for function testing of the coupling section) - Maloperation of the voltage indicator (or device for function testing of the coupling section) ⇨ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)

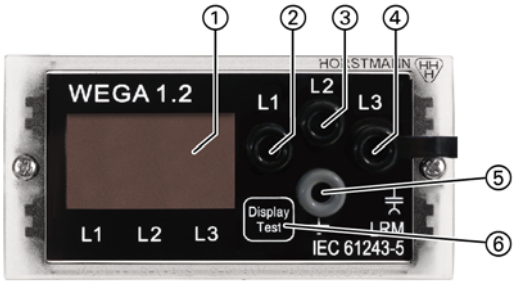


Fig. 212: Operating elements WEGA 1.2/2.2

① LC display (illuminated for WEGA 2.2)
② Test socket L1
③ Test socket L2
④ Test socket L3
⑤ Earth socket
⑥ "Display Test" button

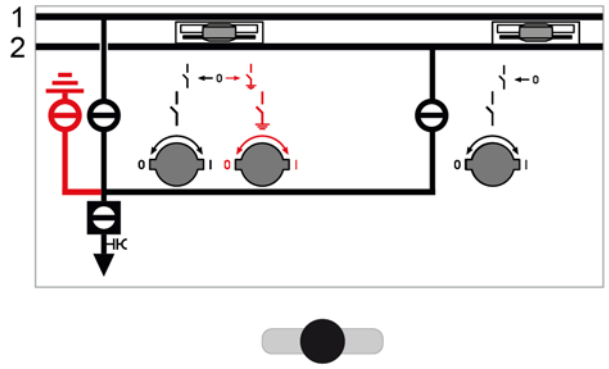
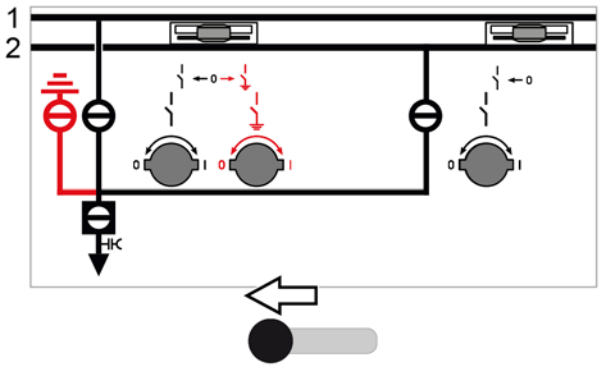
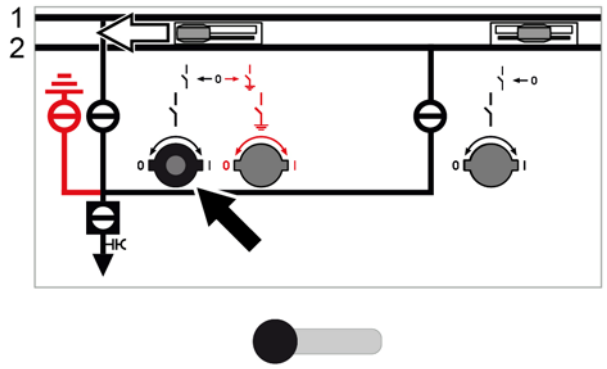
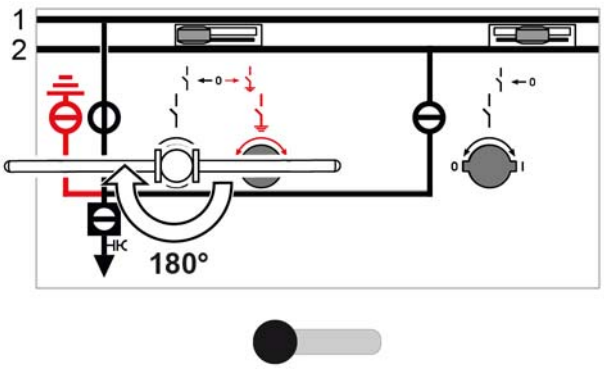
Indications WEGA 1.2, WEGA 2.2

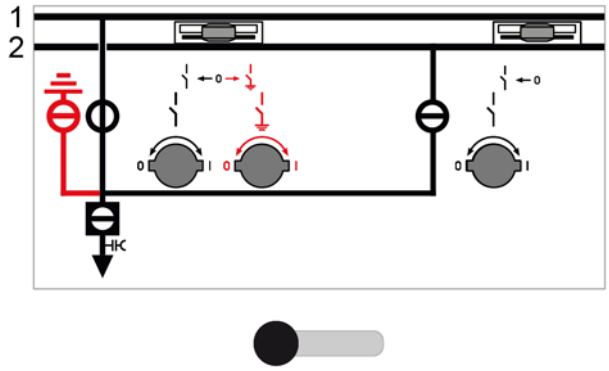
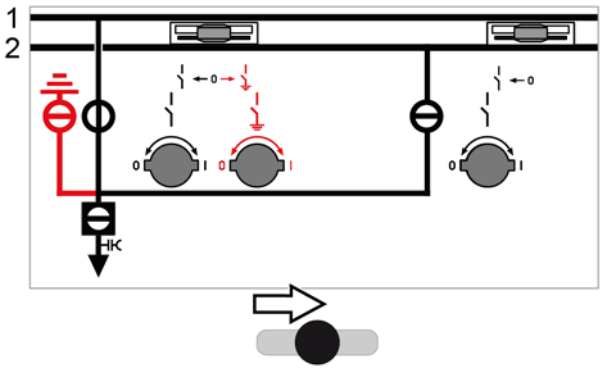
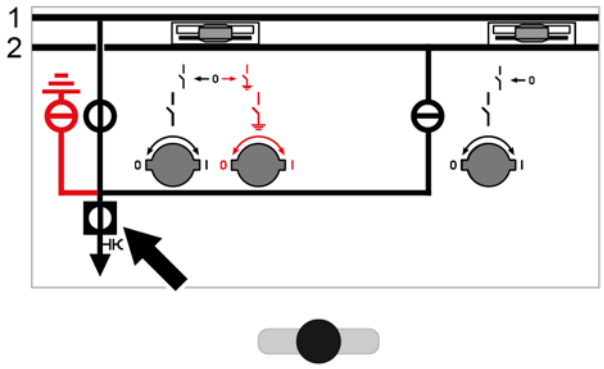
Indication	WEGA 1.2			WEGA 2.2			
	L1	L2	L3	L1	L2	L3	
A0							For WEGA 2.2: Operating voltage not present, auxiliary power present, LCD illuminated
A1							• Operating voltage present • For WEGA 2.2: Auxiliary power present, LCD illuminated
A2							• Operating voltage not present • For WEGA 2.2: Auxiliary 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

42 Overview of switching operations

42.1 Switching operations in the circuit-breaker panel

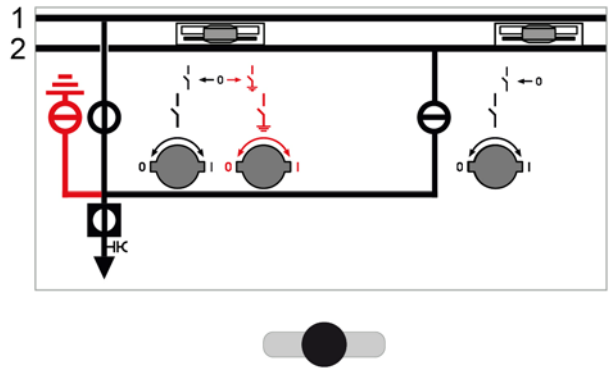
Connecting the feeder with busbar system 1

1  Initial situation	2  ⇨ Push the selector gate to the left.
3  ⇨ Push the left-hand control gate to the left.	4  ⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

5  ⇨ Remove the operating lever for the DISCONNECTING function. The left-hand control gate returns to its initial position.	6  ⇨ Push the selector gate to the center position.
7  ⇨ Close the circuit-breaker.	

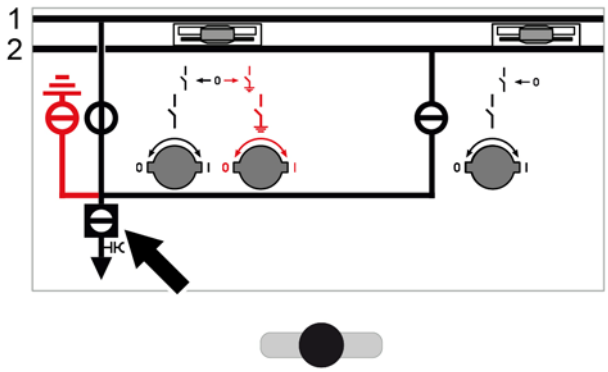
Disconnecting the feeder from busbar system 1

1



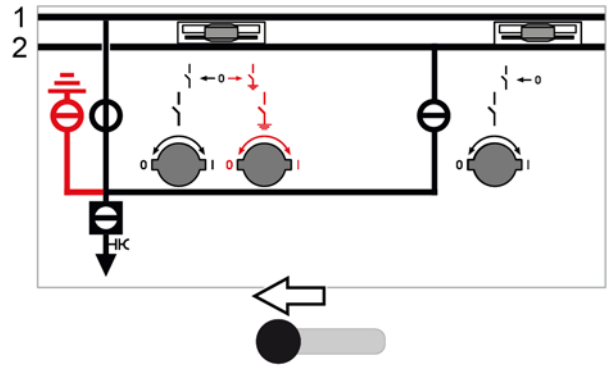
Initial situation

2



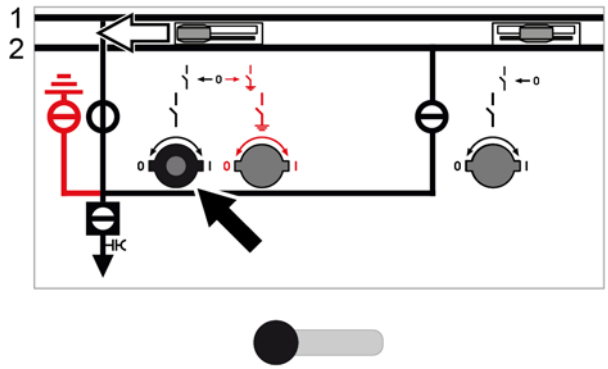
⇨ Open the circuit-breaker.

