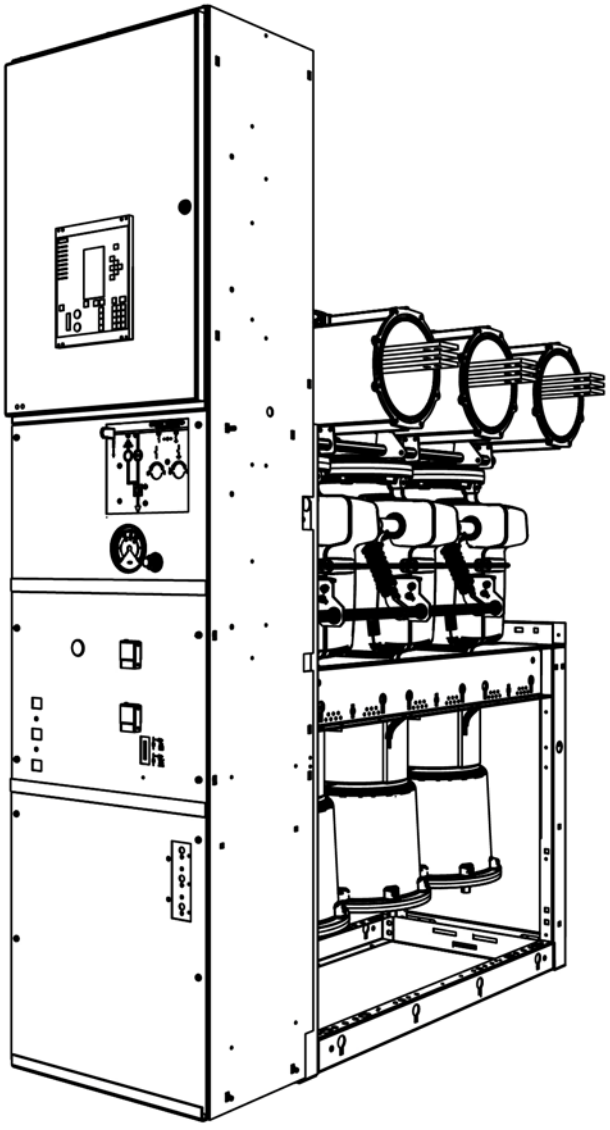
SIEMENS

Medium-Voltage Switchgear

Type 8DA10 Extendable Fixed-Mounted Circuit-Breaker Switchgear up to 40.5 kV

Single Busbar, Single-Pole Metal-Enclosed, Gas-Insulated



INSTALLATION AND OPERATING INSTRUCTIONS

Order No.: 861-9601.9
Revision: 11
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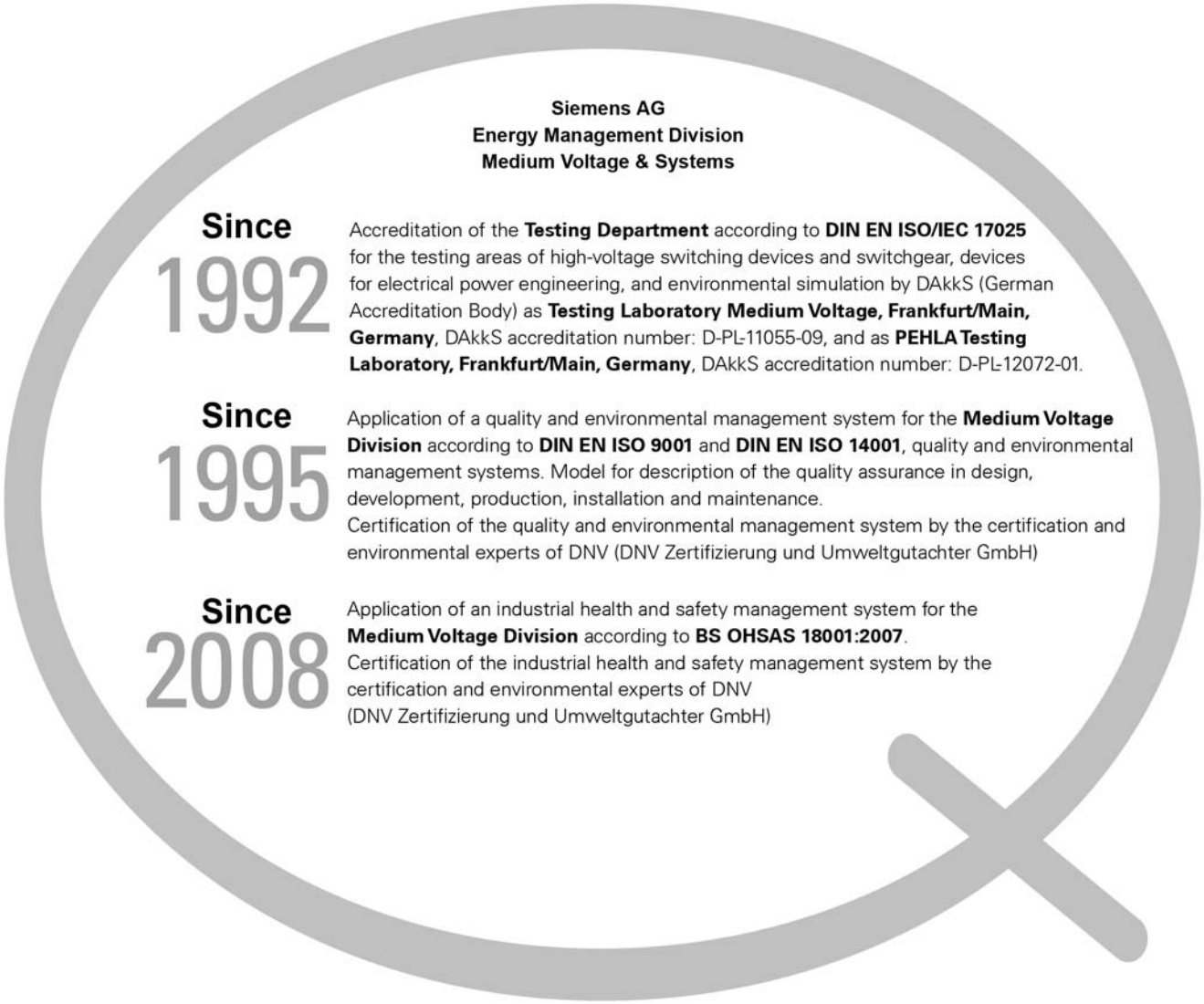


About these Instructions

These instructions do not purport to cover all details or variations in equipment. These instructions also cannot provide for every possible contingency to be met in connection with installation, combination of components, or operation.

For details about technical design and equipment like e.g. technical data, secondary equipment, circuit diagrams, please refer to the order documents.

The switchgear is subject to continuous technical development within the scope of technical progress. If not stated otherwise on the individual pages of these instructions, we reserve the right to modify the specified values and drawings. All dimensions are given in mm.

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.

For further product information related to these instructions, or if particular product problems arise, or if you wish to make suggestions for improvement, or if the contents are incomprehensible, please contact the regional Siemens Service Hotline, see page 210, "Siemens Service Hotline".

Contents

Safety instructions

1 Signal terms and definitions

The signal words "danger," "warning" and "caution" used in this instruction manual indicate the degree of hazard that may be encountered by the user.

⚠DANGER

Danger - Indicates an imminently hazardous situation.

If this hazardous situation is not avoided, death or serious injury will be the consequence.

⇨ Observe the safety instructions.

⚠WARNING

Warning - Indicates a potentially hazardous situation.

If this hazardous situation is not avoided, death or serious injury can be the consequence.

⇨ Observe the safety instructions.

⚠CAUTION

Caution - Indicates a potentially hazardous situation.

If this hazardous situation is not avoided, minor or moderate injury can be the consequence.

⇨ Observe the safety instructions.

NOTICE

Note - Indicates a potentially hazardous situation.

If this hazardous situation is not avoided, damage to property or environment can be the consequence.

⇨ Observe the notes.

☞INFORMATION

Information - Indicates an important information or facilitation of work.

⇨ Observe the information.

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

⚠DANGER

Hazardous voltages and high-speed moving parts

Will cause death, serious injury or property damage.

- ⇨ Always de-energize and earth the switchgear before maintenance.
- ⇨ Read and understand this instruction manual before using switchgear.
- ⇨ Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the switchgear or tampering by unqualified personnel will result in dangerous conditions that will cause death, severe injury or switchgear damage.
- ⇨ Follow all safety instructions contained herein.

⚠DANGER

Internal arcing and explosion hazard

Will cause death, serious injury or property damage.

The switchgear may or may not be classified as arc-resistant switchgear.

Check the information on the rating plate for the switchgear to determine if it has an internal arc classification. If the switchgear has internal arc classification IAC A FL, the area behind the switchgear is not tested to evaluate the effects of internal arcs. Personnel must be prevented from entering the area behind the switchgear when the switchgear is energized.

If the switchgear is classified as arc resistant, note that it is not arc resistant unless all of the following conditions are met:

- ⇨ All pressure relief devices are free to operate as designed.
- ⇨ The fault energy available to the switchgear does not exceed the internal arcing short-circuit current rating and rated arcing duration of the switchgear.
- ⇨ There are no obstructions around the switchgear that could direct the arcing exhaust products into an area intended to be protected.
- ⇨ The switchgear is installed in accordance with the information in the instruction manuals and drawings

Important

- The personnel must read and understand this manual before starting to work.
- Observe all safety instructions and warnings in this manual, and follow the instructions.
- Store this manual carefully, and so that it is accessible to the personnel at any time.
- This manual is a part of the product. When the switchgear is transferred, supply this manual as well.

☞INFORMATION

The illustrations included in this manual are simplified and serve to create a general understanding. The illustrations may therefore deviate from the actual product.

☞INFORMATION

Preconditions for perfect and safe operation of the switchgear:

- ⇨ 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 installation, operation and safety regulations applicable at the place of installation.

⚠ WARNING

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.

- ⇨ Use Siemens original parts only.
- ⇨ Service engineers performing replacement are trained and certified by Siemens.
- ⇨ Install or adjust parts properly.
- ⇨ Perform settings in accordance with Siemens specifications.
- ⇨ After installation and setting, have a final check performed by a service engineer approved by Siemens, including documentation of the test results.
- ⇨ Perform maintenance according to the operating instructions of the Siemens products.

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

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.

The switchgear operator or 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.

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 substances 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 personal protective equipment must be worn for operating the switchgear**.

For switchgear **without proof** of internal arc classification according to IEC 62271 Part 200, **personal protective equipment must be worn for operating the switchgear**.

If covers have to be removed **to work on switchgear**, personal protective equipment must be worn for protection against hot gases exhausting in case of internal arc. In case of internal arc, full personal protection is not provided, even if the personal protective equipment is worn.

To select the protective equipment, the local laws and regulations must be observed and accomplished.

The protective equipment consists of:

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

Removing the front cover from the operating mechanism compartment

⚠WARNING

High speed moving parts

Can cause serious injury.

Do not remove the front cover of the operating mechanism until the following actions have been performed:

⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.:
- Switch the auxiliary voltage supply of the motor.
- Trip the MCB.
- Disconnect the control cables from the low-voltage compartment.

⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:
- Actuate the manual OFF pushbutton.
- Actuate the manual ON pushbutton.
- Actuate the manual OFF pushbutton again.

⇨ Check if the "spring charged" indicator shows "spring charged".

Fig. 1: "Spring not charged" indication

Fig. 2: "Spring charged" indication

3 IT security

The Siemens software is regularly checked for safety. If weak points are identified in the process, which may allow third parties to access protection devices, information thereto is distributed through the **SIPROTEC and SICAM Security Update Report Newsletter**.

The Newsletter can be subscribed to at the following website:

www.siemens.com/gridsecurity

Before commissioning the switchgear, it must be verified that the current firmware version is installed on the protection devices. The latest version of firmware can be obtained from the following website:

http://w3.siemens.com/smartgrid/global/en/products-systems-solutions/downloads/Pages/Overview.aspx

For information to updates for other makes of protection devices, please contact the respective manufacturer.

4 Due application

The fixed-mounted circuit-breaker switchgear 8DA10 is a factory-assembled, type-tested, single-pole metal-enclosed switchgear for indoor installation used in transformer and switching substations.

The switchgear is designed for application under normal ambient conditions according to IEC 62271-1. The switchgear can also be used under special ambient conditions as defined individually between the operator and the manufacturer of the switchgear.

Sulfur hexafluoride SF_6 is used as insulating gas.

8DA10 switchgear is able to switch rated voltages up to 40.5 kV and rated feeder currents up to 3150 A.

5 Qualified personnel

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

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

Medium-voltage switchgear type 8DA10 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 8DA10 at the Siemens Switchgear Factory Frankfurt.

This installation training provides detailed information about transport, design, installation and operation of 8DA10 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 8DA10 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 8DA10, 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 8DA10.
Supervisor	Supervisor in the sense of these operating instructions are persons who own a valid installation certificate for medium-voltage switchgear type 8DA10, and who have installed medium-voltage switchgear type 8DA10 at least once on their own. Moreover, the supervisor is entitled to give instructions about the installation of the medium-voltage switchgear 8DA10 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 8DA10, and who have installed medium-voltage switchgear type 8DA10 at least four times on their own. **The senior supervisor is further entitled to:** • Give instructions on the installation of the medium-voltage switchgear 8DA10 to other personnel • Sign an installation certificate in order to confirm its validity

Description

6 Panel overview

6.1 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

6.2 Switchpanel pole

- Poles arranged one behind the other.
- One switchpanel pole consists of a vertically arranged housing (e.g. with integrated vacuum interrupter).
- The busbar housing with integrated three-position disconnector is mounted horizontally over the switchpanel pole.

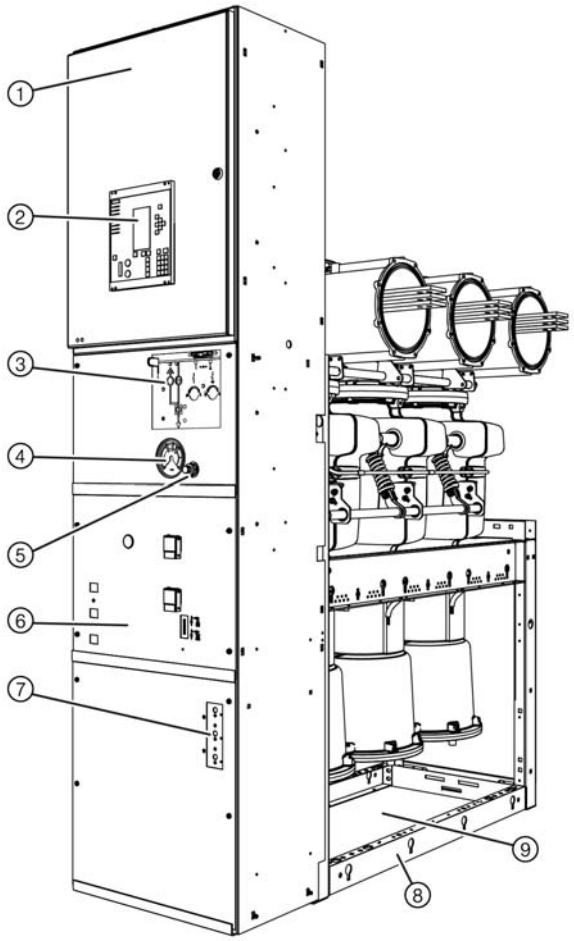
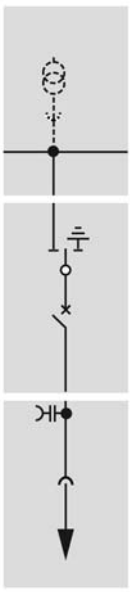


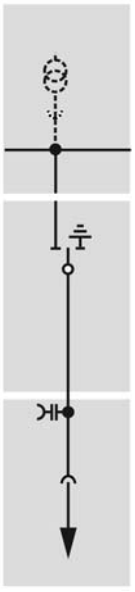
Fig. 3: 8DA10 circuit-breaker panel

① Low-voltage compartment (standard heights: 850/1200 mm)
② SIPROTEC bay controller (option)
③ Indication and control board for three-position disconnector with circuit-breaker position indicator
④ Manometer for gas monitoring of the switchpanel pole housing
⑤ Gas filling valve
⑥ Control board for circuit-breaker
⑦ Voltage detecting system
⑧ Frame
⑨ Cable compartment

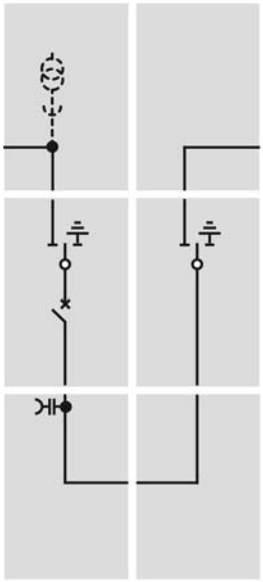
6.3 Examples for panel versions



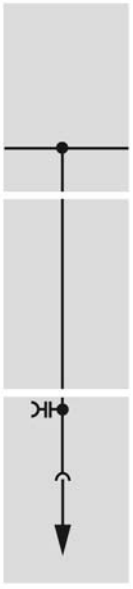
Circuit-breaker panel



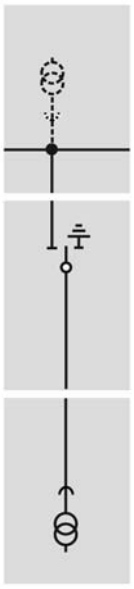
Disconnector panel



Bus sectionalizer



Cable connection panel

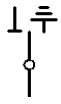


Metering panel

Dummy panel

Vacuum circuit-breaker

Plug-in voltage transformer



Three-position disconnector

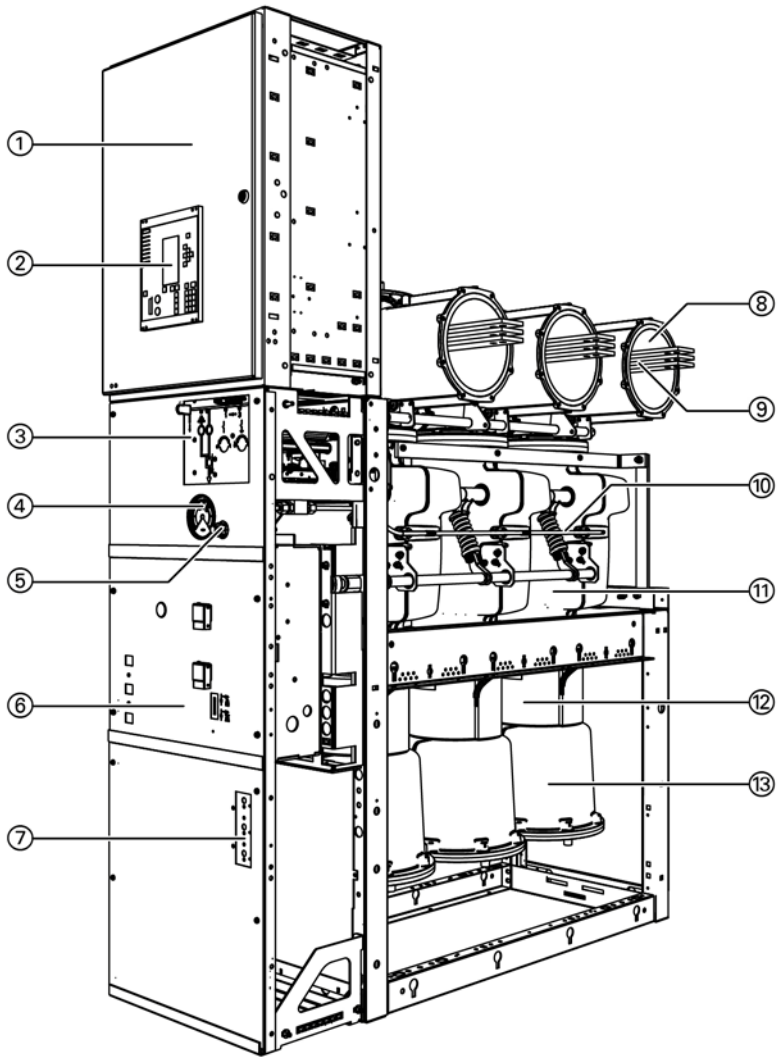
Capacitive voltage detecting system

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

These components are optionally selectable

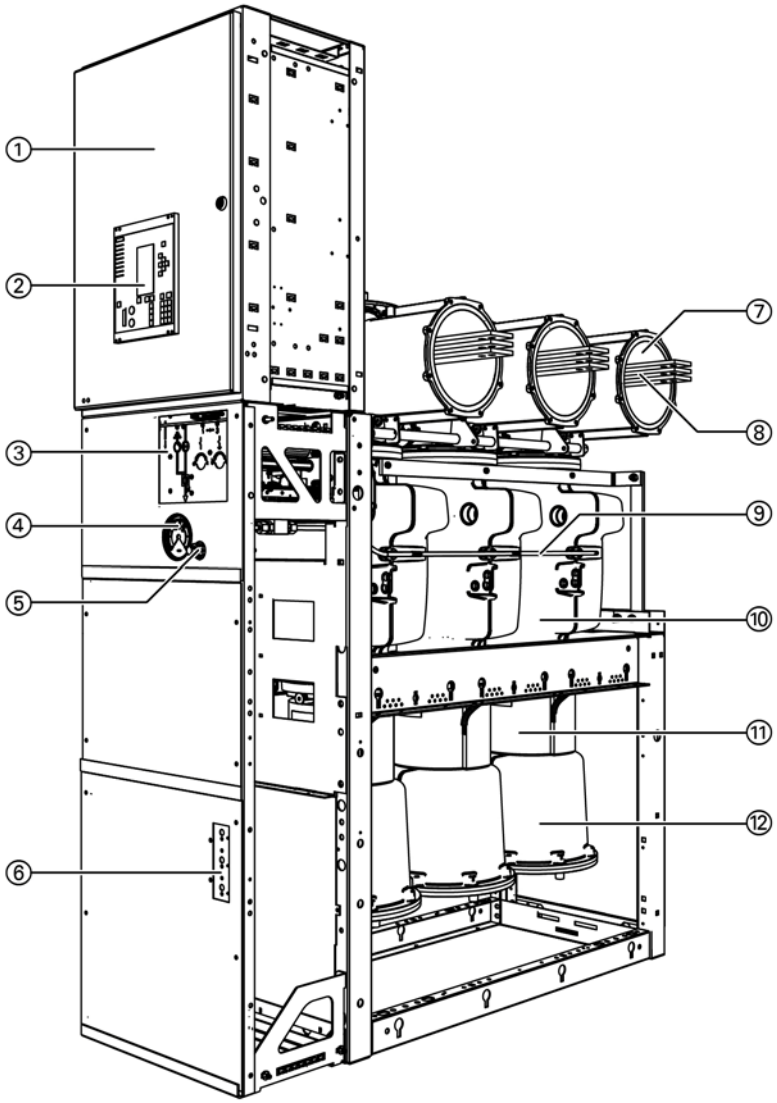
6.4 Examples for panel versions

Circuit-breaker panel up to 3150 A with fan



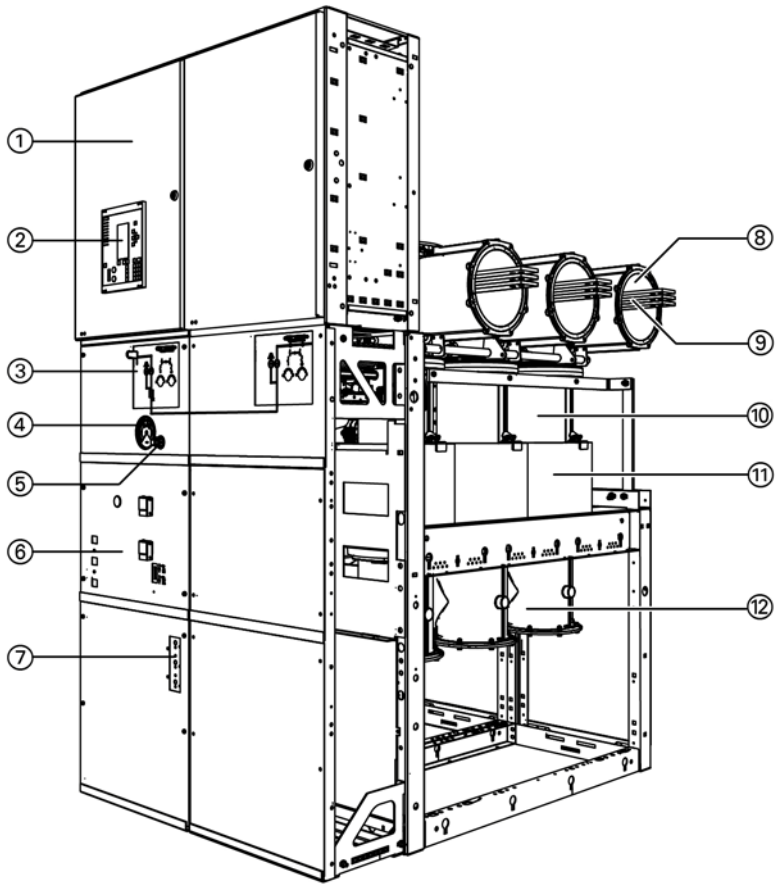
① Low-voltage compartment
② SIPROTEC bay controller (option)
③ Operating mechanism for three-position disconnector
④ Gas pressure manometer for switchpanel pole housing
⑤ Gas filling valve
⑥ Circuit-breaker operating mechanism
⑦ Capacitive voltage detecting system
⑧ Busbar housing
⑨ Busbars
⑩ Gas pipe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

Three-position disconnector panel up to 3150 A



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

Bus sectionalizer up to 3150 A with fan



① Low-voltage compartment
② SIPROTEC bay controller (option)
③ Operating mechanism for three-position disconnector
④ Gas pressure manometer
⑤ Gas filling valve
⑥ Circuit-breaker operating mechanism
⑦ Capacitive voltage detecting system
⑧ Busbar housing
⑨ Busbars
⑩ Bus riser housing
⑪ Current transformer 4MC4
⑫ Coupling housing

6.5 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 DIN rail for incoming and outgoing cables (e.g., bus wires)
- Devices can be optionally mounted in the door or on DIN rail inside the low-voltage compartment
- Height of low-voltage compartment, optionally 850 mm (standard) or 1200 mm (option)

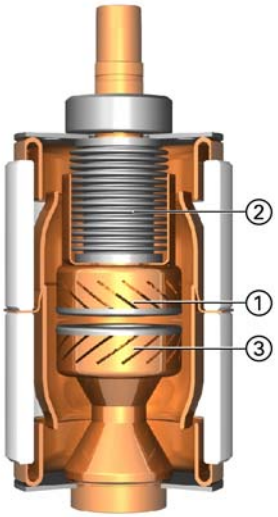
7 Circuit-breaker

7.1 Design

The vacuum circuit-breaker 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

Vacuum interrupters



① Moving contact
② Metal bellows
③ Fixed contact

Fig. 4: Sectional view of a vacuum interrupter

7.2 Circuit-breaker operating mechanism

Design

The circuit-breaker operating mechanism is closed by a front cover. The front cover contains openings for control elements and indicators. All components required for operating the circuit-breaker are accommodated in the operating mechanism housing.

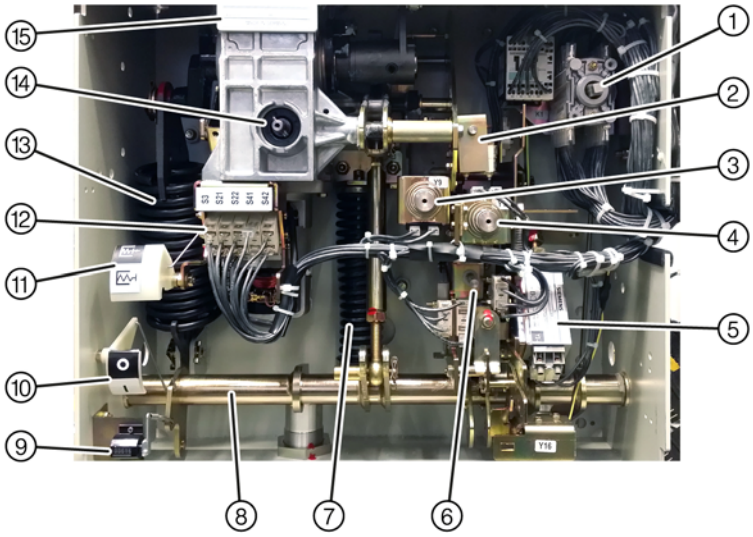


Fig. 5: Circuit-breaker operating mechanism without front cover

① Auxiliary switch (-S1)
② ON pushbutton
③ Closing solenoid (-Y9)
④ 1st shunt release (-Y1)
⑤ Undervoltage release (-Y7)
⑥ OFF pushbutton
⑦ Opening spring
⑧ Operating shaft for circuit-breaker
⑨ Operations counter
⑩ Position indicator for circuit-breaker
⑪ "Spring charged" indicator
⑫ Position switch
⑬ Closing spring
⑭ Actuating opening for "spring charging" (circuit-breaker)
⑮ Rating plate

Function

Depending on its equipment, the circuit-breaker is closed mechanically by means of an ON pushbutton, or electrically. The operating power is transmitted to the vacuum interrupters through an operating linkage.

In case of a motor operating mechanism, the closing spring is charged by means of a motor and latched in the charged position. The "spring charged" indication is visible. Closing is effected via pushbutton or closing solenoid. The closing spring is recharged automatically for auto-reclosing.

If the motor supply voltage fails, the closing spring can be charged manually. To do this, there is an opening in the front cover, with the hand crank coupling of the gear behind. The charging condition of the spring can be read on the "spring charged" indicator, see page 155, "Closing the circuit-breaker manually".

7.3 Equipment

Basic equipment

Basic equipment of the circuit-breaker:

- 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 2-, 4- and 10-pole wiring (-Q0)
- Auxiliary switch, max. 12 NO + 12 NC 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. 22 NO + 22 NC 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)

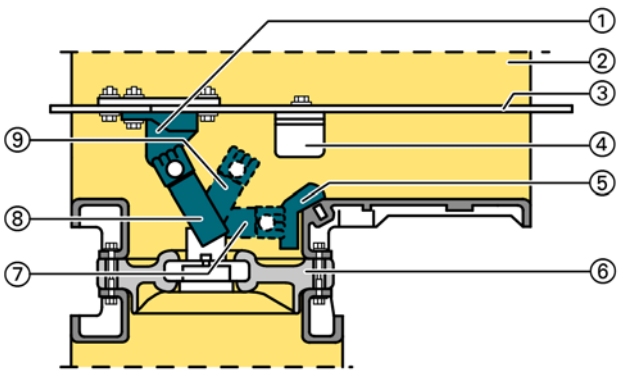
Possible release combinations

Release	Type	Release combination			
		1	2	3	4
1st shunt release	3AY1510	X	X	X	X
2nd shunt release	3AX1101	- - -	X	- - -	X
Undervoltage release	3AX1103	- - -	- - -	X	X

8 Three-position disconnector

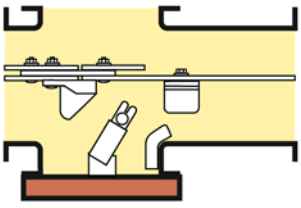
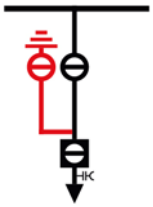
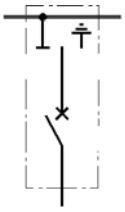
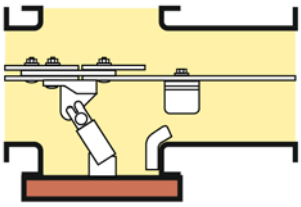
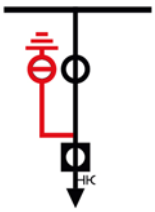
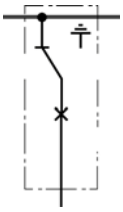
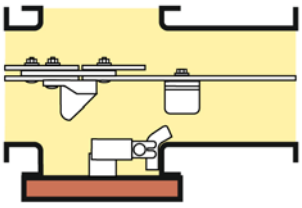
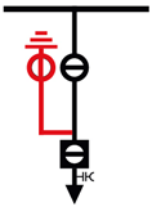
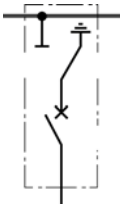
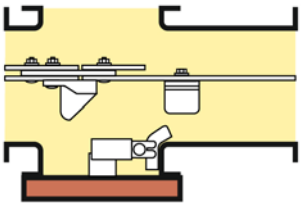
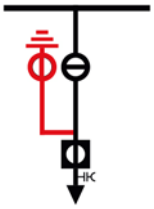
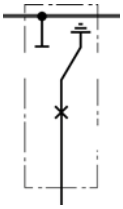
Function

The three-position disconnector combines the functions of a disconnector and an earthing switch. The three-position disconnector is designed for no-load operation only.



① Fixed contact, busbar
② Busbar housing
③ Busbar
④ Busbar support
⑤ Fixed contact, earth
⑥ Bushing
⑦ Moving contact in READY-TO-EARTH/EARTHED position
⑧ Moving contact in CLOSED position
⑨ Moving contact in OPEN position

Fig. 6: Three-position disconnector with busbar and bushing

Switch positions	Position indicator	Basic scheme
 OPEN		 - Three-position disconnector OPEN - Circuit-breaker OPEN
 CLOSED		 - Three-position disconnector CLOSED - Circuit-breaker CLOSED
 READY-TO-EARTH		 - Three-position disconnector READY-TO-EARTH - Circuit-breaker OPEN
 EARTHED		 - Three-position disconnector EARTHED - Circuit-breaker CLOSED

Operating mechanism for three-position disconnector

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

- Auxiliary switch
  - Every operating mechanism is equipped with an auxiliary switch to indicate the switch position.
- Motor operating mechanism
  - Remote operation (standard)
  - 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.

Mechanical interlocking

Interlocking between three-position disconnector and circuit-breaker:

- If the circuit-breaker is in OPEN position, the three-position disconnector can be closed or opened. If one of the actuating openings of the three-position disconnector is opened, the circuit-breaker cannot be operated.
- If the circuit-breaker is in CLOSED position, no operations are possible with the three-position disconnector.

Inserted operating lever

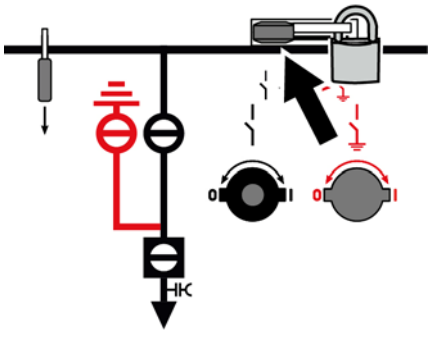
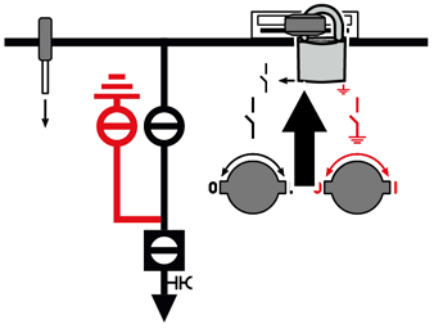
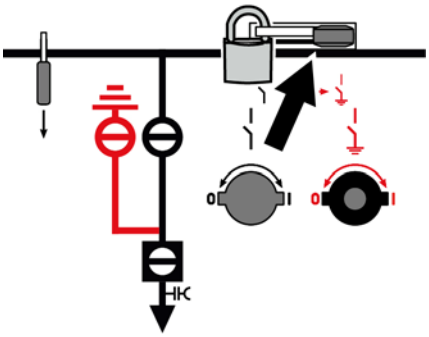
- If the operating lever is inserted, the circuit-breaker cannot be closed or opened.

Operation of the control gate

- The control gate can only be operated if the interrogation lever is pushed downwards.
- The corresponding operating shafts are only released at the control board after having operated the control gate.
- The interrogation lever can only be operated if the circuit-breaker is open.

Locking device of the switching gate

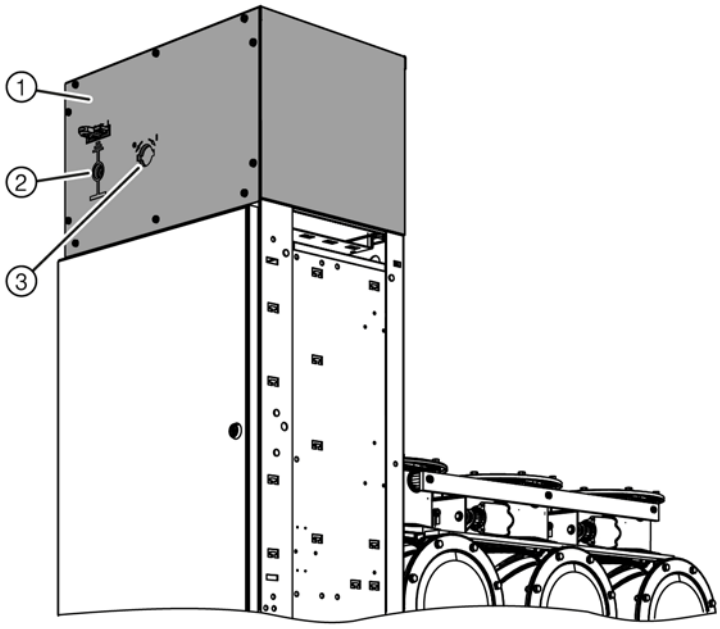
The locking device of the switching gate of the three-position disconnector can be padlocked in all three switch positions.

Holding the control gate on the left	Control gate in the center	Holding the control gate on the right
Three-position disconnector can be closed or opened	No switching operation possible	Ready-to-earth/earthing is possible
		
READY-TO-EARTH function is blocked	DISCONNECTING and READY-TO-EARTH functions are blocked	DISCONNECTING function is blocked

Electrical interlocking

For information about the electrical interlocks, see the supplied circuit diagrams.

9 Make-proof busbar earthing switch



① Operating mechanism housing of busbar earthing switch
② Position indicator
③ Actuating opening

The busbar earthing switch is an earthing switch with short-circuit making capacity for make-proof earthing of the busbar.

10 Current and voltage transformers

10.1 4MT and 4MU voltage transformers

Features

- According to IEC 61869-3
- Cast-resin insulated
- Inductive type
- Safe-to-touch due to metal enclosure

Mounting locations

- On the busbar
- At the panel connection housing

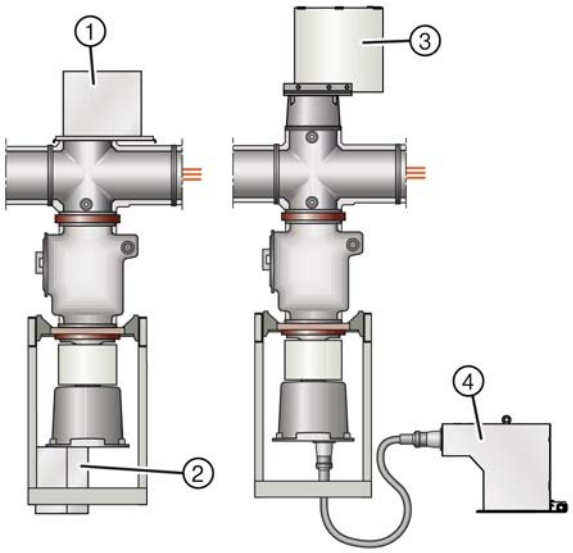


Fig. 7: Voltage transformer installation (basic scheme)

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)

Mounting locations	Type	Remark
Busbar	4MT3	optionally with three-position disconnector
	4MU4	
Panel connection housing	4MU3	external
	4MT7	directly plugged in

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

Damping resistor for voltage transformers

- Damping resistor for voltage transformers at the panel connection housing ①
- Damping resistor for voltage transformers on the busbar ②

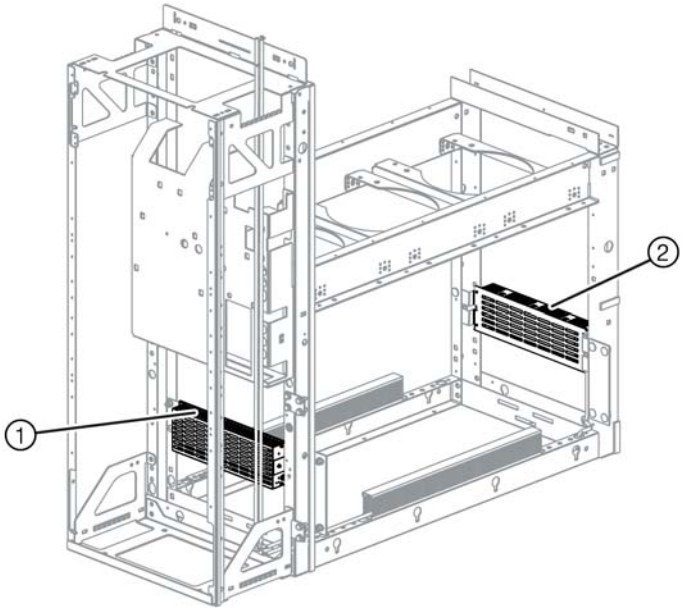


Fig. 8: Position of damping resistors in the switchgear frame

10.2 Current transformers

Features

- According to IEC 61869-2 or EN 61869-2 (depending on the switchgear version)
- 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 housing) due to single-pole design of the panel
- Free of dielectrically stressed cast-resin parts

Mounting locations

- On the busbar
- At the panel connection
- On the cable

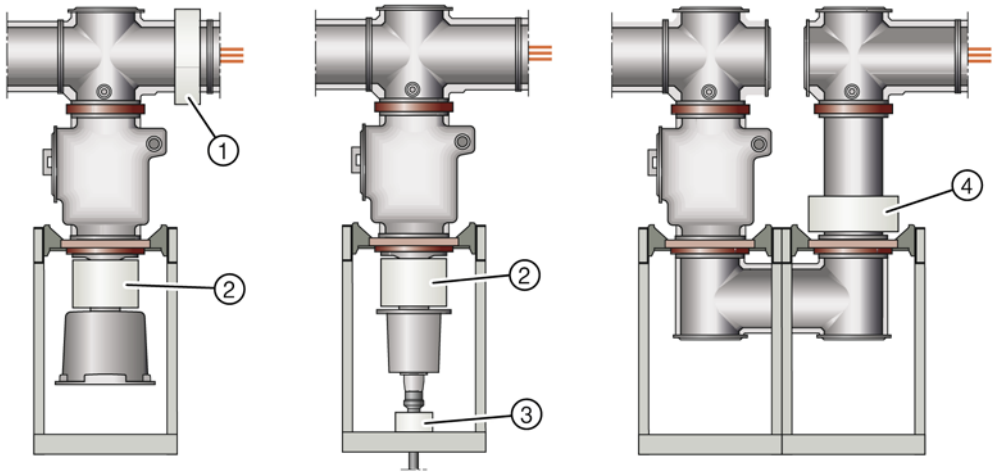


Fig. 9: Current transformer installation (basic scheme)

① Busbar current transformer (type 4MC4_40)
② Feeder current transformer (type 4MC4_90)
③ Feeder current transformer (type 4MC4_10)
④ Current transformer on bus sectionalizer (type 4MC4_40)

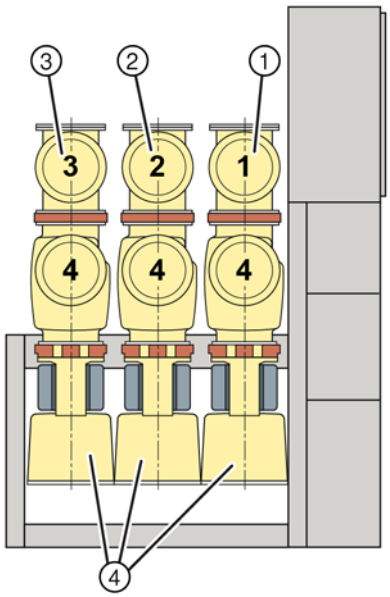
Electrical data

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

11 Gas compartments

Function

The distribution of the gas compartments is decisive for working on 8DA10 switchgear during operation and the resulting operational restrictions. 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 with the associated item designations of the manometers.
For further information, please contact the Siemens Service Hotline.