3



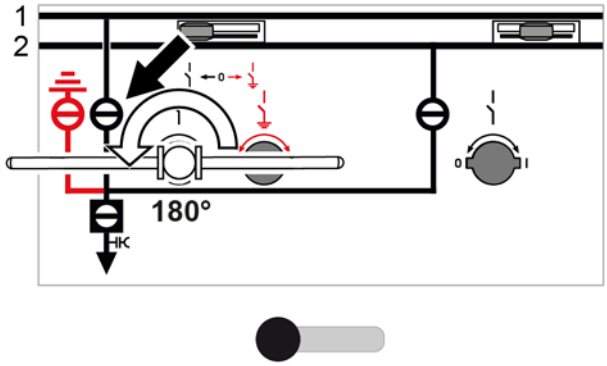
⇨ Push the selector gate to the left.

4



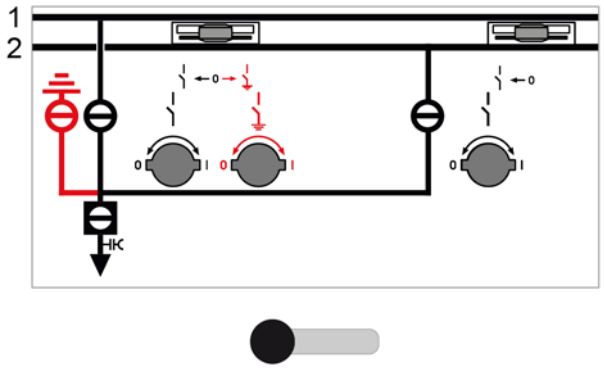
⇨ Push the left-hand control gate to the left.

5



⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).

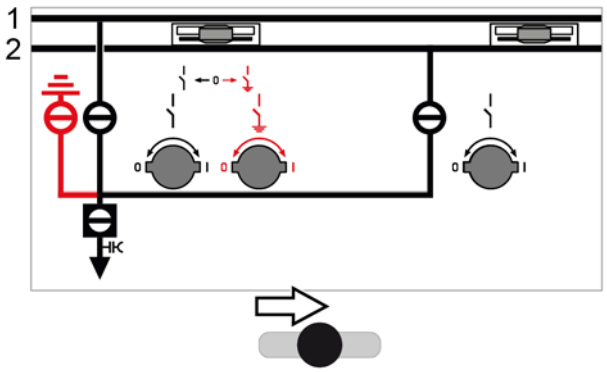
6



⇨ Remove the operating lever for the DISCONNECTING function.

The left-hand control gate returns to its initial position.

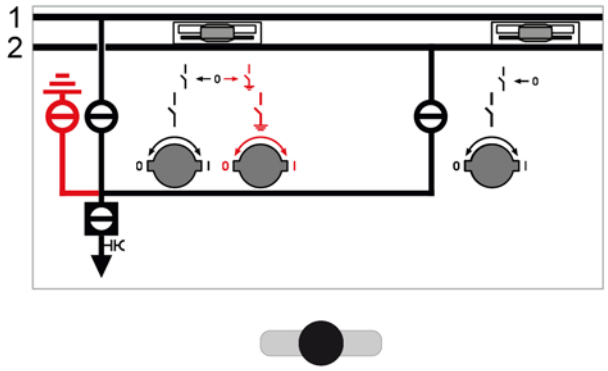
7



⇨ Push the selector gate to the center position.

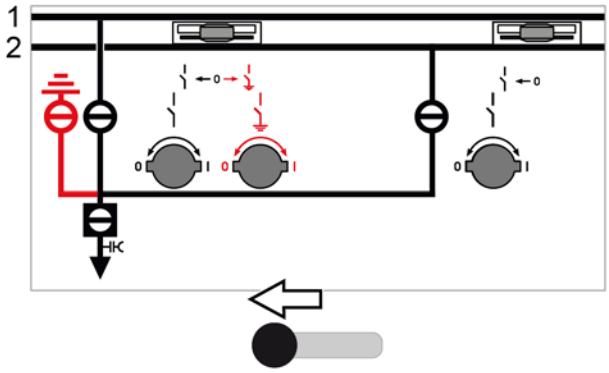
Feeder earthing

1



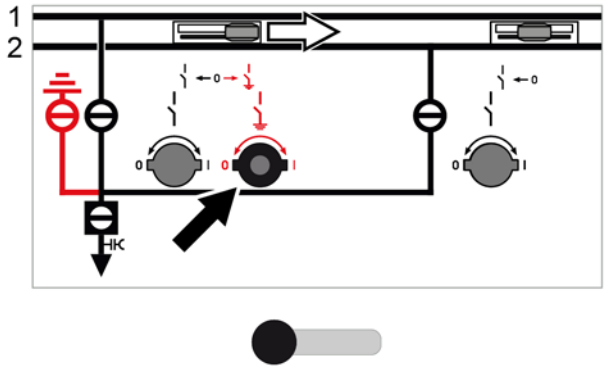
Initial situation

2



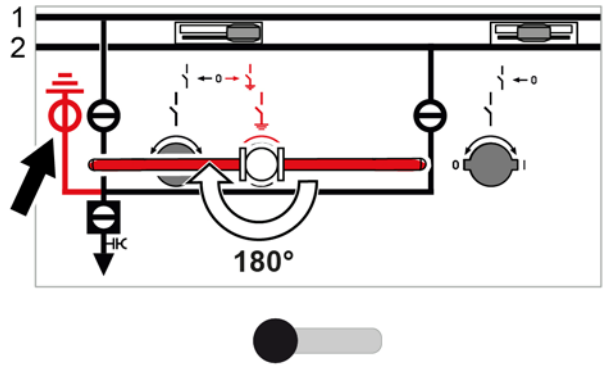
⇨ Push the selector gate to the left.

3



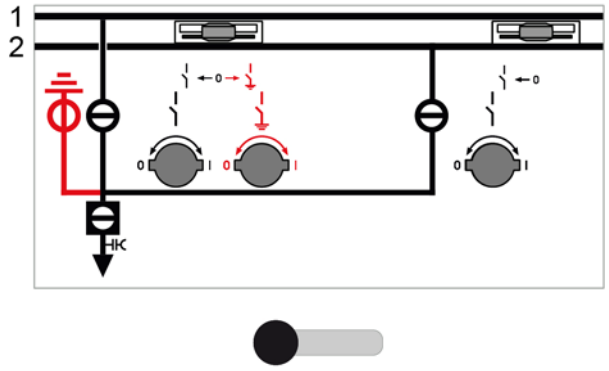
⇨ Push the left-hand control gate to the right.

4



⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).

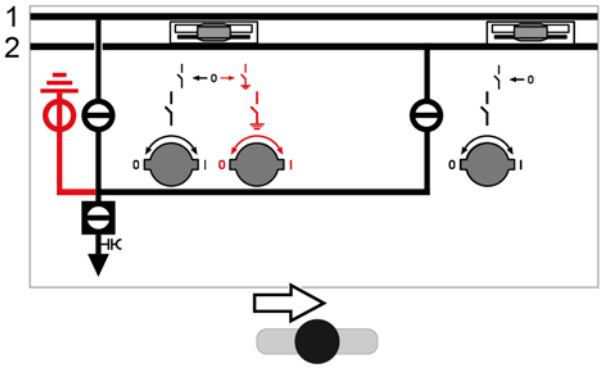
5



⇨ Remove the operating lever for the READY-TO-EARTH function.

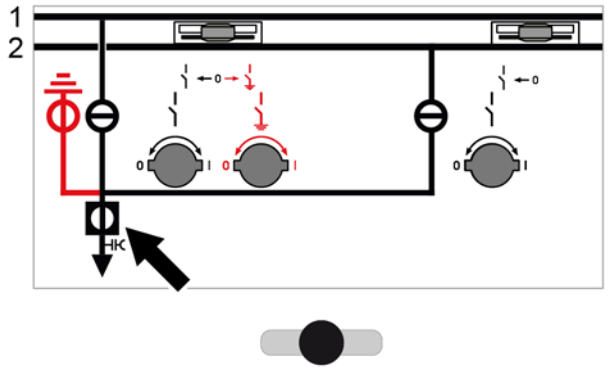
The left-hand control gate returns to its initial position.

6



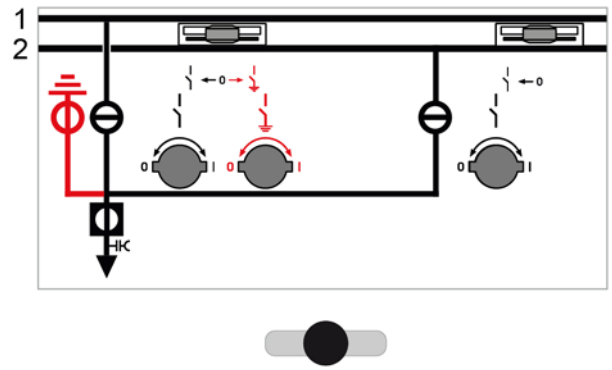
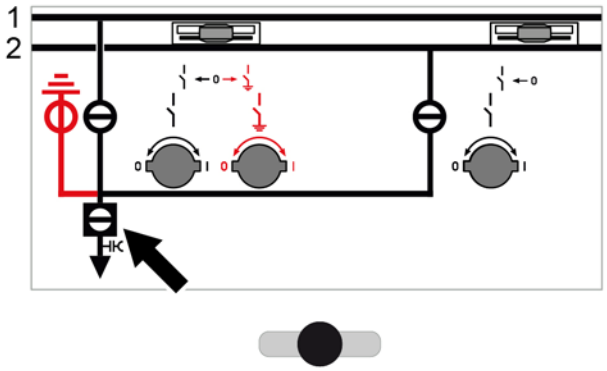
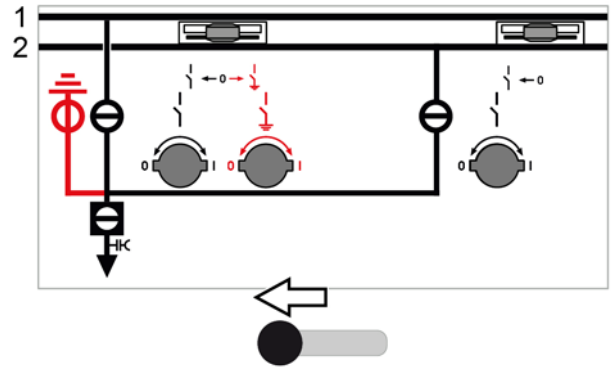
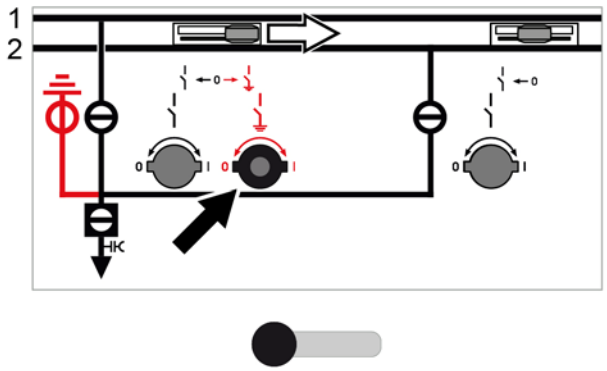
⇨ Push the selector gate to the center position.