① Busbar in phase L1 (manometer B11)
② Busbar in phase L2 (manometer B12)
③ Busbar in phase L3 (manometer B13)
④ Circuit-breaker in phases L1, L2, L3 (manometer B0)
⑤ Top-mounted bus sectionalizer for phases L1, L2, L3 (manometer B15)

Fig. 10: Gas compartment distribution of a single-busbar panel

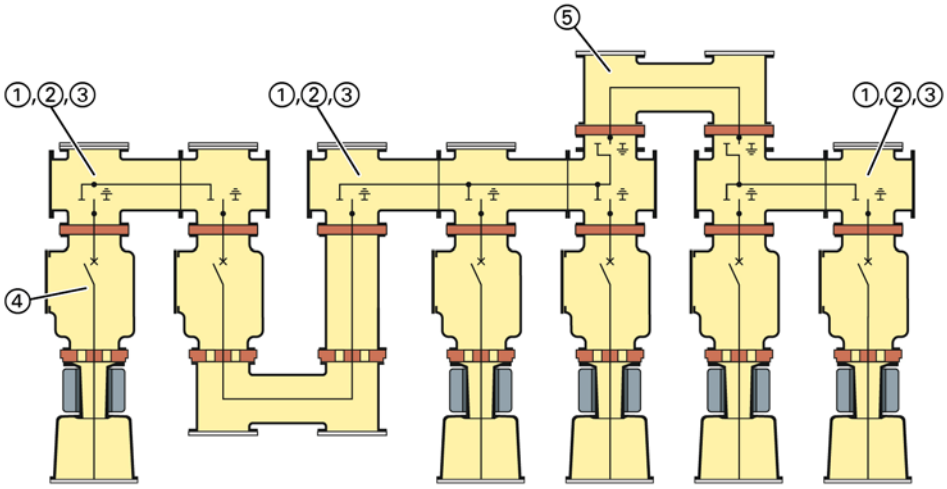
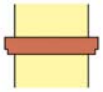
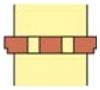
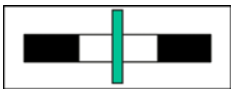


Fig. 11: Gas compartment distribution of a switchgear with single busbar (example)

Bushings

	Symbol	Adhesive label
Gas-tight bushing		
Bushing pervious to gas		

Gas quantity

The gas quantity of 8DA10 varies depending on the pressure, panel connection version and busbar component.

The gas quantities are determined specifically for the project, and are indicated on the rating plates of the panels.

12 Panel connection

12.1 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

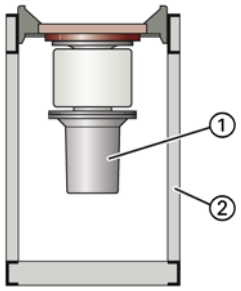
12.2 Cable plugs for panel connection versions

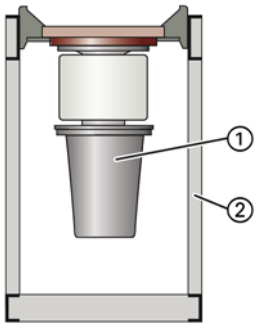
Selection table

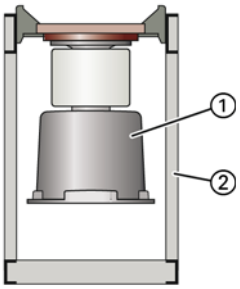
Plug size		**S2**	**S3**	**S4**
Rated normal current	A	800	1250	2500
Rated lightning impulse withstand voltage	kV	200	200	200
Rated short-duration power-frequency withstand voltage	kV	95	95	95
Min. cross-section	mm^2	25	50	95
Min. core diameter	mm	4.9	7.2	9.3
Max. cross-section	mm^2	325	800	1200
Max. 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	51.0	66

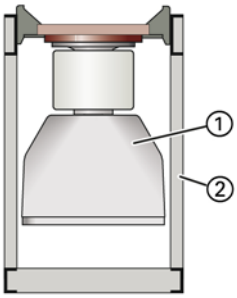
Examples for panel connection versions

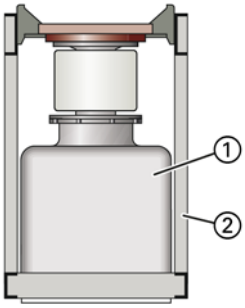
Meaning of the item numbers in the illustrations for the panel connection versions	
①	Panel connection housing
②	Subframe

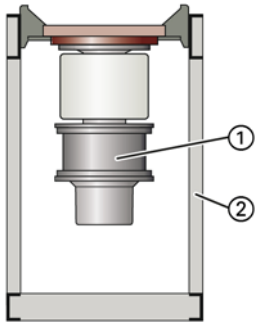
Version 1	S2
	1

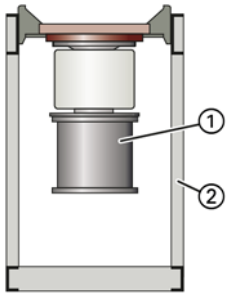
Version 2	S3
	1

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

Version 4 	S2	S3	Solid-insulated bar connection
	4	-	-
	5	-	-
	6	-	-
	-	4	-
	1	3	-
	1	4	-
	2	2	-
	2	3	-
	3	1	-
	3	2	-
	4	1	-
	2	-	1
	-	1	1
	-	2	1
	1	1	1
	1		1
			1

Version 5 	S2	S3	S4
	-	-	1
	1	-	1
	2	1	1
	-	1	1
	1	3	1
	-	-	2
	-	2	1

Version 6	Solid-insulated bar connection
	1

Version 7	Gas-insulated bar connection
	1

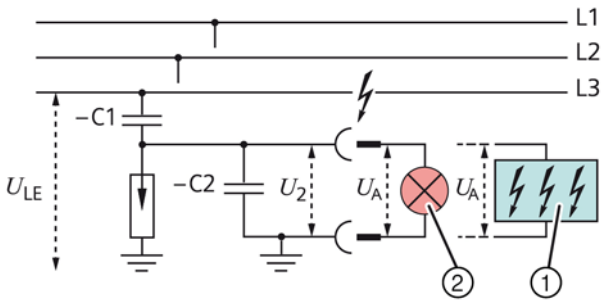
13 Protection and control equipment

The protection equipment and control equipment is designed customer-specifically. T he devices are installed in the low-voltage compartment or in the low-voltage niche. Details are given in the respective circuit documentation.

14 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 Integrated voltage indicator
② Plug-in LRM voltage indicator

Fig. 12: Voltage detecting system via capacitive voltage divider (principle)

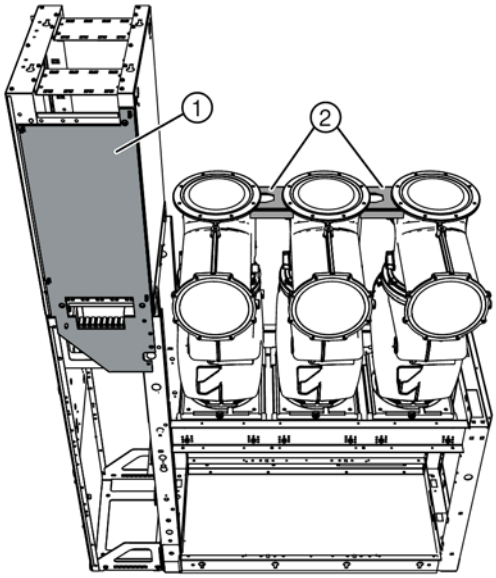
- -C1: Capacitance integrated into bushing
- -C2: Capacitance of the connection leads and the voltage indicator to earth
- $U_{LE} = U_N / \sqrt{3}$ during rated operation in the three-phase system
- $U_2 = U_A$ = Voltage at the interface (plug-in sockets) of the plug-in voltage indicator or the test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

15 Aseismic design (option)

Seismic withstand capability (option)

8DA10 switchgear can be upgraded for operation in regions at risk from earthquakes, see the relevant order and delivery documents.

The additional components for earthquake-resistant design are pre-assembled at the factory.



① Reinforced side plate
② Additional fixing elements between the switchpanel poles

Fig. 13: Earthquake-resistant panel design

The earthquake-resistant design is bolted to the foundation rails at all 4 points on site, using a floor fixing profile.

Fig. 14: Floor fixing profile

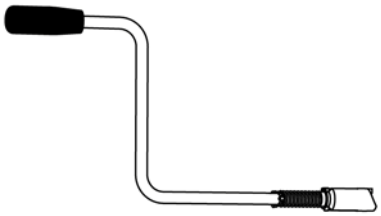
16 Accessories

16.1 Standard accessories

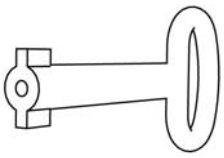
- Operating and installation instructions
- Operating lever for three-position disconnector: DISCONNECTING function

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

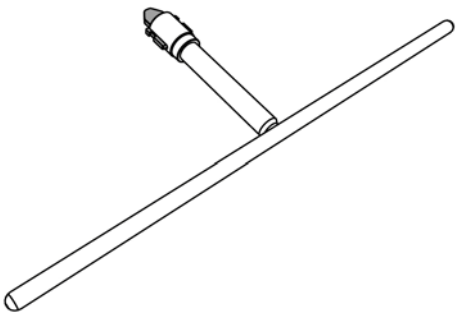
- Hand crank for charging the circuit-breaker closing spring



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



- Operating lever for the make-proof busbar earthing switch

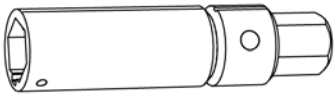


16.2 Other accessories

Other accessories

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

- Plug-in voltage indicators for LRM systems
- Unit to test the function of the plug-in voltage indicators
- Units to test the capacitive interface and the voltage indicators
- Phase comparison test units
- Adapter for emergency operation of the operating mechanism of the three-position switch (to be used only with motor operating mechanism)



Service flap in the switchgear end wall to store the standard accessories.

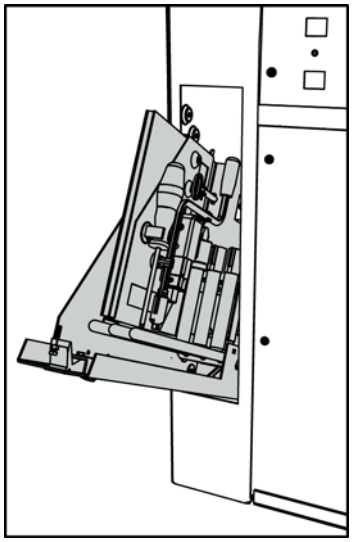


Fig. 15: Open service flap

17 Technical data

17.1 Electrical data

Complete switchgear

Electrical data, filling pressure, temperature for single-busbar switchgear						
Rated insulation level	Rated voltage U_r	kV	**12**	**24**	**36**	**40.5**
	Rated short-duration power-frequency withstand voltage U_d					
	- phase-to-earth, open contact gap	kV	28	50	70	85
	- across the isolating distance	kV	32	60	80	90
	Rated lightning impulse withstand voltage U_p					
	- phase-to-earth, open contact gap	kV	75	125	170	185
	- across the isolating distance	kV	85	145	195	220
Rated frequency f_r		Hz	50/60	50/60	50/60	50/60
Rated normal current[1] I_r	for the busbar	A	1250	1250	1250	1250
		A	2000	2000	2000	2000
		A	2500	2500	2500	2500
		A	3150	3150	3150	3150
		A	4000	4000	4000	4000
		A	5000	5000	5000	5000
Filling pressure (pressure values at 20 °C)	Rated filling level $_{pre}$ (absolute) for busbar	kPa	70/120			
	Minimum functional level p_{me} (absolute)	kPa	50/100			
Ambient air temperature T	Operation without secondary equipment	°C	-25 to +55			
	Operation with secondary equipment[2]	°C	-5/-25 to +55			
	for storage/transport, also with secondary systems[3]	°C	-25 to +55			
		°C	-40 to +70 (option)			
Degree of protection	for parts of the primary circuit under high voltage		IP 65			
	Switchgear enclosure		IP 3XD/IP 31D[3]			
	Low-voltage compartment		IP 31D/IP 41			

[1] The rated normal currents apply to ambient air temperatures of max. +40 °C.
The 24-hour mean value is max. +35 °C (according to IEC 62271-1 and IEC 62271-200).
[2] Depending on the secondary equipment used
[3] Depending on the design option

Circuit-breaker panel, disconnector panel

Data of the switchgear panels (circuit-breaker panel, disconnector panel, bus sectionalizer, cable connection panel, metering panel)						
Rated voltage U_r		kV	**12**	**24**	**36**	**40.5**
Rated normal current I_r[1]		A	1250			
		A	1600[2]			
		A	2000			
		A	2500			
		A	2750			
		A	3150[3]			
Rated short-time withstand current I_k	t_k = 3 s	up to kA	40			
50 Hz	Rated peak withstand current I_p	up to kA	100			
	Rated short-circuit making current I_{ma}	up to kA	100			
60 Hz	Rated peak withstand current I_p	up to kA	104			
	Rated short-circuit making current I_{ma}	up to kA	104			
Rated short-circuit breaking current I_{sc}		up to kA	40			
Electrical endurance of vacuum circuit-breakers	at rated normal current	Standard	10,000 operating cycles			
		Option	30,000 operating cycles			
	at rated short-circuit breaking current		50 breaking operations			
Filling pressure (pressure values at 20 °C)	Rated filling level p_{re} (absolute) for feeders	kPa	70/120			
	Minimum functional level p_{me} (absolute)	kPa	50/100			

[1] Maximum permissible normal current dependent on ambient air temperature
[2] 1600 A not available for bus sectionalizer, cable connection panel, metering panel
[3] 3150 A with forced ventilation

17.2 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

Currents	Number of operating cycles	Maintenance
Rated normal current	10000	without
	30000 (option)	with
Short-circuit breaking current	50	without

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 of the internal arc contact separate in all poles in the subsequent opening process.

Motor operating mechanism

The operating mechanisms of the 3AH49 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.

Protection equipment of the motor operating mechanism

Rated supply voltage [V]	Recommended rated current for the protection equipment[1] [A]
24 DC	8
48 DC	6
60 DC	4
DC/AC 110 50/60 Hz	2
DC 220 / AC 230 50/60 Hz	1.6

[1] M.c.b. with C-characteristic

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

Breaking capacity of auxiliary switch 3SV92

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

Closing solenoid (-Y9)

The closing solenoid 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.

Integrated varistor

NOTICE
Overvoltages in inductive circuits **Electrical control devices can be damaged by switching overvoltages.** ⇨ Do not switch off inductive consumers in DC circuits.

The integrated varistor limits overvoltages to approx. 500 V for

- protection devices (when inductive components are mounted in the vacuum circuit-breaker)
- auxiliary voltages ≥ 60 V DC

17.3 Endurance classes

The switching devices of 8DA10 switchgear conform to the classes according to IEC 62 271-100 and -102.

Overview

Panel type	Circuit-breaker	Disconnector	Earthing switch
Circuit-breaker panel	M2	M1	E2[1]
	E2		
	C2		
Bus sectionalizer panel	M2	M1	E2[1]
	E2		
	C2		
Disconnector panel		M1	E0

[1] By closing the circuit-breaker

Circuit-breaker

Function	Class	Standard	Property
BREAKING	M2	IEC 62271-100	10000 times mechanically
	M2 (extended version)		30000 times mechanically with maintenance
	E2	IEC 62271-100	10000 times rated normal current 50 times short-circuit breaking current
	C2	IEC 62271-100	Very low probability of restrikes

Three-position disconnector

Function	Class	Standard	Property
DISCONNECTING	M1	IEC 62271-102	2000 times mechanically
	M1 (extended version)		3000 times mechanically
READY-TO-EARTH			1000 times mechanically
EARTHING	E2 [1]	IEC 62271-102	5 times rated short-circuit making current I_{ma}

[1] By closing the circuit-breaker

Make-proof earthing switch

Function	Class	Standard	Property
EARTHING	E1	IEC 62271-102	1000 times mechanically
			2 times rated short-circuit making current I_{ma}

17.4 Insulating gas

The sealed pressure system of the switchgear contains the insulating gas SF_6 (fluorinated greenhouse gas, GWP 22,800).

Example for a typical amount of SF_6 gas: 8DA10 circuit-breaker panel 36 kV, 40 kA, 1250 A, cable connection 2 x plug size S3 with 2.8 kg SF_6 (CO_2e = 64t).

The respective amount of SF_6 gas included is indicated on the rating plate of the switchgear.

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.

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.

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.

Gas pressures in kPa at 20°C

All gas pressures specified are relative overpressures at an ambient air temperature of 20 °C, and are valid for IEC, GOST and GB.

☞INFORMATION
Select the gas pressure according to the higher value of the rated lightning impulse withstand voltage or rated short-duration power-frequency withstand voltage.

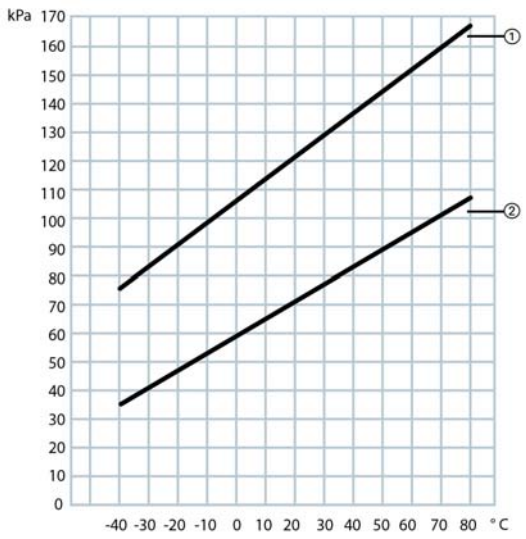
Busbar housing				
Rated busbar current	A	1250 2000 2500 5000		3150 4000
Rated lightning impulse withstand voltage	kV	≤ 170	> 170	all
Rated short-duration power-frequency withstand voltage	kV	≤ 70	> 70	all
Rated functional level	**kPa**	**70**	**120**	
Min. functional level [1]	kPa	50	100	
Signal "pressure low"	kPa	50	100	
Signal "pressure very low"	kPa	40	90	
Max. functional level	kPa	120	180	
Signal "pressure rising"	kPa	120	180	

[1] Min. functional level at which the rated insulation levels are accomplished.

Circuit-breaker housing				
Rated busbar current	A	≤ 1250		> 1250
Rated lightning impulse withstand voltage	kV	≤ 170	> 170	all
Rated short-duration power-frequency withstand voltage	kV	≤ 70	> 70	all
Rated functional level	**kPa**	**70**	**120**	
Min. functional level [1]	kPa	50	100	
Signal "pressure low"	kPa	50	100	
Signal "pressure very low"	kPa	40	90	
Max. functional level	kPa	120	180	
Signal "pressure rising"	kPa	120	180	

[1] Min. functional level at which the rated insulation levels are accomplished.

Characteristics of gas pressure - temperature



① 120 kPa/20 °C
② 70 kPa/20 °C

Fig. 16: 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.

Depending on the age and configuration of the switchgear, there may be deviations from the characteristics shown above.

Gas leakage rate

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

17.5 Classification of 8DA10 according to IEC 62 271-200

⚠DANGER

Internal arcing and explosion hazard

Will cause death, serious injury or property damage.

The switchgear may or may not be classified as arc-resistant switchgear.

If the switchgear has internal arc classification IAC A FL, the area behind the switchgear is not tested to evaluate the effects of internal arcs.

⇨ Check the information on the rating plate for the switchgear to determine if it has an internal arc classification.

⇨ Personnel must be prevented from entering the area behind the switchgear when the switchgear is energized.

Design and construction according to IEC 62271-100

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 according to IEC 62271-200

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

17.6 Standards, specifications, guidelines

Basic prescriptions and standards

The fixed-mounted circuit-breaker switchgear 8DA10 for indoor installation complies with the following prescriptions and standards:

		IEC/EN standard	**VDE standard**
Switchgear	8DA10	62271-1	0671-1
		62271-200	0671-200
Devices	Circuit-breakers	62271-100	0671-100
	Disconnector	62271-102	0671-102
	Earthing switches		
	Voltage detecting systems	61243-5	0682-415
Degree of protection	IP code	60529	0470-1
	IK code	62262 / 50102	0470-100
Insulation		60071	0111
Instrument transformers	-	61869-1	0414-9-1
	Current transformers	61869-2	0414-9-2
	Voltage transformers	61869-3	0414-9-3
Installation, erection	-	61936-1 / -	0101
Insulating gas SF_6	Use and handling of SF_6	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

National approvals

8DA10 switchgear has obtained the following national approval:

- GOST R certificate

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"[1] 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 Directive.

Protection against solid foreign objects, electric shock and water

The fixed-mounted circuit-breaker switchgear of the 8DA10 series fulfills the following degrees of protection according to IEC 62271-1, IEC 62271-200, IEC 60529 and IEC 62262:

- IP65 standard for parts under high voltage
- IP3XD standard for switchgear enclosure
- IP31D option for switchgear enclosure
- IP41 option for low-voltage compartment

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).

17.7 Phase sequence

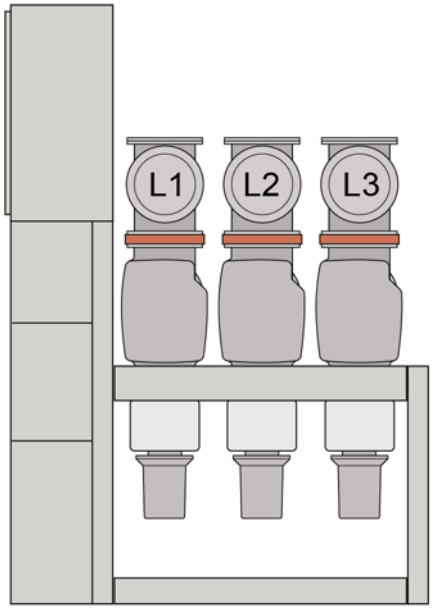


Fig. 17: Phase sequence of busbars

[1] Dr. Bernd Jäkel, Ansgar Müller, "Medium-Voltage Systems – EMC Guide for Switchgear", Siemens AG 2012

17.8 Rating plates

Switchgear panel

The rating plate contains all information that is binding for the panel and its components.

The rating plate is located:

- On the inside of the low-voltage compartment door (rating plates for panel, optionally for voltage transformers and current transformers)

If the circuit-breaker class is specified as M2, a maximum of 10000 (optionally 30000) mechanical operating cycles are possible with the circuit-breaker.

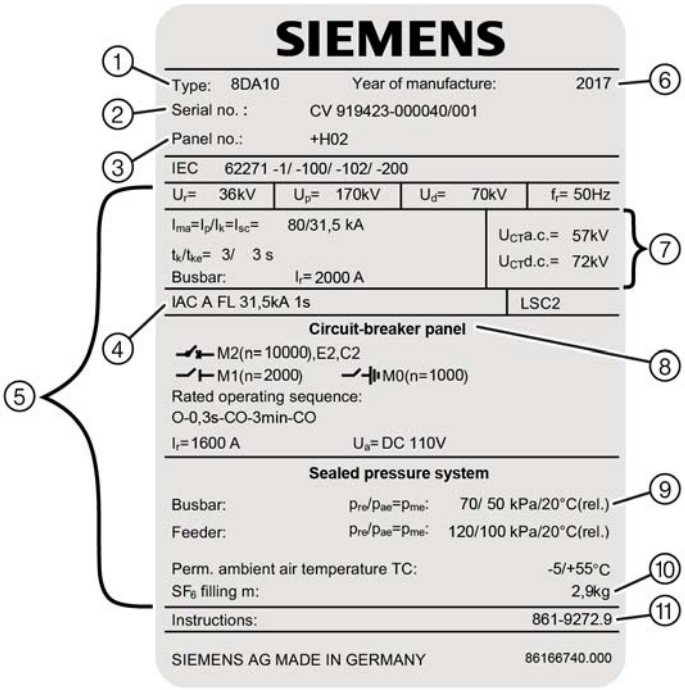


Fig. 18: Rating plate of switchgear (example)

① Switchgear type
② Serial number
③ Panel number
④ Internal arc classification
⑤ Technical data
⑥ Year of manufacture
⑦ Cable test voltages
⑧ Panel type
⑨ Relative filling pressures
⑩ Filling quantity of SF_6 gas
⑪ Number of operating instructions for the panel

Installation

18 Constructional stipulations

18.1 Switchgear room

The switchgear can be used at the following locations as an indoor installation according to IEC 61936 (Power Installations exceeding AC 1 kV) and VDE 0101:

- Lockable electrical service locations. Requirements on lockable electrical service locations (room or location):
  - Are exclusively used for operation of electrical equipment.
  - Are kept under lock and key.
  - Access is exclusively restricted to electricians and persons who have been properly instructed in electrical engineering.
  - Untrained or unskilled persons may only enter under the supervision of electricians or persons who have been properly instructed in electrical engineering.
- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.

Preparing the switchgear room

Observe the following points when preparing the switchgear room:

- Base frame and switchgear dimensions
- Transport ways 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
- Switchgear room free of dirt and dust

Dimensions of the switchgear room

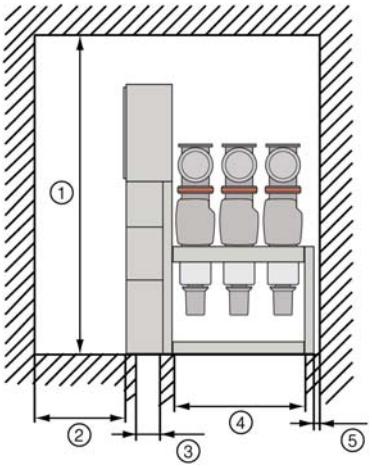


Fig. 19: Room planning

		mm
①	Room height [1]	≥ switchgear height + 200
②	Lateral wall distance from the switchgear front	≥ 800
③	Floor opening for control cables	210
④	Floor opening for high-voltage cables [2]	1145
⑤	Lateral wall distance from the rear side of the switchgear in case of wall-standing arrangement	≥ 100
	Lateral wall distance in case of free-standing arrangement	≥ 800

[1] If there are any busbar components, the room may have to be higher.
[2] For large panel connection housings (versions 4 and 5), the dimension must not be smaller than 1145 mm.

Room dimensions and wall distances

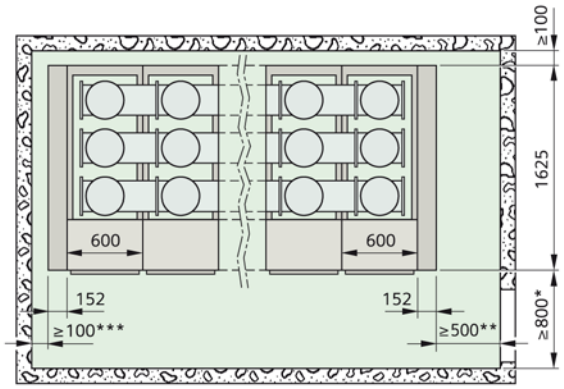


Fig. 20: Wall-standing arrangement

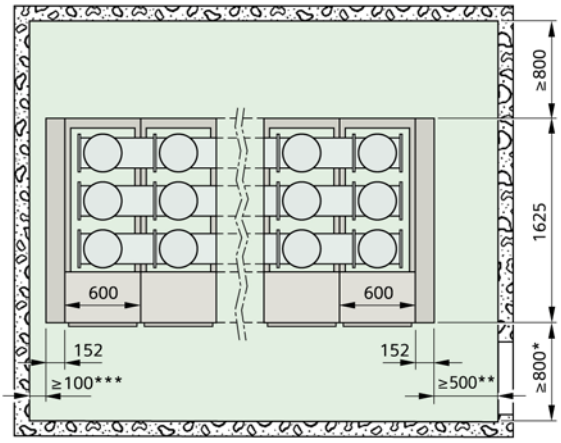


Fig. 21: Free-standing arrangement

*) 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		
Constant loads	Vertical single load[1]	12 kN/m^2
Not constant loads	Live load	9 kN/m^2

[1] Without busbar components / height of low-voltage compartment 850 mm
[2] Depending on national requirements

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 8DA10 (see page 43, "Constructional data of the foundation").

Fig. 22: Frame construction with longitudinal girders

Fig. 23: Frame construction with longitudinal girders (cable basement)

Reinforced-concrete floor

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 100 cm to 60 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

NOTICE
Incorrectly dimensioned cable basement **Can damage cables or cable connections.** ⇨ The cable basement must allow adequate space for connecting and laying the cables. ⇨ Do not violate the minimum cable bending radius of the cables.

The cable basement must have the following characteristics:

- Dry
- Accessible at any time
- Sufficiently illuminated

18.2 Constructional data of the foundation

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.

NOTICE

Damage to the welded seams

Welded seams are susceptible to corrosion.

⇨ After welding, protect the welded seams professionally against corrosion.

Floor openings and fixing points

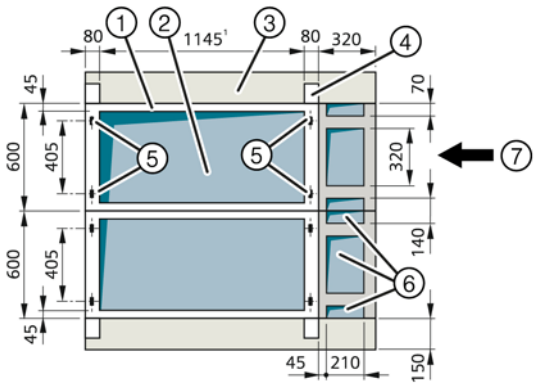


Fig. 24: Overview of floor openings and fixing points

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		

1) For large panel connection housings, the dimension must not be smaller than 1145 mm

Bolted joint of the standard design

Bolt the standard design diagonally to the foundation rails at 2 points (use sheet EN 10021, 4x40x60 mm).

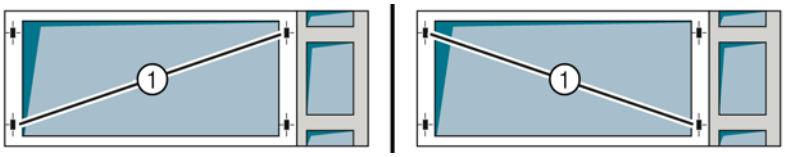
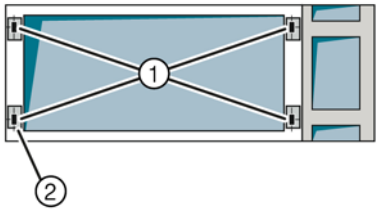


Fig. 25: Bolted joints of standard design

① Fixing points (26x45 mm) for M10

Bolted joint of the aseismic design

Bolt the aseismic design 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).

Bolted joints of the aseismic design		Fixing profile
		
①	Fixing points (26x45 mm) for M10	
②	Fixing profile	

Welded joint of the standard design

Weld the standard design diagonally to the foundation rails at 2 points. A floor fixing profile is not necessary.

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

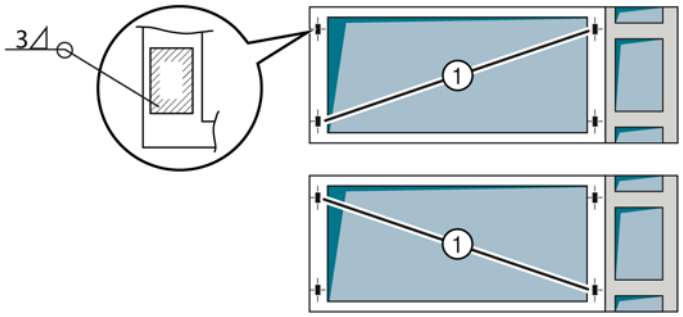


Fig. 26: Welding seams of the standard version

① Fixing points (26x45 mm)

Welded joint of the aseismic design

Weld the aseismic design to the foundation rails at all 4 points. A floor fixing profile is not necessary.

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

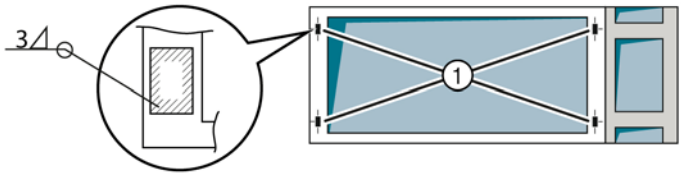


Fig. 27: Welding seams of the aseismic design

① Fixing points (26x45 mm)

Stipulations for the foundation

Observe the following items when preparing the foundation:

- Dimensions of the floor opening and fixing points of the switchgear frame (see page 43, "Constructional data of the foundation").
- Align the base frame of the switchgear starting from a fixed point.
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate with shims (0.5 - 1.0 mm).

Stipulations for evenness and straightness

Evenness/straightness tolerance according to DIN 43661: 1 mm for 1 m length, 2 mm over the width of the complete switchgear.

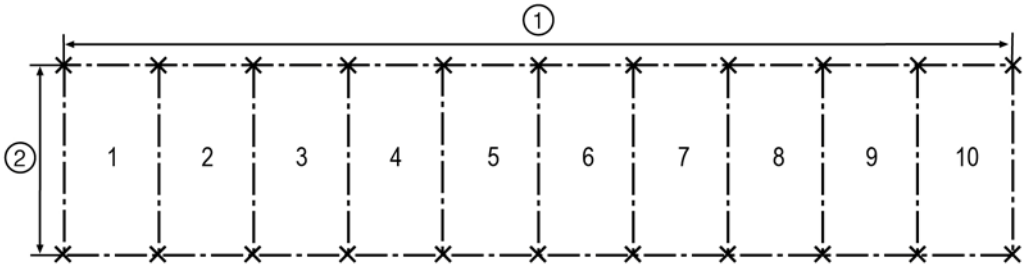


Fig. 28: Measuring sheet for the foundation

① Width of complete switchgear

② 1625 mm

18.3 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
Means of transport: Truck			
1 x 600	1370 x 2550 x 1888	850	750
2 x 600	1764 x 2550 x 1870	1700	1500
3 x 600	2400 x 2550 x 1870	2550	2250
4 x 600	2964 x 2550 x 1870	3400	3000
Means of transport: Ship and airplane			
1 x 600	1388 x 2700 x 1888	850	750
2 x 600	1764 x 2700 x 1888	1700	1500
3 x 600	2400 x 2700 x 1888	2550	2250
4 x 600	2964 x 2700 x 1888	3400	3000

[1] Average values based on standard base frame with 850 mm low-voltage compartment 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:

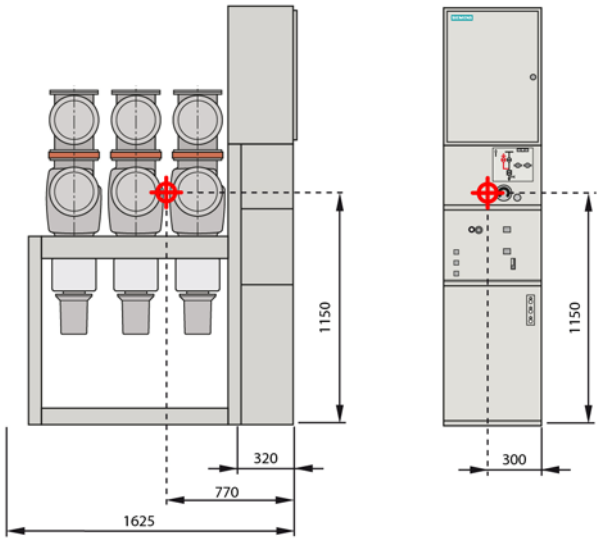


Fig. 29: Position of the center of gravity (depending on the switchgear version)

19 Before installation

19.1 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.

19.2 Installation and fixing material

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

19.3 Working materials

Materials

- Emery paper (K 360)
- Shims 0.5...1 mm
- Guide string
- Use only the supplied or released mounting paste. Use the mounting paste only according to the installation instructions.
- Cleaning agents (see page 207, "Cleaning agents and cleaning aids")

Tools

- Roller crowbars
- Reinforcing bars
- Racks (crank winch)
- Hydraulic jack (2...3 t, for vertical and horizontal stroke)
- Torque wrench 8...20 Nm, 20...70 Nm
- Torx reversing ratchet / screwdriver T10/80, T20/100, T25/100, T30/115
- Water level
- Open spanners size 13, 16, 17, 18, 19, 24, 27, 32 , 36
- Ring spanners size 13, 16, 17, 18, 19, 22, 24, 27
- Various screwdrivers
- Vernier caliper
- Water pump pliers

Auxiliary means

- Vacuum pump, DN8 connection
- Portable hygrometer, DN8 connection
- Volume percentage meter, DN8 connection
- Gas leak detector
- SF_6 gas filling device, DN8 connection
- 1 set roller pads

- Minimum requirements of lifting rods:
  - Material 42CrMo4 / AISI 4140 1.7225
  - Diameter 30 mm
  - Length of lifting rod for a single panel 1000 mm
  - Length of lifting rod for a double panel 1600 mm
  - Increase the length of the lifting rod by + 600 mmfor each further panel
  - Certified lifting rods may be procured from the local Siemens representative.
- Chain with transport shackles
- Step-ladder
- Cable drum
- Guide string
- Rod magnet with flexible shaft
- Mirror with flexible shaft (welding mirror)
- Vacuum cleaner with flexible, thin tube and plastic tip

19.4 Overview of busbar housing covers with desiccant bags

NOTICE

Property damage

If busbar housing covers are removed from the switchgear, ensure that the correct cover type is refitted on the busbar housing.

⇨ Mark the cover type before removal.

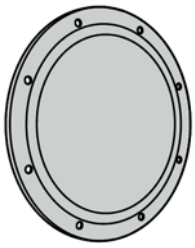
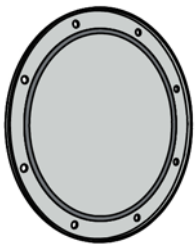
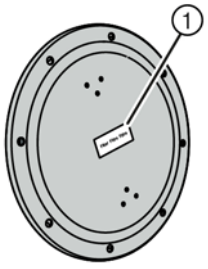
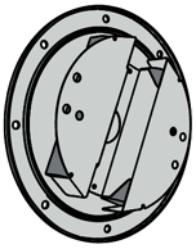
⇨ Verify that the correct cover type is refitted on the correct busbar housing.

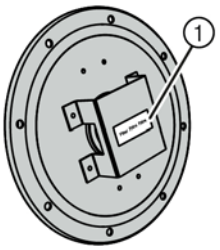
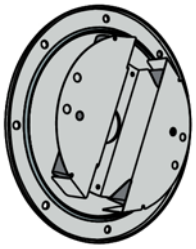
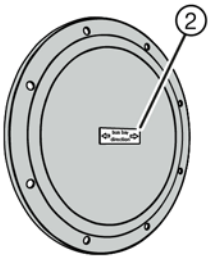
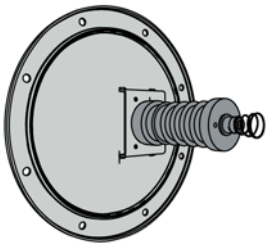
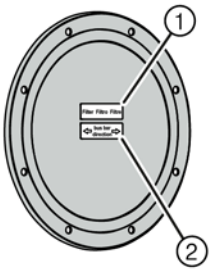
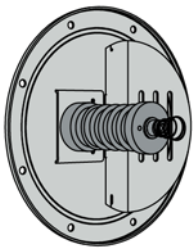
NOTICE

Property damage

The busbar housing post insulator cover is marked with the designation "Busbar direction". The marking must always point towards the busbars when the cover is mounted.

⇨ Observe the correct mounting position of the busbar housing post insulator cover.

Type of housing cover	Front view	Rear view
Busbar housing cover without desiccant bag holder		
Busbar housing cover with desiccant bag holder for 2x 250 g desiccant bags • ① Adhesive label: Filter		

Type of housing cover	Front view	Rear view
Busbar housing cover with bursting disc and desiccant bag holder for 2x 250 g desiccant bags • ① Adhesive label: Filter		
Busbar housing post insulator cover without desiccant holder • ② Adhesive label: Busbar direction		
Busbar housing post insulator cover with desiccant holder for 1x 450 g desiccant bag • ① Adhesive label: Filter • ② Adhesive label: Busbar direction		

19.5 Tightening torques

If not stated otherwise and if there is no deviating manufacturer information, the following tightening torques apply to 8DA10 switchgear:

Joint	Material/material	Thread	Tightening torque
Metal joints	Sheet-steel/sheet-steel	M6 (self-tapping)	12 Nm
	e. g.: front plates, top plates, etc.	M8	30 Nm
Earthing busbar	Sheet-steel/copper	M8	21 Nm
	Sheet-steel/copper	M10	30 Nm
	Sheet-steel/copper	M12	70 Nm
	Copper/copper	M8	21 Nm
	Copper/copper	M12	70 Nm
Current conductor joint	Copper/copper	M8	21 Nm
	Copper/copper	M10	40 Nm
	Copper/aluminum	M12	50 Nm

19.6 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 low-voltage 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. This makes it possible 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, e.g. 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.