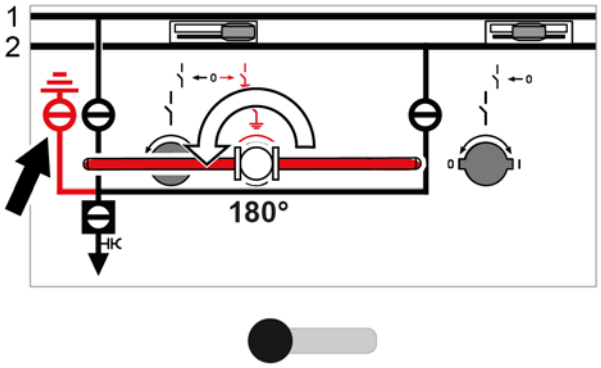
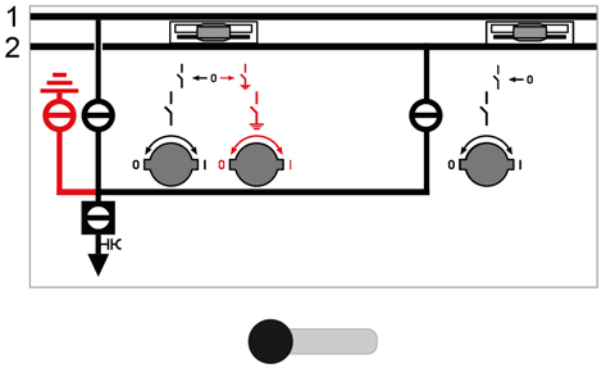
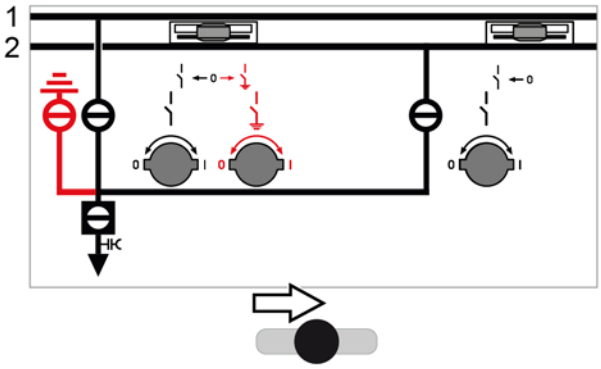
7



⇨ Close the circuit-breaker.

Feeder de-earthing

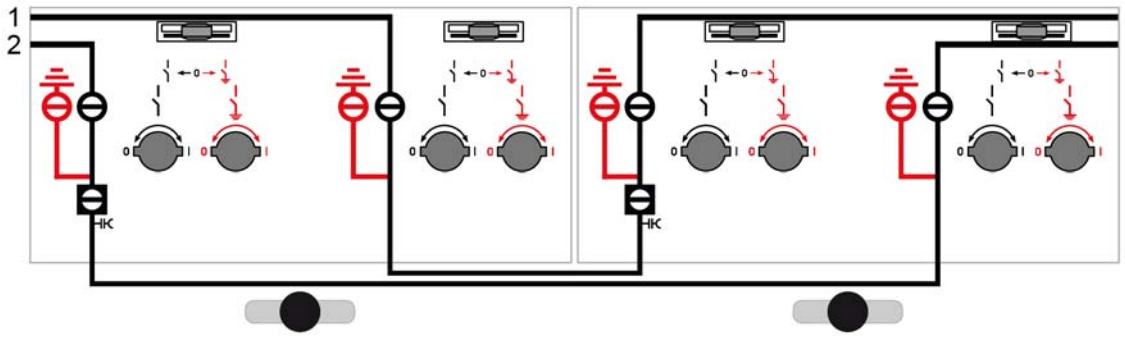
1  Initial situation	2  ⇨ Open the circuit-breaker.
3  ⇨ Push the selector gate to the left.	4  ⇨ Push the left-hand control gate to the right.

5  ⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).	6  ⇨ Remove the operating lever for the READY-TO-EARTH function. The left-hand control gate returns to its initial position.
7  ⇨ Push the selector gate to the center position.	

42.2 Switching operations in the bus sectionalizer panel

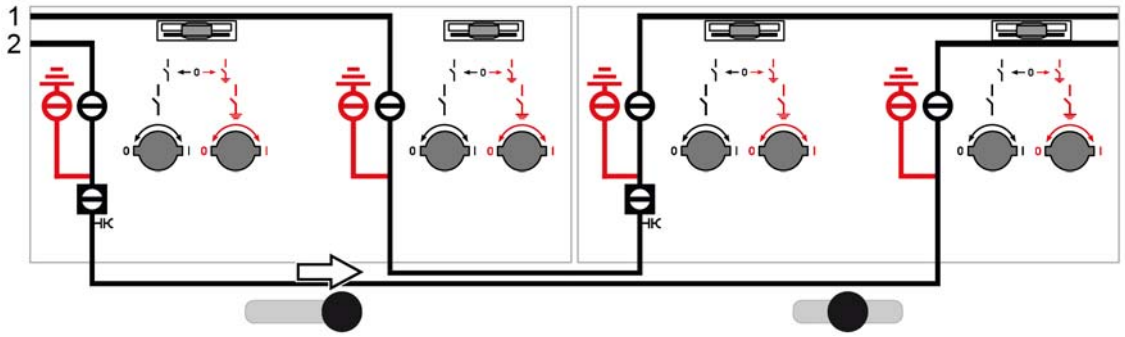
Coupling the busbar sections of system 1

1



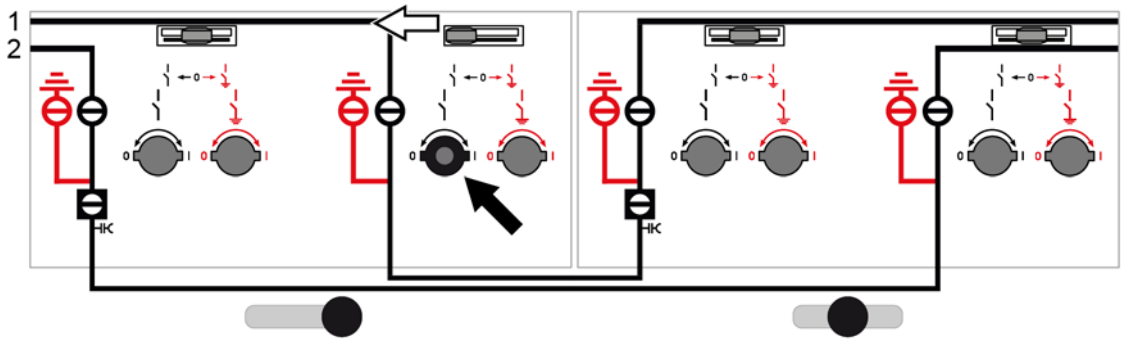
Initial situation

2



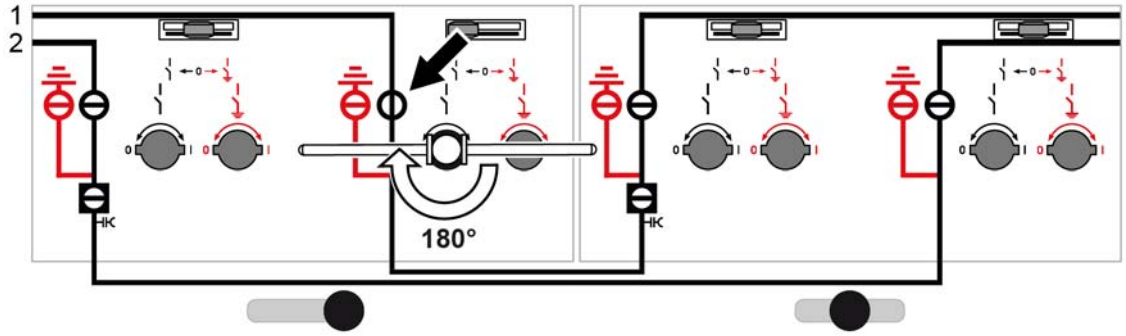
⇨ Push the left-hand selector gate to the right.

3



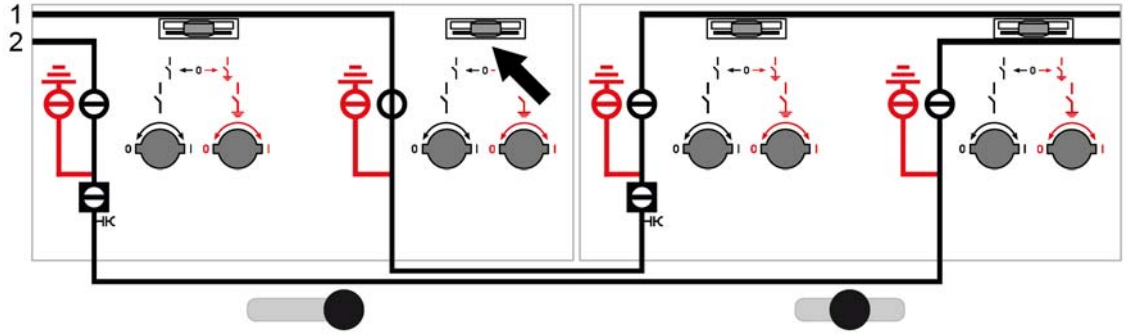
⇨ Push the right-hand selector gate in the left-hand panel to the left.