20 Transport and storage

20.1 Packing and transport unit

Transport unit

Transport units consist of:

- Individual panels or panel groups consisting of up to 4 individual panels
- Accessories

Packing

NOTICE

Disposal of packing and consumables

Incorrectly disposed of packings and consumables can pollute the environment.

⇨ Packing and consumable materials of the switchgear must be disposed of in an environmentally compatible way or recycled.

⇨ Observe local regulations for disposal and environmental protection.

The transport units can be packed as follows:

- On pallet, covered with film
- In a seaworthy crate (switchgear is sealed with desiccant bags in PE film)
- In a seaworthy crate with long-time packing (switchgear is sealed with desiccant bags in aluminum-coated PE film)
- Other packing types in special cases (e.g. latticed crate)

20.2 Completeness and transport damages

Checking for completeness

⇨ Check whether the delivery is complete and correct using the delivery note 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 damages

⇨ Temporarily open the packing in a weatherproof place to detect hidden damages. Stick the PE film together again and do not remove it totally until reaching the final mounting position in order to keep the switchgear as clean as possible.

⇨ Check the gas pressure.

⇨ 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.

⇨ Refit the packing.

20.3 Intermediate storage

⚠WARNING

Overloading of the storage space

Can cause serious injury. Can damage the storage place or the stored goods.

⇨ Observe the load-bearing capacity of the floor.

⇨ Do not stack the transport units.

⇨ Do not overload lighter components by stacking.

⚠WARNING

Fire risk

The transport unit is packed in flammable materials.

⇨ No smoking.

⇨ Keep fire extinguishers in a weatherproof place.

⇨ Mark the location of the fire extinguisher.

NOTICE

Damaged packings of desiccant bags

Can cause corrosion of switchgear parts and formation of creepage distances by high air humidity.

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

⇨ Do not damage or remove packing of desiccant bags.

⇨ Do not unpack desiccant bags before use.

NOTICE

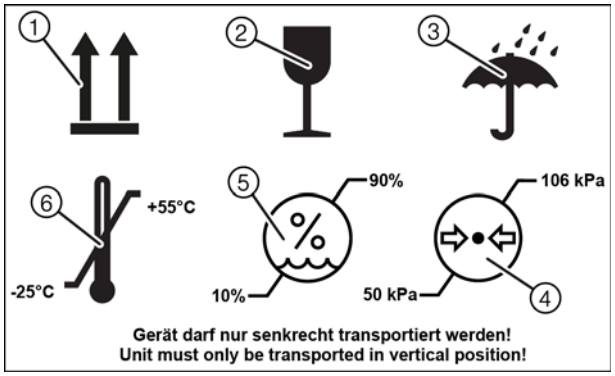
Outdoor storage of unpacked transport units

Can damage the transport units.

⇨ Store transport units outdoors packed in seaworthy crates and in a weatherproof place.

For intermediate storage of delivered switchgear, parts of the switchgear or accessories before installation, select a suitable storage place.

Observe the information provided on the switchgear packing and concerning transport and storage.



① Transport and store in vertical position
② Fragile contents
③ Protect against moisture
④ Pressure
⑤ Humidity
⑥ Storage temperature, values depending on ordered design

Fig. 30: Storage and transport information (example)

Intermediate storage of the transport units:

- In original packing as far as possible
- Primary part including current and voltage transformers: Permissible storage temperature of - 30 °C to 70 °C
- In a weatherproof place
- Protected against damage
- If packed in seaworthy crates, the switchgear can be stored for a maximum of 6 months (desiccant bags)
- Store transport units in such a way that they can be taken out later in the correct order for installation.

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 should have the following characteristics:

- Well-ventilated
- Free of dust
- Dry and protected against flooding
- The 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. Then, re-pack the switchgear.

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.

⇨ Replace the desiccant bags by the same number of new desiccant bags.

⇨ Pack the switchgear so as to reach full protection:
Heat-seal the PE films hermetically tight and rebuild the seaworthy crates completely.

20.4 Transporting and unloading the transport unit

⚠CAUTION

Risk of property damage

If the panels are transported without transport blocks (fixing brackets) at the busbars, parts of the switchgear may be damaged.

- ⇨ Do not remove the transport blocks until right before assembling the busbars.
- ⇨ Do not move the panels over a longer distance without transport blocks at the busbars.

⚠WARNING

Risk of injury due to transport unit falling down.

The transport unit can slip off the transport tackle due to the high position of the center of gravity.

- ⇨ Make sure that nobody is standing in the swinging area of lifted switchgear.
- ⇨ Observe even weight distribution and the high center of gravity of the switchgear.
- ⇨ Avoid heavy movement of the load.
- ⇨ Secure ropes against slipping off at the fixing points.

NOTICE

The transport unit may be damaged by touching ropes or chains when lifted.

Under load, ropes and chains exert a force onto the walls of the panel and can damage them.

- ⇨ Do not use any ropes or chains for lifting the transport units if those are touching a panel.
- ⇨ Use transport tackle / expander.

NOTICE

Damage to sensitive parts of the switchgear

By pushing the transport unit on the transport pallet, sensitive parts of the switchgear such as gas pipes, bursting discs, shafts, etc. may be damaged.

- ⇨ Push the transport unit only at the corners of the base frame.
- ⇨ Move the transport unit as close as possible to the place of installation (switchgear room) by means of a lifting truck or fork-lift truck.

Craning packed transport unit with transport pallet

To avoid damage and pollution, the transport unit should be transported as long as possible in its original packing. The packed transport unit is lifted with the transport pallet

- ⇨ Use transport tackle / expander to prevent the transport unit from being damaged by the ropes.
- ⇨ Sling the ropes around the ends of the transport pallet.
- ⇨ Unload the transport unit and set it down as close to the place of installation as possible in order to avoid unnecessary ways.
- ⇨ Move the transport unit into the building, as far as possible on its transport pallet. To keep the switchgear clean, remove only as little packing as necessary.
- ⇨ Remove film only in the building, right before assembling the transport unit.

Lifting unpacked transport unit with transport pallet

⇨ Knock the boards marked at the front out of the transport pallet by means of the fork-lift truck.

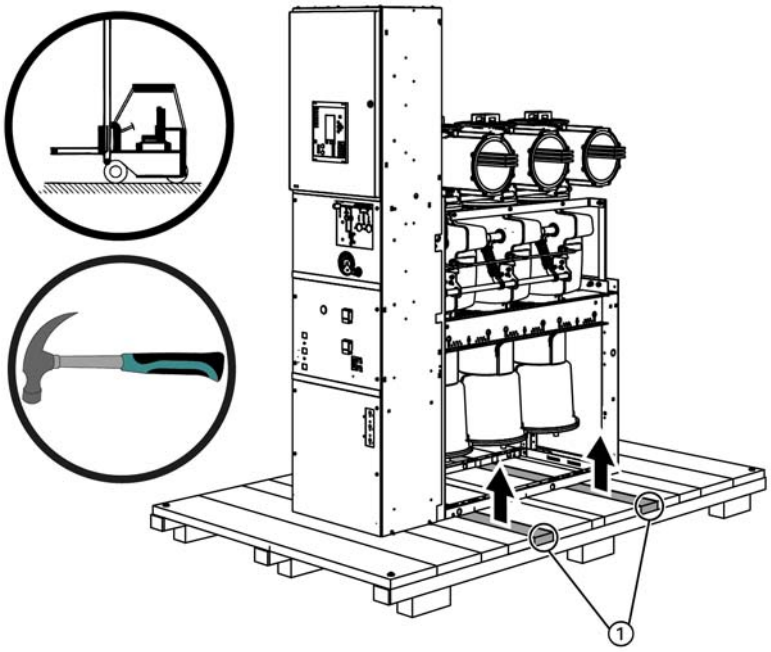


Fig. 31: Example for lifting the transport unit with the fork-lift truck on an individual panel

① Boards marked at the front

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

Removing the transport unit from the transport pallet

Remove the transport unit from the transport pallet only if

- there are only short transportation ways left, or
- the transport unit can be directly set down at the place of use.

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

⇨ Remove front cover sheets from the subframe of the panel.

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

Lifting unpacked transport unit with transport pallet

To lift the switchgear, use two lifting rods with a diameter of 30 mm.
Minimum length of the lifting rods: Width of transport unit plus 400 mm.

Certified lifting rods for different panel widths are available at the regional Siemens representative.

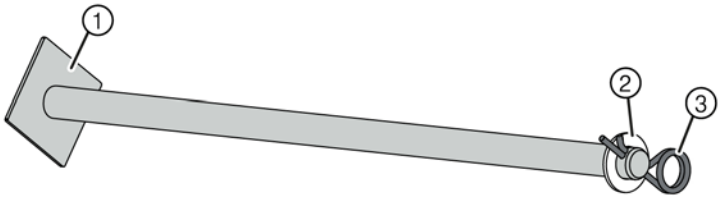


Fig. 32: Certified lifting rod for panels of 8DA10

① Lifting rod with termination plate

② Lock washer

③ Retaining element

The transport holes for pushing the lifting rods in are marked on the transport unit with a red symbol.

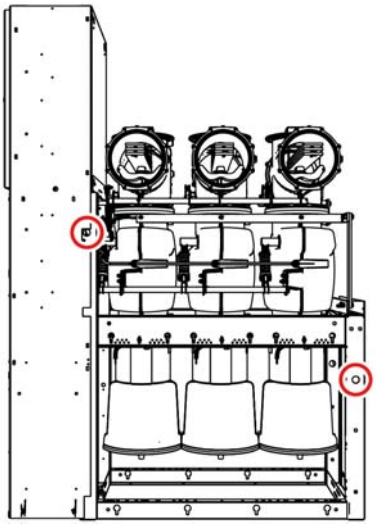


Fig. 33: Position of transport holes

Fig. 34: Marking of transport holes

- ⇨ If necessary, remove the switchgear termination.
- ⇨ Push the lifting rods into the transport holes at the front and at the rear.
- ⇨ Attach ropes or chains at the ends of the lifting rods.
- ⇨ Stretch the ropes or chains by lifting the hoisting tackle carefully.
- ⇨ If the ropes or chains are touching the transport unit, use transport tackle/expander.
- ⇨ Lift the transport unit carefully.
- ⇨ Lif the transport unit by means of a crane.

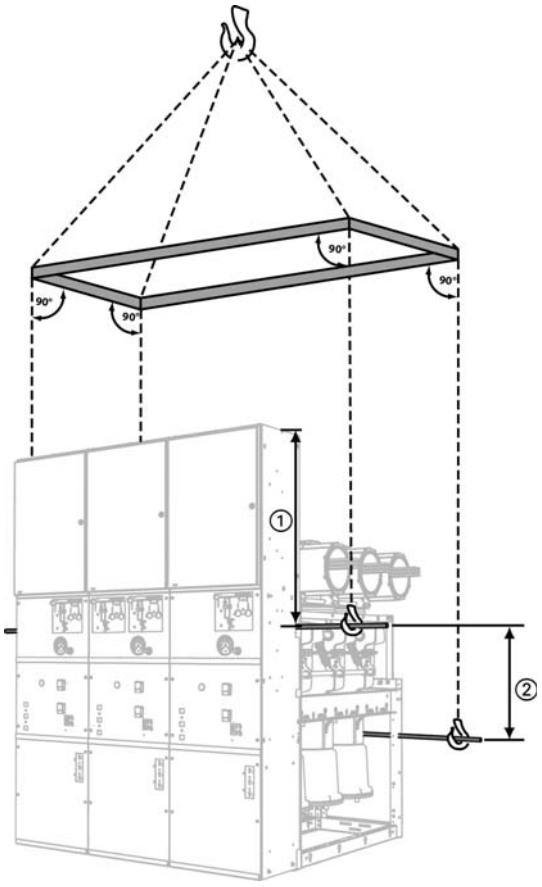


Fig. 35: Example for craning the transport unit

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

② 462 mm

Lifting the transport unit with hydraulic or lifting jacks

⚠WARNING

If it is lifted unevenly, the transport unit can fall over due to its high center of gravity.

If a transport unit falls down on a person, this can cause life-endangering injuries.

⇨ Lift the transport unit slowly and evenly.

Same as for lifting with the crane, two lifting rods with a diameter of 30 mm are required.

⇨ Push the lifting rods 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.

Transporting the unit on roller pads

☞INFORMATION

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.

⇨ Prepare four roller pads (reinforced rollers).

⇨ Lift the transport unit.

⇨ Place the roller pads in position at the external corners of the base frame under the vertical frame supports.

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

Transporting the unit on tubes

⇨ Prepare two tubes with a diameter of approx. 30 mm.

⇨ Lift the transport unit.

⇨ Lay the tubes crosswise under the base frame of the transport unit.

⇨ Lower the transport unit slowly and evenly onto the tubes.

20.5 Setting down the transport units at the place of installation

⚠DANGER

Transport units falling down.

The transport units can slip off due to mistakes during transport or while unloading from the roller pads, rollers or tubes. Can cause death, serious injury, or damage the transport units.

⇨ Observe the dimensions and weights of the transport unit (delivery note).

⇨ Please ensure that the transport gear used meets the requirements as regards construction and load-bearing capacity.

⇨ Observe the center of gravity of the transport units.

⇨ Observe the instructions on the packing.

⇨ Provide protection equipment to prevent damages to sensitive switchgear components.

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

⇨ Move the transport unit only straight ahead on roller pads, tubes or rollers. To change the direction, change the position of the roller pads, tubes or rollers.

⇨ While moving the transport unit, apply force only at floor level at the corners of the base frame.

⚠DANGER

Damage to the transport units possible.

Shifting the transport unit without roller pads, tubes or rollers is done using hydraulic equipment or lifting jacks.

⇨ Apply auxiliary means at floor level and only at the base frame of the transport unit.

⇨ Place wooden boards under the points where auxiliary means are applied.

⚠DANGER

Risk of injury due to transport unit falling over.

Will cause death, injury or considerable property damage.

Bridge floor openings that have to be crossed. When it is shifted, the transport unit may slip off the bridge and fall over.

- ⇨ Secure bridges with adjustable supports.
- ⇨ Wedge bridges against displacement.
- ⇨ Ensure that the used bridge corresponds to the requirements on assembly and load-bearing capacity.
- ⇨ When shifting the transport unit, make sure that there is sufficient standing surface for the panel.

Preparing the switchgear room

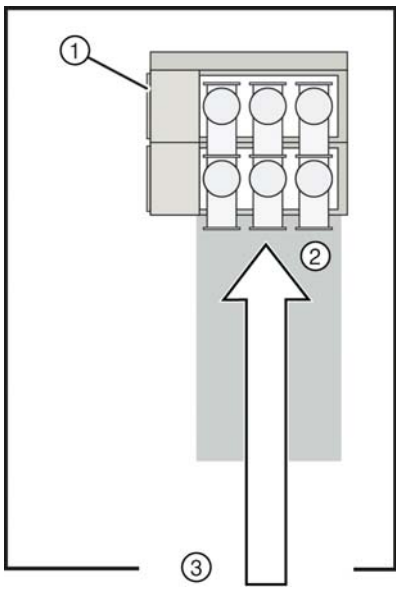
- ⇨ Clean the switchgear room thoroughly.
- ⇨ Draw a marking line at the mounting position in order to align the switchgear.
- ⇨ Unpack the transport units at the place of installation. Do not unpack parts supplied with the switchgear in order to avoid loss and damage.

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

- Setting down from the narrow side of the floor opening
- Setting down from the long side of the floor opening

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

The transport units are moved over the floor opening coming from the narrow side of the floor opening, and are set down side by side.



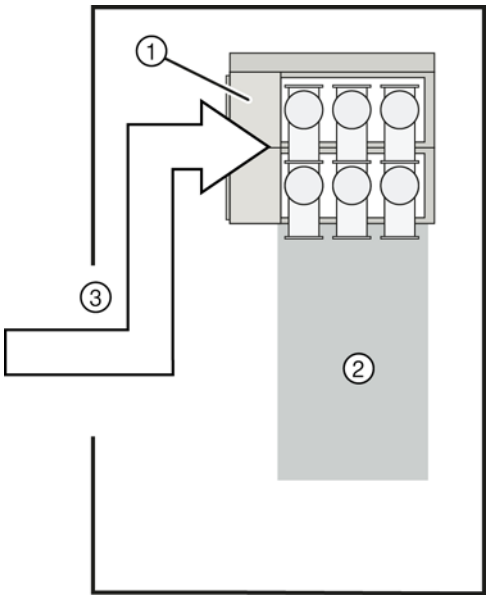
① Transport unit
② Floor opening
③ Door to the switchgear room

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

- ⇨ Move the first transport unit (end panel) along the floor opening up to its final position.
- ⇨ Lift the transport unit.
- ⇨ Remove the roller pads / tubes 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 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 / tubes and set down the transport unit carefully.
- ⇨ Proceed in the same way with all other transport units, keeping a distance of 500 mm between them.

Setting down the transport units 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.



① Transport unit
② Floor opening
③ Door to the switchgear room

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

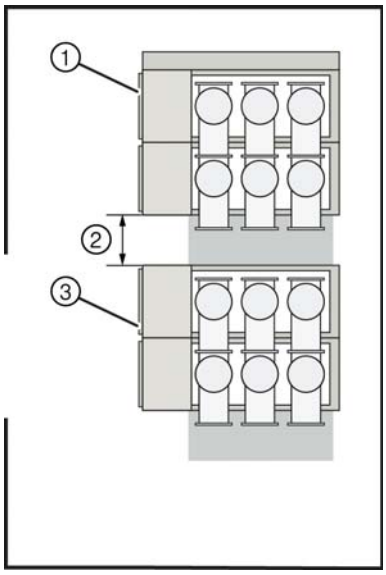
⇨ Roll the first transport unit up to the final position in parallel to the floor opening.
⇨ Lift the transport unit.
⇨ Remove the roller pads / tubes from underneath the transport unit.
⇨ To shift the transport unit more easily and to protect the floor, shims can be laid under as a sliding aid.
⇨ Set down the transport unit carefully.
⇨ Shift the transport unit with hydraulic jacks, lifting equipment or lifting jacks until it is exactly aligned on its place of installation. Prop the hydraulic equipment or jacks up at the surrounding walls.
⇨ If the transport unit is partly or totally standing on the sliding aids, lift the transport unit, remove the sliding aids 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 / tubes from underneath the transport unit and lay sliding aids under, if required.
⇨ Set down the transport unit carefully and push it over the floor opening.
⇨ Align the transport unit roughly, keeping a distance of 500 mmas a minimum.
⇨ Remove the sliding aids from underneath the transport unit as described above.
⇨ Proceed in the same way with all other transport units.

20.6 Aligning the switchgear

⇨ Align the first transport unit (end panel) completely and bolt it to the foundation (see page 43, "Constructional data of the foundation").

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

⇨ Keep a distance of at least 500 mmbetween the transport units for the subsequent installation work.



① First transport unit, completely aligned
② Min. distance 500 mm
③ Other transport units, roughly aligned

Fig. 36: Position of the transport units after erection

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.

20.7 Checking the SF_6 gas pressure

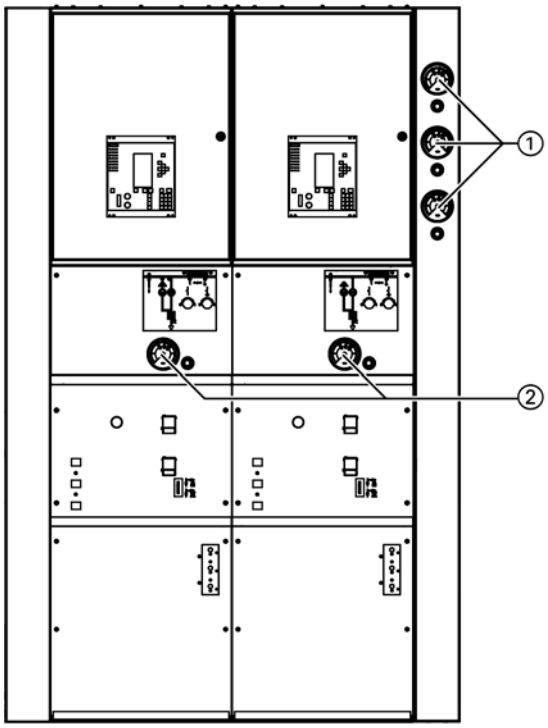
To exclude any gas losses caused by transportation in the gas compartments filled at the factory, the indications of the gas pressure manometers at the panels must be checked.

⚠ CAUTION

Insufficient gas filling can cause injury or property damage.

Operating the switchgear without service readiness due to insufficient gas filling can cause injury and the destruction of parts of the switchgear.

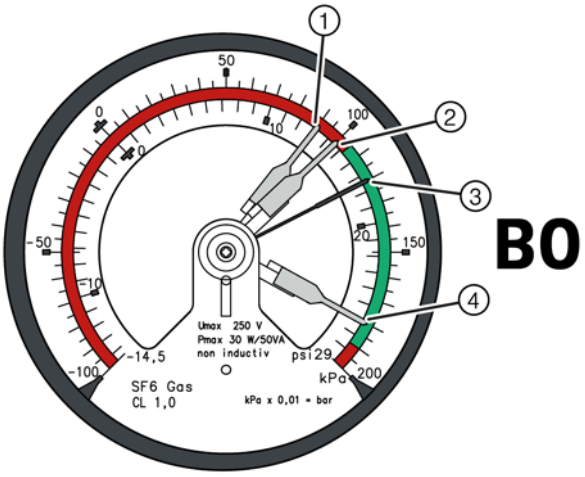
- ⇨ Before performing any switching operation, check the gas pressure in the compartments pre-filled at the factory on the associated gas pressure indicators. The values must not drop below the temperature-dependent limit values.
- ⇨ Do not install, commission or operate a switchgear with incorrect or too low SF_6 gas pressures. If required, isolate the switchgear and put it out of service.
- ⇨ Inform the competent regional Siemens representative.



① Gas pressure manometers for the busbar compartments

② Gas pressure manometers for the circuit-breaker / panel connection housings

Fig. 37: Gas pressure manometers at the panel



① Signaling contact: Pressure lower than minimum functional level

② Signaling contact: Minimum functional level 100 kPa

③ Gas pressure indicator: Rated functional level 120 kPa

④ Signaling contact: Maximum functional level 180 kPa

The data in kPa are values at 20 °C ambient air temperature

Fig. 38: Indication of gas pressure manometer

21 Switchgear installation

⚠WARNING

Risk of injury due to inappropriate installation.

The activities described below must be performed professionally in order to minimize the risk of injury.

⇨ The switchgear must be assembled by certified personnel only (see page 10, "Qualified personnel").

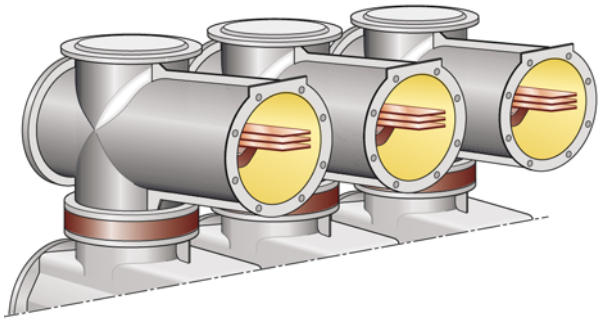
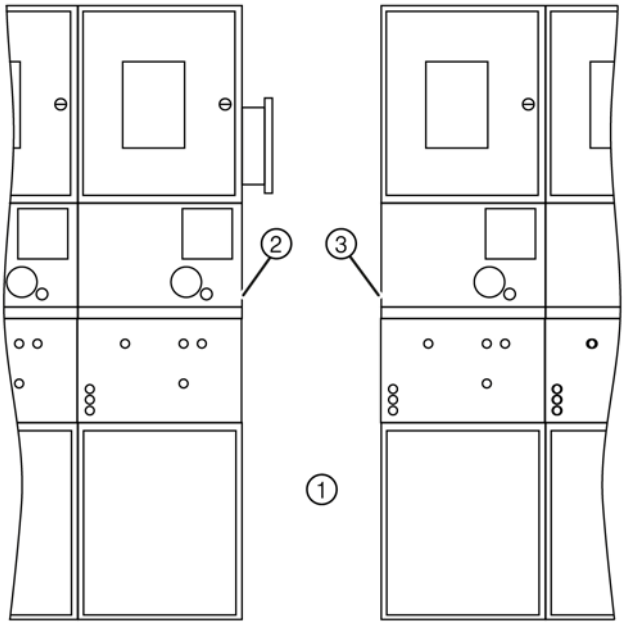


Fig. 39: Busbar version up to 3150 A

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



① Panel joint
② Fixed-mounted panel
③ Panel to be lined up

Precondition: The panels are standing in the switchgear room and are aligned for assembly (see page 59, "Aligning the switchgear").

Principle: Repeat the following operations for all panels until final assembly.

21.1 Preparing busbar assembly

Removing transport blocks

⚠CAUTION

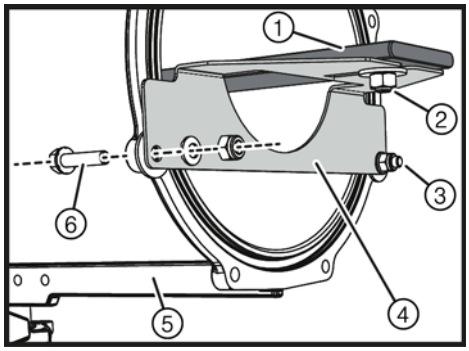
Risk of property damage

If the panels are transported without transport blocks (fixing brackets) at the busbars, parts of the switchgear may be damaged.

⇨ Do not remove the transport blocks until right before assembling the busbars.

⇨ Do not move the panels over a longer distance without transport blocks at the busbars.

During transport, fixing brackets retain the busbars in the open busbar housings.



① Busbar
② Bolt with contact washer, plain washer and nut
③ Bolt with contact washer, plain washer and nut
④ Fixing bracket for the busbar
⑤ Busbar housing
⑥ Bolt with contact washer, plain washer and nut

Fig. 40: Mounting direction of the fixing bracket in the long busbar housing

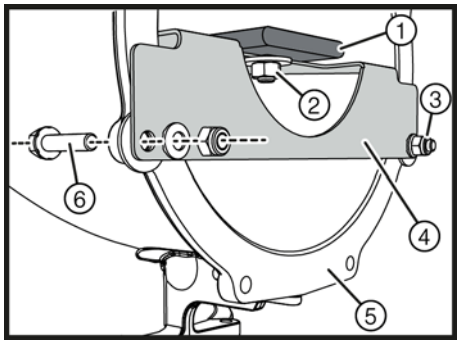


Fig. 41: Mounting direction of the fixing bracket in the short busbar housing

⇨ Switch all disconnectors of the panels located on the right and on the left of the panel joint to READY-TO-EARTH position.

⇨ If make-proof busbar earthing switches are mounted: Switch make-proof busbar earthing switches to OPEN position.

⇨ Remove the fixing brackets.

⇨ Reuse the bolts for busbar assembly.

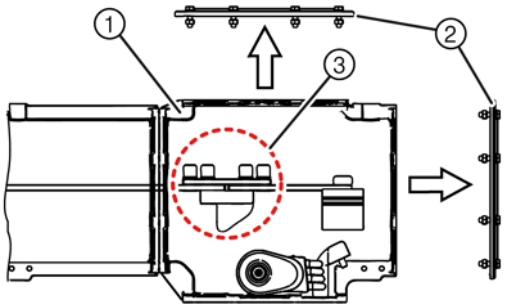
⇨ Dispose of the fixing brackets properly.

Preparing busbar assembly on the right end panel

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

⇨ Remove all flange covers ② from the assembly openings of the short busbar housing ① .

⇨ If required, remove the protective caps from the bolts at the busbar ends, and loosen the bolts.



① Short busbar housing
② Flange cover
③ 4 bolts with protective caps at the joint of the busbar ends

Fig. 42: Short busbar housing in right end panel of fixed-mounted switchgear assembly

Re-assembling the busbars

NOTICE

This operation is only performed if one of the following components is mounted on the busbar housings of the panel to be lined up.

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

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

Before starting to interconnect the panels, the busbar sections of the fixed-mounted panel must be re-assembled to the panel to be lined up. The illustrations below show the state after re-assembling.

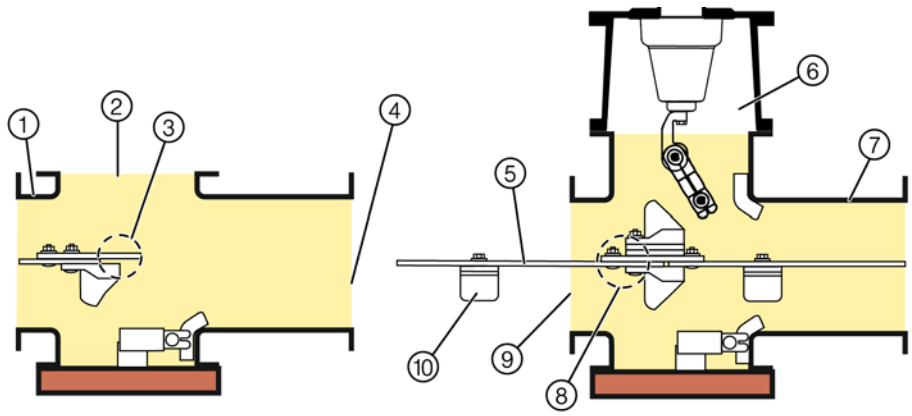


Fig. 43: Busbar re-assembled (example 1250 A)

① Short busbar housing of the fixed-mounted panel
② Assembly openings (horizontal flanges)
③ Joint of the fixed-mounted panel
④ Vertical flanges of the fixed-mounted panel
⑤ Busbar
⑥ Transformer connection housing for the contact of the busbar voltage transformer
⑦ Busbar housing of the panel to be lined up
⑧ Joint of the panel to be lined up
⑨ Vertical flanges of the panel to be lined up
⑩ Busbar support

- ⇨ Clear the assembly opening ② : Remove all horizontal flange covers on the busbar housing ① of the fixed-mounted panel.
- ⇨ Undo the busbar ⑤ at the joint ③ in the busbar housing through the assembly opening ② . The busbar support ⑩ remains in the disassembled busbar section.
- ⇨ Take the busbar section ⑤ with the busbar support ⑩ out of the housing through the vertical flange ④ .
- ⇨ Through the vertical flange ⑨ , push the busbar section ⑤ into the busbar housing ⑦ of the panel to be lined up
- ⇨ Clean the links at the busbar sections using an emery sponge and a lint-free cloth. Then, apply a very thin film of the supplied mounting paste.
- ⇨ Assemble the busbar section at the joint ⑧ .
- ⇨ Check alignment and parallel position of the assembled busbar section, and correct if required.

Special configurations of the interconnected busbar

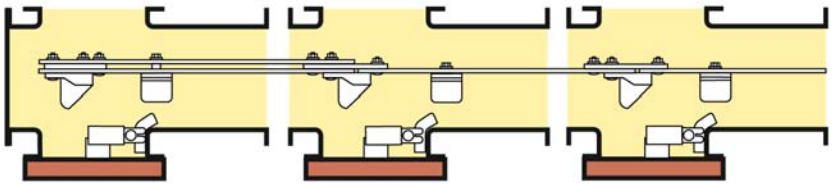


Fig. 44: Busbar assembly, left end panel (example: 1250 A)

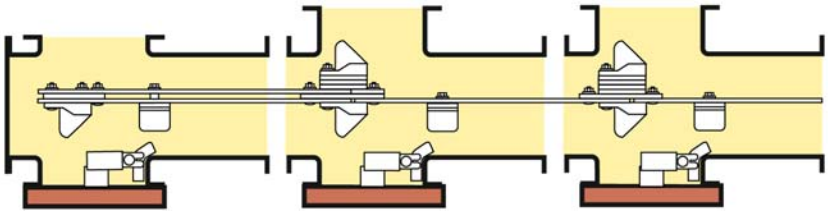
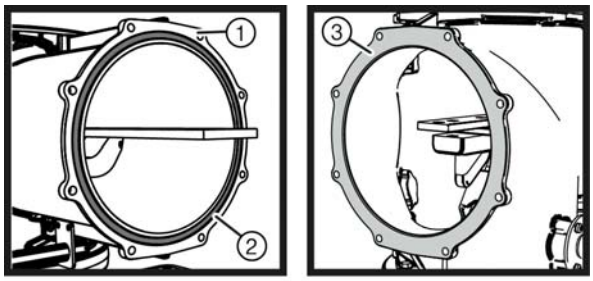


Fig. 45: Busbar assembly, left end panel, adjacent panels with disconnectable busbar components (example: 1250 A)

Preparing the flanges of the busbar housings



① External contact surface of the flange
② Groove for toroidal sealing ring
③ Sealing surface at the opposite flange

Fig. 46: Flange on the busbar housing

- ⇨ Clean all vertical flanges of the busbar housings at the panel joint and the grooves for the toroidal sealing rings (O rings) carefully with lint-free paper.
- ⇨ Carefully check the sealing surfaces ③ of the flanges for scratches, other damages or pollution. Damages and pollution will cause leaks.
- ⇨ If the sealing surfaces ③ are damaged: Inform the regional Siemens representative and coordinate the elimination of damages.
- ⇨ Grease the toroidal sealing rings ② uniformly with the supplied mounting paste (Polylub GLY 801).
- ⇨ Apply a layer of mounting paste (Polylub GLY 801) with a thickness of approx. 3 mm all around on the external contact surfaces of the flanges.
- ⇨ Distribute the mounting paste (Polylub GLY 801) evenly on the external contact surfaces ① with a fine line brush.
- ⇨ Lay the toroidal sealing rings (O-rings) into the grooves of the flanges.

Preparing the busbar sections

⇨ Undo the bolted joints ① and ② .

⇨ Remove the bolted joint ③ .

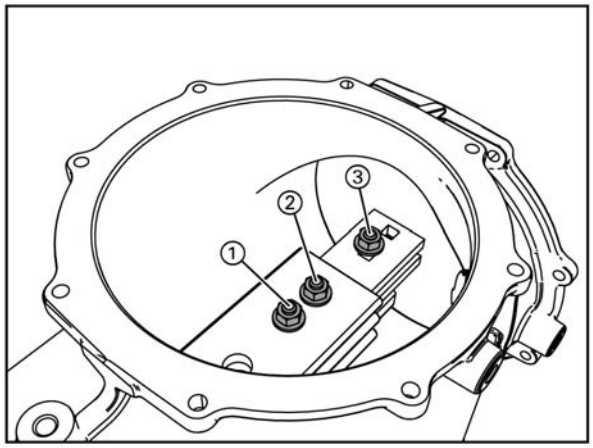
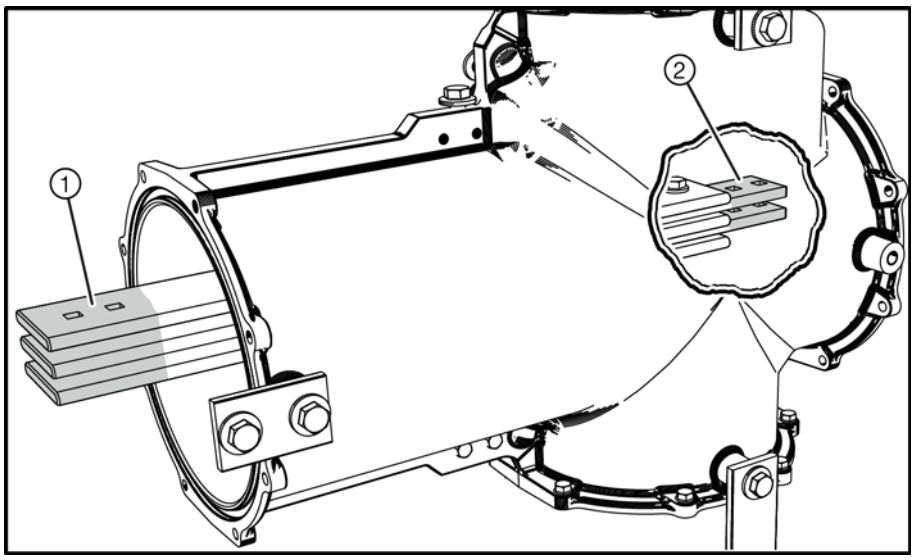


Fig. 47: Bolted joints at the busbar section

⇨ Clean the links at the busbar sections using an emery sponge and a lint-free cloth. Then, apply a very thin film of the supplied mounting paste.



① Link at the busbar

② Link at the joint of the busbars

Preparing busbar assembly for 4000 A busbar version

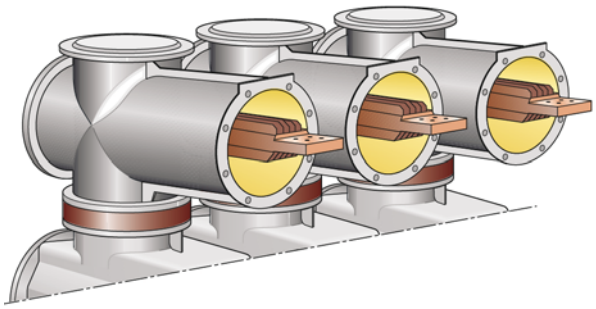
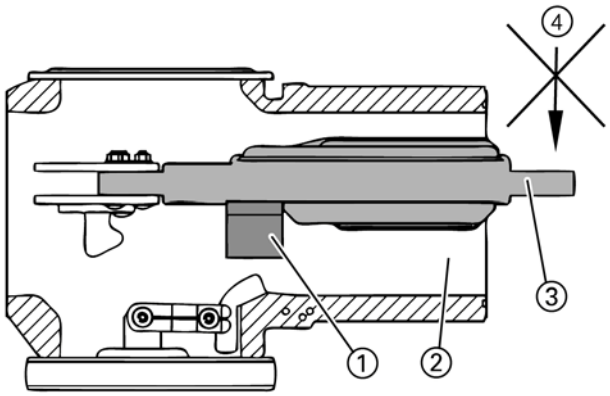


Fig. 48: Busbar version 4000A

☞INFORMATION
Execute this installation section only if one of the following devices is mounted on the busbar housing of the panel to be lined up for a 4000 A busbar: • Disconnectable busbar connection • Disconnectable busbar voltage transformer

For other disconnectable components, e.g. make-proof busbar earthing switch, the busbar joints are not accessible anymore after the transport units have been interconnected.
For further information, please contact the Siemens Service Hotline.

NOTICE
Damage to the busbar support **The busbar support keeps the busbar with a weight of approx. 26 kg in the correct position for the busbar connection.** ⇨ After removal of the transport block, do not exert any force on the busbar in order not to damage the busbar support.



① Busbar support
② Busbar housing
③ Busbar
④ Force in kg

Fig. 49: 4000 A busbar without transport block

Preparing busbar assembly on the panel to be lined up

This operation is **only** performed if there is a horizontal flange cover available on the busbar housing of the panel to be lined up.

NOTICE

Risk of property damage

During assembly of the 4000 A busbar, there is risk of property damage in case of re-assembling the busbar into the panel to be lined up.

⇨ Do **not** re-assemble the busbar from the fixed-mounted panel to the panel to be lined up.

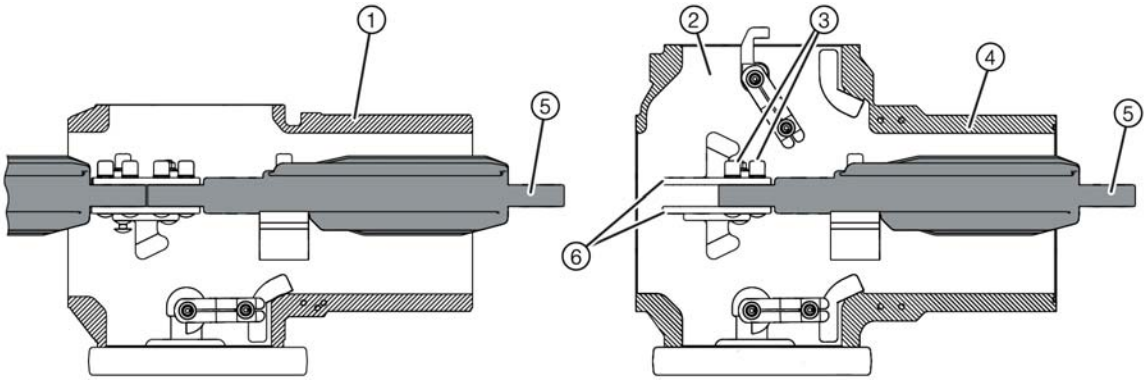


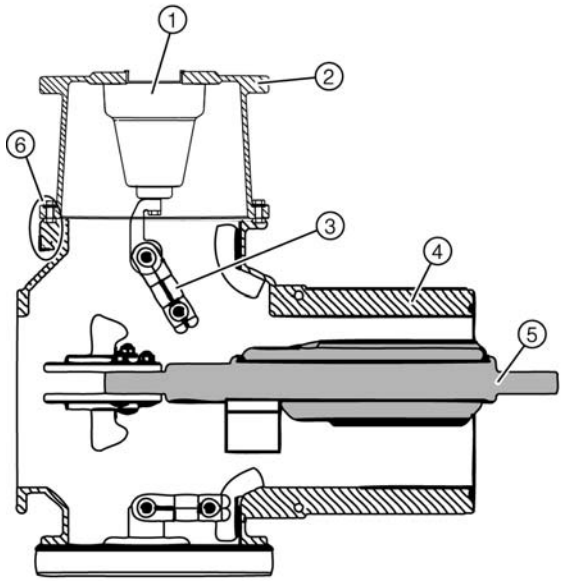
Fig. 50: Preparing busbar assembly on the panel to be lined up (example 4000 A)

① Busbar housing of the fixed-mounted panel
② Assembly openings (horizontal flanges) in the busbar housings of the panel to be lined up
③ Fixing bolts
④ Busbar housing of the panel to be lined up
⑤ Busbar for 4000 A
⑥ Interconnecting bars

⇨ Remove all horizontal flange covers from the assembly openings ② on the busbar housings ④ of the panel to be lined up.

⇨ Loosen the fixing bolts ③ at the busbar ends.

Example: Removing top units for busbar voltage transformers 4MU4



① Bushing for voltage transformer 4MU4
② Transformer connection housing
③ Disconnector in OPEN position
④ Busbar housing
⑤ 4000 A busbar
⑥ Bolted joint of transformer connnection housing with busbar housing

Fig. 51: Connection of disconnectable busbar voltage transformer 4MU4 to the busbar (sectional view)

⇨ Switch the disconnector ③ of the disconnectable busbar voltage transformer to OPEN position.

⇨ Mark the position from the transformer connection housing ② to the busbar housing ④ by two lines offset by 90°. The lines serve as positioning aid for later assembly.