4



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

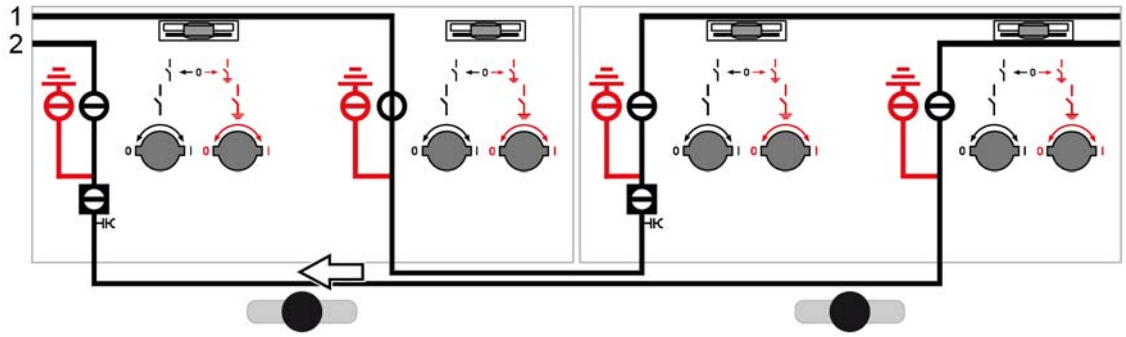
5



⇨ Remove the operating lever for the DISCONNECTING function.

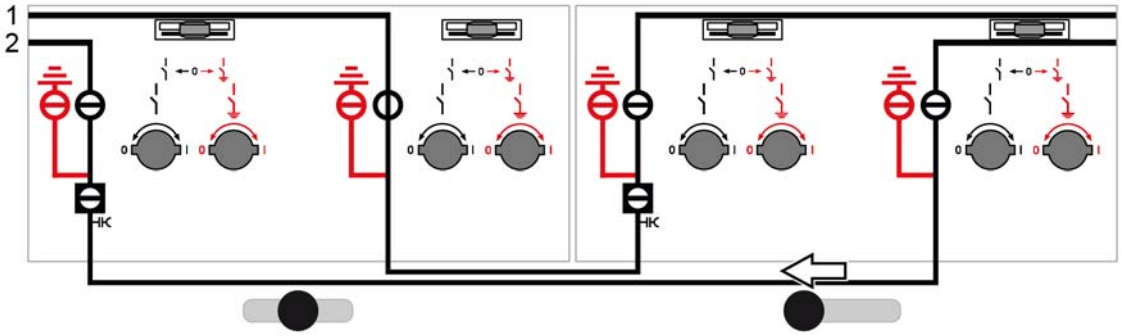
The right-hand control gate in the left-hand panel returns to its initial position.

6



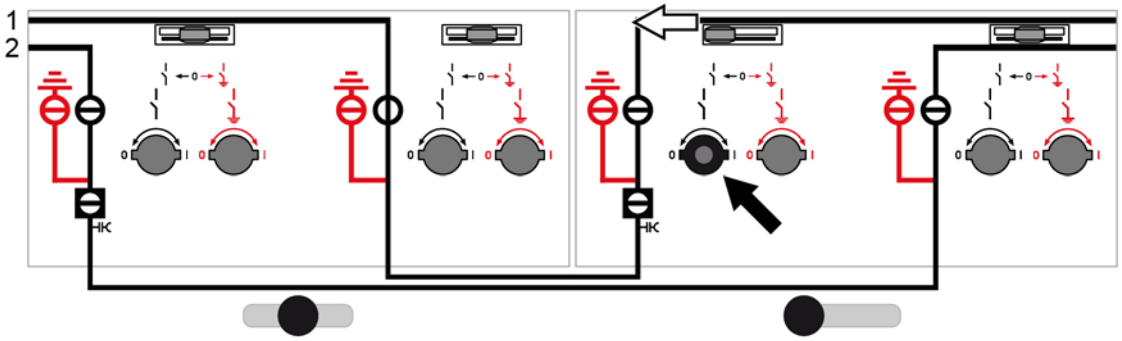
⇨ Push the left-hand selector gate to the center position.

7



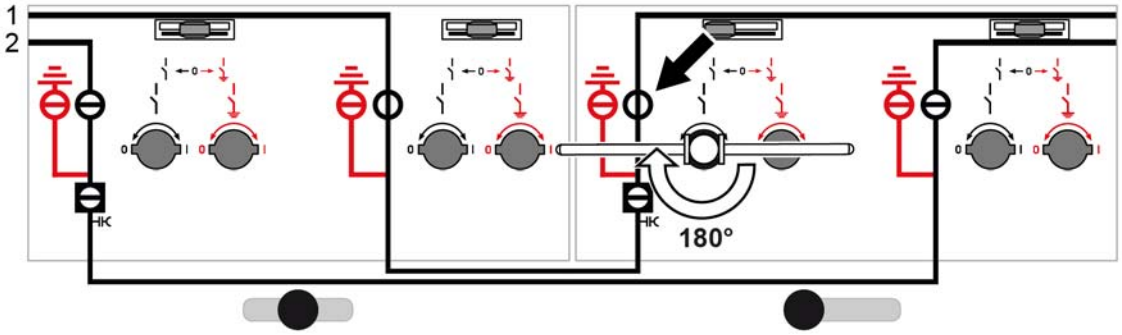
⇨ Push the right-hand selector gate to the left.

8



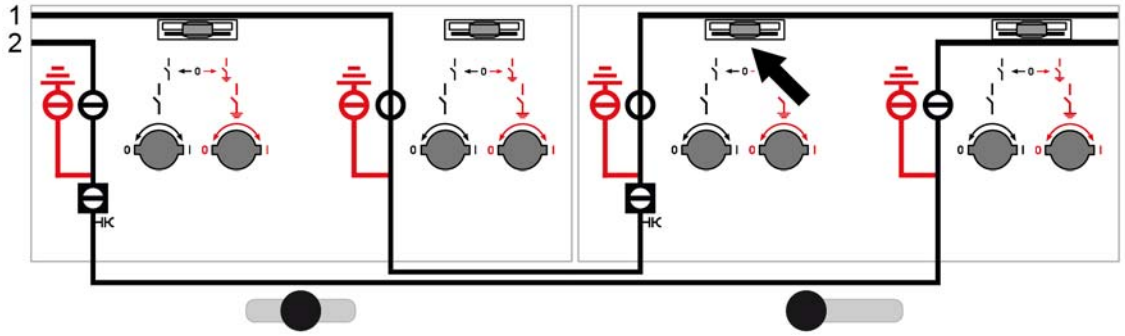
⇨ Push the left-hand control gate in the right-hand panel to the left.

9



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

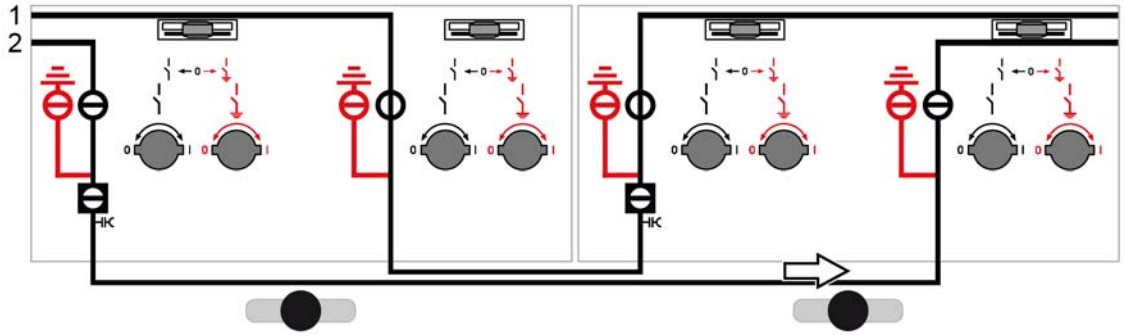
10



⇨ Remove the operating lever for the DISCONNECTING function.

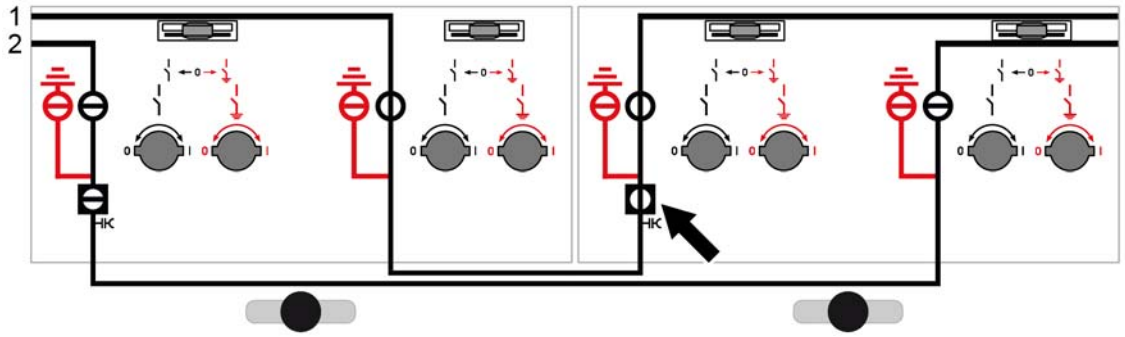
The left-hand control gate in the right-hand panel returns to its initial position.

11



⇨ Push the right-hand selector gate to the center position.