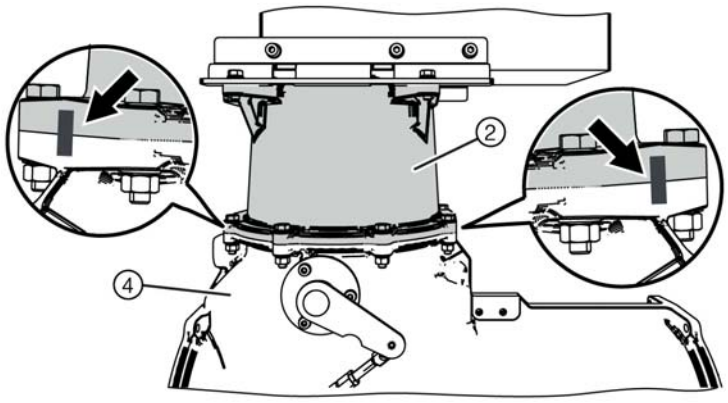
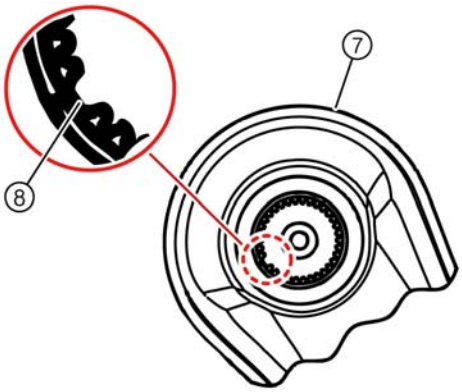


Fig. 52: Positioning aids (zooms show side views)

⇨ Remove the bolted joint ⑥ between the transformer connection housing ② and the busbar housing ④ . Remove the intermediate ring with supporting plate and disconnector.
The disconnector kinematics of the disconnectable voltage transformer with the short disconnector shaft remain mounted.



⑦ Rotary post insulator

⑧ Coding (slot)
The coding at the rotary post insulator helps to position the component correctly during later installation.

Fig. 53: Coding at the rotary post insulator

⇨ Pull the rotary post insulator ⑦ off the disconnector shaft.

⇨ Loosen the fixing bolts at the busbar ends.

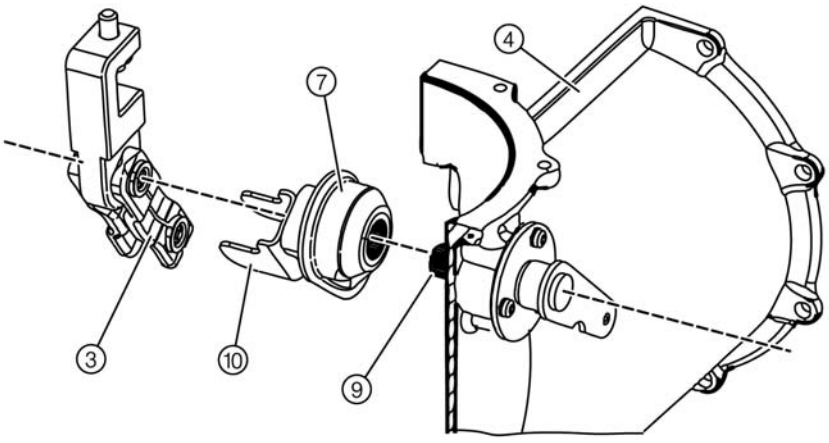


Fig. 54: Setup of the voltage transformer disconnector at the busbar

③ Disconnector

⑩ Driver

⑦ Rotary post insulator

⑨ Disconnector shaft

④ Busbar housing

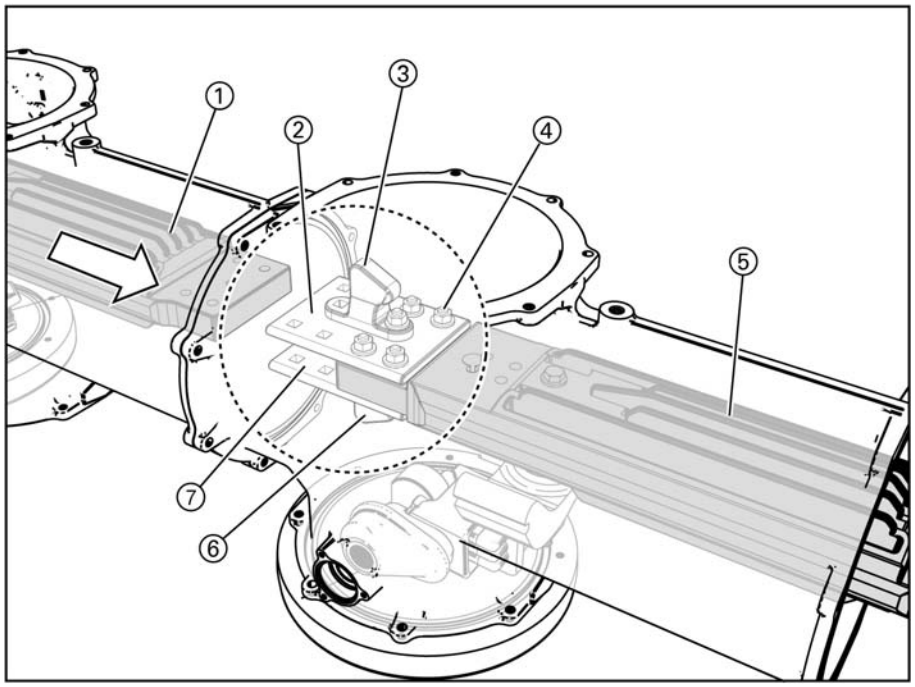


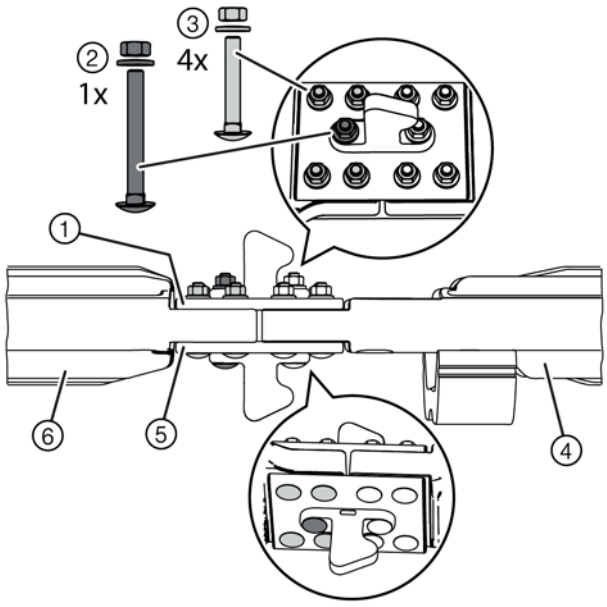
Fig. 55: Inserting the busbar

① Busbar in the fixed-mounted panel
② Upper connecting bar
③ Upper disconnector contact
④ Cup head bolt with hexagon nut and conical spring washer (5x)
⑤ Busbar in the panel to be lined up
⑥ Lower disconnector contact
⑦ Lower connecting bar

Example: Assembling top units for busbar voltage transformer 4MU4

⇨ Prepare the flanges of the busbar housing, and bolt them together.

⇨ Align the busbar and the connecting bars so that the busbar section is in line and the bolts fit through the hole.

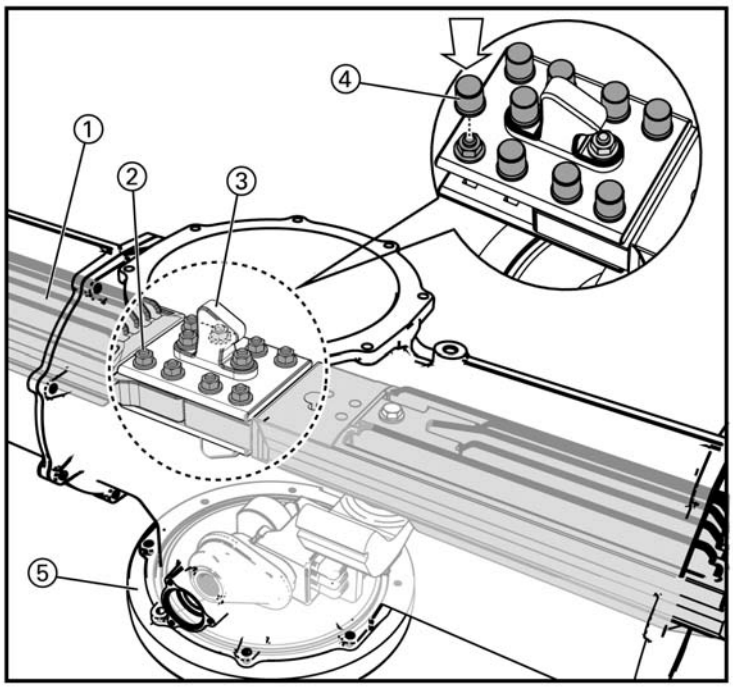


① Upper connecting bar
② Cup head bolt with hexagon nut and conical spring washer M10x85 (1x)
③ Cup head bolt with hexagon nut and conical spring washer M10x65 (4x)
④ Busbar in the panel to be lined up
⑤ Lower connecting bar
⑥ Busbar in the fixed-mounted panel

Fig. 56: Bolting the busbar and the connecting bars together

⇨ Tighten the bolts in this busbar section (tightening torque: 40 Nm).

⇨ Fit the protective caps on the bolted joints of the busbar.



① Busbar in the fixed-mounted panel
② Cup head bolt M10x65 with hexagon nut and conical spring washer
③ Upper disconnector contact
④ Protective caps (9x)
⑤ Bushing plate

Fig. 57: Fitting protective caps

⇨ Clean the inside of the housing with a hand vacuum cleaner. The hand vacuum cleaner should feature a sufficiently long, flexible tube (maximum diameter 20 mm) and a plastic tip.

⇨ Clean the bushing plate ⑤ inside with a cloth.

⇨ Push the rotary post insulator onto the disconnector shaft. Due to the coding, the rotary post insulator can only be pushed onto the disconnector shaft in one position.

⇨ Mount the transformer connection housing of the disconnectable busbar voltage transformer with supporting plate and disconnector at the busbar housing. To do this, compress the potential spring of the disconnector. The disconnector with the potential spring must be fully positioned in the driver of the rotary post insulator.

⇨ Verify contact overlapping with suitable means.

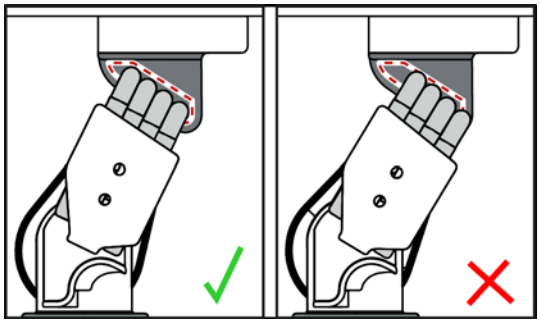


Fig. 58: Example for correct and incorrect position of the contact fingers on the fixed contact

⇨ Position further transport units.

⇨ Re-install the voltage transformer type 4MU4.

21.2 Lining up panels

Positioning the panel

The panel to be lined up 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.

NOTICE
Risk of property damages to the panel **When the panels are joined, the busbar housings, busbars, busbar supports, or other components may be damaged.** ⇨ To avoid damages to the panel to be lined up, use auxiliary means such as hydraulic equipment or lifting jacks carefully when joining the panels. Apply auxiliary means at floor level and only at the base frame of the panel. Place boards under the points where auxiliary means are applied. ⇨ Join the panels carefully. While doing so, observe the position of the busbar supports. ⇨ While working at the busbars or the busbar housings, prop up only on the frame of the panels. ⇨ Do not prop up on sensitive parts of the switchgear like gas pipes, bursting discs, shafts, etc.

☞INFORMATION
For proper busbar assembly, remove all busbar housing covers ⇨ Remove all busbar housing covers from the panels before starting installation. ⇨ Keep the busbar housing covers and toroidal sealing rings (O-rings) for later reuse.

⇨ Apply one lifting gear each at the rear and at the front of the base frame of the panel to be shifted. Prop the lifting gear up at the surrounding walls.

⇨ Place one person in observer position at the already mounted panel. 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 washers provisionally at the flange side of the already fixed-mounted panel.

⇨ On the observer's command, push the panel to be lined up towards the already fixed-mounted one using the lifting gear. The observer checks and corrects the approach of the busbar sections.

⇨ Continue approaching the panels until the flanges touch evenly.

⇨ In case of deviations, correct the position of the panel, compensating any floor unevenness with shims under the corners (same points as for roller pads / tubes).

Bolting the flanges of the busbar housings together

NOTICE

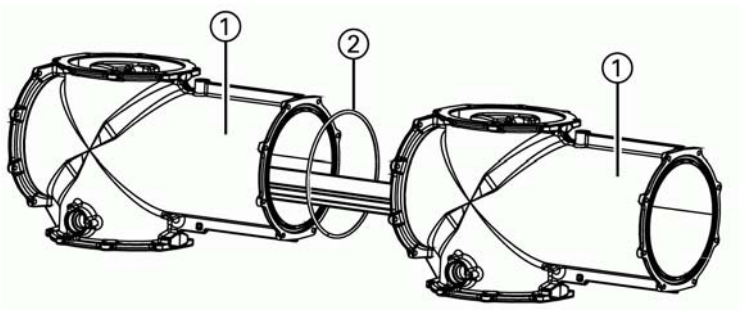
Risk of damage to property

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.

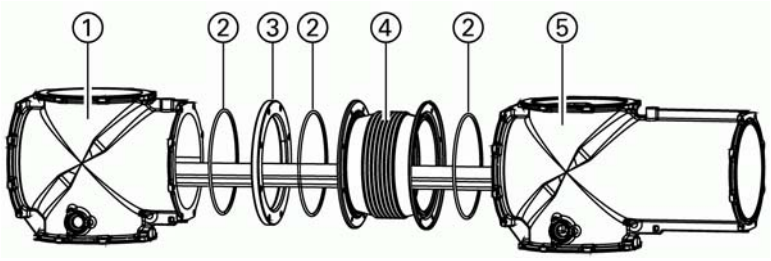
⇨ **Flange-to-flange connections:**
8 tighten M8x40 bolts crosswise (tightening torque: 20 Nm).



① Busbar housing
② Toroidal sealing ring

Fig. 59: Flange-to-flange connection

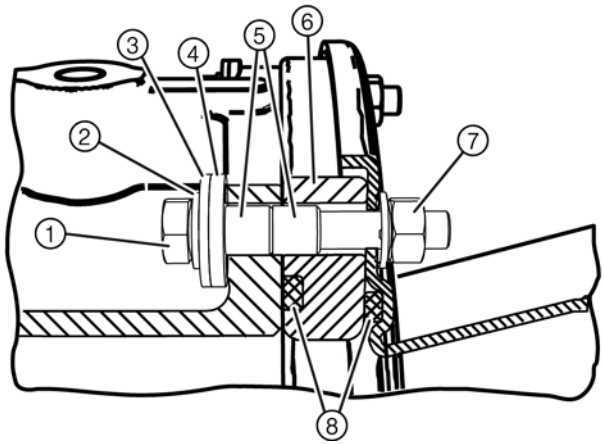
⇨ **Flange connections with compensator:** Push insulating ring between the flanges.
Fasten M8x55 bolts crosswise with one insulating sleeve each (tightening torque: 20 Nm).



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

Fig. 60: Short busbar housing with compensator

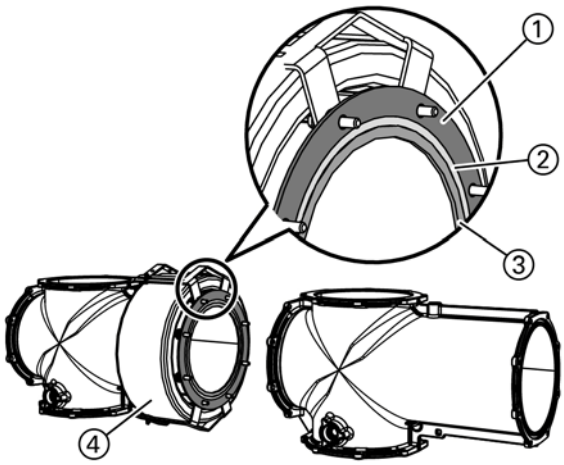
⇨ For flange connections with compensator, insulating sleeves must be inserted at the bolted joints.



① Hexagon head bolt M8x55 with washer
② Busbar housing
③ Plain washer
④ Insulating washer
⑤ Insulating sleeve (2x)
⑥ Insulating ring (thickness: 18 mm)
⑦ Hexagon nut with washer
⑧ Toroidal sealing rings

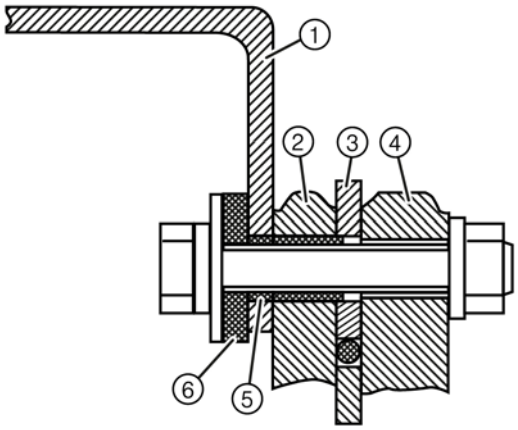
Fig. 61: Flange connection with compensator and insulating sleeve

➪ **Flange connections with current transformer:** If there are busbar current transformers or expansion joints available, the flange connections must be equipped with insulating sleeves. Slide two insulating rings between the flanges. Fasten M8x45 bolts crosswise with one insulating sleeve each (tightening torque: 20 Nm).



① Insulating ring outside (thickness: 4 mm)
② Toroidal sealing ring
③ Insulating ring inside (thickness: 4 mm)
④ Current transformer

Fig. 62: Long busbar housing with insulating joint



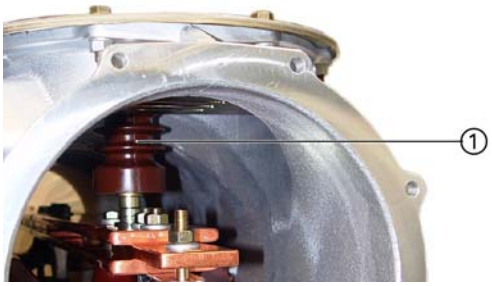
① Current transformer mounting plate
② Flange
③ Insulating ring inside and outside
④ Flange
⑤ Insulating sleeve
⑥ Insulating washer

Fig. 63: Flange connections with insulating sleeve

Fastening the busbars

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 .



➪ After having joined all panels, align the busbar and the post insulator horizontally with each other. To do this, use 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.

21.3 Lining up further panels

⇨ Repeat the work operations (see page 64, "Preparing the flanges of the busbar housings") until all panels are installed.

☞INFORMATION
If required, mount loosely delivered panel connections and earthing busbars before lining up another panel.

21.4 Completing switchgear installation

As a precondition for this work, the switchgear must have been completely assembled as described above (see page 61, "Switchgear installation").

Tightening the busbar fixing bolts

⇨ Tighten the fixing bolts of all busbars and fixed contacts at all panel joints of the switchgear (tightening torque: 30 Nm).

Checking contact overlapping of 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.

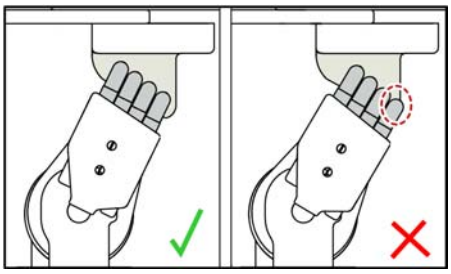
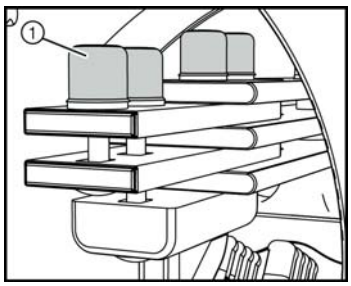


Fig. 64: Example for correct and incorrect position of the contact fingers on the fixed contact

Fitting protective caps

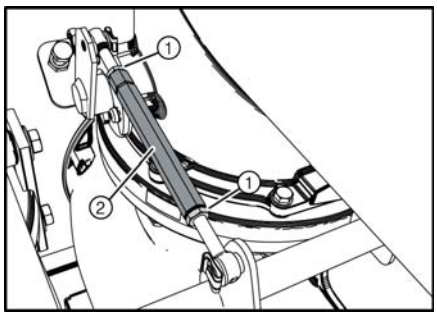
⇨ Fit the protective caps on the bolted busbar joints.



① Protective cap

Correcting contact overlapping of disconnector contacts

☞INFORMATION
The coupling rod is pre-adjusted at the factory. ⇨ In case of bad contact overlapping, check the busbar assembly and the busbar alignment first. If required, correct the contact overlapping. ⇨ If necessary, adjust by means of the coupling rods.



① Locknuts
② Hexagonal sleeve of disconnector coupling rod

Fig. 65: 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.

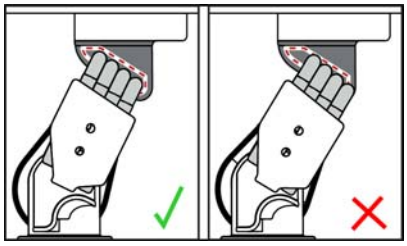


Fig. 66: Example for correct and incorrect position of the contact fingers on the fixed contact

⇨ 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.

Busbar housing covers with desiccant bag

⚠WARNING

In the ambient air, the desiccant bags lose their effectiveness rapidly

The formation of condensation can lead to corrosion of switchgear parts.
High air humidity can lead to creepage distances.

⇨ If a gas compartment has been open for more than 30 minutes, replace all desiccant bags.

⇨ Do not open the packing of the desiccant bags until right before putting them into the panel.

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

⇨ If the humidity indicators are **pink**, do not use the desiccant bags.

⇨ If the desiccant bags have been exposed to the air for more than 30 minutes, do not use the desiccant bags anymore.

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

⇨ Close the gas compartment hermetically with sealing rings (O-rings).

⇨ Evacuate the gas compartment immediately.

Mounting busbar housing covers without desiccant bag holders

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

⇨ Remove the tools.

⇨ Clean the inside of the busbar housings with a hand vacuum cleaner with plastic tip.

⇨ Clean the bushing plates with a cloth.

⇨ Prepare the flanges of the cleaned busbar housings for assembly (see page 62, "Preparing busbar assembly").

⇨ Clean the sealing surfaces of the busbar housing covers with a lint-free paper, and apply a thin film of grease (see page 62, "Preparing busbar assembly").

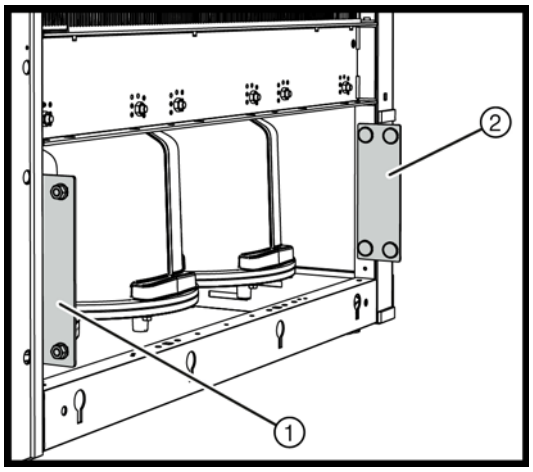
⇨ Insert the sealing rings in the busbar housing covers.

⇨ Put the busbar housing covers on the prepared flanges.

⇨ Fasten the busbar housing covers crosswise. Tightening torque: 20 Nm.

Panel links for panel groups delivered by the factory

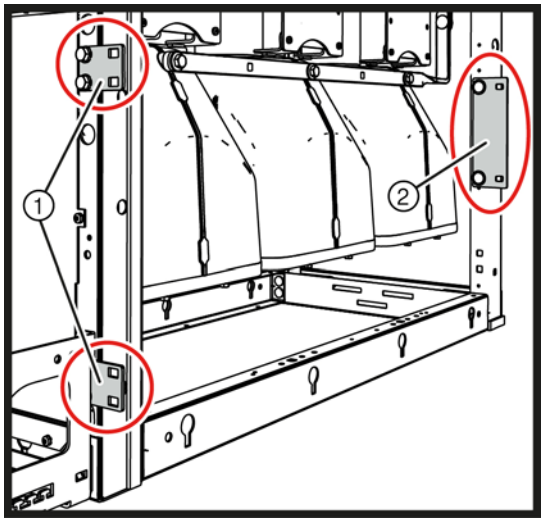
The frames of the panel groups pre-assembled at the factory are bolted together at the panel joints at the front ① and rear ② with one panel link each.



① Large panel link (front)
② Large panel link (rear)

Fig. 67: Panel links for panel groups assembled at the factory

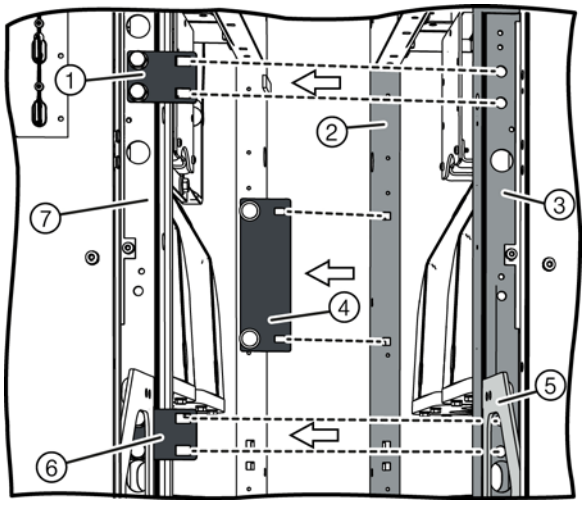
Panel links for panel groups to be assembled



① Small panel links (front)
② Large panel link (rear)

Fig. 68: Panel links for panel groups to be assembled on site

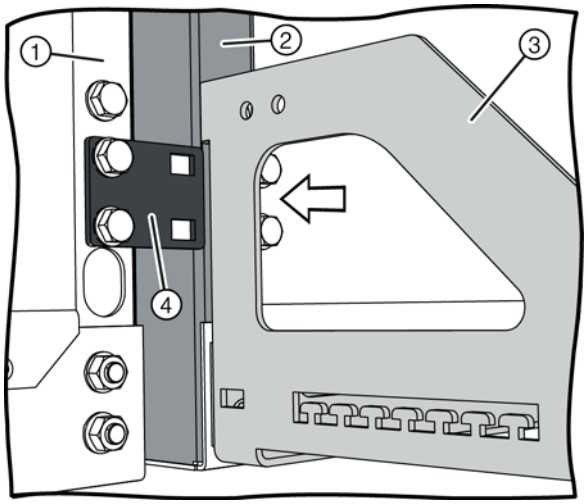
⇨ Align adjacent connecting plates at the frames. The holes must be in line.



① Small panel link, top
② Rear part of the frame at the panel to be lined up
③ Front part of the frame at the panel to be lined up
④ Large panel link
⑤ Front support
⑥ Small panel link, bottom
⑦ Front part of the frame at the fixed-mounted panel

Fig. 69: Bolted joint at the frame, executed on site (front view)

⇨ Bolted joint an the front of the panels: Bolt the small panel links at the top and bottom in the fixed-mounted panel together with the front part of the frame at the panel to be lined up. Thread the upper panel link through the slot of the front support. Use 2 cup head bolts M10x20, plain washers and hexagon nuts for each small panel link (tightening torque: 40 Nm).



① Front part of the frame at the fixed-mounted panel
② Front part of the frame at the panel to be lined up
③ Front support
④ Small panel link, bottom

Fig. 70: Bolted joint at the frame, executed on site (detail view)

⇨ Bolted joint an the rear of the panels: Bolt the large panel link in the fixed-mounted panel together with the rear part of the frame at the panel to be lined up.
Use 2 cup head bolts M10x20, plain washers and hexagon nuts for the large panel link (tightening torque: 40 Nm).

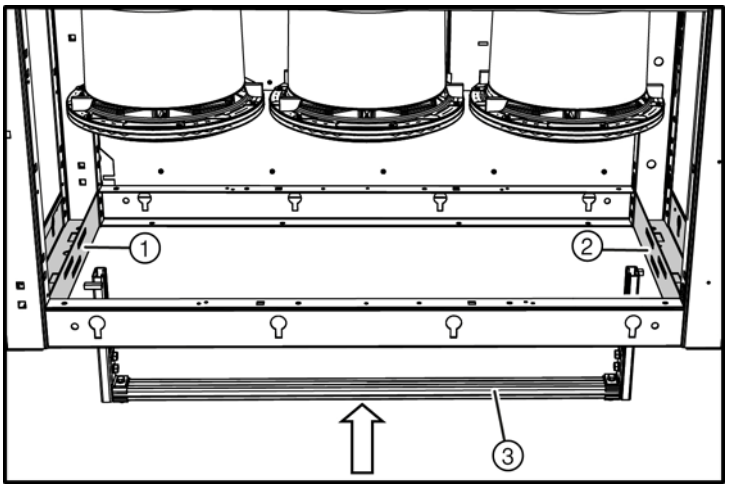
Fastening the panels to the foundation

⇨ Fasten the panels to the foundation (see page 43, "Constructional data of the foundation").
⇨ The fixing material is not included in the scope of supply.

21.5 Mounting the cable bracket

If the circuit-breaker switchgear has been delivered with cable brackets, execute the following assembly operations:

⇨ Mount the cable bracket ③ at the cross members down at the frame.



① Cross member, rear
② Cross member, front
③ Cable bracket

Fig. 71: Mounting the cable bracket

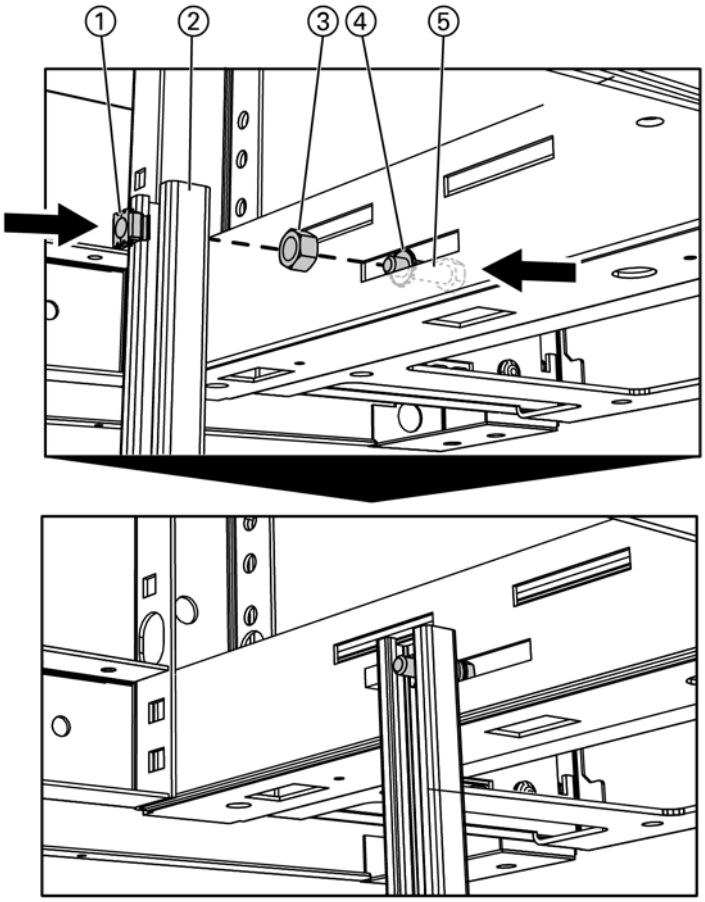


Fig. 72: Mounting the cable bracket at the cross members

① Cage nut
② Cable bracket
③ Hexagon nut M12 (used as spacer)
④ Contact washer
⑤ Hexagon head bolt M10x40

⇨ Mount the cable plugs.
⇨ Fasten the cables at the cable bracket using cable clamps.
⇨ Earth the C-rail at the nearest earthing point using the supplied PE conductor.

21.6 Installing the earthing busbar

Earthing busbars at the switchgear

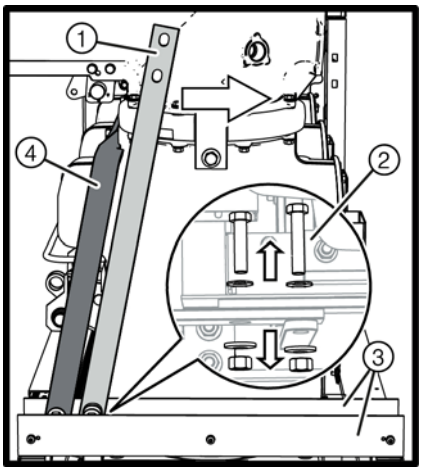
Earthing busbars at the intermediate panel

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

⇨ Remove the bolts ② at the joint.

⇨ Remove the upright earthing busbar ① .

⇨ Put the upright earthing busbar with the bolted joint aside for later reuse.



① Upright earthing busbar
② 2x M12 with contact washers, conical spring washers and nuts (top view onto the joint)
③ Switchgear frame
④ Short-circuit bridge at the circuit-breaker housings

Fig. 73: As-delivered condition of panel to be lined up

⇨ Push the removed earthing busbar horizontally into the switchgear frame so that it will overlap with the earthing busbar of the next panel.

⇨ At the joint, bolt the earthing busbars of the adjacent panels together using 2x bolts M12 including contact washers, conical spring washers and nuts. To do this, reuse the disassembled bolted joint. Tightening torque: 70 Nm.

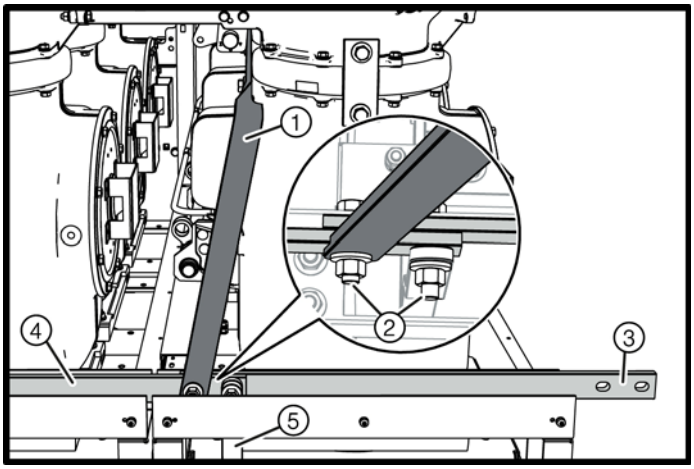


Fig. 74: Interconnecting the earthing busbars

① Short-circuit bridge at the circuit-breaker housings
② 2x M12 with contact washers, conical spring washers and nuts (top view onto the joint)
③ Earthing busbar connection to the next panel
④ Earthing busbar connection of adjacent panels
⑤ Short-circuit bridge at the panel connection housings

⇨ Repeat the assembly operations for all panels until all earthing busbars have been interconnected.

Earthing busbars at the end panel

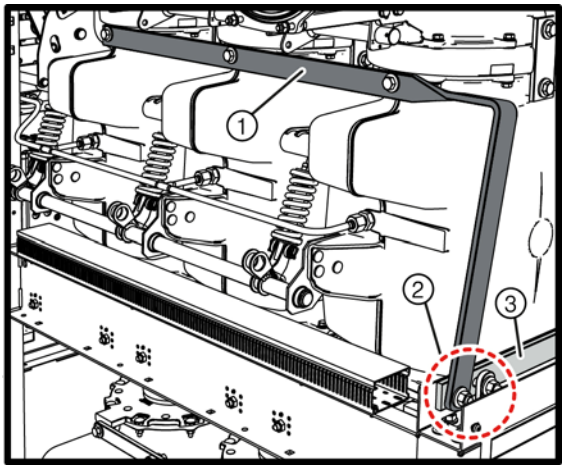


Fig. 75: Earthing busbars at the end panel

① Short-circuit bridge at the circuit-breaker housing

② 2x M12 with contact washers, conical spring washers and nuts at the joint

③ Earthing busbar connection to the next panel

Short-circuit bridge at the panel connection housing

If the panel connection housings are delivered separately, the short-circuit bridge ③ must be mounted on site.

The earthing busbars ② of the switchgear frame are pre-assembled at the factory.

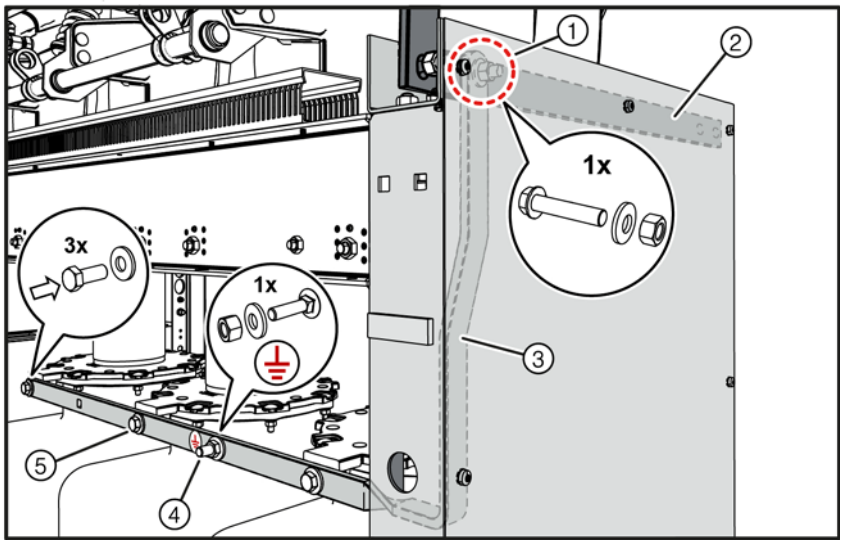


Fig. 76: Mounting the earthing busbar at the panel connection housing

① Joint of earthing busbar at the switchgear frame and short-circuit bridge at the panel connection housing

② Earthing busbar at the switchgear frame

③ Short-circuit bridge at the panel connection housing

④ Earthing at the short-circuit bridge of the panel connection housing (work-in-progress earthing)

⑤ Hexagon head bolts M12 (3x)

Mount the short-circuit bridge at the panel connection housings as follows:

⇨ Fasten the short-circuit bridge ③ at the panel connection housings using 3 hexagon head bolts M12 ⑤ .

⇨ At the joint ① , bolt the short-circuit bridge of the panel connection housings together with the earthing busbar of the switchgear frame ② . To do this, use a cup head bolt M12 with contact washer, conical spring washer and nut. Tightening torque: 70 Nm.

➪ Repeat the assembly operations for the short-circuit bridges at the panel connection housings until all bar ends of the switchgear are interconnected.

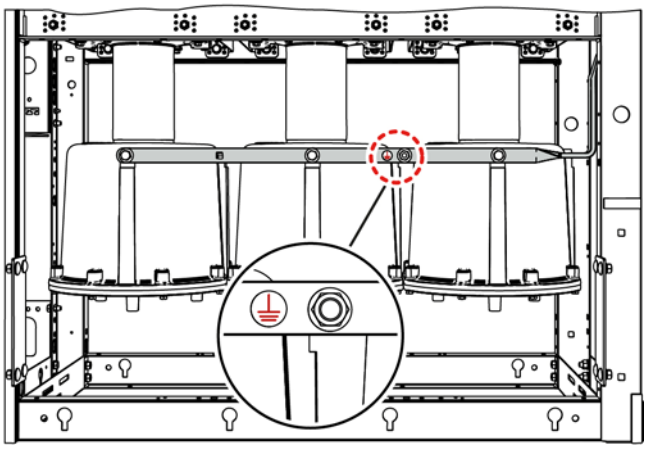


Fig. 77: Earthing at the short-circuit bridge of the panel connection housings (work-in-progress earthing)

Earthing the panels

The cross-sections and materials of the earthing conductors are specified in the DIN/VDE 0101 or IEC 61936-1 standard 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 and every fifth panel at least.

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

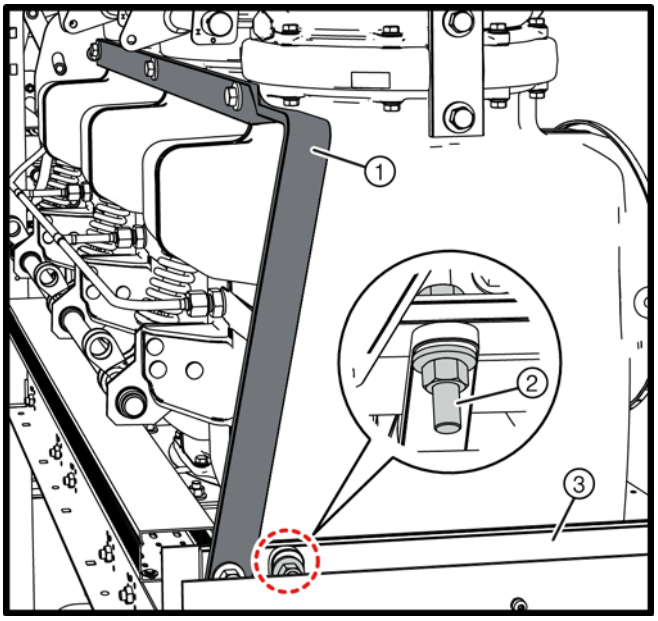


Fig. 78: Earthing bolt of earthing busbar at the right end panel (example)

① Short-circuit bridge at the circuit-breaker housings
② Earthing bolt M12 (earthing point for substation earth)
③ Earthing bar in the switchgear frame

Optional earthing bar

The optional earthing bar for the panel connection is supplied loosely. It must be mounted on site.

The optional earthing bar consists of two vertical and one horizontal earthing bars. Determine the height of the horizontal earthing bar ① . Use one cup head bolt M12x40, one conical spring washer and one hexagon nut to bolt the horizontal earthing bar together with the two vertical earthing bars.

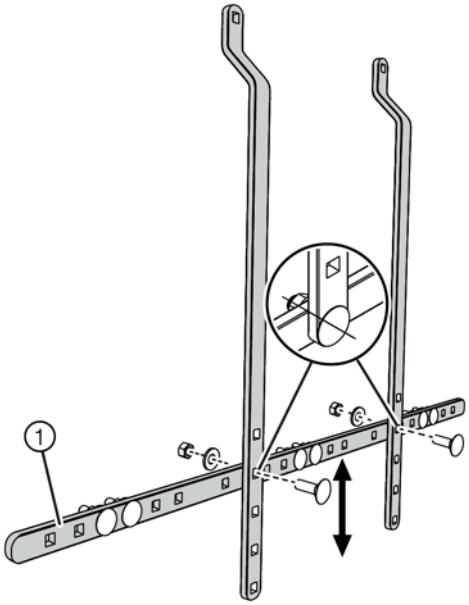


Fig. 79: Adjusting the height of the optional earthing bar

The optional earthing bar ① is bolted onto the short-circuit bridge of the panel connection housings ② , which was pre-assembled at the factory, using 2 hexagon head bolts M12x40.

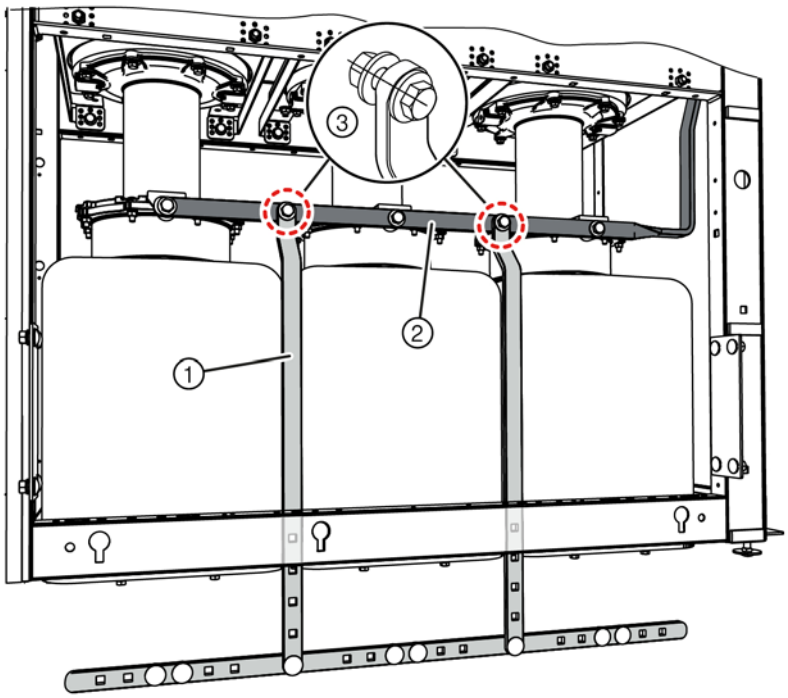


Fig. 80: Optional earthing bar at the panel connection

① Optional earthing bar

② Short-circuit bridge at the panel connection, pre-assembled at the factory

③ Hexagon head bolt M12x40 with conical spring washer, hexagon nut with conical spring washer

Mounting the short-circuit bridge on the bus sectionalizer

In the case of the bus sectionalizer, the short-circuit bridge ① must be mounted on site.

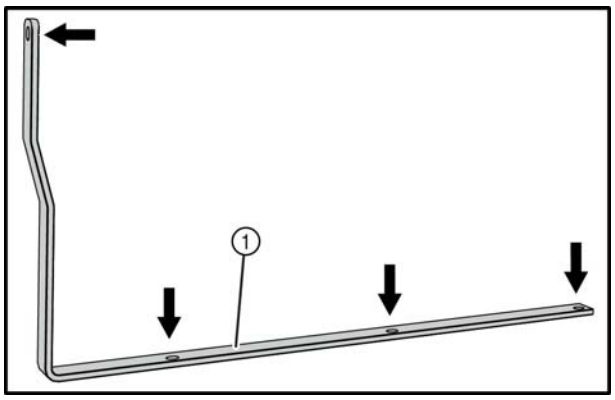
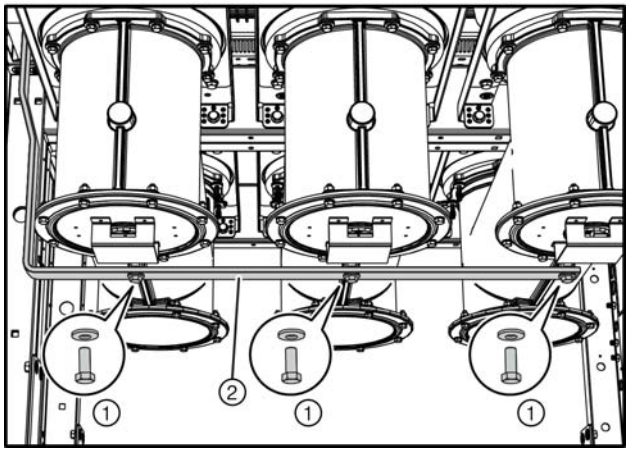


Fig. 81: Fixing points at the short-circuit bridge

The earthing busbars of the switchgear frame are pre-assembled at the factory.

Mount the short-circuit bridge at the bus sectionalizer housings as follows:

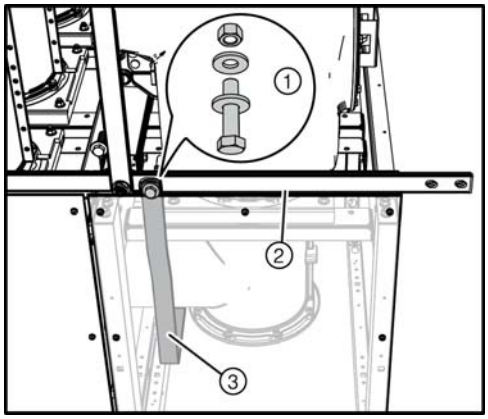
⇨ Fasten the short-circuit bridge at the bus sectionalizer housings using 3 hexagon head bolts M12.



① Hexagon head bolt M12 with plain washer (3x)
② Short-circuit bridge

Fig. 82: Short-circuit bridge (side view of the switchgear)

⇨ At the joint ① , bolt the short-circuit bridge of the bus sectionalizer housings together with the earthing busbar of the switchgear frame ② . To do this, use a cup head bolt M12 with contact washer, conical spring washer and nut. Tightening torque: 70 Nm.



① Cup head bolt M12 with contact washer, conical spring washer and nut.
② Earthing busbar
③ Short-circuit bridge

Fig. 83: Short-circuit bridge (rear view of the switchgear)

⇨ Repeat the assembly operations for the short-circuit bridges at the bus sectionalizer housings until all bar ends of the switchgear are interconnected.

21.7 Interconnecting panels with 5000 A busbar (twin busbar)

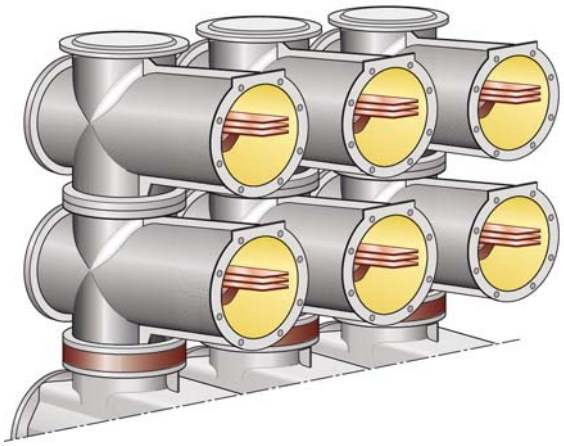


Fig. 84: Busbar version 5000 A (twin busbar)

Preparations: Removing upper row of busbar housings

The upper row of busbar housings has been pre-assembled at the factory. To interconnect the panels, this row must first be dismantled.

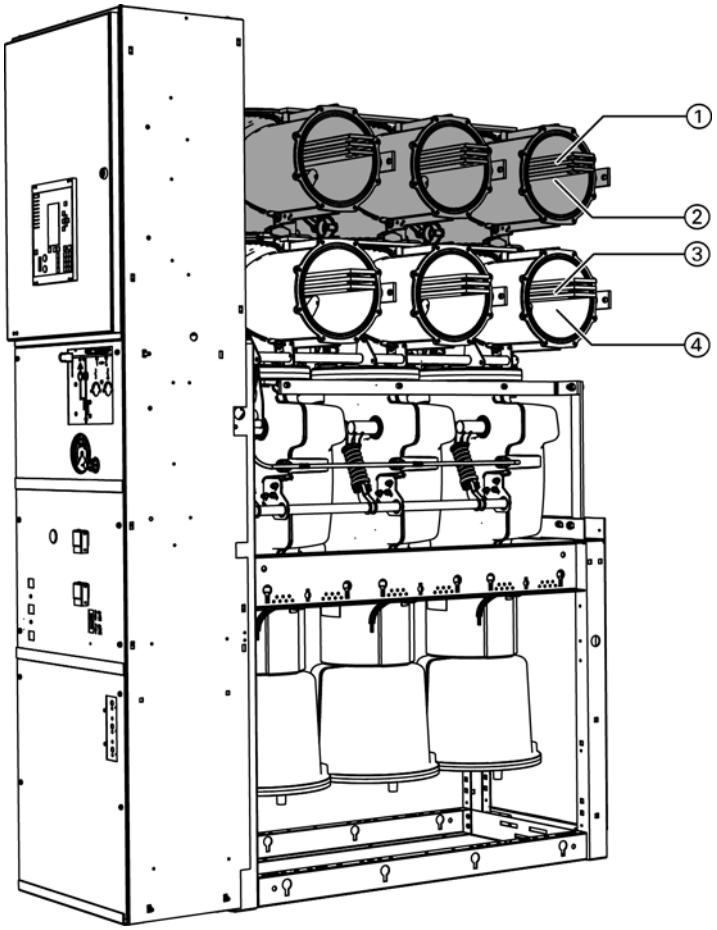


Fig. 85: Overview: Twin busbar

① Busbars (upper row)
② Busbar housing (upper row)
③ Busbars (lower row)
④ Busbar housing (lower row)

⇨ Remove the earthing bar ① . To do this, loosen the three hexagon head bolts M12x30.

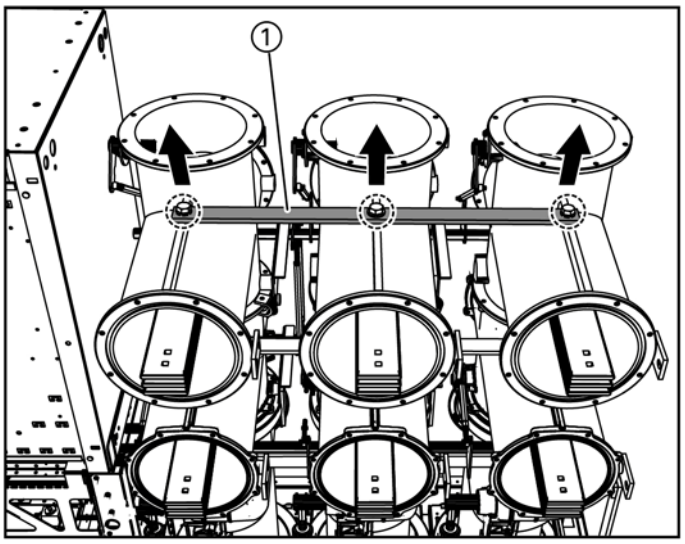


Fig. 86: Removing the earthing bar

⇨ Detach the coupling rod ① (option) from all upper busbar housings.

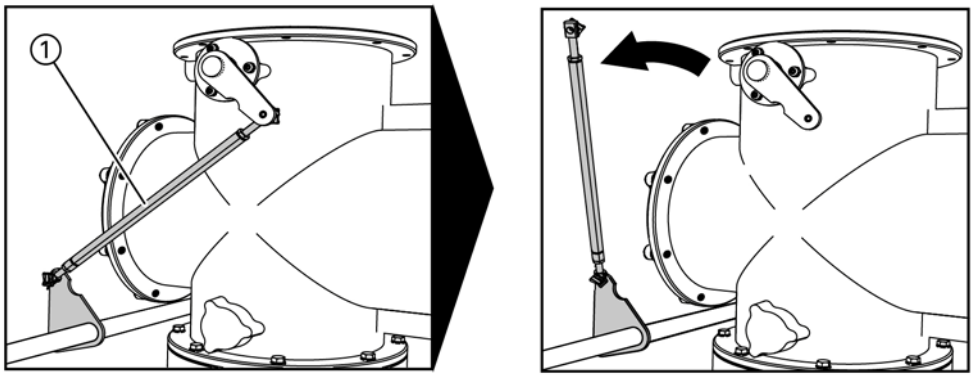


Fig. 87: Detaching the coupling rod ① (option)

⇨ Detach the 3-pole disconnector shaft from the busbar housings.

➩ Remove the busbars ④ linked to the twin busbar connection. To do this, remove the four hexagon nuts M10 with plain washers ① . Secure the two links ② against falling down, and take the three busbars ④ out carefully.

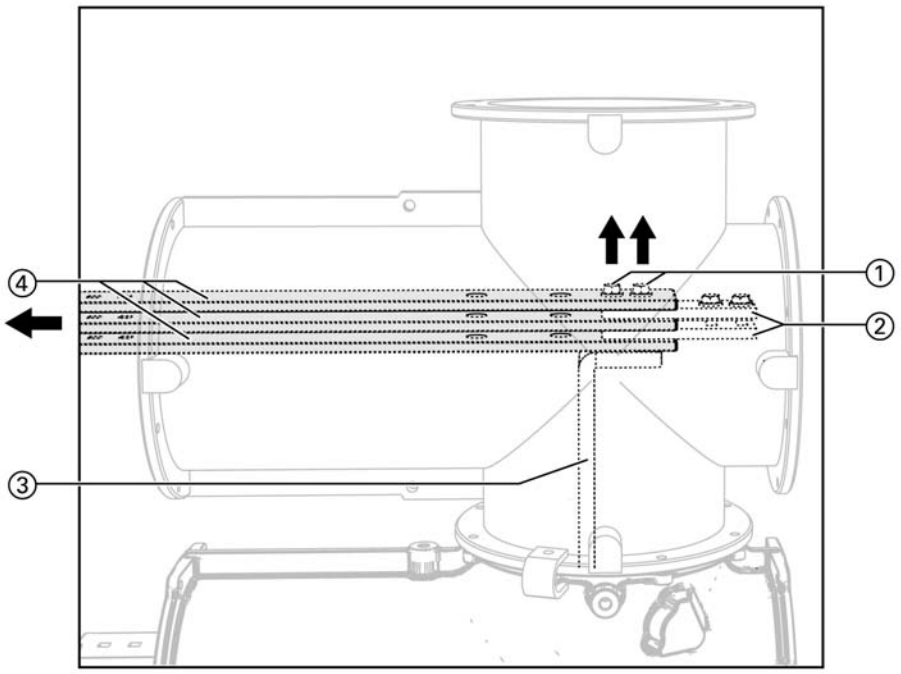
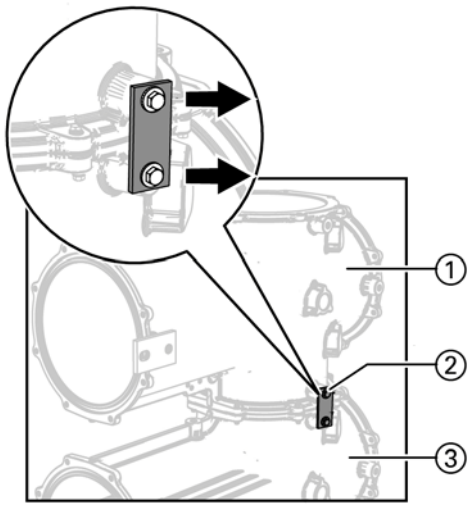


Fig. 88: Removing the busbar

① Hexagon nut M10 with plain washer
② Link
③ Twin busbar link (called supporting angle hereafter)
④ Busbars

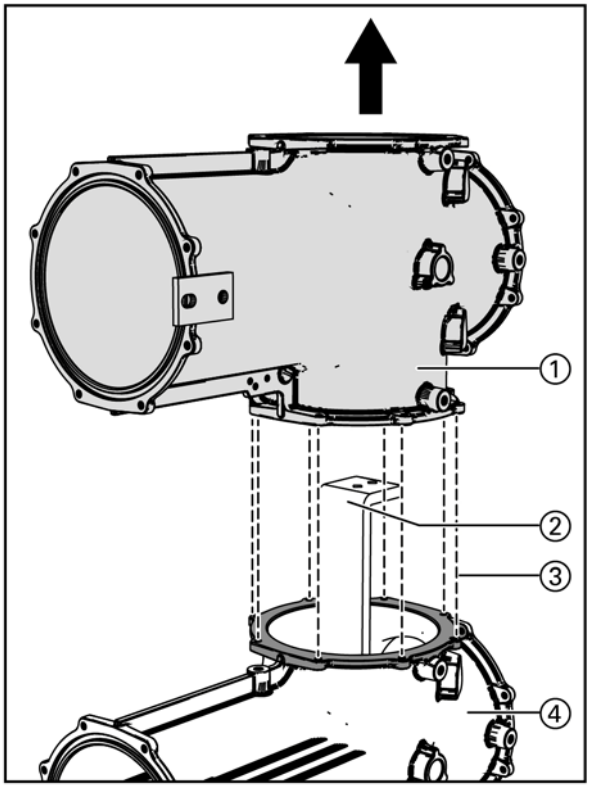
➩ To remove the earthing lug ② , unscrew the two hexagon head bolts M12x30 with plain washers.



① Busbar housing (upper row)
② Earthing lug
③ Busbar housing (lower row)

Fig. 89: Removing the earthing lug

⇨ Loosen the bolted joint between the upper row of busbar housings ① and the lower row of busbar housings ④ . To do this, undo the eight bolt-and-washer assemblies M8 ③ .



① Busbar housing (upper row)
② Supporting angle
③ Guide line for bolt-and-washer assembly M8 (8x)
④ Busbar housing (lower row)

Fig. 90: Removing the upper busbar housing

⇨ Remove the supporting angle ① . To do this, remove the two hexagon head bolts with plain washers ② .

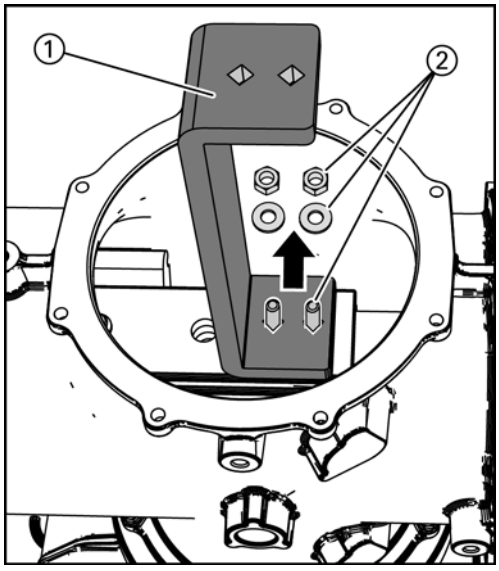


Fig. 91: Removing the supporting angle

✔ Upper busbar housing system removed.

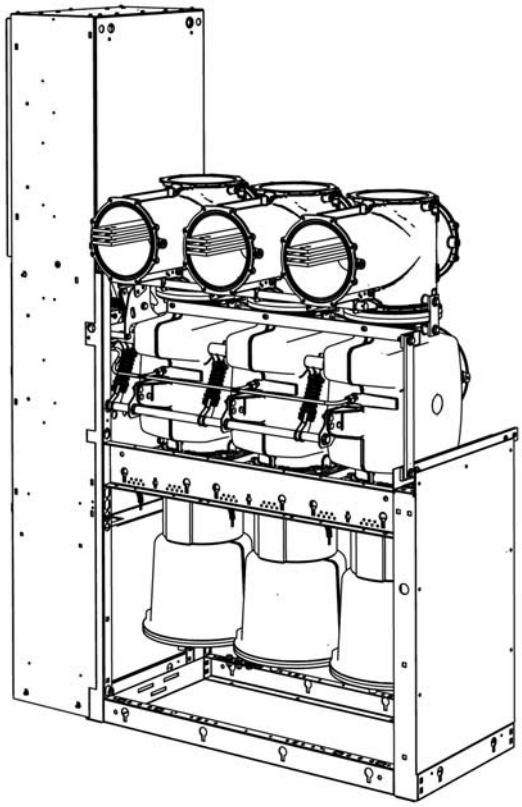


Fig. 92: Panel after removal of upper busbar housing system

Assembly aid

⚠WARNING

Risk of falling due to uncovered openings and cutouts

A cover prevents the person from falling into or through an opening or a cutout.

- ⇨ Provide for sufficient load-bearing capacity of the cover.
- ⇨ Provide for sufficient width of the cover.
- ⇨ Secure the cover against shifting.

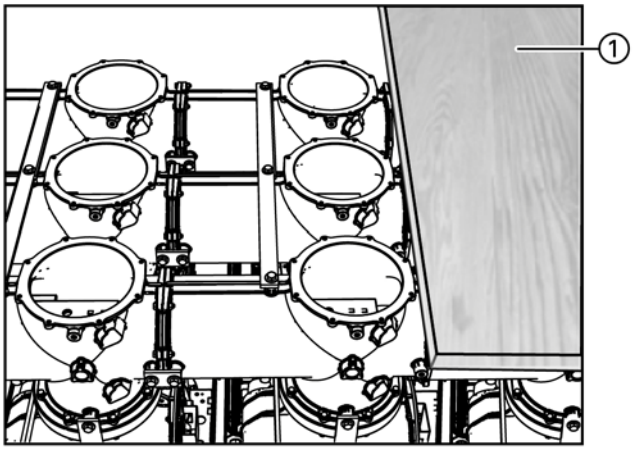


Fig. 93: Example for an assembly aid (plank ①)

Mounting the supporting angle

⇨ Undo the hexagon nuts at the busbar and mount the supporting angle. Tightening torque: 40 Nm.

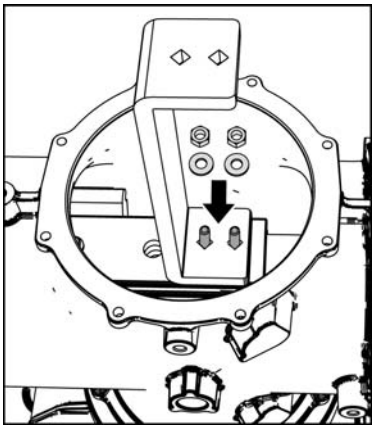


Fig. 94: Fixing the supporting angle

⇨ Fit supporting angles for the complete panel, and fit protective caps on the bolted joints.

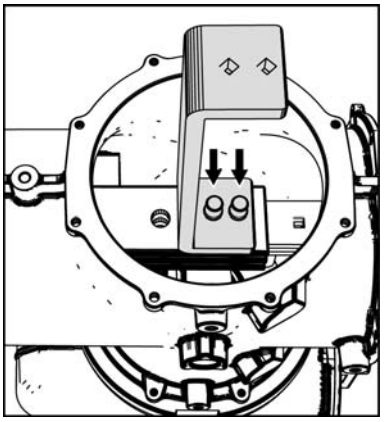


Fig. 95: Fitting protective caps

Cleaning and greasing the flanges

⇨ Clean all horizontal flanges of the busbar housings and the grooves for the sealing rings carefully with lint-free paper.

⇨ Carefully check the external contact surfaces of the flanges and the grooves for scratches and 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 coordinate the elimination of damages.

⇨ Apply a uniform film of the supplied mounting paste to the flanges and O-rings (sealing rings). To do this, apply a grease strip of approx. 3 mm thickness on the external contact surface of the flanges. Use the supplied Polylub GLY 801 mounting paste only.

⇨ Lay the O-rings into the grooves of the flanges.

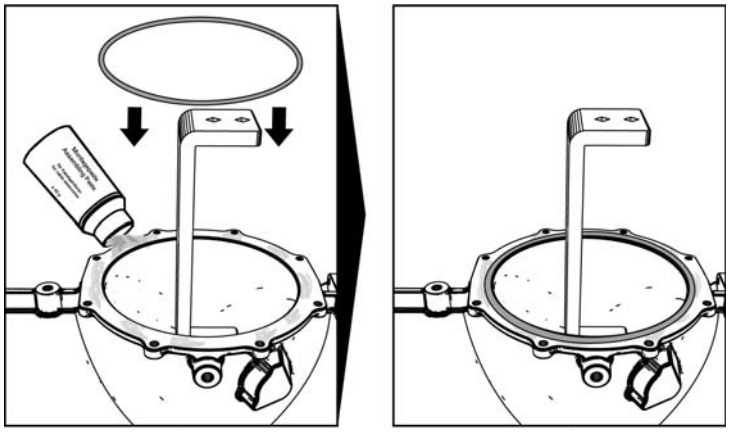


Fig. 96: Greasing and inserting the sealing ring

Setting down and mounting the busbar housing

⇨ Set down the busbar housing.

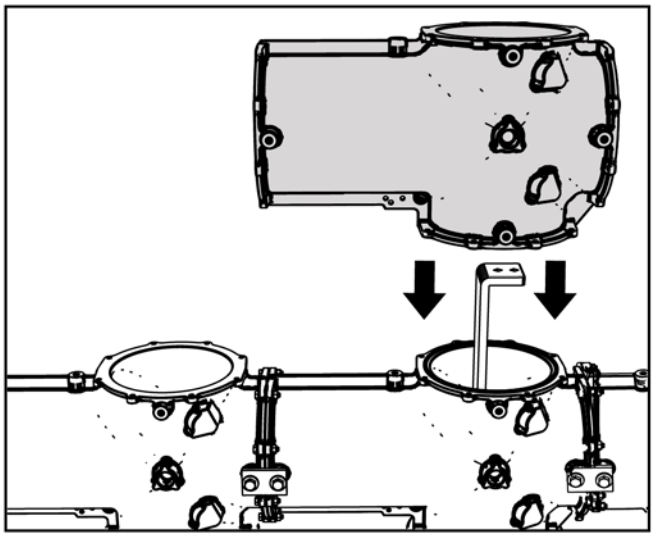


Fig. 97: Setting down the busbar housing

⇨ Align the housings to be interconnected using a suitable auxiliary means and bolt together.

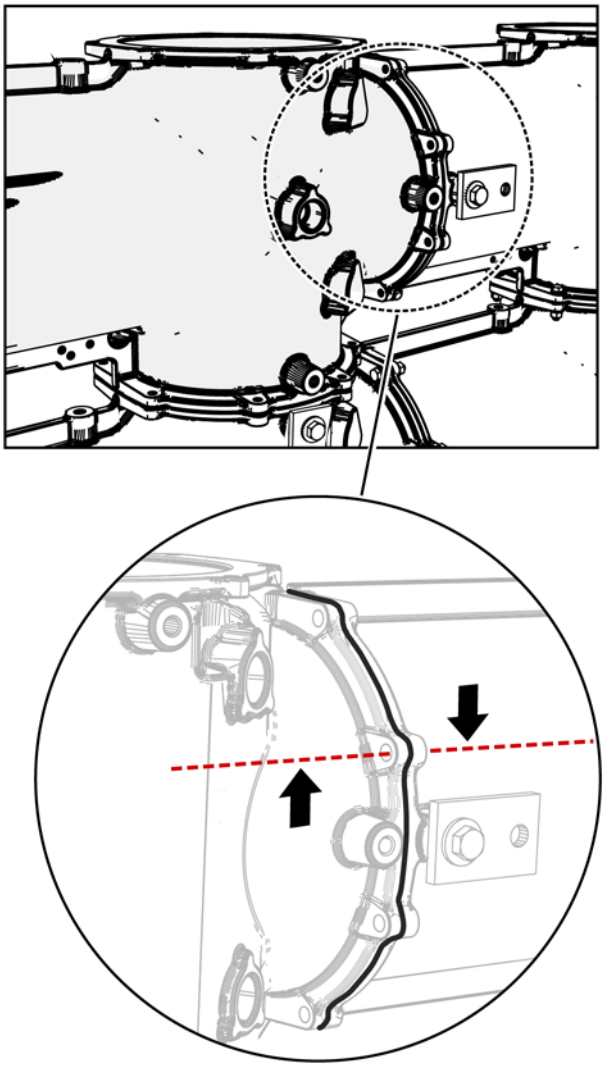


Fig. 98: Aligning the busbar housings

⇨ Use 8 bolt-and-washer assemblies M8 ③ in order to bolt busbar housings located one beneath the other together (tightening torque: 20 Nm).

⇨ Use 8 bolt-and-washer assemblies M8 ① in order to bolt busbar housings located side by side together (tightening torque: 20 Nm).

⇨ Fasten earthing lugs ② to the busbar housings. To do this, use two hexagon head bolts M12x30 with plain washers (tightening torque: 20 Nm).

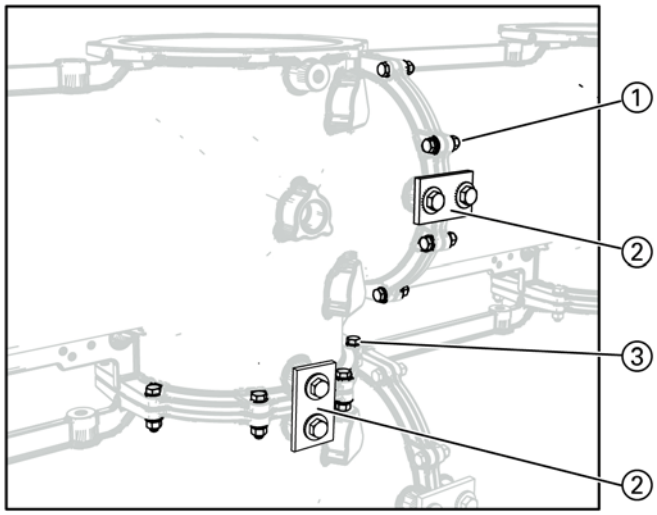


Fig. 99: Bolting busbar housings together

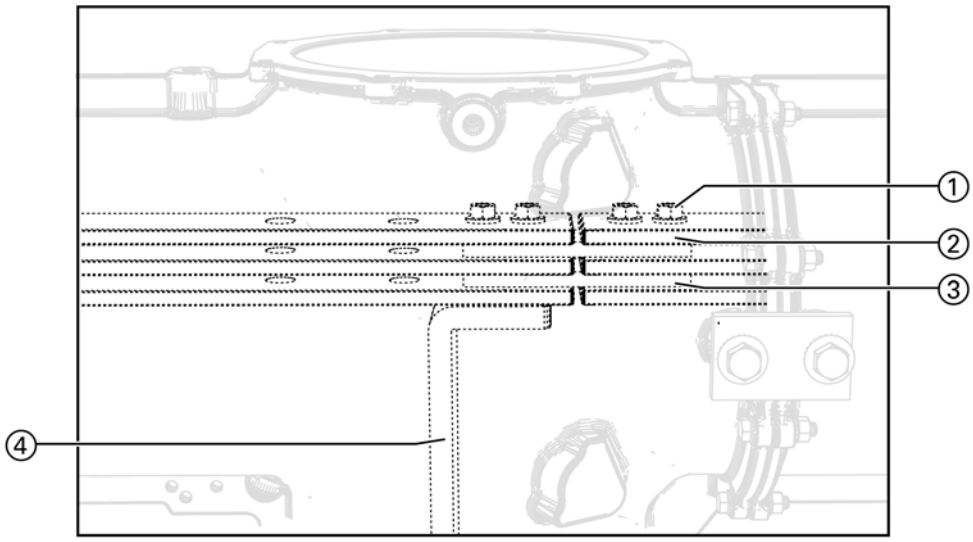


Fig. 100: Setup: Completely assembled busbar

① Hexagon nut M10 with plain washer

② Busbar

③ Busbar lug

④ Twin busbar connection

⇨ To simplify installation, bolt the three busbars together using one bar support (if not pre-assembled at the factory)

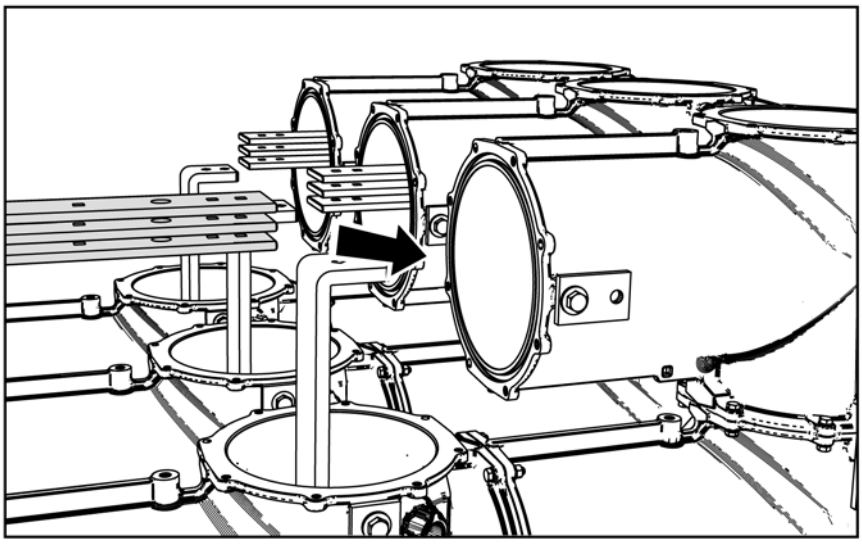


Fig. 101: Inserting the busbars

⇨ Interconnect the busbars and bolt them together at the twin busbar connection.

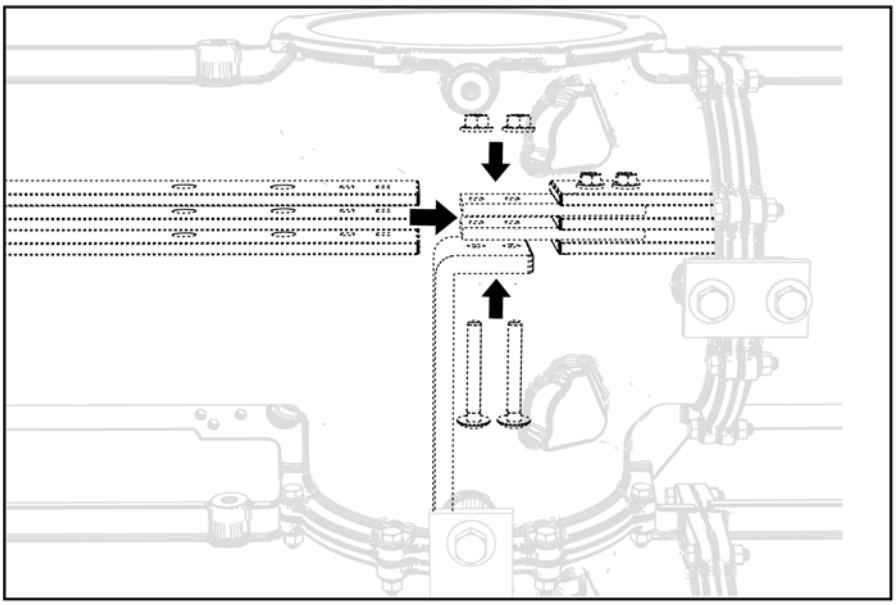


Fig. 102: Bolting busbars together

⇨ Tighten the bolts lightly. The busbar sections must still be able to move.

⇨ Repeat the operations until all busbar housings are mounted.

⇨ 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.

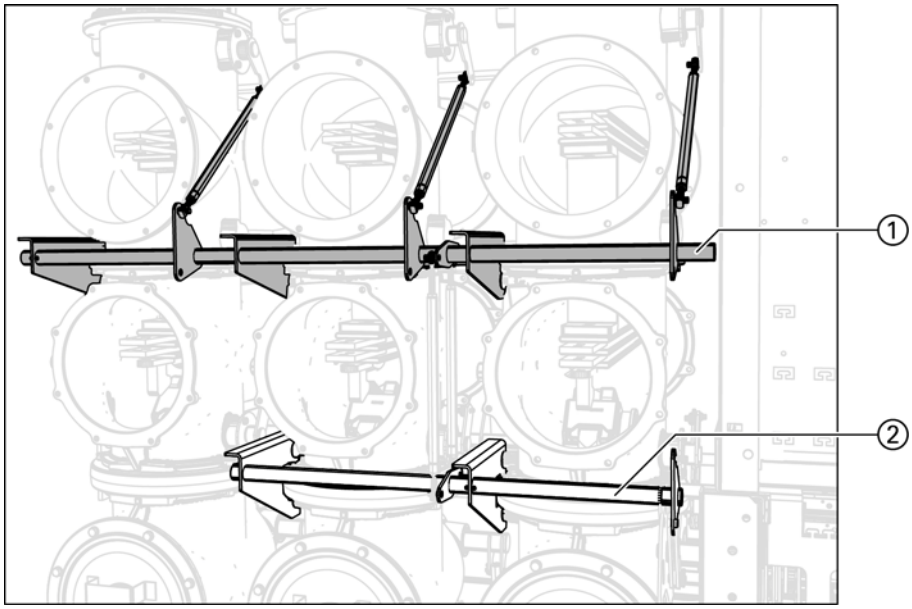
⇨ Mount the housing covers.

Installing disconnectable busbar components

When disconnectable busbar components such as voltage transformers with fuses must be mounted, the kinematic system has to be assembled first.

Assembling the kinematic system

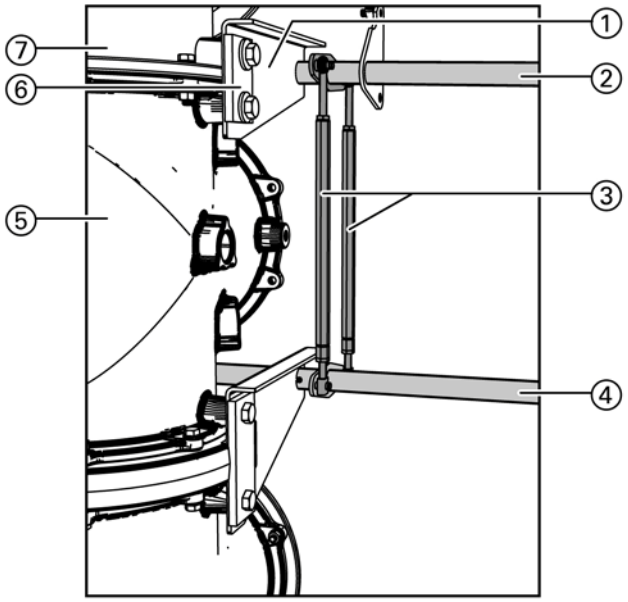
⇨ The operating shaft with coupling rods ① at the upper row of busbar housings and the operating shaft ② at the lower row of busbar housings have been pre-assembled at the factory.



① Operating shaft with coupling rod for upper row of busbar housings
② Operating shaft for lower row of busbar housings

Fig. 103: Operating shafts at the busbar housings

⇨ Interconnect the upper operating shaft ② and the lower operating shaft ④ by means of a double coupling rod ③ .



① Bearing plate for fixing the operating shaft at the busbar housing
② Operating shaft for upper busbar housing
③ Double coupling rod, interconnects upper and lower operating shaft
④ Operating shaft for lower busbar housing
⑤ Busbar housing (lower row)
⑥ Earthing lug
⑦ Busbar housing (upper row)

Fig. 104: Fixing of operating shafts ② , ④ at the busbar housing

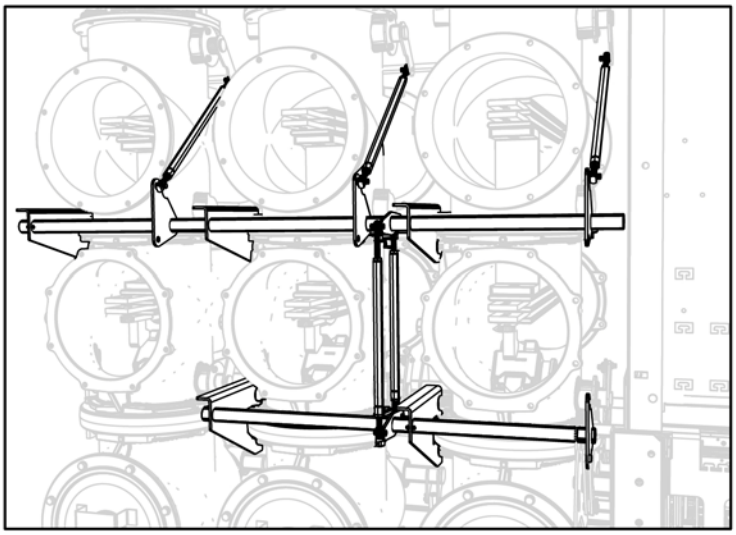


Fig. 105: Mounting position of kinematic system at the upper and lower busbar housings

⇨ Secure the rear end of the operating shaft ① with spring-type straight pins ② to prevent displacement of the operating shaft.

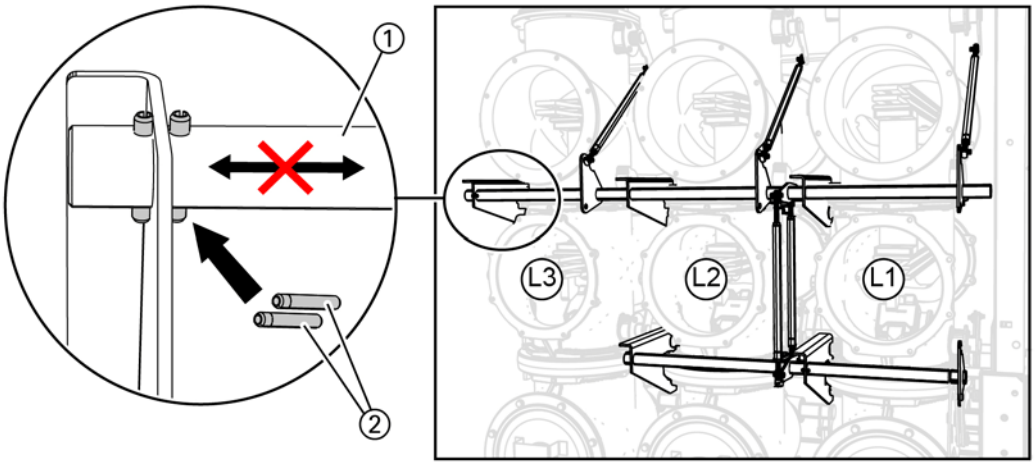


Fig. 106: Securing the operating shaft

⇨ Hook the coupling rod ① in at the lever of the disconnector shaft ② (upper busbar housing).