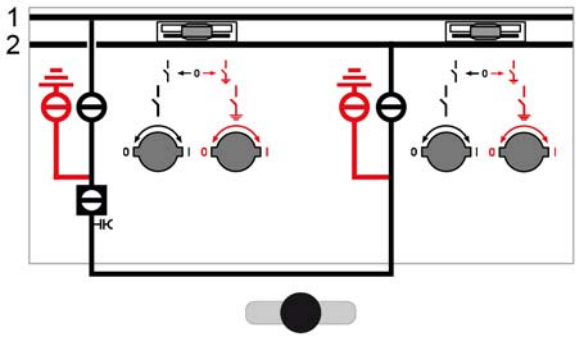
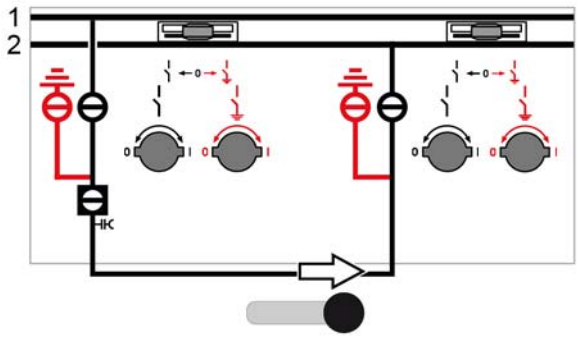
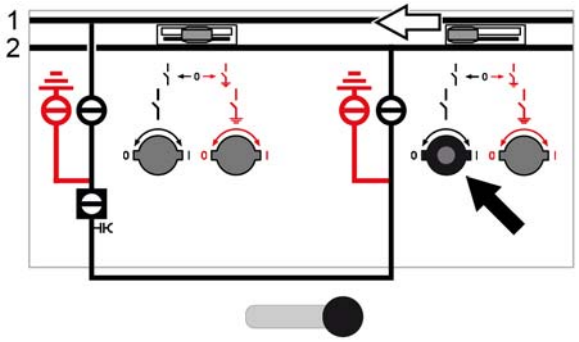
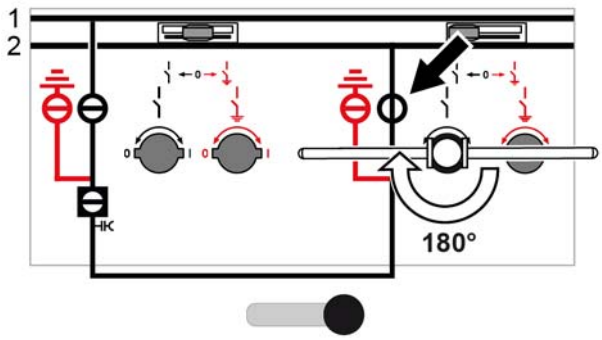
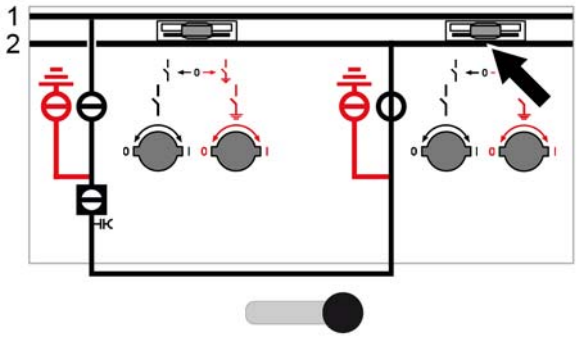
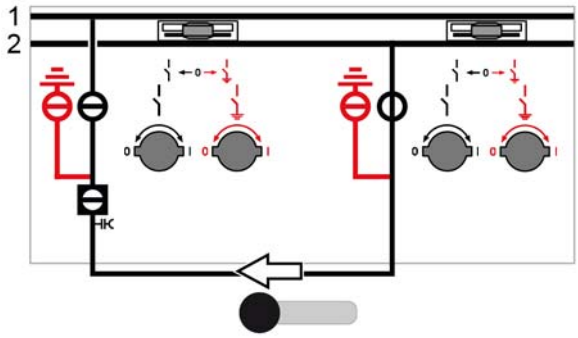
12



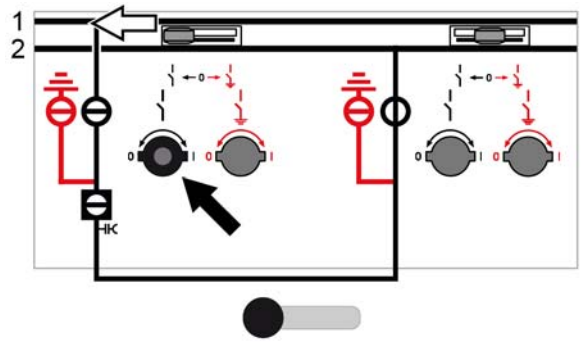
⇨ Close the circuit-breaker in the right-hand panel.

42.3 Switching operations in the bus coupler panel

Coupling systems 1 and 2

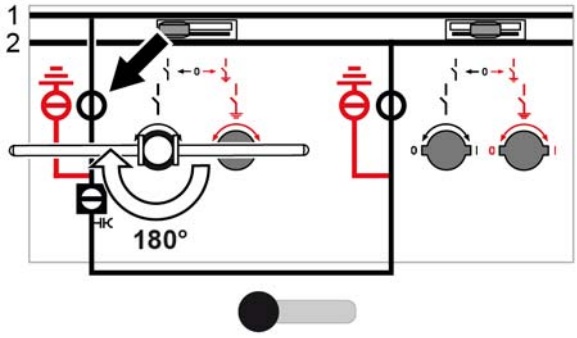
1  Initial situation	2  ⇨ Push the selector gate to the right.
3  ⇨ Push the right-hand control gate to the left.	4  ⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).
5  ⇨ Remove the operating lever for the DISCONNECTING function. The right-hand control gate returns to its initial position.	6  ⇨ Push the selector gate to the left.

7



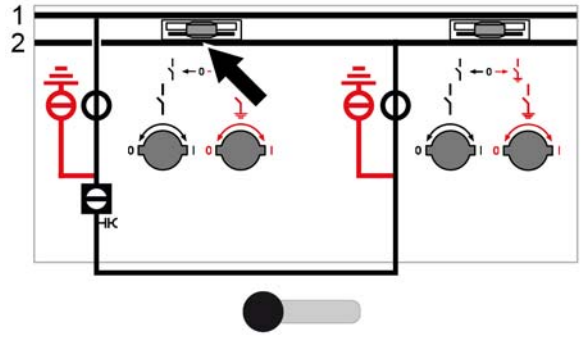
⇨ Push the left-hand control gate to the left.

8



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

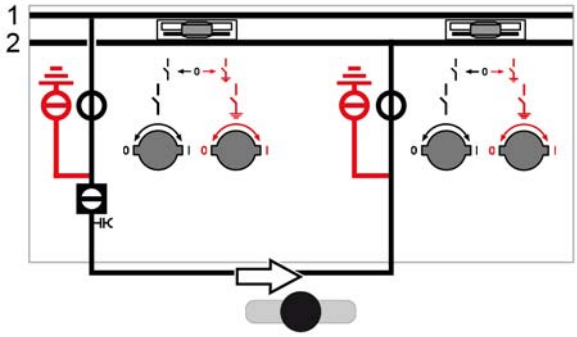
9



⇨ Remove the operating lever for the DISCONNECTING function.

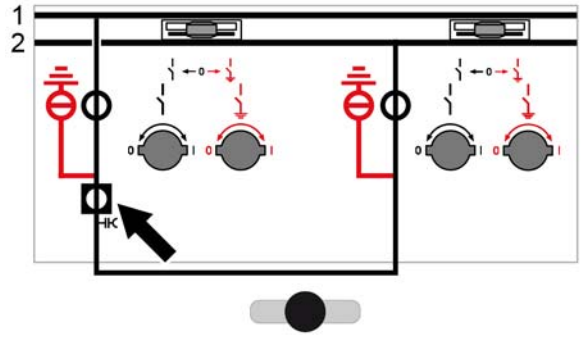
The left-hand control gate returns to its initial position.

10



⇨ Push the selector gate to the center position.

11

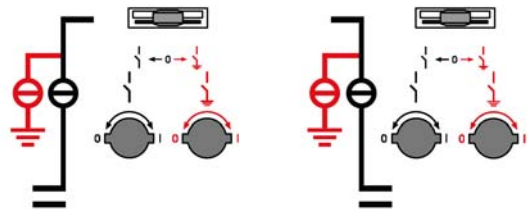


⇨ Close the circuit-breaker.

42.4 Switching operations in top-mounted bus sectionalizer, system 1

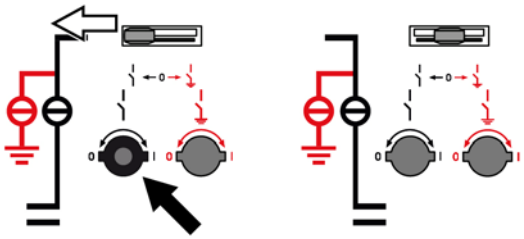
Coupling busbar sections (system 1)

1



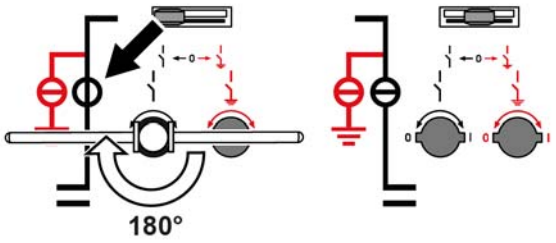
Initial situation

2



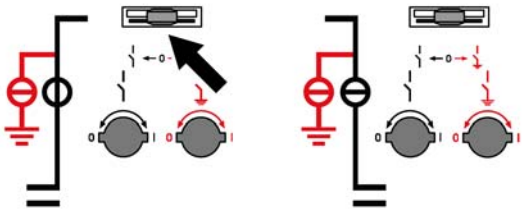
⇨ Push the left-hand control gate to the left.

3



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

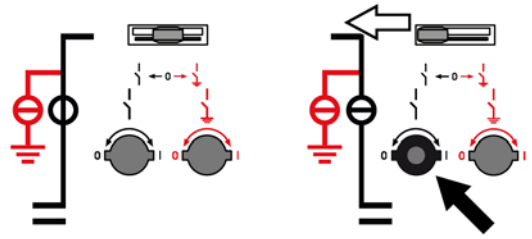
4



⇨ Remove the operating lever for the DISCONNECTING function.

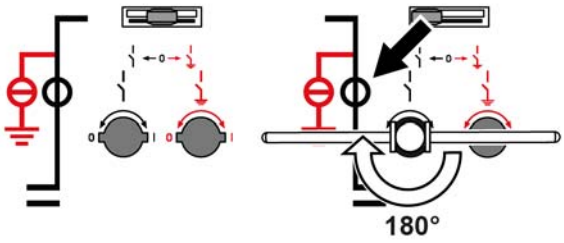
The left-hand control gate returns to its initial position.

5



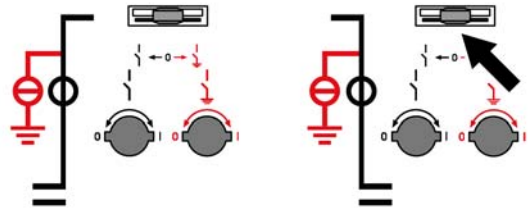
⇨ Push the right-hand control gate to the left.

6



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

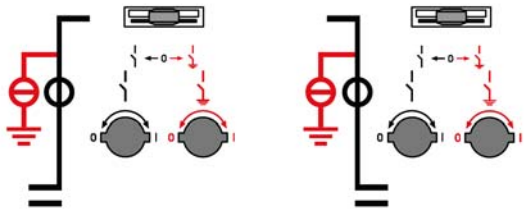
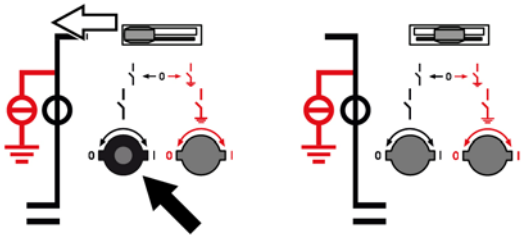
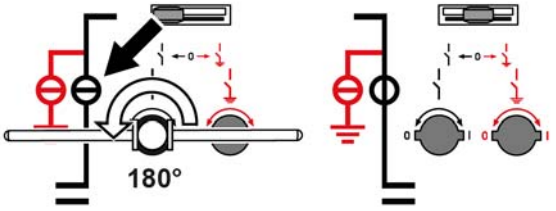
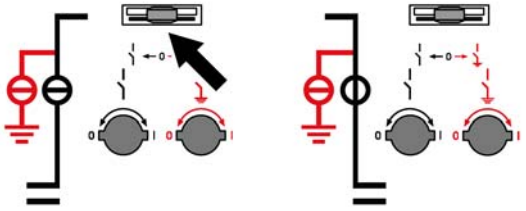
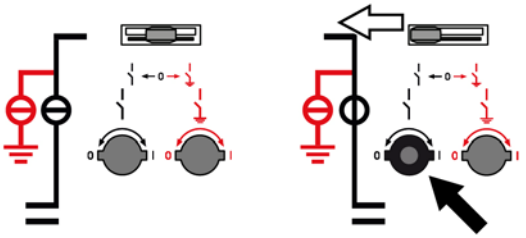
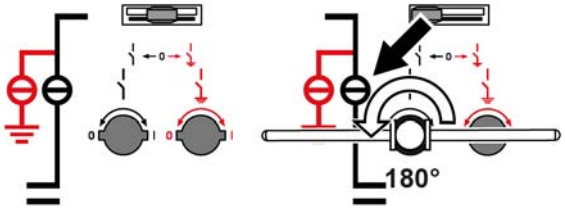
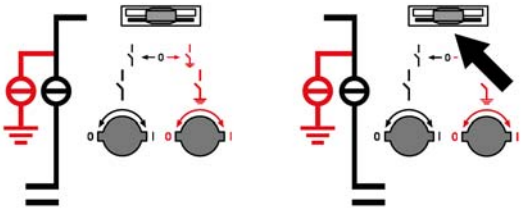
7



⇨ Remove the operating lever for the DISCONNECTING function.

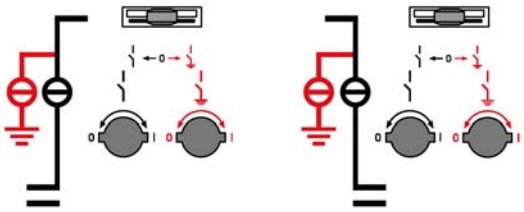
The right-hand control gate returns to its initial position.

Decoupling the busbar section (system 1)

1  Initial situation	2  ⇨ Push the left-hand control gate to the left.
3  ⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).	4  ⇨ Remove the operating lever for the DISCONNECTING function. The left-hand control gate returns to its initial position.
5  ⇨ Push the right-hand control gate to the left.	6  ⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).
7  ⇨ Remove the operating lever for the DISCONNECTING function. The right-hand control gate returns to its initial position.	

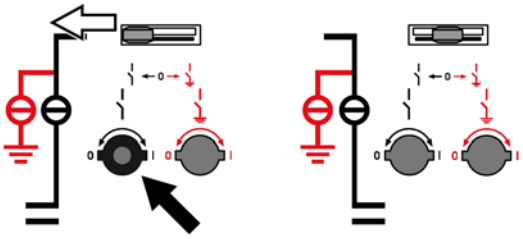
Earthing the busbar section (system 1)

1



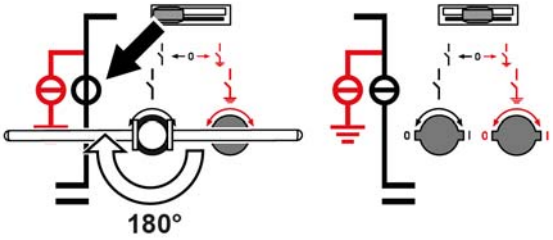
Initial situation

2



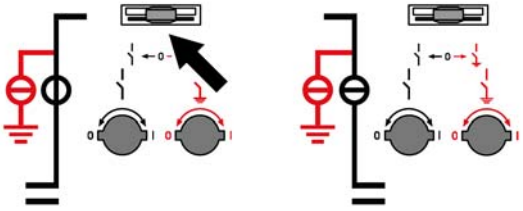
⇨ Push the left-hand control gate to the left.

3



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

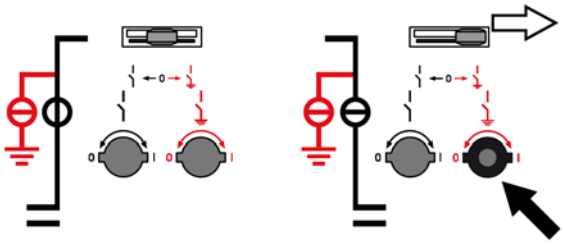
4



⇨ Remove the operating lever for the DISCONNECTING function.

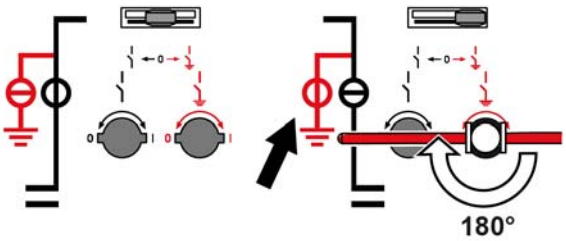
The left-hand control gate returns to its initial position.

5



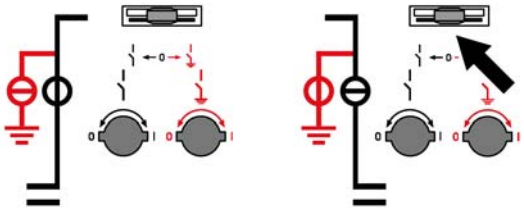
⇨ Push the right-hand control gate to the right.

6



⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).

7

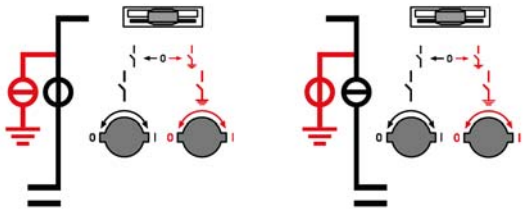


⇨ Remove the operating lever for the READY-TO-EARTH function.

The left-hand control gate returns to its initial position.

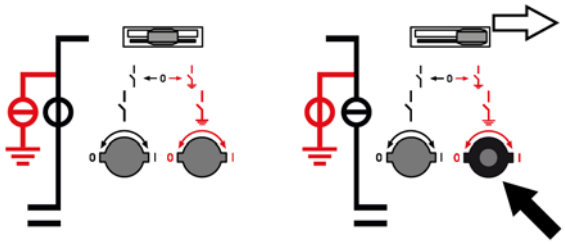
De-earthing the busbar section (system 1)

1



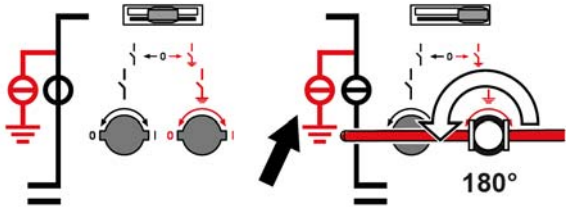
Initial situation

2



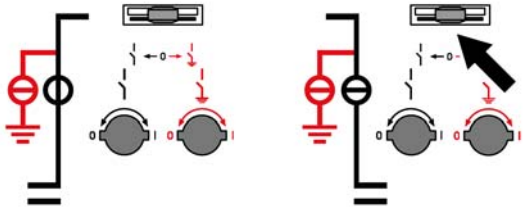
⇨ Push the right-hand control gate to the right.

3



⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).

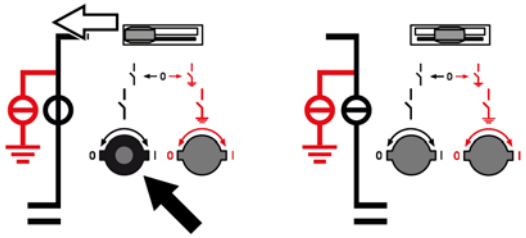
4



⇨ Remove the operating lever for the READY-TO-EARTH function.

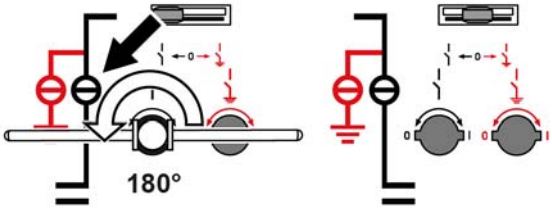
The right-hand control gate returns to its initial position.

5



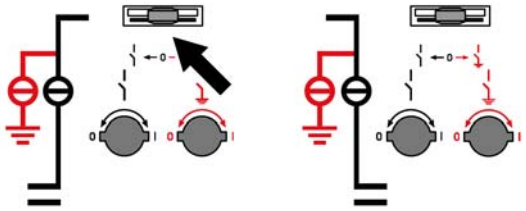
⇨ Push the left-hand control gate to the left.

6



⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).

7

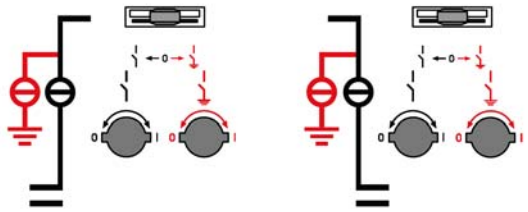


⇨ Remove the operating lever for the DISCONNECTING function.

The left-hand control gate returns to its initial position.