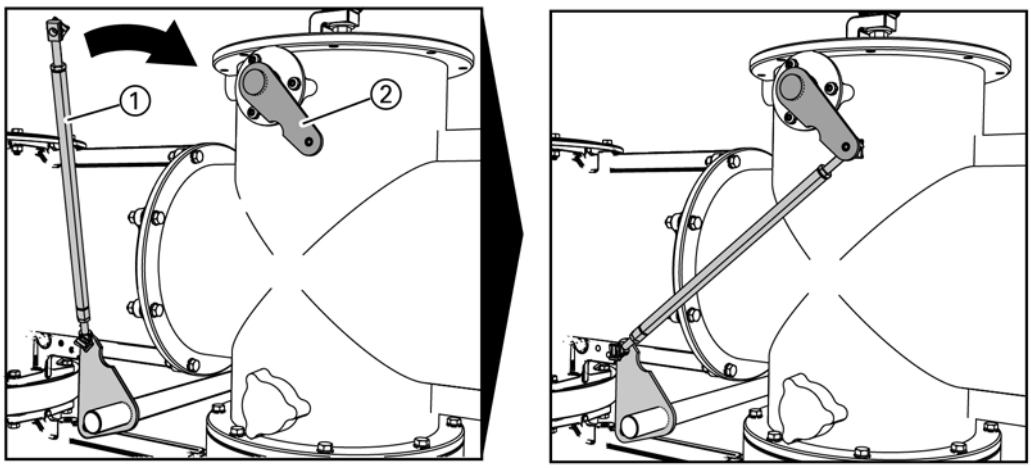


Fig. 107: Fixing the coupling rod at the upper busbar housing

⇨ Checking contact overlapping of disconnector contacts and adjust, see page 74, "Completing switchgear installation".

22 Installation work with SF_6 gas before commissioning

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

⚠WARNING

Danger of suffocation

Inhaling high concentrations of SF_6 can cause death or serious injury.

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

- ⇨ Observe the safety data sheet for SF_6 gas.
- ⇨ Do not enter confined spaces where SF_6 gas may accumulate.
- ⇨ Check and document reusability (dew-point, gas quality) before working with SF_6 gas.
- ⇨ While working with SF_6 gas, provide for good ventilation.
- ⇨ After working with SF_6 gas, vent the cable basement and any hollows in the floors with special care.

22.1 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 SF_6 gas on 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 filled with SF_6 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.

For equipping of busbar housing covers with desiccant bags, see page 47, "Overview of busbar housing covers with desiccant bags".

⚠WARNING

In the ambient air, the desiccant bags lose their effectiveness rapidly

The formation of condensation can lead to corrosion of switchgear parts. High air humidity can lead to creepage distances.

- ⇨ If a gas compartment has been open for more than 30 minutes, replace all desiccant bags.
- ⇨ Do not open the packing of the desiccant bags until right before putting them into the panel.
- ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**.
- ⇨ If the humidity indicators are **pink**, do not use the desiccant bags.
- ⇨ If the desiccant bags have been exposed to the air for more than 30 minutes, do not use the desiccant bags anymore.
- ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes.
- ⇨ Close the gas compartment hermetically with sealing rings (O-rings).
- ⇨ Evacuate the gas compartment immediately.

- ⇨ Remove all covers with the **"Filter"** inscription from the busbar housings of one busbar run.
- ⇨ Clean busbar housings that are dirty inside with a hand vacuum cleaner.
  The hand vacuum cleaner must feature a plastic tip.
- ⇨ Clean the bushing plates with a cloth.

⇨ Prepare the flanges of the busbar housings for assembly (see page 62, "Preparing busbar assembly").

⇨ Clean the sealing surfaces of the busbar housing covers with a lint-free paper, and apply a thin film of grease.

⇨ Determine the size of the desiccant bags required for each busbar housing.

⇨ Place the desiccant bags in their original packing at the corresponding covers.

⇨ Remove the desiccant bags from the packings.

⇨ Lay the desiccant bags completely into the associated holder in the busbar housing covers.

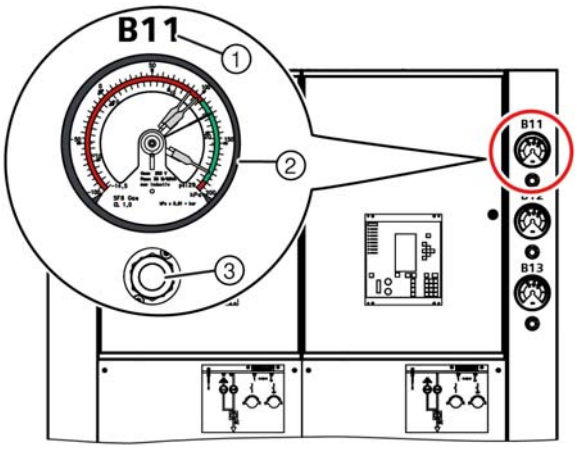
⇨ Put the busbar housing covers with the inserted bags into position. Do not jam any parts of the desiccant bags in the sealing surfaces; otherwise, there will be leaks.

⇨ Fasten the busbar housing covers crosswise. Tightening torque: 20 Nm.

Evacuating the busbar run with the vacuum pump

Before filling with SF_6 gas, 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 manometers and gas filling valves for one busbar run.

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



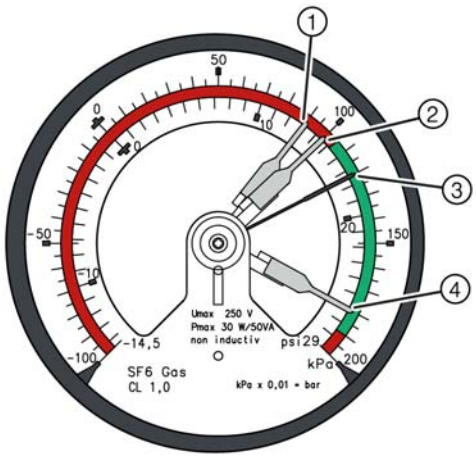
① Designation for the busbar run
② Manometer
③ Gas filling valve

Fig. 108: Manometer and gas filling valve at the switchgear front

⇨ Undo the locking cap of the gas filling valve ③ from the closed busbar run.

⇨ Connect the vacuum pump to the valve of the busbar run. 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.



① Signaling contact:
Pressure lower than minimum functional level
② Signaling contact:
Minimum functional level
③ Gas pressure indicator:
Rated functional level 120 kPa
④ Signaling contact:
Maximum functional level 180 kPa

The data in kPa are values at 20 °C ambient air temperature

Fig. 109: Detail view of manometer

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

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

Filling the busbar run with SF_6 gas

- ⇨ Determine the filling pressure required according to the rating plate (see page 39, "Rating plates") and the data given in Section "Insulating gas SF_6" (see page 35, "Insulating gas"). 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.
- ⇨ In the case of non-compensated manometers for circuit-breaker housings: Adjust the limit pressures on the pressure indicators (signaling contacts) in the manometer with the supplied square socket spanner (see page 35, "Insulating gas").

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

- ⇨ Fill all other busbar runs as described above (see page 95, "Completing busbar assembly and filling with SF_6 gas").

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

To install 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 following assembly operations are performed **completely for one circuit-breaker housing on one panel each**.

⚠WARNING

In the ambient air, the desiccant bags lose their effectiveness rapidly

The formation of condensation can lead to corrosion of switchgear parts. High air humidity can lead to creepage distances.

- ⇨ If a gas compartment has been open for more than 30 minutes, replace all desiccant bags.
- ⇨ Do not open the packing of the desiccant bags until right before putting them into the panel.
- ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**.
- ⇨ If the humidity indicators are **pink**, do not use the desiccant bags.
- ⇨ If the desiccant bags have been exposed to the air for more than 30 minutes, do not use the desiccant bags anymore.
- ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes.
- ⇨ Close the gas compartment hermetically with sealing rings (O-rings).
- ⇨ Evacuate the gas compartment immediately.

Assembling panel connections supplied separately

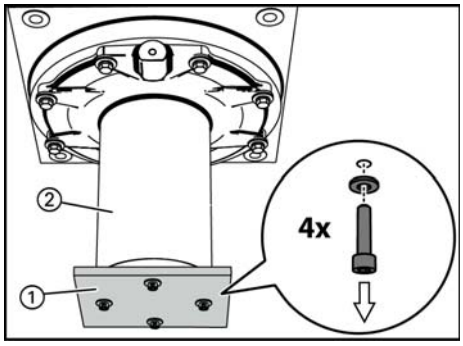
- ⇨ Remove 4 cheese head bolts M6 and 4 conical spring washers from the cover of the transformer housing ① .

⚠CAUTION

Risk of property damage

Components may be damaged during disassembly.

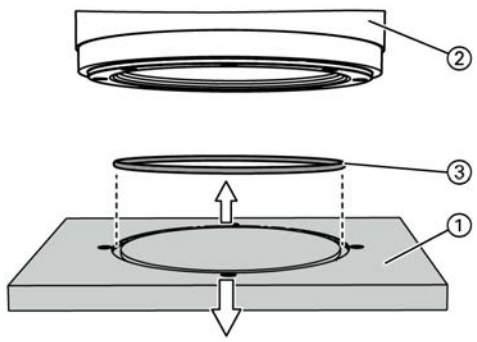
- ⇨ Do not reuse cheese head bolts, conical spring washers, toroidal sealing rings and nuts.
- ⇨ Dispose of disassembled components in an environmentally compatible way.



① Transformer housing
② Cover of transformer housing

Fig. 110: Removing the cover of the transformer housing

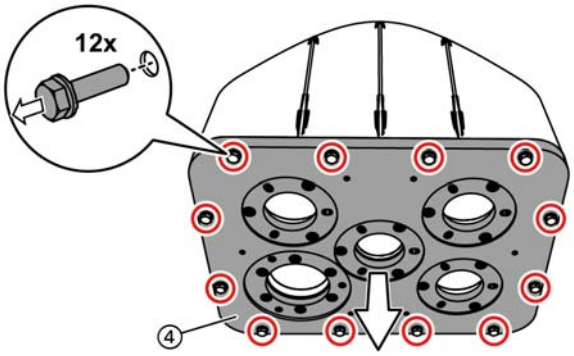
➪ Remove the cover of the transformer housing ① and the sealing ring ③ .



① Cover of transformer housing
② Transformer housing
③ Sealing ring (O-ring)

Fig. 111: Removing the cover of the transformer housing and the sealing ring

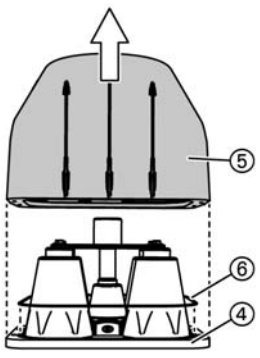
➪ Undo 12 bolt-and-washer assemblies M8x40 at the cover of the panel connection housing ④ .



④ Cover of panel connection housing

Fig. 112: 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. 113: Removing the panel connection housing

⇨ Remove the cover of the panel connection housing ⑦ .

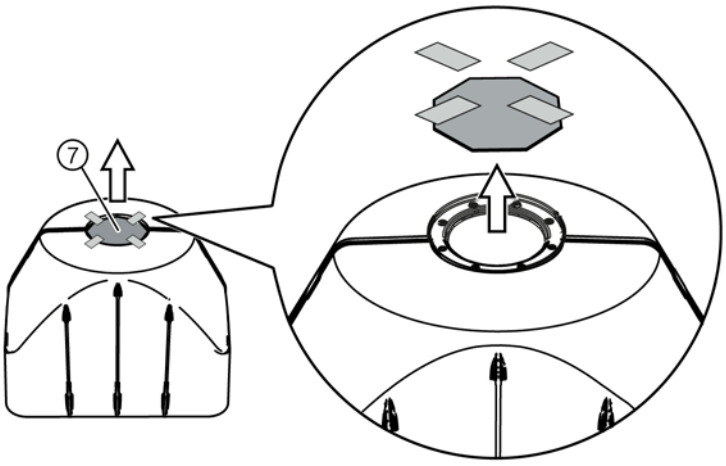
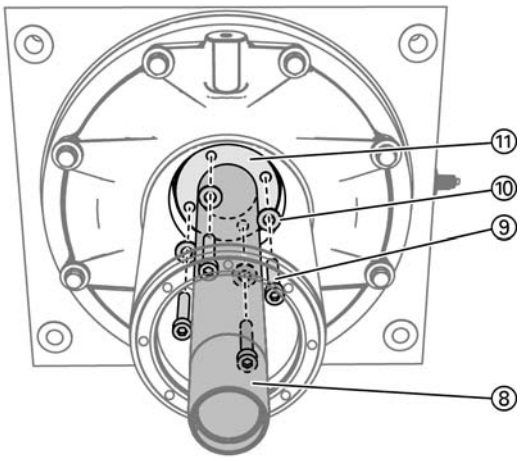


Fig. 114: Removing the cover of the panel connection housing

☞INFORMATION
The length of the panel connection stud depends on the version of the panel connection, the feeder current, and on whether there are voltage transformers available. ⇨ Before assembling the panel connection stud, verify the correct length of the panel connection stud. To do this, use the overview (861-9582.9) provided with the supplementary equipment.

⇨ Bolt the panel connection stud ⑧ to the bushing terminal ⑪ using 4 cheese head bolts M8x50 ⑨ and 4 conical spring washers ⑩ from the accessories.
Tightening torque: 20 Nm.



⑧ Panel connection stud
⑨ Cheese head bolt M8x50 (4x)
⑩ Conical spring washer (4x)
⑪ Bushing terminal

Fig. 115: Fastening the panel connection stud

⇨ Clean the flange of the transformer housing and the groove for accommodation of the sealing ring with lint-free paper.

⇨ Carefully check the external contact surface of the flange and the groove for scratches and other damages or pollution. Damages and pollution will cause leaks.

⇨ If the external contact surface or the groove are damaged: Inform the regional Siemens representative and coordinate the elimination of damages.

⇨ Grease the sealing ring ③ uniformly with the supplied Polylub GLY 801 mounting paste.

⇨ Apply a layer of Polylub GLY 801 mounting paste with a thickness of approx. 3 mm all around on the external contact surface of the flange. Distribute the mounting paste evenly using a fine line brush.

⇨ Lay the sealing ring ③ into the panel connection housing ⑤ .

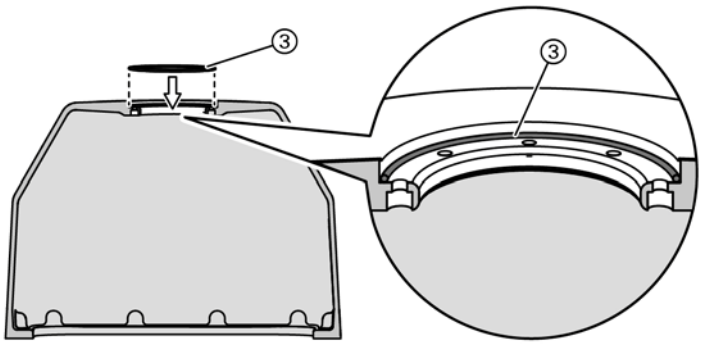
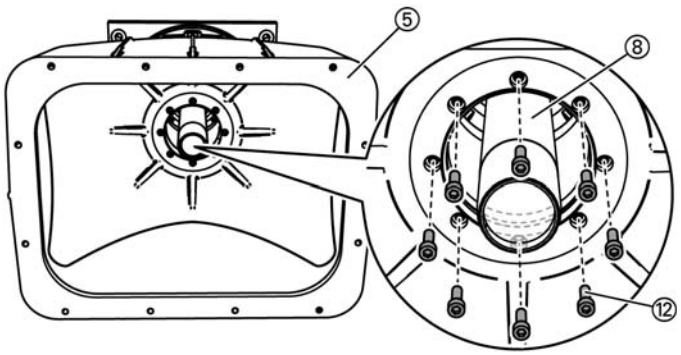


Fig. 116: Inserting the toroidal sealing ring

⇨ Bolt the panel connection housing ⑤ to the transformer housing ② using 8 cheese head bolts M6x20 ⑫ from the accessories (tightening torque: 6 Nm).



⑤ Panel connection housing
⑧ Panel connection stud
⑫ Cheese head bolt M6x20 (8x)

Fig. 117: Fastening the panel connection housing (view from below)

⇨ Clean the flange of the transformer housing and the groove for accommodation of the sealing ring with lint-free paper.

⇨ Carefully check the external contact surface of the flange and the groove for scratches and other damages or pollution. Damages and pollution will cause leaks.

⇨ If the external contact surface or the groove are damaged: Inform the regional Siemens representative and coordinate the elimination of damages.

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

⇨ Grease the sealing ring ⑥ uniformly with the supplied Polylub GLY 801 mounting paste.

⇨ Apply a layer of Polylub GLY 801 mounting paste with a thickness of approx. 3 mm all around on the external contact surface of the flange. Distribute the mounting paste evenly using a fine line brush.

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

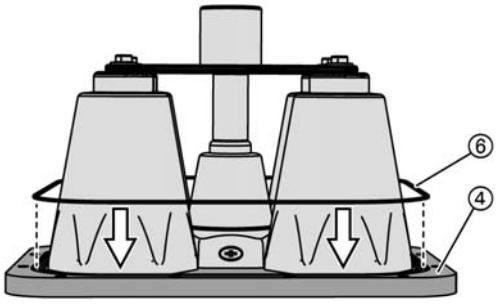


Fig. 118: Inserting the sealing ring

➪ Grease the contact laminations ⑬ with mounting paste Vaseline 8422 DAB 8 (order number: 8BX2041).

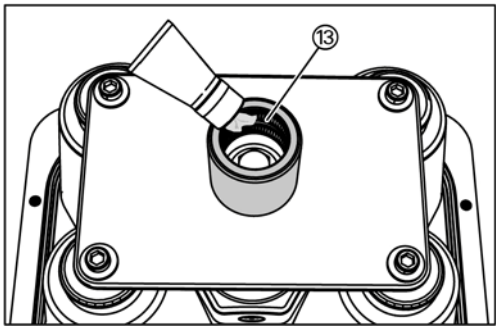


Fig. 119: Greasing the socket

☞INFORMATION
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 at the panel connection housing.

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

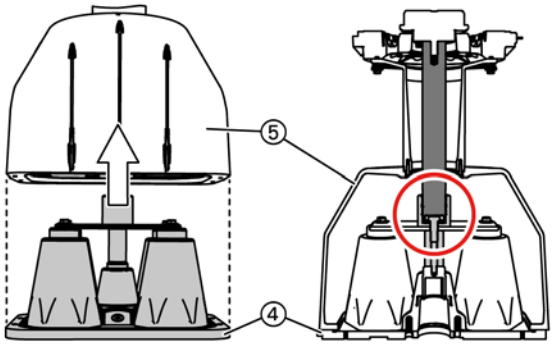


Fig. 120: Pushing in the cover of panel connection housing

➪ Fasten the cover of the panel connection housing ④ with 12 bolt-and-washer assemblies M8x40. Tightening torque: 20 Nm.

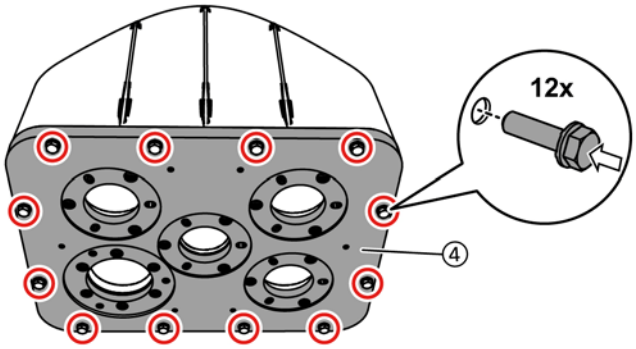


Fig. 121: Fastening the cover with the plug sockets

➪ 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 bursting disc cover at the side of the circuit-breaker housing. The cover has the inscription "Filter" ① .

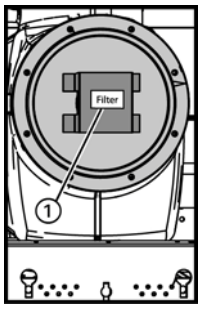


Fig. 122: Bursting disc cover on circuit-breaker housing

⚠ WARNING

In the ambient air, the desiccant bags lose their effectiveness rapidly

The formation of condensation can lead to corrosion of switchgear parts.
High air humidity can lead to creepage distances.

- ⇨ If a gas compartment has been open for more than 30 minutes, replace all desiccant bags.
- ⇨ Do not open the packing of the desiccant bags until right before putting them into the panel.
- ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**.
- ⇨ If the humidity indicators are **pink**, do not use the desiccant bags.
- ⇨ If the desiccant bags have been exposed to the air for more than 30 minutes, do not use the desiccant bags anymore.
- ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes.
- ⇨ Close the gas compartment hermetically with sealing rings (O-rings).
- ⇨ Evacuate the gas compartment immediately.

- ⇨ Remove the lateral bursting disc cover with the **"Filter"** inscription on **one** circuit-breaker housing.
- ⇨ Unpack 2 new desiccant bags of 250 g each per pole, and lay them completely into the holder.
- ⇨ Clean the sealing surfaces of the bursting disc cover with a lint-free paper, and apply a thin film of Polylub GLY 801 mounting paste.
- ⇨ Lay a new sealing ring (O-ring) into the groove of the bursting disc cover.
- ⇨ Put the bursting disc covers with the inserted bags into position. Observe that no part of the bags is jammed in the sealing surfaces in order to prevent leaks.
- ⇨ Bolt the bursting disc 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.

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 manometer 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 marked with B0 for the circuit-breaker housings.
- ⇨ Connect the vacuum pump to the valve. Use short tubes with a large inside diameter.
- ⇨ Evacuate the circuit-breaker 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 type plate and the data given in Section "Technical data" (see page 31, "Technical data"). The pressure depends on the gas temperature.
- ⇨ Connect the gas filling equipment to the gas filling valve of the evacuated circuit-breaker housings.
- ⇨ Fill circuit-breaker housings with SF_6 until the necessary pressure is reached. Check the filling pressure on the manometer for the circuit-breaker housings and on the manometer of the gas filling equipment.
- ⇨ Remove the connecting tube of the gas filling equipment from the gas filling valve. The gas filling valve closes automatically.
- ⇨ Refit the locking cap of the gas filling valve.
- ⇨ In the case of non-compensated manometers for circuit-breaker housings: Adjust the limit pressures on the pressure indicators (signaling contacts) in the manometer with the supplied square socket spanner (see page 35, "Insulating gas").

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!

22.3 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 for eliminating the residual humidity in the gas filling. To expose the desiccant bags as briefly as possible to the ambient air, the following assembly operations are performed **completely for one bar connection on one panel each**.

⚠WARNING

In the ambient air, the desiccant bags lose their effectiveness rapidly

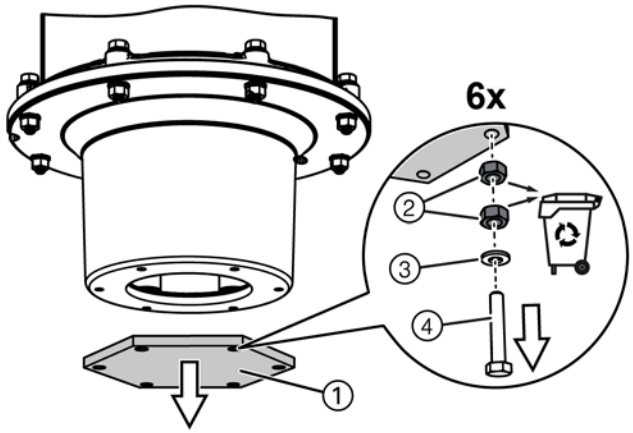
The formation of condensation can lead to corrosion of switchgear parts. High air humidity can lead to creepage distances.

- ⇨ If a gas compartment has been open for more than 30 minutes, replace all desiccant bags.
- ⇨ Do not open the packing of the desiccant bags until right before putting them into the panel.
- ⇨ Use only desiccant bags whose packing is not damaged and whose humidity indicators in the packing are **blue**.
- ⇨ If the humidity indicators are **pink**, do not use the desiccant bags.
- ⇨ If the desiccant bags have been exposed to the air for more than 30 minutes, do not use the desiccant bags anymore.
- ⇨ After opening the packings, mount the desiccant bags in the gas compartment within 30 minutes.
- ⇨ Close the gas compartment hermetically with sealing rings (O-rings).
- ⇨ Evacuate the gas compartment immediately.

Mounting solid-insulated bars

⇨ Repeat the following work operations for all solid-insulated bars in the same panel.

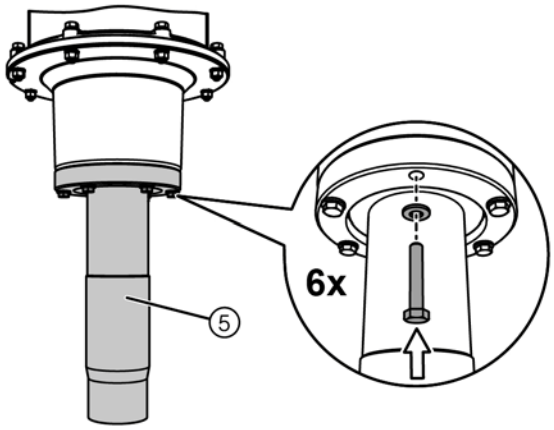
⇨ Remove the provisional cover ① from one panel connection. Keep the removed bolts ④ and contact washers ③ for later installation. Dispose of the spacing nuts ② required for transport in an environmentally compatible way.



⇨ 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 at the panel connection for assembly.

⇨ Mount the solid-insulated bar ⑤ using the previously removed bolts and contact washers. Tightening torque: 20 Nm.



⇨ Replace the desiccant bags if the circuit-breaker housing was ventilated for more than half an hour.

⇨ Evacuate the circuit-breaker housings and fill with SF_6 gas.

23 Performing the power- frequency voltage test

If required, a test with rated short-duration power-frequency withstand voltage can be performed at the readily installed switchgear on site. The busbar voltage transformers are designed for a repeat test at 80% U_D at 60 Hz according to IEC 62271-200.

⚠WARNING

Hazardous electrical voltage!

An incorrectly performed high-voltage test can cause death, serious injury and property damage.

- ⇨ Observe the specifications for prevention of accidents.
- ⇨ Observe the operating instructions and work instructions of the switchgear operator.
- ⇨ Have the high-voltage test only performed by operating personnel who was instructed in theory and practice of switchgear operation (see page 10, "Qualified personnel").
- ⇨ Keep a minimum safety distance of 3 m during the test.
- ⇨ Install safety barriers.
- ⇨ Earth test leads when test is complete.

NOTICE

Considerable property damage

During the high-voltage test, connected non-disconnectable inductive voltage transformers may be damaged.

- ⇨ During commissioning, perform the high-voltage test before installing the non-disconnectable voltage transformers.
- ⇨ Remove already mounted non-disconnectable inductive voltage transformers.
- ⇨ Close the transformer bushings in a surge-proof way.
- ⇨ Check the SF6 gas filling (see page 60, "Checking the SF_6 gas pressure").
- ⇨ Switch the disconnecting facility for panels with disconnectable voltage transformers to OPEN position before performing the high-voltage test.

Preparing the power-frequency voltage test

- ⇨ Check the SF_6 gas filling (see page 60, "Checking the SF_6 gas pressure").
- ⇨ Before the test, remove non-disconnectable voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200.
- ⇨ Close the transformer bushings in a surge-proof way.
- ⇨ Switch the voltage transformer disconnector of the disconnectable voltage transformers to OPEN position.
- ⇨ For the rated short-duration power-frequency withstand voltage test, first close the three-position disconnector and then the circuit-breaker in the incoming panel.
- ⇨ Close all free sockets in the test section in a surge-proof way.
- ⇨ 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.

24 Installing the voltage transformers

⚠DANGER

Hazardous voltage.

Will cause death, serious injury and property damage.

Always observe the Five Safety Rules:

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

⚠DANGER

Hazardous voltage

Can cause death, injury or considerable property damage.

The metal coating on the outside of voltage transformers is connected to earth potential.
If the metal coating is damaged, the voltage transformer is not safe-to-touch anymore.

- ⇨ Do not damage the metal coating of voltage transformers.

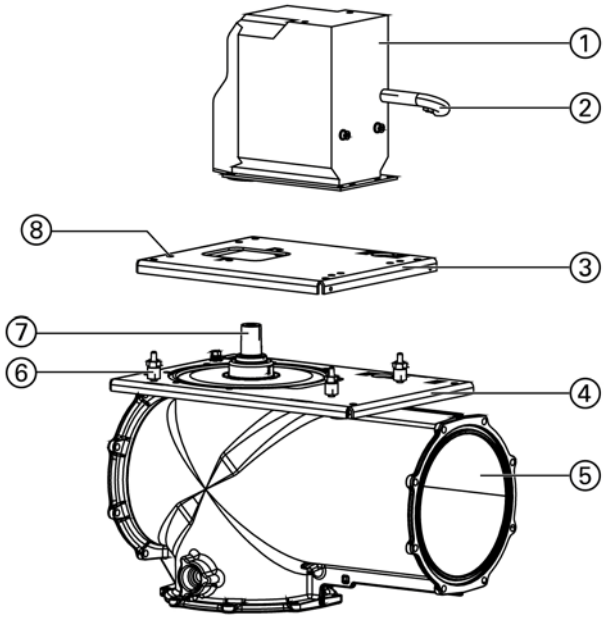
⚠WARNING

Internal arcing and explosion hazard

If a voltage transformer is short-circuited, there will be a considerable current flow. This considerable current flow implies the risk of internal arcing, and the voltage transformer can explode and produce a fire. Death, serious injury and considerable property damage can be the consequence.

- ⇨ Never short-circuit voltage transformers on the secondary side.
- ⇨ Check the voltage transformer circuits from the voltage transformer to the secondary fuse or short-circuit protective device for short circuits.
- ⇨ Check correct operation of the existing protective devices in the voltage transformer secondary circuit.

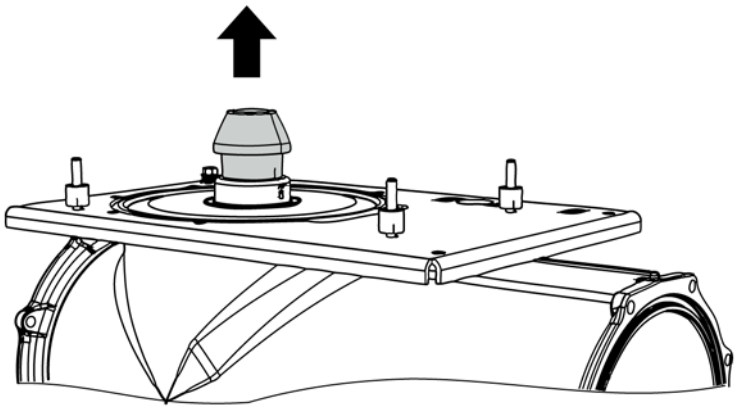
24.1 Installation of voltage transformers type 4MT3 on the busbar



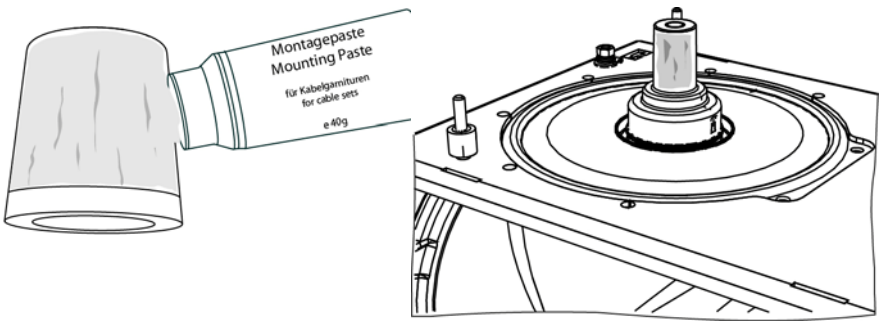
① 4MT3 voltage transformer
② Low-voltage plug connector
③ Adapter plate
④ Voltage transformer mounting plate
⑤ Busbar housing
⑥ Distance sleeves
⑦ Outside-cone bushing
⑧ Hole with setnut for press-out bolt

Fig. 123: 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.

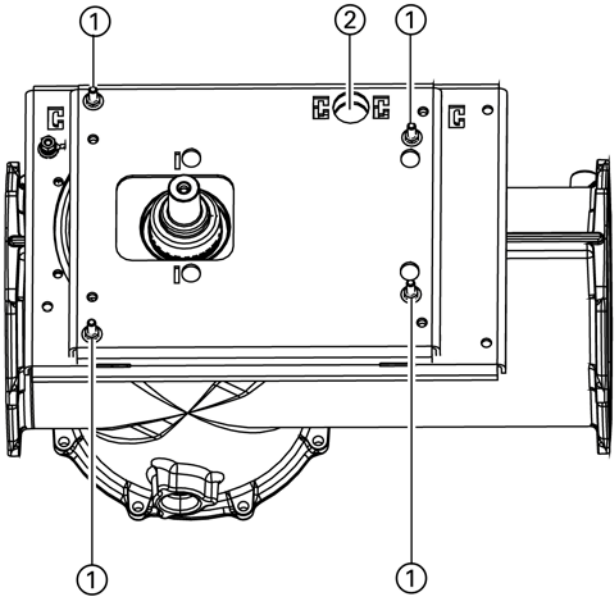


⇨ Clean the silicone adapter of the voltage transformer and the outside-cone bushing carefully. Use a cleaning agent without solvents and a lint-free cloth.
⇨ Grease the silicone adapter of the voltage transformer and the outside-cone bushing of the voltage transformer mounting plate uniformly with mounting paste for cable sets.



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

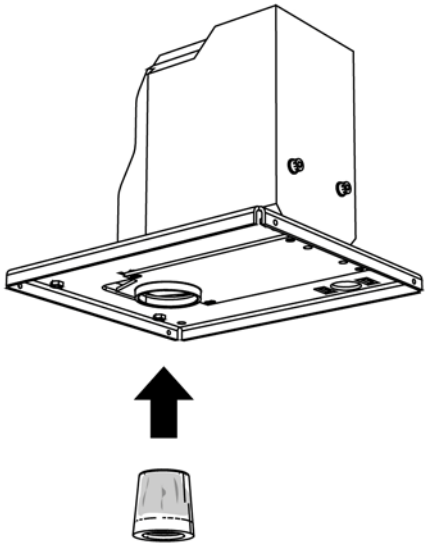
☞INFORMATION
The already assembled adapter plate can be displaced due to vibrations during transport. To position the adapter plate correctly: ⇨ Loosen the M8 bolts of the adapter plate a little bit. ⇨ Bolt the adapter plate uniformly together with the voltage transformer mounting plate. Tightening torque: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



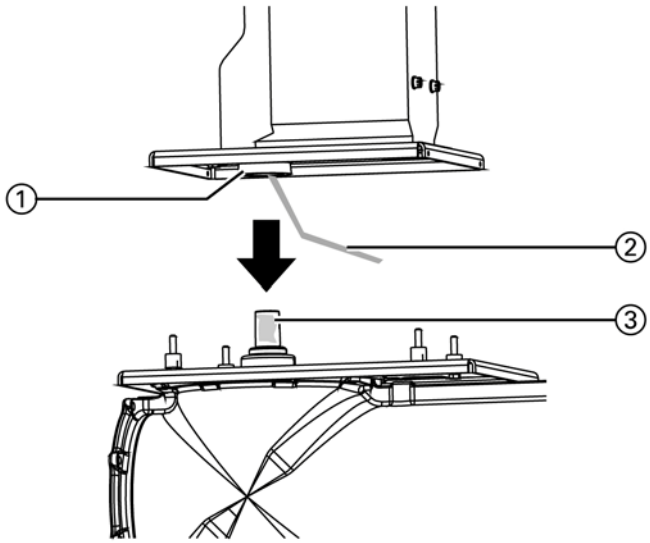
NOTICE

Risk of partial discharges at the outside-cone bushing.

Damage to the switchgear can be the consequence.

⇨ 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

⚠WARNING

Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

⇨ Secure the voltage transformer against falling down. If required, use a support.

⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

⚠CAUTION

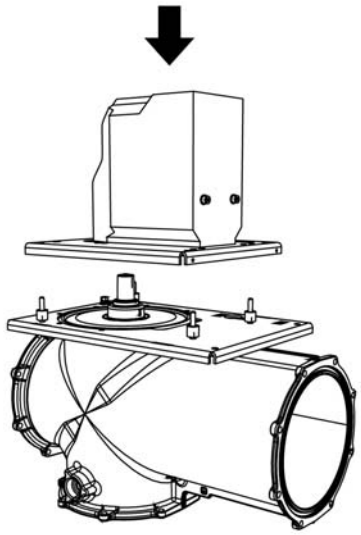
Disruptive discharges due to air inclusions

Will damage the cast-resin bushing.

⇨ While installing the voltage transformer, let excess air out of the plug-in connection with a cable strap.

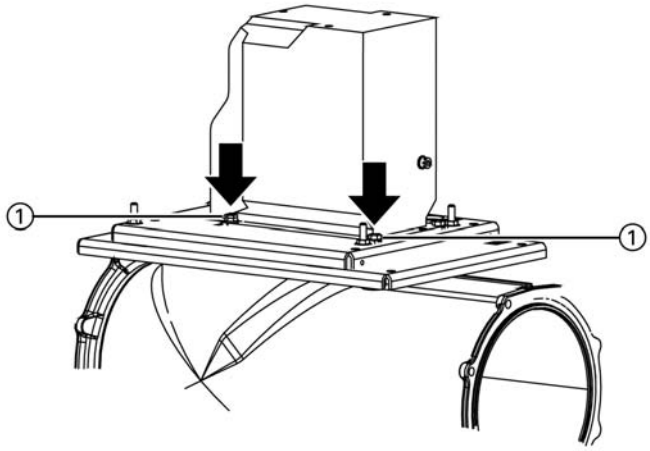
⇨ Verify intact condition of the cable strap. If the cable strap was damaged when it was pulled out, remove the voltage transformer and eliminate the residues of the cable strap.

⇨ 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.



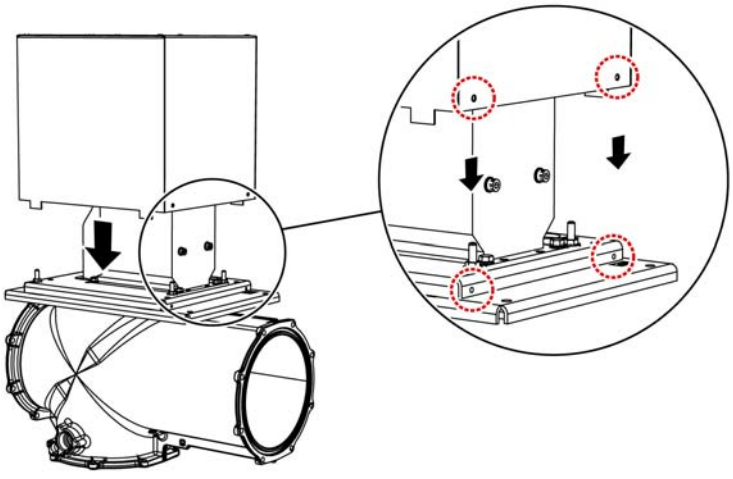
⇨ Plug the low-voltage plug connectors in at the voltage transformers.

⇨ 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.

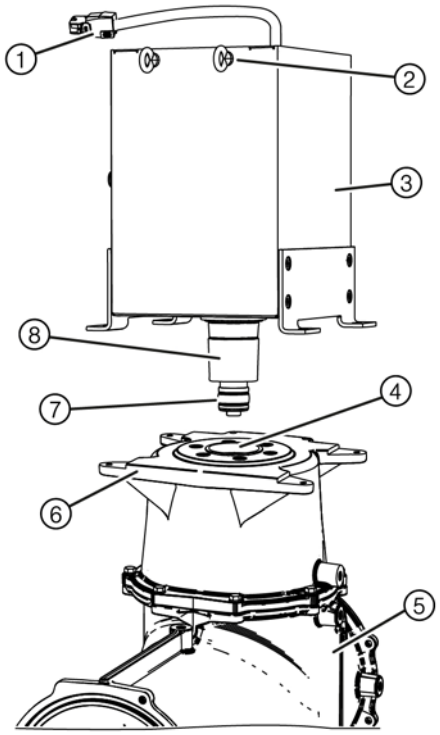


① Fixing bolts for connecting the voltage transformer with the voltage transformer mounting plate

⇨ Mount the cover of the voltage transformer using four bolts M6x12 and contact washers. Tightening torque: 8 Nm.



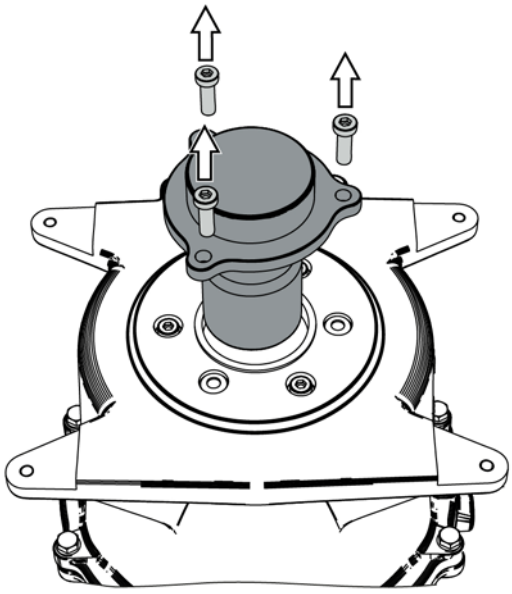
24.2 Installation of voltage transformers type 4MU4 on the busbar



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

Fig. 124: 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. 125: Removing the dummy plug

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

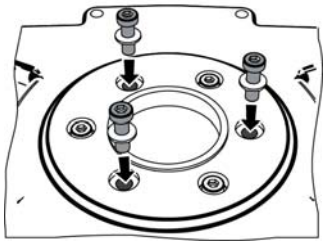


Fig. 126: Inserting hexagon socket head bolts

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

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

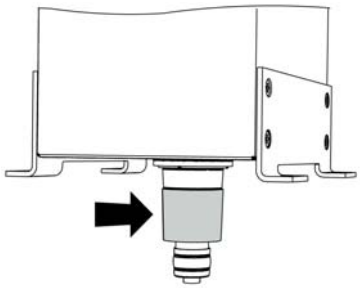


Fig. 127: Greasing and cleaning the silicone adapter

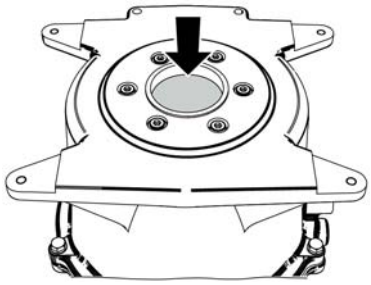


Fig. 128: Greasing and cleaning the inside-cone cast-resin bush

⚠WARNING

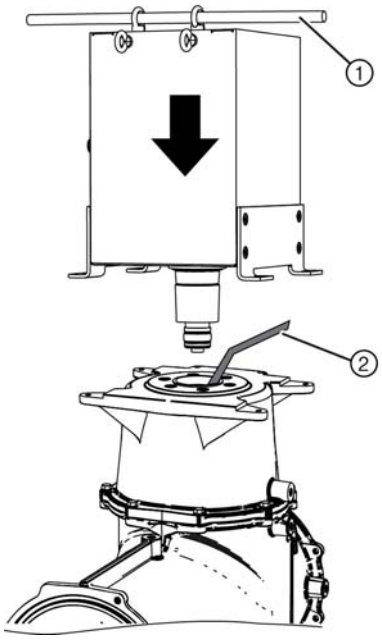
Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

⇨ Secure the voltage transformer against falling down. If required, use a support.

⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

⇨ Lower the voltage transformer slowly onto the busbar housing.



① Lifting gear
② Cable strap

Fig. 129: Setting down the voltage transformer

⚠CAUTION
Disruptive discharges due to air inclusions **Will damage the cast-resin bushing.** ➪ While installing the voltage transformer, let excess air out of the plug-in connection with a cable strap. ➪ Verify intact condition of the cable strap. If the cable strap was damaged when it was pulled out, remove the voltage transformer and eliminate the residues of the cable strap.

➪ 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.

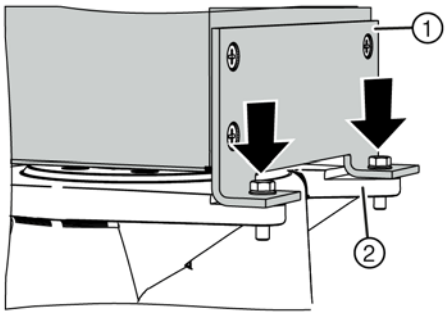
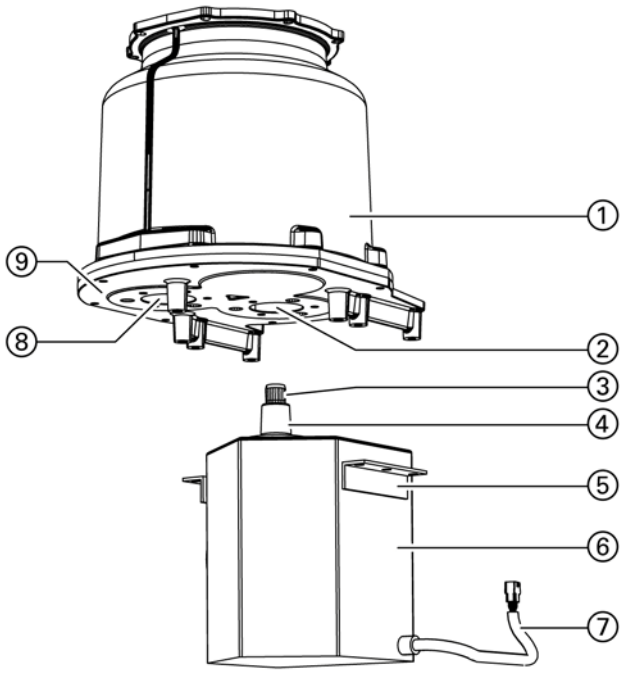


Fig. 130: Fastening the voltage transformer

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



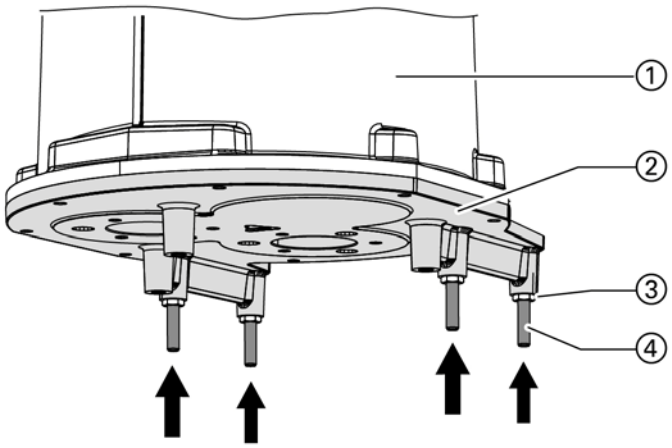
① Panel connection housing
② Inside-cone bushing for primary terminal of transformer
③ Primary terminal at the voltage transformer
④ Silicone adapter
⑤ Fixing bracket (fastened to the voltage transformer housing)
⑥ 4MT7 voltage transformer
⑦ Low-voltage plug connector
⑧ Inside-cone bushing for cable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

Fig. 131: 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. 132: Mounting the threaded rods

⇨ For first installation: Remove protective cap.

If available: Remove the surge-proof dummy plug from the inside-cone bushing. To do this, undo the 3 bolts M8.

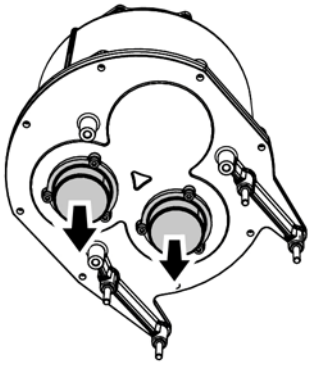


Fig. 133: Removing surge-proof dummy plugs

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

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

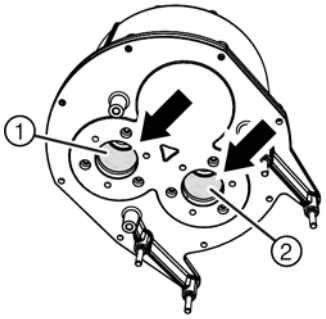


Fig. 134: Greasing the silicone adapter

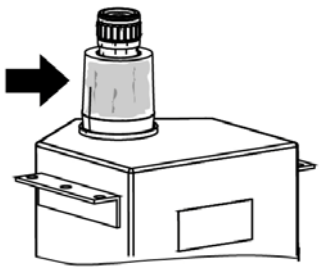


Fig. 135: Greasing the inside-cone cast-resin bush

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

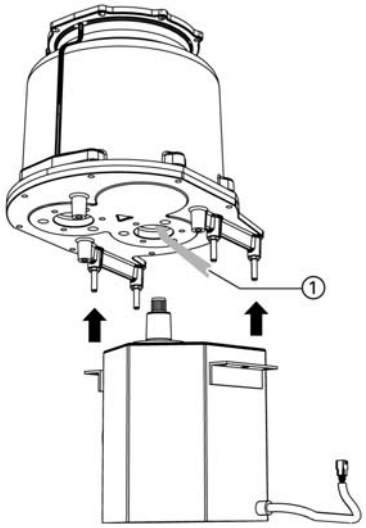
⚠WARNING

Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

- ⇨ Secure the voltage transformer against falling down. If required, use a support.
- ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

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



① Cable strap

Fig. 136: Setting down the voltage transformer

⚠CAUTION

Disruptive discharges due to air inclusions

Will damage the cast-resin bushing.

- ⇨ While installing the voltage transformer, let excess air out of the plug-in connection with a cable strap.
- ⇨ Verify intact condition of the cable strap. If the cable strap was damaged when it was pulled out, remove the voltage transformer and eliminate the residues of the cable strap.

⇨ 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.

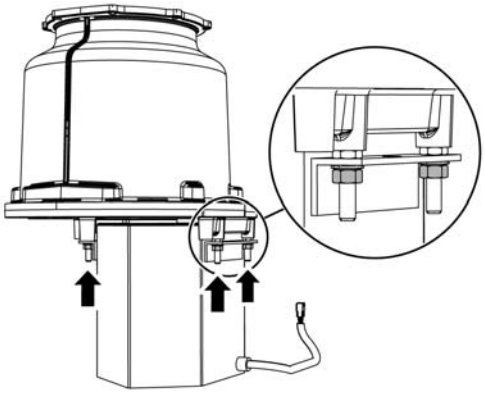


Fig. 137: Bolting the voltage transformer together

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

25 Removing the voltage transformers

⚠DANGER

Hazardous voltage.

Will cause death, serious injury and property damage.

Always observe the Five Safety Rules:

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

⚠DANGER

Hazardous voltage

Can cause death, injury or considerable property damage.

The metal coating on the outside of voltage transformers is connected to earth potential. If the metal coating is damaged, the voltage transformer is not safe-to-touch anymore.

- ⇨ Do not damage the metal coating of voltage transformers.

⚠WARNING

Internal arcing and explosion hazard

If a voltage transformer is short-circuited, there will be a considerable current flow. This considerable current flow implies the risk of internal arcing, and the voltage transformer can explode and produce a fire. Death, serious injury and considerable property damage can be the consequence.

- ⇨ Never short-circuit voltage transformers on the secondary side.
- ⇨ Check the voltage transformer circuits from the voltage transformer to the secondary fuse or short-circuit protective device for short circuits.
- ⇨ Check correct operation of the existing protective devices in the voltage transformer secondary circuit.

NOTICE

Damage to parts of the switchgear

Non-observance of the following instructions can damage sensitive parts of the switchgear while working at the busbars and busbar housings.

- ⇨ Position and align the busbars and busbar supports carefully.
- ⇨ 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.

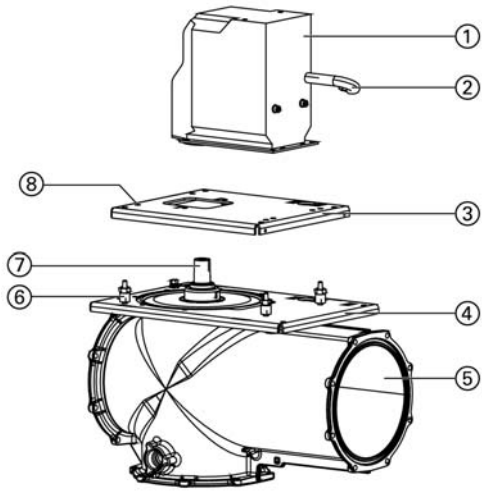
NOTICE

Considerable property damage

During the high-voltage test, connected non-disconnectable inductive voltage transformers may be damaged.

- ⇨ Remove any already mounted non-disconnectable inductive busbar voltage transformers which are not suitable at least for tests at 80% values according to IEC 62271-200.
- ⇨ Close the transformer bushings in a surge-proof way.
- ⇨ Check the SF6 gas filling (see page 60, "Checking the SF_6 gas pressure").
- ⇨ Switch the disconnecting facility for panels with disconnectable voltage transformers to OPEN position before performing the high-voltage test.

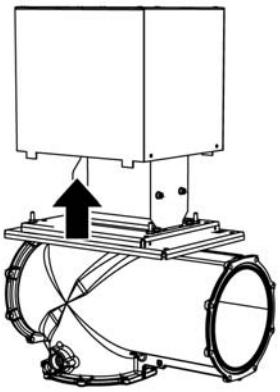
25.1 Removal of voltage transformers type 4MT3 from the busbar



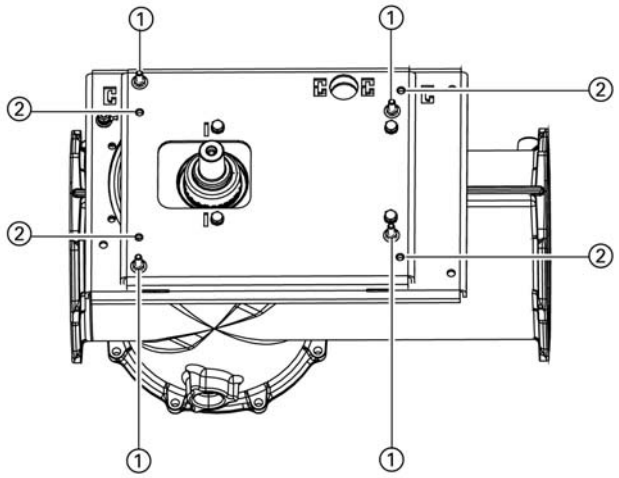
① 4MT3 voltage transformer
② Low-voltage plug connector
③ Adapter plate
④ Voltage transformer mounting plate
⑤ Busbar housing
⑥ Distance sleeves
⑦ Outside-cone bushing
⑧ Hole with setnut for press-out bolts

Fig. 138: 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 setnuts for press-out bolt

⚠CAUTION

Voltage transformer falling down

Can cause injury and property damage.

While being removed from the bushing, the voltage transformer can detach suddenly.

⇨ Remove the voltage transformer upwards as uniformly as possible.

⇨ Adequately support the voltage transformer so that it cannot fall as it is being withdrawn.

⇨ Do not use excessive force.

⚠WARNING

Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

⇨ Secure the voltage transformer against falling down. If required, use a support.

⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

☞INFORMATION

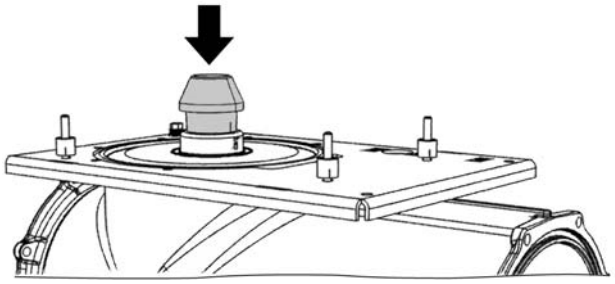
While removing the voltage transformer, the silicone adapter may fall out of the voltage transformer.

⇨ Keep the silicone adapter carefully for later use.

⇨ Clean the silicone adapter and the outside-cone bushing carefully. Use 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.



25.2 Removal of voltage transformers type 4MU4 from the busbar

- ⇨ Isolate and earth the busbar.
- ⇨ Verify safe isolation from supply.
- ⇨ Remove the low-voltage plug connector.
- ⇨ Remove the 4 fixing bolts M8x35 of the fixing brackets at the voltage transformer mounting plate.

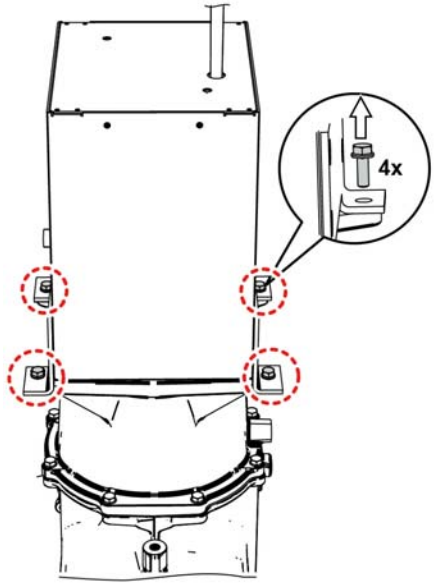
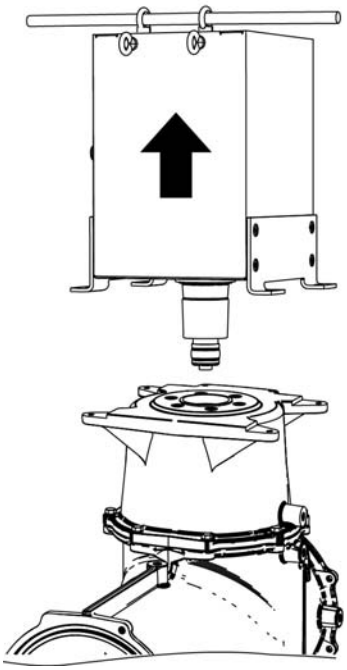


Fig. 139: Removing the fixing bolts at the voltage transformer mounting plate

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



⚠WARNING

Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

- ⇨ Secure the voltage transformer against falling down. If required, use a support.
- ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

⚠CAUTION

Voltage transformer falling down

Can cause injury and property damage.

While being removed from the bushing, the voltage transformer can detach suddenly.

⇨ Remove the voltage transformer upwards as uniformly as possible.

⇨ Adequately support the voltage transformer so that it cannot fall as it is being withdrawn.

⇨ Do not use excessive force.

☞INFORMATION

While removing the voltage transformer, the silicone adapter may fall out of the voltage transformer.

⇨ Keep the silicone adapter carefully for later use.

⇨ 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, undo the 3 bolts M8x25. Store these bolts carefully. Insert the dummy plug and bolt together with 3 bolts M8.

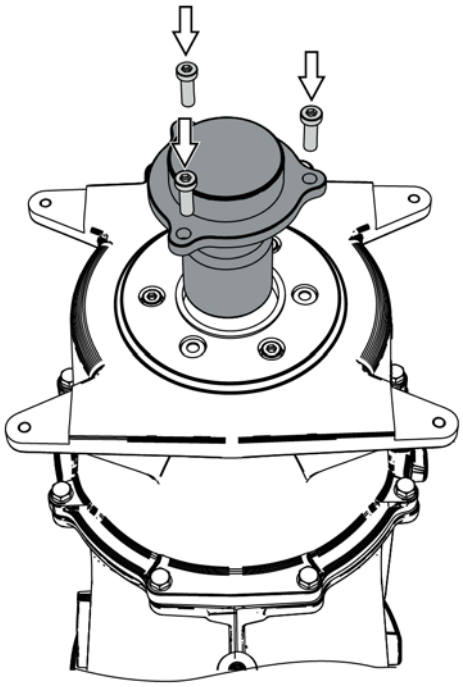
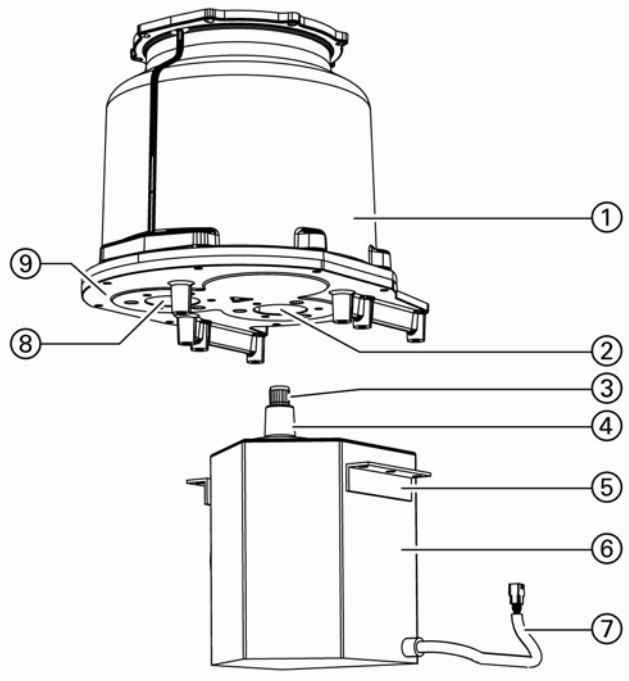


Fig. 140: Closing the inside-cone bushing in a surge-proof way

25.3 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. 141: 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

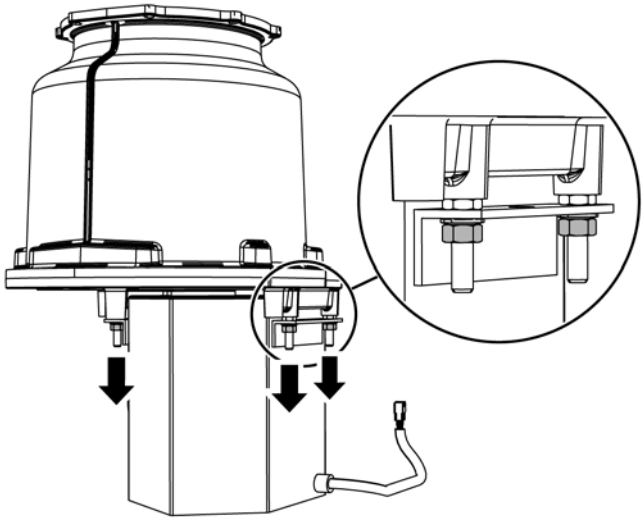


Fig. 142: Removing the voltage transformer

⚠ WARNING

Risk of injury while transporting the voltage transformer

The voltage transformer may fall down during transport. Serious injury and property damage can be the consequence.

- ⇨ Secure the voltage transformer against falling down. If required, use a support.
- ⇨ If necessary, transport the voltage transformer with several persons or with suitable aids.

⚠ CAUTION

Voltage transformer falling down

Can cause injury and property damage.

While being removed from the bushing, the voltage transformer can detach suddenly.

- ⇨ Remove the voltage transformer upwards as uniformly as possible.
- ⇨ Adequately support the voltage transformer so that it cannot fall as it is being withdrawn.
- ⇨ Do not use excessive force.

- ⇨ 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.

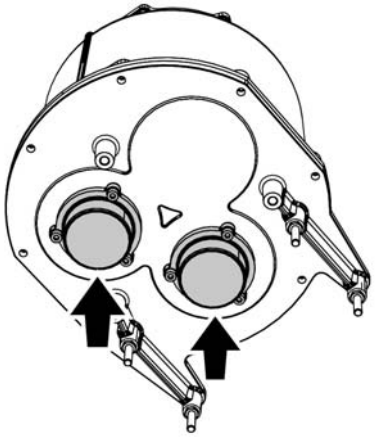


Fig. 143: Mounting surge-proof dummy plugs

26 Busbar components

For 8DA10 switchgear, there are the following busbar components:

- Plug-in, metal-enclosed busbar voltage transformers, with or without three-position disconnector
- Busbar current transformers
- Busbar connection with cable plug, with or without three-position disconnector
- Busbar connection with solid-insulated bar connection, with or without three-position disconnector
- Busbar connection with gas-insulated bar connection, with or without three-position disconnector
- Busbar earthing switch
- Make-proof busbar earthing switch
- Capacitive voltage detecting system according to IEC 61243-5 or IEC 61958
- Top-mounted bus sectionalizer

This chapter describes the basic assembly operations for busbar components by means of several examples.

Example: Busbar voltage transformer

Depending on the design option of the switchgear, the voltage transformer is available with or without three-position disconnector.

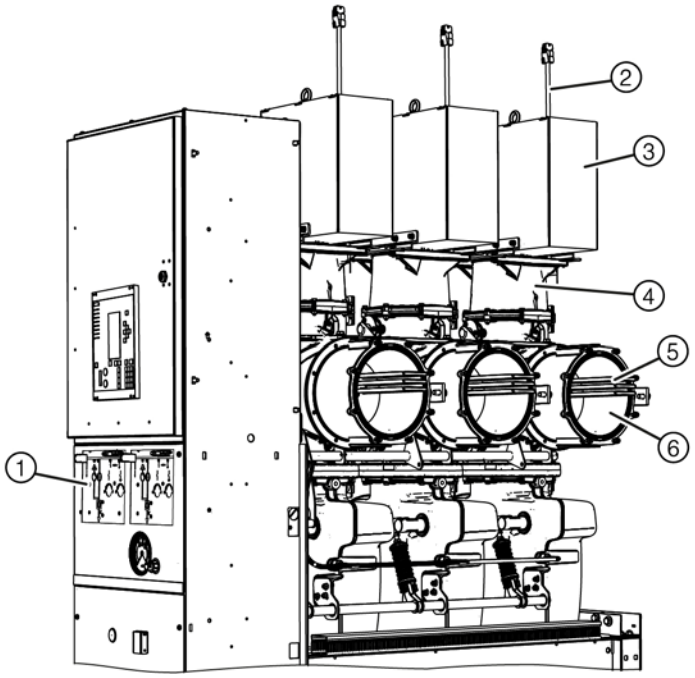


Fig. 144: Voltage transformer 4MU4 with three-position disconnector

① Control and indication board of the three-position disconnector for the busbar component (option)
② Low-voltage plug connector
③ Voltage transformer 4MU4
④ Voltage transformer connection housing
⑤ Busbars
⑥ Busbar housing

For assembly operations for the voltage transformer 4MU4, see page 111, "Installation of voltage transformers type 4MU4 on the busbar".

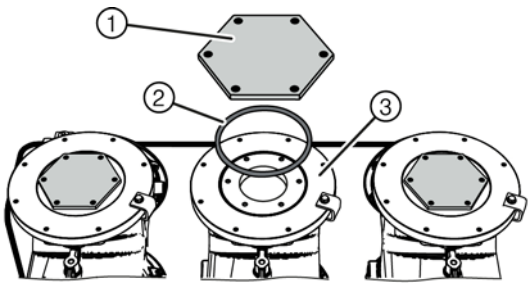
Example: Solid-insulated bar connection

Depending on the design option of the switchgear, the solid-insulated bar connection is available with or without three-position disconnector.

The solid-insulated bar connection must be assembled on site.
The busbar housings must be free from gas.

Perform the following assembly operations for all switchpanel poles:

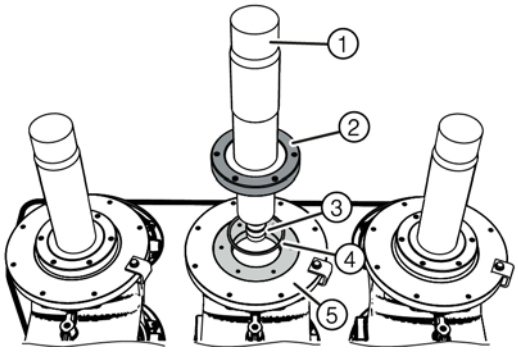
⇨ Remove the provisional cover at the busbar housing. Keep the removed bolts and conical spring washers for later installation. Dispose of the spacing nuts required for transport in an environmentally compatible way.



① Provisional cover
② Sealing ring
③ Busbar housing

Fig. 145: Unscrewing the covers and removing the sealing rings

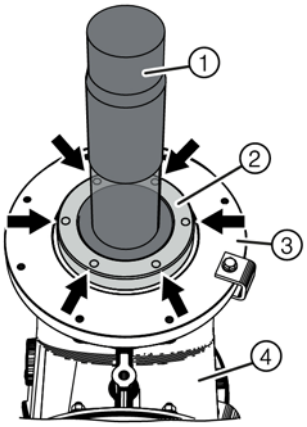
⇨ Insert a new sealing ring and the solid-insulated bar connection.



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

Fig. 146: Solid-insulated bar

⇨ Mount the solid-insulated bar using the previously removed bolts and contact washers. Tightening torque: 20 Nm.



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

Fig. 147: Fixing points at the pressure ring

⇨ Evacuate the busbar housings and fill with SF_6 gas.

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

Example: Gas-insulated bar connection

Depending on the design option of the switchgear, the gas-insulated bar connection is available with or without three-position disconnector.

The busbar housings must be free from gas.

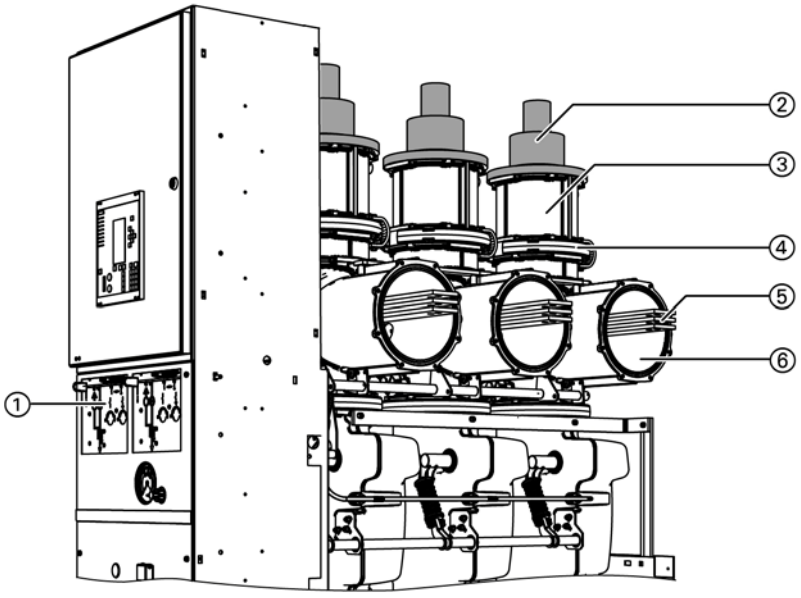


Fig. 148: Overview of busbar component: Gas-insulated bar with three-position disconnector

① Control and indication board of the three-position disconnector for the busbar component
② Gas-insulated bar with integrated pressure ring
③ Connection housing for gas-insulated bar
④ Bushing
⑤ Busbars
⑥ Busbar housing

⇨ Remove the covers ① . To do this, remove the 8 bolts M8x20 and the nuts. Reuse the bolts for fixing the gas-insulated bar.

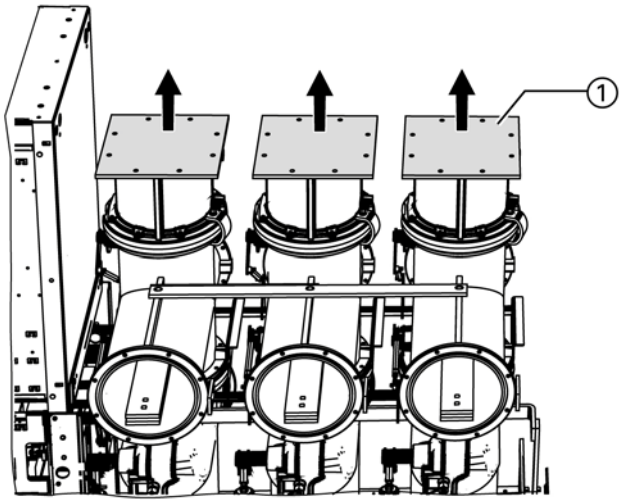
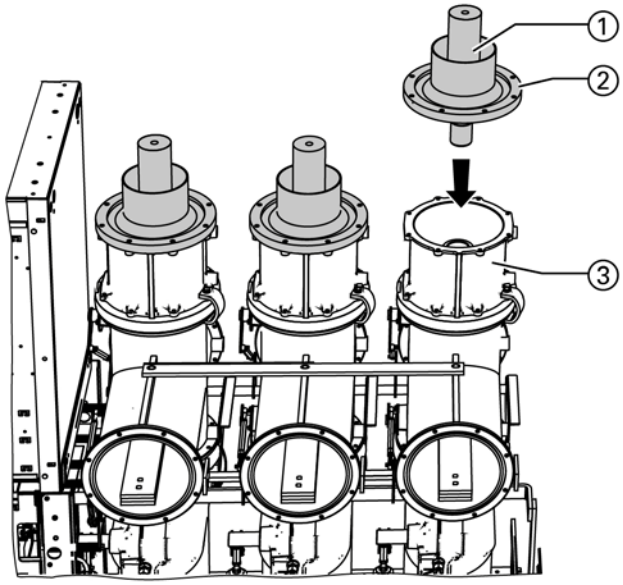


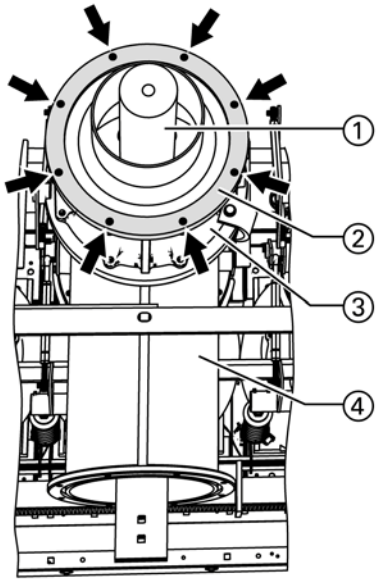
Fig. 149: Removing the covers ①

➩ Mount the gas-insulated bar.



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

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



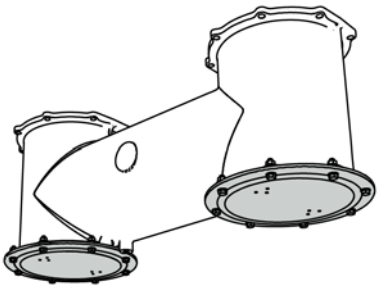
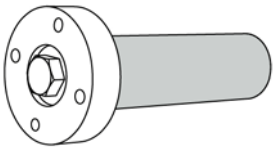
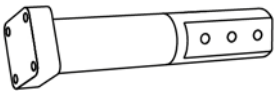
① Gas-insulated bar
② Pressure ring
③ Connection housing
④ Busbar housing

Fig. 150: 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.

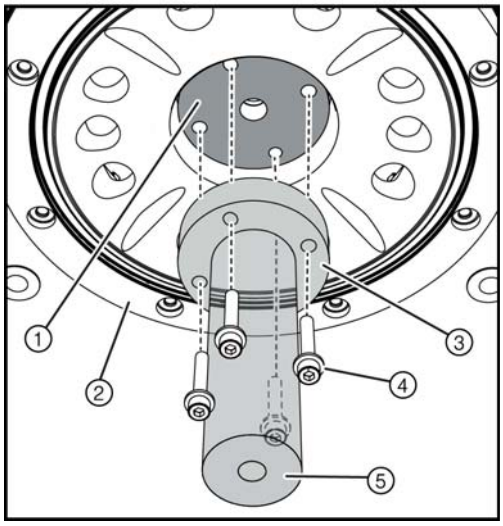
27 Installing the bus sectionalizer

The bus sectionalizer installation is shown exemplarily by means of the 1250 A bus sectionalizer panel. For bus sectionalizer panels 1600 A, 2000 A and 2500 A, mount the bus sectionalizer in the same way as for the 1250 A version. Deviating assembly operations and components for the 3150 A version are shown additionally.

<table>
<tr><th colspan="2">Required components</th></tr>
<tr><td>3x bus sectionalizer housings with housing covers pre-assembled at the factory
 
Bolted joint per housing cover: 8x hexagon head bolts M8x30 with plain washers and nuts</td><td>12x 250 g desiccant bags
 
2x desiccant bags per housing cover</td></tr>
<tr><td>Number of bus sectionalizer busbars
• 1x bus sectionalizer busbar for 1250 A version
• 2x bus sectionalizer busbars for 1600 A version
• 3x bus sectionalizer busbars as from 2000 A version
 
Bolted joint per bus sectionalizer busbar: The bolt length of the 2 hexagon head bolts increases with the number of bus sectionalizer busbars and the normal current. For the example of the 1250 A version, use 2 hexagon head bolts M16x40 with plain washers.</td><td>6x connection flange including contact stud for the bus sectionalizer busbar
 
Bolted joint per connection flange: 4x hexagon socket head cap bolt M8x50 and conical spring washers</td></tr>
<tr><td>Use only for the 3150 A version: 2x bus sectionalizer busbars including bolted joint
 
Bolted joint for 2 bus sectionalizer busbars: 6x cup head square neck bolt M10x75, conical spring washers and hexagon nuts</td><td>Use only for the 3150 A version: 6x connection flange including contact stud for the bus sectionalizer busbars
 
Bolted joint per connection flange: 4x hexagon socket head cap bolt M8x50 and conical spring washers</td></tr>
<tr><td>Various bolting material</td><td></td></tr>
</table>

Installing the bus sectionalizer

⇨ Fasten the connection flange to the terminal of the pole supporting plate using 4 cheese head bolts and conical spring washers each. Tightening torque: 20 Nm.



① Terminal
② Pole supporting plate
③ Connection flange
④ Cheese head bolt with hexagon socket M8x50 and conical spring washer
⑤ Contact stud of the terminal

Fig. 151: Connection flange for 1250 A version

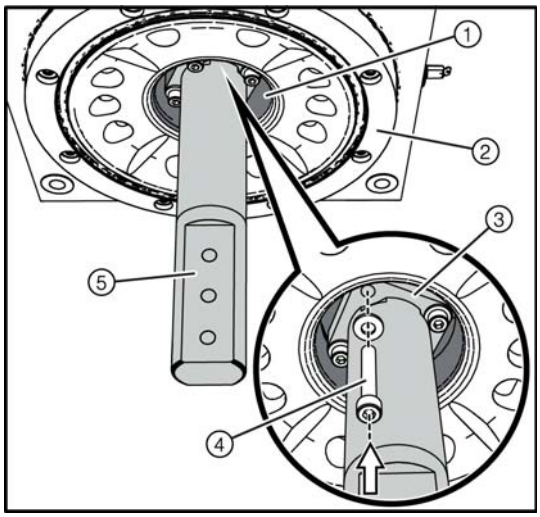
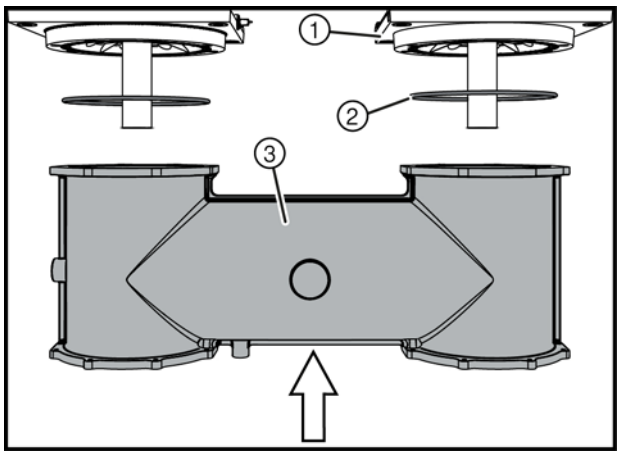


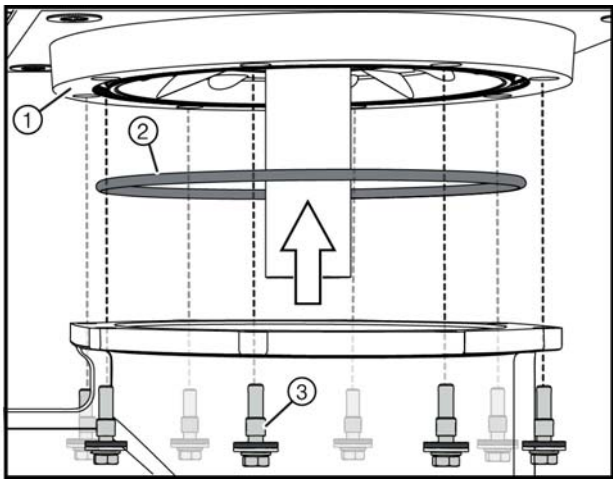
Fig. 152: Connection flange for 3150 A version

⇨ Bolt the bus sectionalizer housing together with the pole supporting plate. Observe that a sealing ring is inserted between the bus sectionalizer housing and the pole supporting plate.



① Pole supporting plate
② Sealing ring (O-ring)
③ Bus sectionalizer housing

➪ Bolt the bus sectionalizer housing together with the pole supporting plate using bolt-and-washer assemblies, conical spring washers, insulating washers and insulating sleeves M8. Tightening torque: 20 Nm.

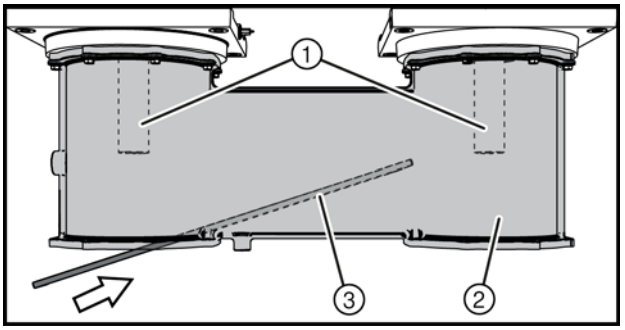


① Pole supporting plate
② Sealing ring (O-ring)
③ Bolt-and-washer assembly M8 with conical spring washer, insulating washer and insulating sleeve

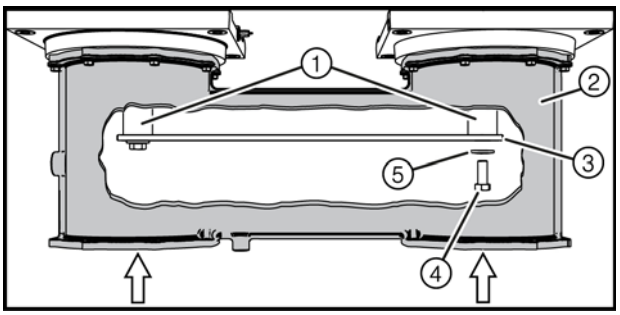
➪ Remove the 2 housing covers from the bus sectionalizer. Keep all bolt-and-washer assemblies and nuts for later reuse.

➪ Undo the 2 hexagon head bolts and conical spring washers from the bus sectionalizer busbar. Keep the bolting material for later reuse.

➪ Push the bus sectionalizer busbar into the bus sectionalizer housing and fasten it to the contact studs on both sides using one hexagon head bolt M16x40 and conical spring washer each. Tightening torque: 130 Nm.



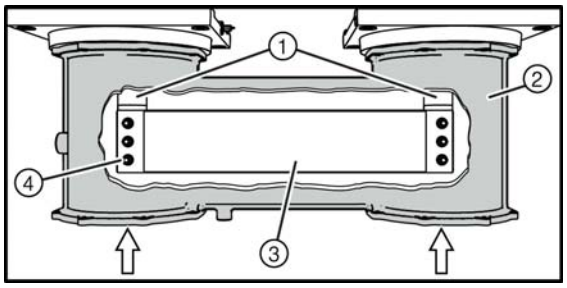
① Contact stud
② Bus sectionalizer housing
③ Bus sectionalizer busbar



④ Hexagon head bolt
⑤ Conical spring washer

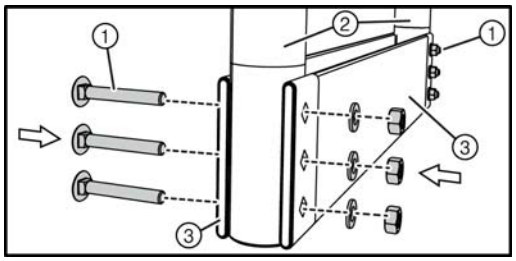
Fig. 153: Bus sectionalizer busbar for 1250 A version

➪ **Only for 3150 A version:** Insert the 2 bus sectionalizer busbars into the bus sectionalizer housing and fasten to the contact stud on both sides using three cup head square neck bolts M10x75, conical spring washers and hexagon nuts each. Tightening torque: 40 Nm.



① Contact stud
② Bus sectionalizer housing
③ Bus sectionalizer busbar
④ Cup head square neck bolt, conical spring washers and hexagon nuts

Fig. 154: Bus sectionalizer busbars for 3150 A version



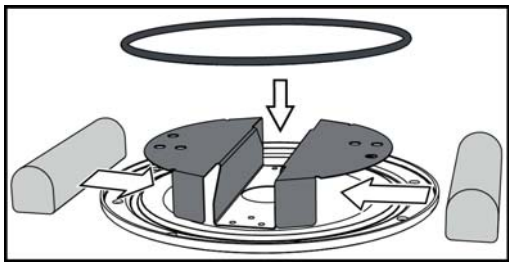
① Cup head square neck bolts
② Contact stud
③ Bus sectionalizer busbars

Fig. 155: Bolted joint of bus sectionalizer busbars for 3150 A version

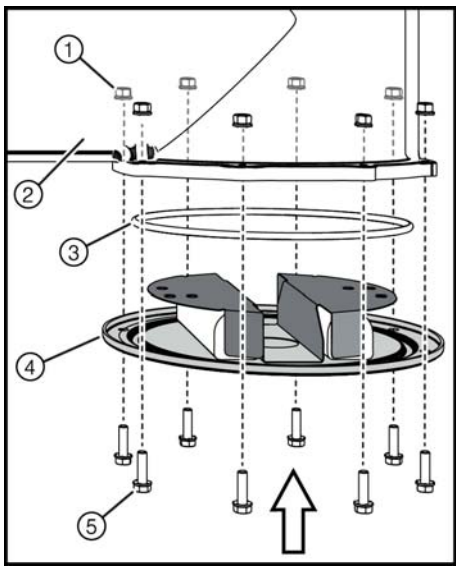
➪ Equip every housing cover with 2 desiccant bags of 250 g.