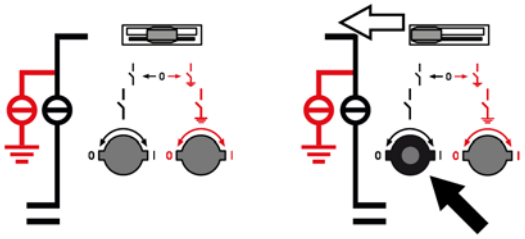
Earthing the busbar section (system 2)

1



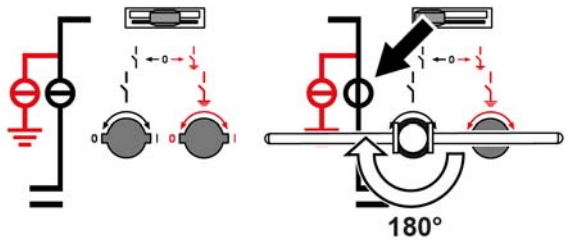
Initial situation

2



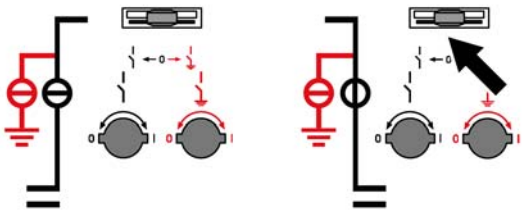
⇨ Push the right-hand control gate to the left.

3



⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

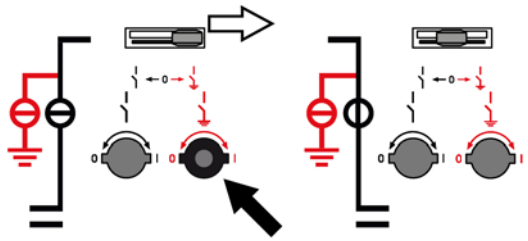
4



⇨ Remove the operating lever for the DISCONNECTING function.

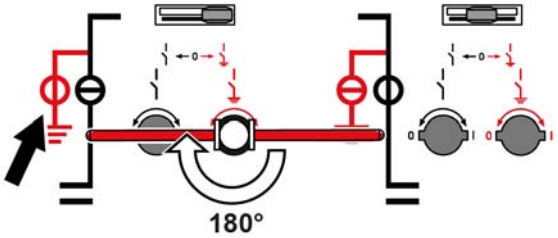
The right-hand control gate returns to its initial position.

5



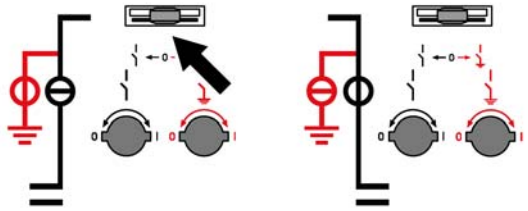
⇨ Push the left-hand control gate to the right.

6



⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).

7

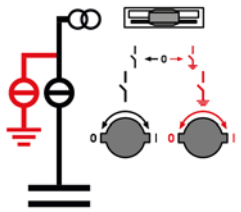
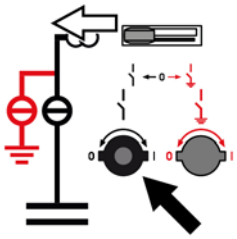
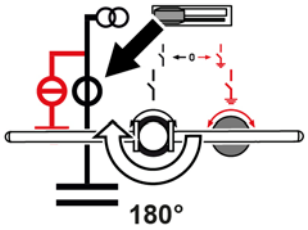
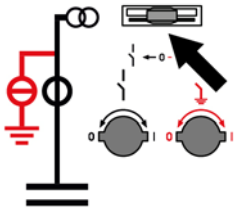


⇨ Remove the operating lever for the READY-TO-EARTH function.

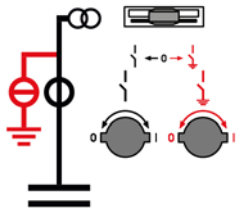
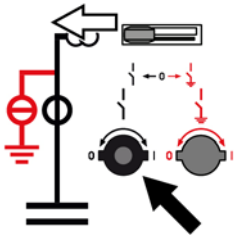
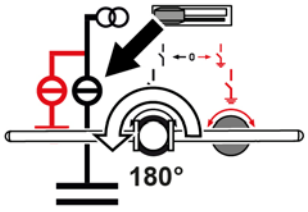
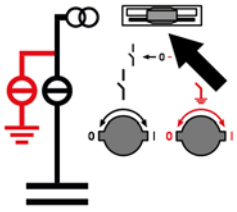
The left-hand control gate returns to its initial position.

42.5 Switching operations for disconnectable voltage transformers

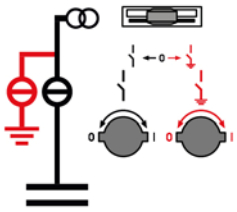
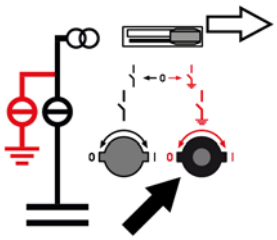
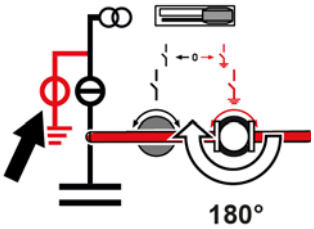
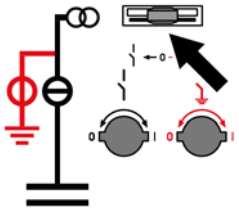
Connecting voltage transformers with busbar 1

1  Initial situation	2  ⇨ Push the control gate to the left.
3  ⇨ Switch the three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).	4  ⇨ Remove the operating lever for the DISCONNECTING function. The control gate returns to its initial position.

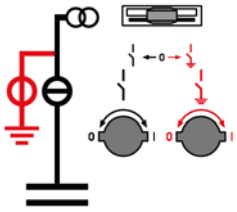
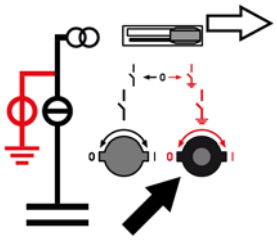
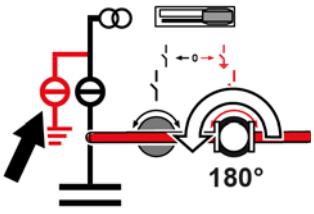
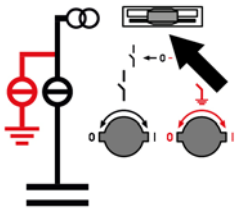
Disconnecting voltage transformers from busbar 1

1  Initial situation	2  ⇨ Push the control gate to the left.
3  ⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).	4  ⇨ Remove the operating lever for the DISCONNECTING function. The control gate returns to its initial position.

Earthing voltage transformers

1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).	4  ⇨ Remove the operating lever for the READY-TO-EARTH function. The control gate returns to its initial position.

De-earthing voltage transformers

1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).	4  ⇨ Remove the operating lever for the READY-TO-EARTH function. The control gate returns to its initial position.

43 Cable testing

43.1 Test voltage

Two possibilities for cable testing are described hereafter.

The following table contains the maximum values for the DC test voltage:

Rated voltage of switchgear [kV]	DC test voltage, maximum value [kV]	Test duration [min]	AC test voltage 0.1 Hz, maximum value [kV]	Test duration [min]
12	48	15	21	60
24	72	15	42	60
36	72	15	63	60
40.5	72	15	70	60

ATTENTION

Before starting the cable test, the suitability of the cables and cable T-plugs must be ensured regarding the selected test voltage.

⇨ If another test duration than specified above is to be applied, please contact the regiuonal Siemens representative.

43.2 Safety instructions

DANGER

High voltage! Danger! Cable testing may produce flashovers which can cause death or serious bodily injuries.

⇨ Cable testing may only be performed by qualified personnel who is familiar with the danger involved.

⇨ The permissible test voltages must not be exceeded.

⇨ Keep safety distances.

⇨ Install barriers.

⇨ Switch on warnings.

ATTENTION

If the voltage transformer is energized, or if it is of the non-disconnectable type, the test voltage can destroy the voltage transformer and cause personal injuries.

⇨ Earth disconnectable voltage transformers before cable testing.

⇨ Remove non-disconnectable voltage transformers.

ATTENTION

The voltage indicators CAPDIS-S1+ and CAPDIS-S2+ may be damaged during power-frequency voltage tests.

⇨ Short-circuit voltage indicators with the earthing points of the test sockets.

43.3 Function test

Cable testing with dismantled cable

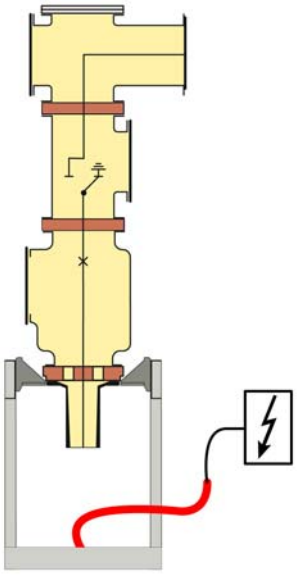


Fig. 213: Test arrangement with dismantled cable

- ⇨ Earth the feeder (see page 167, "Feeder earthing").
- ⇨ Remove cable to be tested.
- ⇨ Screw test adapter tight onto cable termination of dismantled cable.
- ⇨ Connect test lead.
- ⇨ Perform voltage test.

Cable testing with connected cable

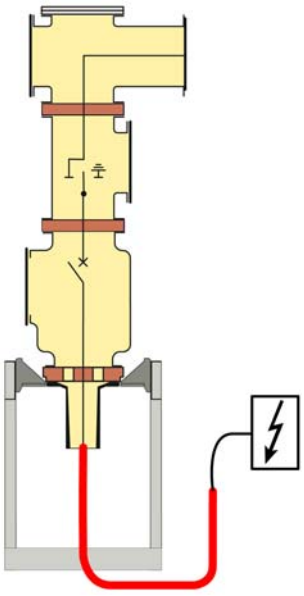


Fig. 214: Test arrangement with connected cable

- ⇨ Earth the feeder (see page 167, "Feeder earthing").
- ⇨ Short-circuit capacitive test sockets and test sockets on integrated voltage detecting systems (e. g. CAPDIS).
- ⇨ Open the circuit-breaker (see page 148, "Opening the circuit-breaker manually").
- ⇨ Switch three-position disconnector to OPEN position (see page 155, "Opening the three-position disconnector manually ").
- ⇨ Screw test adapter onto cable termination.
- ⇨ Connect test lead.
- ⇨ Perform voltage test.
- ⇨ After voltage test, earth the feeder (see page 167, "Feeder earthing").

Servicing

44 Maintenance

44.1 Switchgear maintenance

Under normal operating conditions the fixed-mounted circuit-breaker switchgear 8DB10 and the 3AH49 circuit-breaker are maintenance-free. We recommend to inspect the switchgear according to the following maintenance recommendation. To prevent any danger during maintenance, please observe the following safety instructions.

Inspection/testing of the secondary equipment such as the capacitive voltage detecting system is done within the scope of national standards and customer-specific regulations.

44.2 Safety instructions

DANGER

High voltage! Danger! Do always observe the Five Safety Rules:

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

DANGER

High voltage! Danger! Touching live parts will cause death or serious injuries.

- ⇨ Switchgear maintenance may only be performed by qualified personnel who is familiar with the danger involved.

44.3 Maintenance recommendation

The switchgear should be inspected at the following intervals:

Visual check	every 5 years
Status inspection	every 10 years
Maintenance	after 10000 operating cycles of the circuit-breaker, see page 205, "Maintenance of the vacuum circuit-breaker operating mechanism"
These intervals are guidelines which have to be adjusted to the different operating conditions (e.g. dusty environment, frequent condensation, etc.). The maintenance actions with the associated test and maintenance operations are shown in the following table.	

	**DANGER** Danger of suffocation! SF_6 gas is heavier than air and concentrates first near to the floor and in floor openings. ⇨ Do not let SF_6 gas get into the environment. ⇨ While working with SF_6 gas, provide for sufficient ventilation. ⇨ After working with SF_6 gas, vent the cable basement and any hollows in the floors with special care. ⇨ Observe the safety data sheet for SF_6 gas. ⇨ Cover or barrier adjacent live parts. ⇨ To be done generally before working with SF_6 gas: Check and document reusability (dew-point, gas quality) of the SF_6.

Maintenance recommendation

Visual check	Status inspection	Maintenance	
X	X	X	Check and document SF_6 gas pressure (see page 44, "Insulating gas SF_6")
	X	X	Check and document dew-point (humidity content) (≤ −15° C)
	X	X	Check and document gas quality (air content) (SF_6 share ≥ 95 %)
		X	Check operating mechanism and interlocking of disconnector and earthing switch (if required, grease linkage and bearings)
		X	Vacuum circuit-breaker operating mechanism
		X	**In all gas compartments, if gas has to be exchanged or upon reaching the number of operating cycles:** ⇨ Evacuate SF6 gas. ⇨ Replace desiccant bags. ⇨ Replace toroidal sealing rings. ⇨ Fill in SF_6 gas. ⇨ Check and document gas pressure. ⇨ Check tightness.

44.4 Procedure for bolted joints and seals

Please observe the following procedure for maintenance of switchgear parts with bolted joints:

⇨ Recommendation: Always replace the spring elements on loosened bolted joints.

Please observe the following procedure for maintenance of switchgear parts with seals:

⇨ Always replace removed toroidal sealing rings by new ones. Toroidal sealing rings can be obtained from your regional Siemens representative.

⇨ Clean the sealing surfaces and grooves in the flanges with a lint-free cloth.

⇨ Check the sealing surfaces before installation.

⇨ Grease the toroidal sealing rings and place them in the grooves of the flanges.

⇨ If required, place desiccant bags in the cover.

⇨ Mount the cover.

⇨ Bolt the flanges tight cross-wise with the hexagonal bolts M8 with new spring elements. Tightening torque: 20 Nm.

44.5 Maintenance of the vacuum circuit-breaker operating mechanism

Under normal operating conditions the fixed-mounted circuit-breaker switchgear 8DB10 and the 3AH49 circuit-breaker are maintenance-free.

After 10,000 operating cycles or depending on the respective operating conditions (e. g. dusty environment, frequent condensation, etc.) we recommend to clean the external parts and, if necessary, to renew the anti-corrosion protection greasing. To do this, you may only use the materials specified hereafter on the individual functional parts of the circuit-breaker.

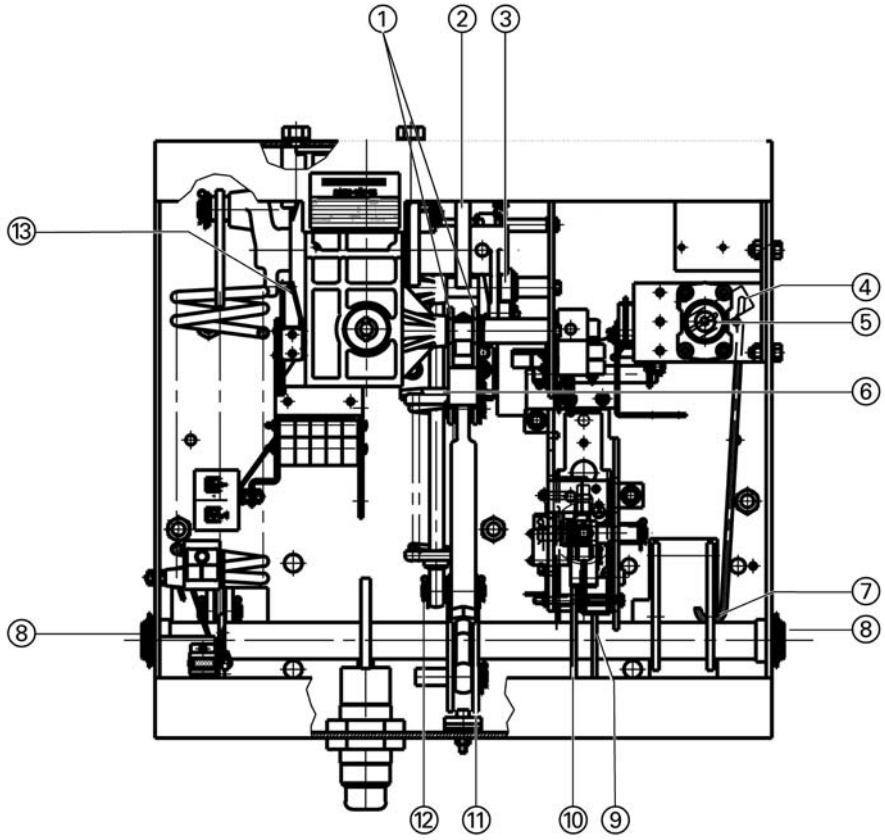


Fig. 215: Greasing plan for 3AH49 operating mechanism

Isoflex Topas L 32

- ② Curve contour
- ③ Closing latch
- ④ Deflection of auxiliary switch
- ⑥ Guide of opening spring
- ⑦ Deflecton of auxiliary switch
- ⑨ Opening latch
- ⑩ Curve for opening latch
- ⑪ End stop
- ⑬ Crank pin for pushbutton operation

Shell Tellus Oil 32

- ① Bearing for deflection lever
- ⑤ Auxiliary switch
- ⑧ Bearing of operating shaft
- ⑫ Opening spring

Permissible lubricants:

For bearings, sliding surfaces:

Isoflex Topas L 32
Klüber - Lubrication KG
Geisenhauer Str. 7
Postfach 70 10 47
D-81310 München

For bearings that are inaccessible for grease, and bearings of the auxiliary switch S1:

Tellus Oil 32
Shell Direct GmbH
Suhrenkamp 71
D-22335 Hamburg

ATTENTION

Parts of the switchgear that cannot be dismantled may be damaged if they come into contact with cleaning agents.

⇨ Do **not** wash joints and bearings which cannot be dismantled with a cleaning agent.

⇨ Renew the anti-corrosion protection greasing.

⇨ Operate the circuit-breaker several times mechanically by hand for test.

44.6 Cleaning agents and cleaning aids

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	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 cleaning liquid cleaning agent (single use)
	Brush	
	Cleaning rag	
	Vacuum cleaner	

44.7 Lubricants

Designation	Manufacturer	Application	Comment
Polylub GLY 801	Siemens	Current-carrying fixed-mounted connections (current conductors and earthing bars, connections), flanges with toroidal sealing rings	No greasing effect; used as mounting aid for toroidal sealing rings; mounting paste for flanges
Barrierta GTE 403	Klüber	Contact blades and contacts of the three-position disconnector	Observe the designation "GTE 403" in order to avoid mistakes with other Barrierta products
Longtherm 2+	Molykote	Bearings of the operating linkage	Not suitable for greasing points on the circuit-breaker operating mechanism

44.8 Switchgear extension and replacement of panels and components

For switchgear extension and replacement of components, please contact the regional Siemens representative.

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

- Type and serial number of the switchgear and the circuit-breaker (see rating plates)
- Precise designation of the device or component, if applicable on the basis of the information and illustrations in the associated instructions, a drawing, sketch or circuit diagram

44.9 Spare parts

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

45 End of service life

Service life

Under normal operating conditions, the expected service life of gas-insulated switchgear 8DB10 is at least 35 years, probably 40 to 50 years, taking the tightness of the enclosed high-voltage parts into account. The service life is limited by the maximum number of operating cycles of the switching devices installed:

- For circuit-breakers, according to the (endurance) class defined in IEC 62271-100
- For three-position disconnectors and earthing switches, according to the (endurance) class defined in IEC 62271-102.

The maximum permissible number of operating cycles of the built-in circuit-breakers is 20,000. The current number of operating cycles can be checked on the mechanical operations counter.

SF_6 gas

	NOTE
	The equipment contains the fluorized greenhouse gas SF_6 registrated by the Kyoto Protocol with a global warming potential (GWP) of 22 800. SF_6 has to be reclaimed and must not be released into the atmosphere. ⇨ For use and handling of SF_6, IEC 62271-4: High-voltage switchgear and controlgear - Part 4: Use and handling of sulphur hexafluoride (SF6) has to be observed.

1) Source: „Regulation (EU) No. 517/2014 of the European Parlament and of the council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006“

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 SF_6 gas, the switchgear mainly consists of the following materials:

- Steel
- Copper
- Aluminum
- Cast resin
- Fiber-reinforced plastics
- Rubber materials
- Ceramic materials
- Lubricants

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.

Any existing 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 observed.

For further information, please contact the regional Siemens representative.

Siemens Service Hotline

- **Customer Support Global**
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  - support.energy@siemens.com
  - 24 hours
- **Customer Support Brazil** (only for Brazilian market)
  - +55 11 4585 8040
  - suporte.br@siemens.com
  - local working hours
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  - +91 1 800 419 7477
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