➪ Clean the sealing ring and groove of the housing cover and apply a uniform film of Polylub GLY 801 mounting paste.

➪ Lay the sealing ring (O-ring) into the groove of the housing cover.



➪ Fasten the housing cover to the bus sectionalizer using 8 bolt-and-washer assemblies M8 and nut-and-washer assemblies each. Tightening torque: 20 Nm.



① Nut-and-washer assembly
② Bus sectionalizer housing
③ Sealing ring (O-ring)
④ Housing cover with desiccant holder
⑤ Bolt-and-washer assembly M8x30

28 Tests

28.1 Checking the SF_6 gas filling

⚠CAUTION

Insufficient gas filling can cause injury or property damage.

Operating the switchgear without service readiness due to insufficient gas filling can cause injury and the destruction of parts of the switchgear.

- ⇨ Before performing any switching operation, 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.
- ⇨ Do not install, commission or operate a switchgear with incorrect or too low SF_6 gas pressures. If required, isolate the switchgear and put it out of service.
- ⇨ Inform the competent regional Siemens representative.

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 gas pressure is lower or higher than the limit values adjusted on the indicators, 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.

28.2 Monitoring the gas pressure

⚠CAUTION

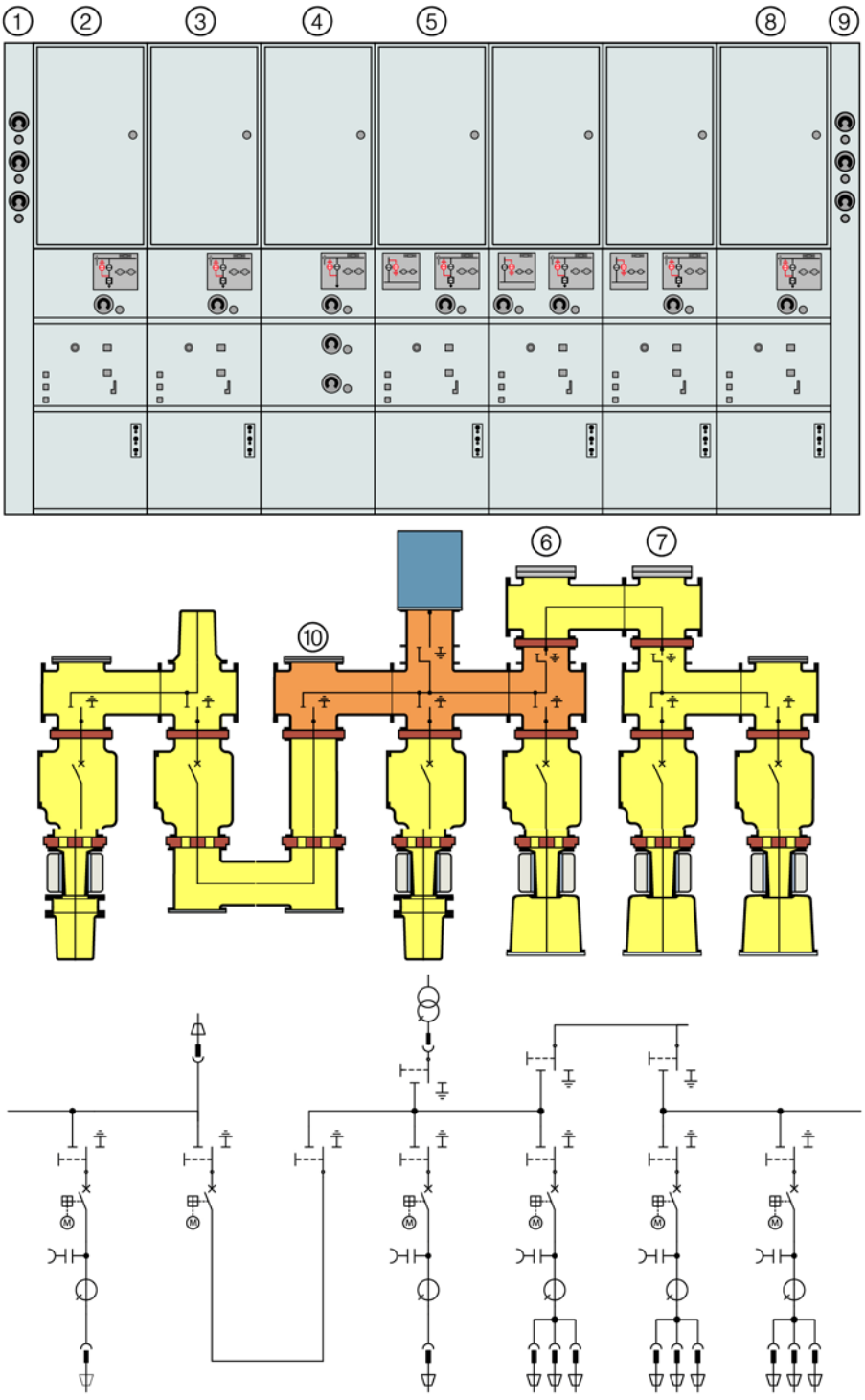
Insufficient gas filling can cause injury or property damage.

Operating the switchgear without service readiness due to insufficient gas filling can cause injury and the destruction of parts of the switchgear.

- ⇨ Before performing any switching operation, 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.
- ⇨ Do not install, commission or operate a switchgear with incorrect or too low SF_6 gas pressures. If required, isolate the switchgear and put it out of service.
- ⇨ Inform the competent regional Siemens representative.

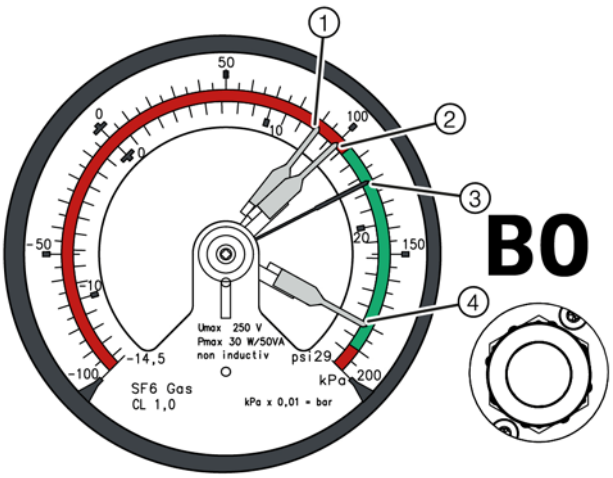
The perfect functioning of the switchgear is only guaranteed if the gas pressure indication of the manometer is between the minimum and the maximum functional level (see page 35, "Insulating gas").

Example: Manometers at the panel



① Switchgear termination (left)
② Circuit-breaker panel
③ Bus sectionalizer panel with busbar connection
④ Bus sectionalizer panel (bus riser)
⑤ Circuit-breaker panel with disconnectable voltage transformer on the busbar
⑥ Top-mounted bus sectionalizer (left)
⑦ Top-mounted bus sectionalizer (right)
⑧ Circuit-breaker panel
⑨ Switchgear termination (right)
⑩ Intermediate busbar section

Manometer designation	Function
B0	Circuit-breaker, phase L1, L2, L3
B11	Busbar, phase L1
B12	Busbar, phase L2
B13	Busbar, phase L3
B15	Busbar connection / disconnectable solid-insulated connection



① < minimum functional level
② Minimum functional level
③ Rated functional level 120 kPa
④ Maximum functional level 180 kPa

The data in kPa are values at 20 °C ambient air temperature

Fig. 156: Indication at the gas pressure manometer

28.3 Checking the circuits of the low-voltage equipment

⚠WARNING

Internal arcing and explosion hazard

If a voltage transformer is short-circuited, there will be a considerable current flow. This considerable current flow implies the risk of internal arcing, and the voltage transformer can explode and produce a fire. Death, serious injury and considerable property damage can be the consequence.

- ⇨ Never short-circuit voltage transformers on the secondary side.
- ⇨ Check the voltage transformer circuits from the voltage transformer to the secondary fuse or short-circuit protective device for short circuits.
- ⇨ Check correct operation of the existing protective devices in the voltage transformer secondary circuit.

- ⇨ Check the current transformer circuits according to the circuit diagrams.
- ⇨ Check the functions of all protection devices with a secondary test unit for relays.

28.4 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.

28.5 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.

28.6 Checking protection against environmental influences

For touch-up work on doors and front parts, a paint pen is available on request.

- ⇨ Touch up surface damages.

29 Final installation work

29.1 Mounting cables with plugs

⚠WARNING

Hazardous high voltage

The use of dust-proof caps on live switchgear can cause death, serious injury or property damage. The dust-proof caps mounted on the plug sockets of the panel connection housings protect the plug sockets against pollution. The dust-proof caps do not provide sufficient shock protection.

⇨ If the operator's cables are not connected before the switchgear is energized, remove the dust-proof caps. Close unused plug sockets of the panel connection housings in a surge-proof way.

⇨ 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.

NOTICE

Risk of property damage

Do not bolt cable shields to the panel connection housings. Connecting the cable shields to the aluminum housings of the panels can damage the switchgear.

⇨ Connect cable shields to the cable bracket or to the switchgear earth.

⇨ Do not connect the cable shields to the work-in-progress earthing at the panel connection housings.

29.2 Connecting low-voltage cables

Connect low-voltage cables of customer (option):

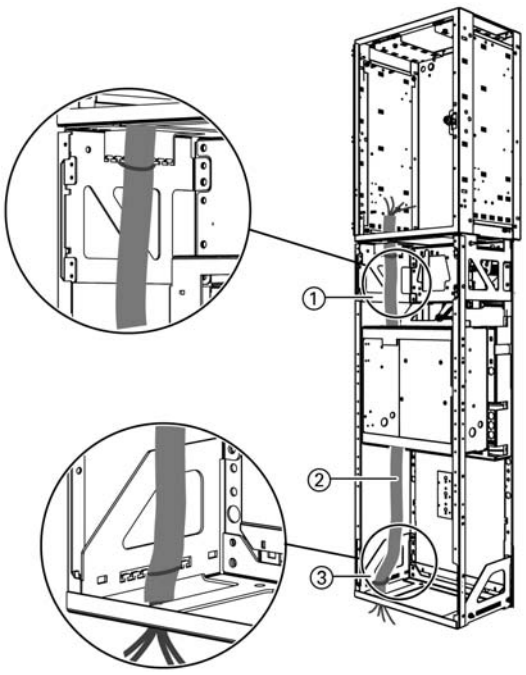
⇨ Remove the metal covers from the frames.

⇨ 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.



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

② Low-voltage cables

③ Fixing of low-voltage cables at the lower front support

Fig. 157: Fixing of low-voltage cables

Connecting the STG plug with the VBSTB4 modular terminal

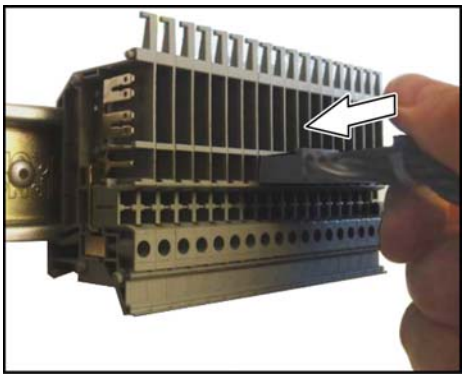
For 2-, 4- and 10-pole STG plugs make PHOENIX CONTACT, observe the instructions for installation and removal given hereafter.

☞INFORMATION
The information stated herein refers to the user instructions of PHOENIX CONTACT. The user is obliged to inform himself about the latest state of the instructions before 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.

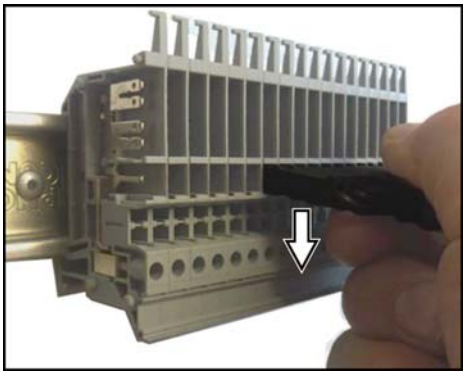
⇨ Push the STG plug horizontally into the modular terminal until the STG plug latches in.



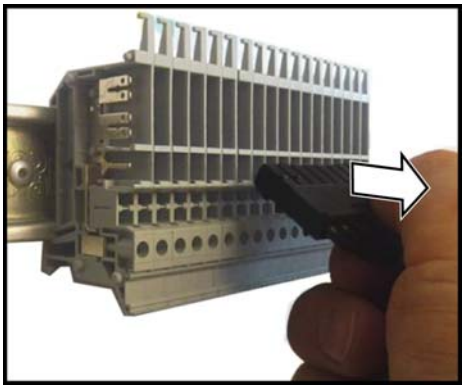
✔ The STG plug is latched into the modular terminal and mounted.

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.

29.3 Mounting the metal covers

⇨ Screw all metal covers to the frames again.

30 Installation of degree of protection version IPX1

Degree of protection version IPX1 for panels with and without busbar earthing switch

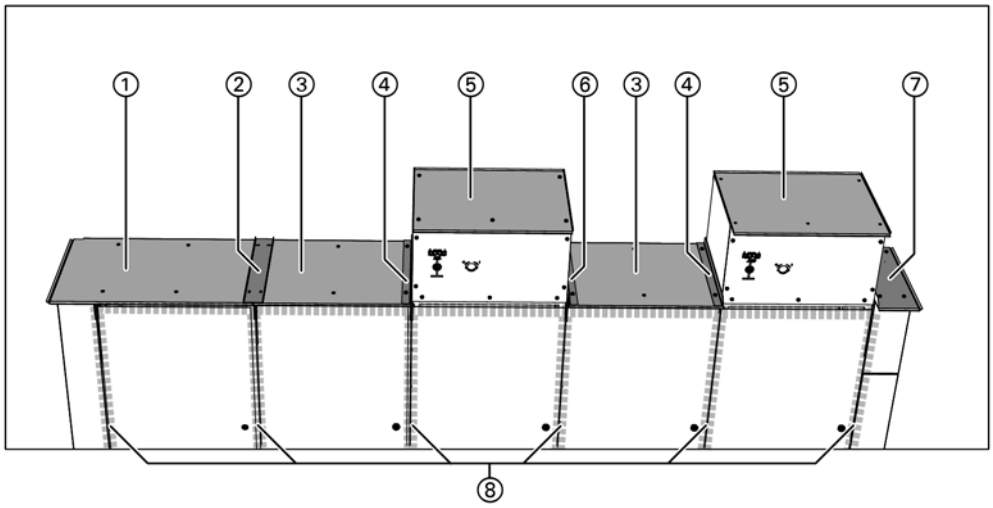


Fig. 158: Basic scheme with 850 mm low-voltage compartment

① Protection plate for left end panel
② Sealing ledge for intermediate panels
③ Protection plate for intermediate panels
④ Left-hand angle
⑤ Protection plate for busbar earthing switch
⑥ Right-hand angle
⑦ Protection plate for right end panels located beside busbar earthing switches
⑧ Felt strips between the individual panels, and felt strips between roof plate and protection plate

30.1 IP31D - protection against vertically falling water drops

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

⇨ Stick sealing straps ③ on the roof plates of panels without busbar earthing switch.

⇨ Mount protection plate for intermediate and end panels. To do this, use bolts M6x25. Tightening torque: 12 Nm.

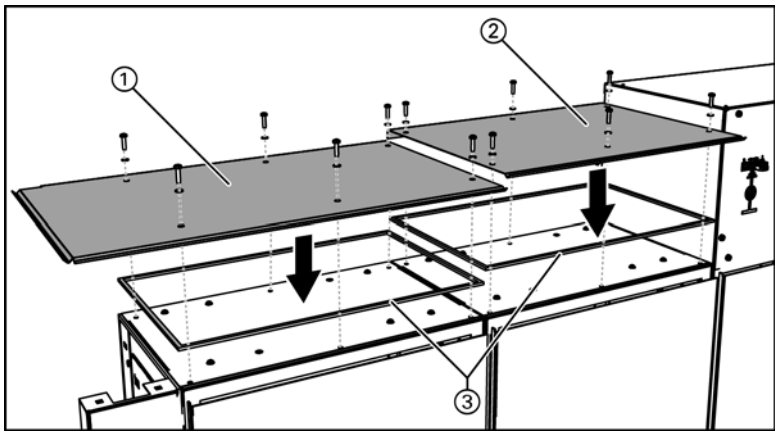
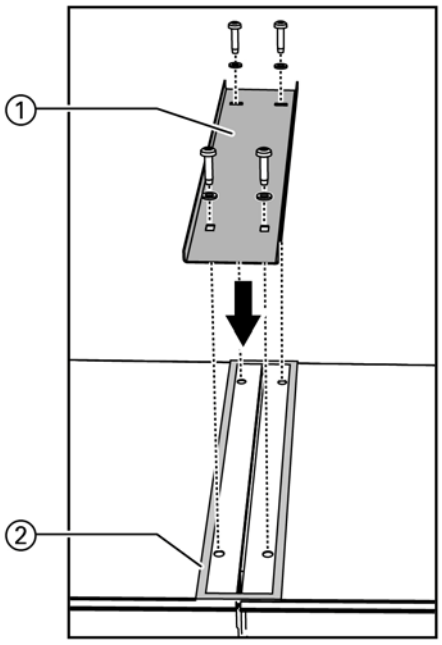


Fig. 159: Example: Fastening protection plate for end panel and intermediate panel (basic scheme)

① Protection plate for left end panels (6 bolts M6x25)
② Protection plate for intermediate panels (6 bolts M6x25)
③ Sealing strap

➪ Protect the junction edges of panels without busbar earthing switch with additional sealing ledges ① . Tightening torque of the bolts: 12 Nm. Stick a sealing strap ② under the sealing ledge.



① Sealing ledge (4 bolts M6x25)
② Sealing strap

Fig. 160: Example: Fastening the sealing ledge on the junction edge between two panels

➪ Attach sealing straps and fasten an angle between an intermediate panel and a panel with make-proof busbar earthing switch. Tightening torque: 12 Nm.

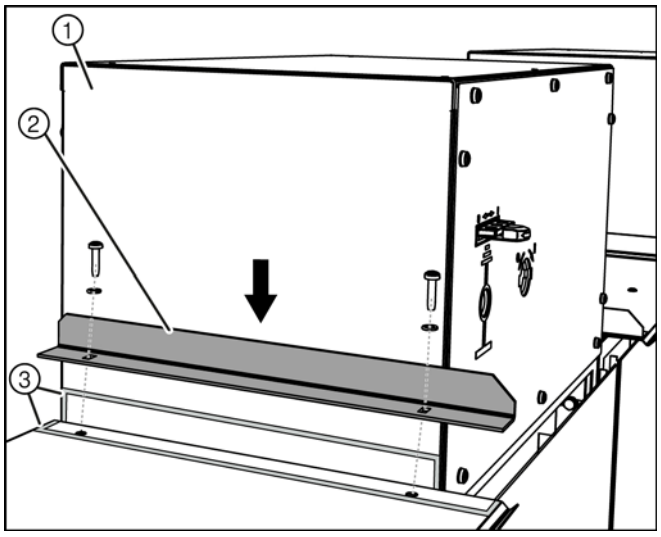


Fig. 161: Example: Fastening an angle between intermediate panels and panels with make-proof earthing switches (basic scheme)

① Angle (2 bolts M6x25)
② Busbar earthing switch
③ Sealing strap

⇨ Next to an end panel with make-proof busbar earthing switch, mount a protection plate on the switchgear termination. Tightening torque: 12 Nm.

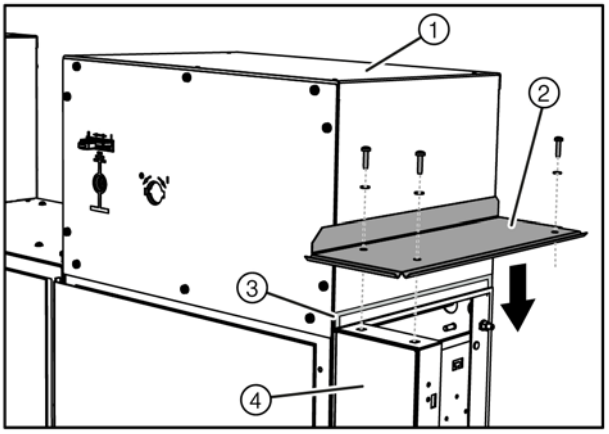


Fig. 162: Example: Fastening a protection plate for end panels with make-proof earthing switch (basic scheme)

① Busbar earthing switch
② Protection plate for right end panels with make-proof earthing switch (3x bolts M6x25)
③ Sealing strap
④ Switchgear termination (only partly shown here)

⇨ Mount the protection plate on the roof plate of the busbar earthing switch. Tightening torque: 12 Nm.

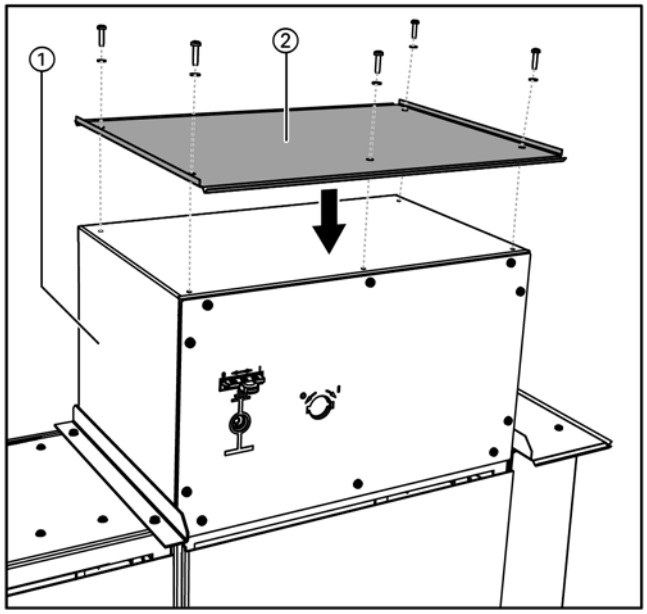


Fig. 163: Example: Mounting the protection plate on the roof plate of the busbar earthing switch (basic scheme)

① Busbar earthing switch
② Protection plate (5 bolts M6x25)

31 Installation of rear walls of switchgear

⚠CAUTION

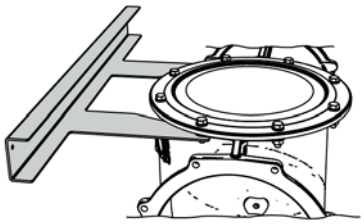
Environmental damages due to escaping SF_6 gas

If panels are filled with SF_6 gas, prevent the escape of SF_6 gas while mounting the fixing cross members.

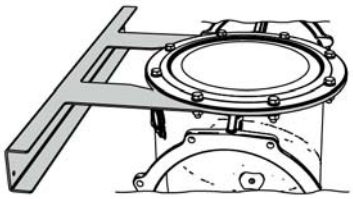
⇨ Do not remove the busbar housing covers.

⇨ Undo just one bolt at the busbar housing cover at a time.

⇨ Fasten the fixing cross members at the retainers and the busbar housings using 2 bolts M8x30 each. Tightening torque: 20 Nm.



Mounting position for intermediate panels or end panels



Mounting position turned by 180° for intermediate panels or end panels with

- disconnectable busbar voltage transformer
- disconnectable busbar connection
- make-proof earthing switch at the busbar
- top-mounted busbar sectionalizer

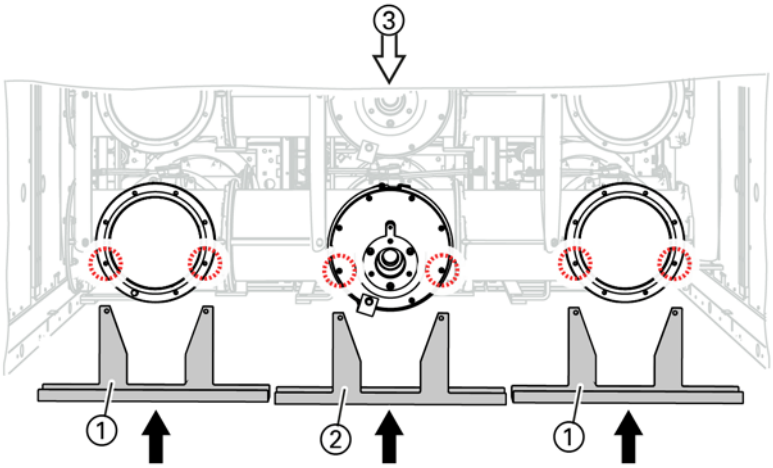


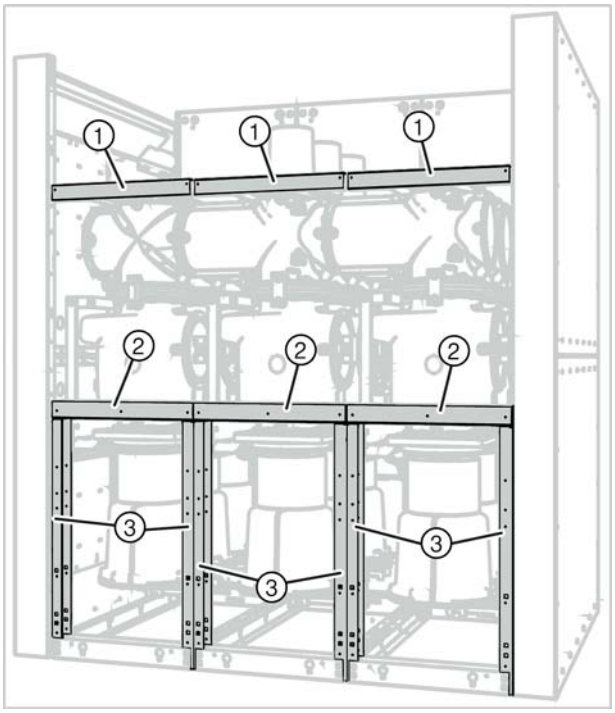
Fig. 164: Mounting fixing cross members on busbar housings

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. If a higher busbar housing with disconnectable feeder to the top was mounted, turn the fixing cross member by 180°.

③ Switchgear front

➪ Fasten the retainers for the rear walls to the fixing cross members, cross members and supports using bolts M6x16. Tightening torque: 12 Nm.



① Fixing cross member
② Cross member (rear-top)
③ Support (vertical)

Fig. 165: Number of bolts for retainers

➪ Fasten the retainers on end panels ① , ④ using 5 bolts. Fasten the retainers on intermediate panels ② , ③ using 10 bolts.

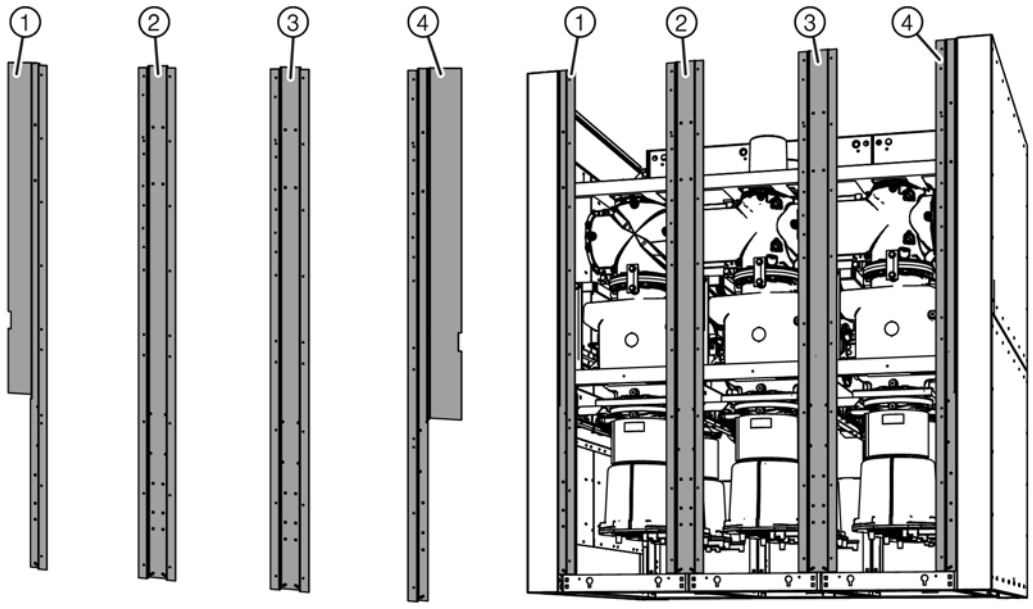


Fig. 166: Retainers for the rear walls

① Retainer for right end panel
② Retainer for intermediate panel
③ Retainer for intermediate panel
④ Retainer for left end panel

⇨ Bolt the lower rear walls together with the retainers. Use 8 bolts M6x12 for each rear wall. Tightening torque: 12 Nm.

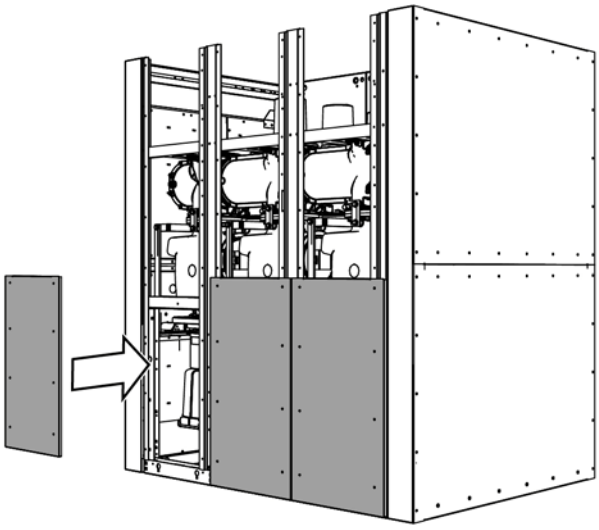


Fig. 167: Mounting lower rear walls

⇨ Bolt the upper rear walls together with the retainers. Use 10 bolts M6x12 for each rear wall. Tightening torque: 12 Nm.

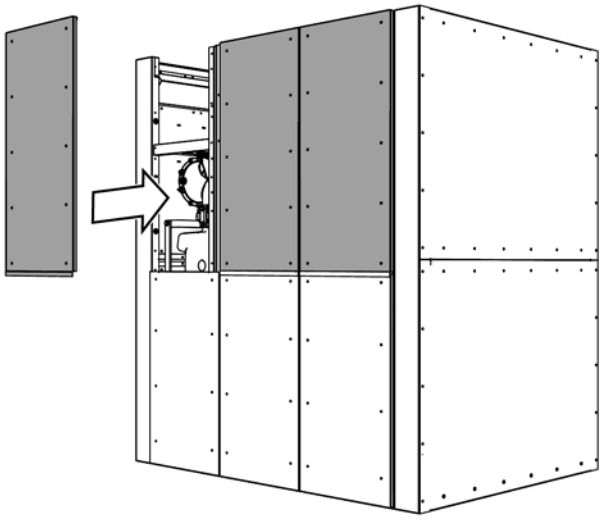


Fig. 168: Mounting upper rear walls

32 Installation of end walls

As-delivered condition of panel:

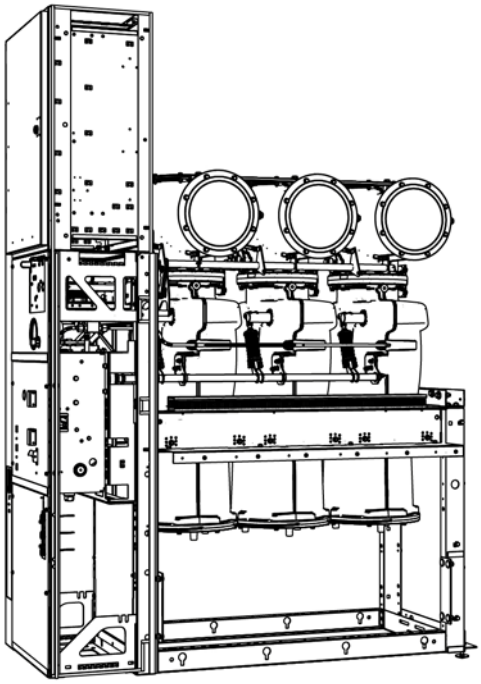
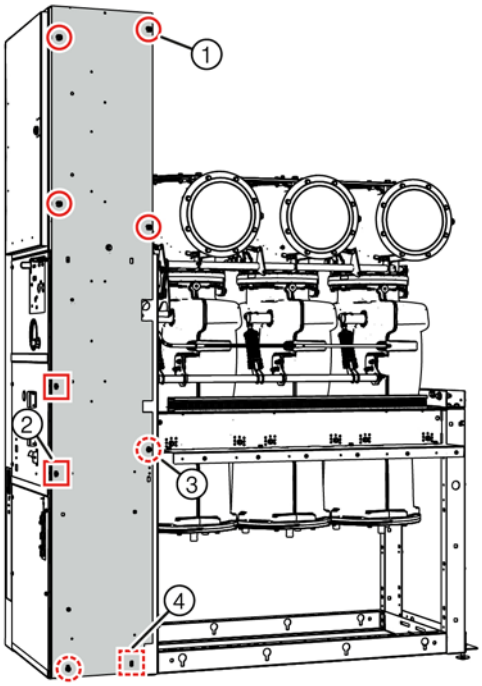


Fig. 169: As-delivered condition

➪ Screw termination plate on **loosely** using bolts and contact washers (do not tighten yet).



① Hexagon head bolt M8x25 with cage nut (4x)
② Bolt M6x20 (2x)
③ Bolt M8x25 (2x)
④ Use bolt M8x25 only for a frame height 1020 mm

Fig. 170: Fixing points for the termination plate

⇨ Attach one sealing strap each at the front, rear and top of the termination plate.

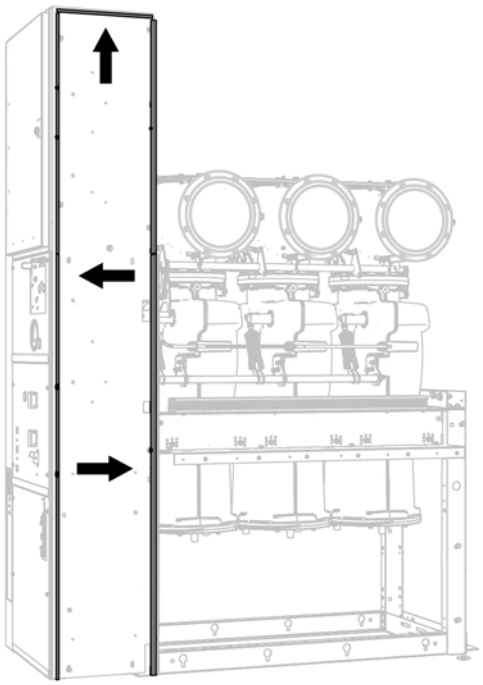
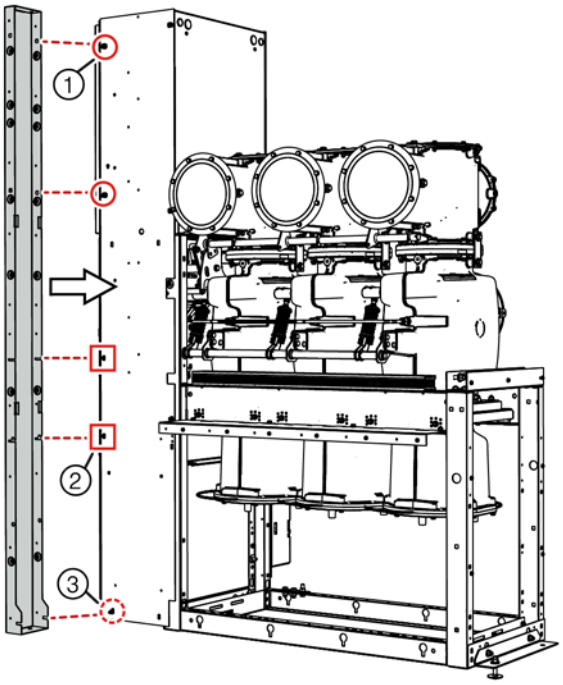


Fig. 171: Sealing straps on the termination plate

⇨ Slide front end cover under the loosely fixed termination plate, and bolt tight.



① Hexagon head bolt M8x25 with cage nut (2x)
② M6x20
③ M8x25

Fig. 172: Inserting front end cover

⇨ **Tighten all bolts at the termination plate and the front end cover.**

⇨ Bolt the rear end cover to the frame using 3 bolts M8x20.

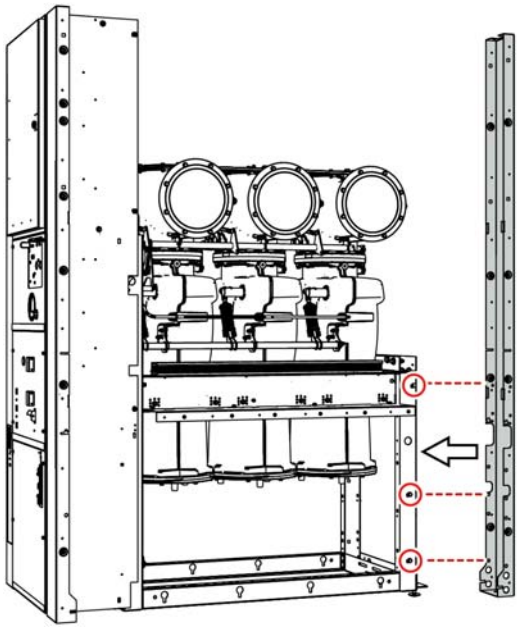
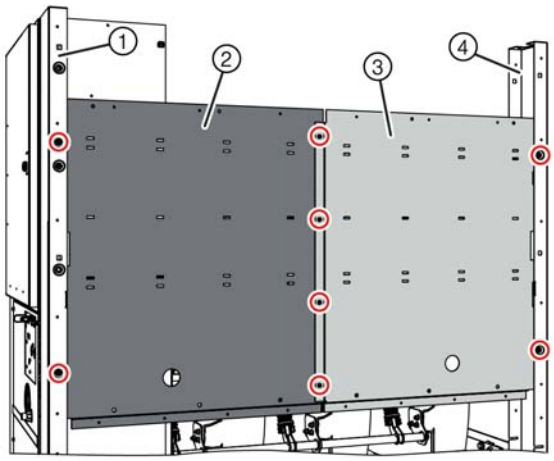


Fig. 173: Fixing points for rear end cover

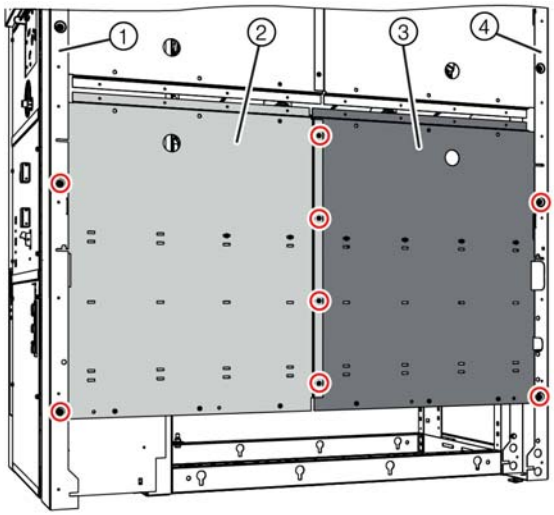
⇨ Hook in the upper arc protection walls, and fix loosely using bolts.



① Front end cover
② Middle left arc protection wall
③ Middle right arc protection wall
④ Rear end cover

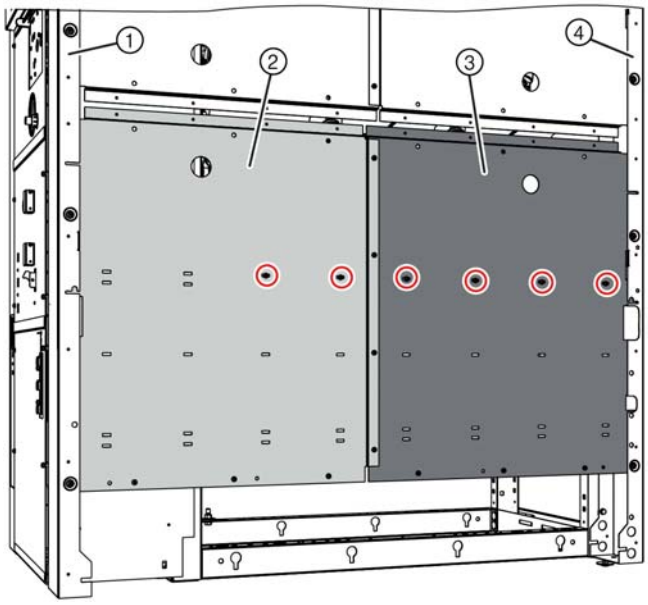
Fig. 174: Fixing points for upper arc protection walls

⇨ Hook in the upper arc protection walls, and fix loosely using bolts.



① Front end cover
② Middle left arc protection wall
③ Middle right arc protection wall
④ Rear end cover

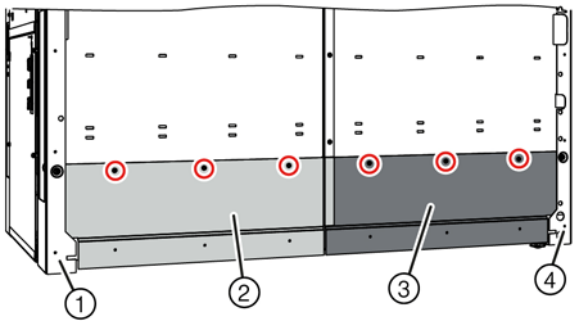
Fig. 175: Fixing points for central arc protection walls



① Front end cover
② Middle left arc protection wall
③ Middle right arc protection wall
④ Rear end cover

Fig. 176: Fixing points for central arc protection walls

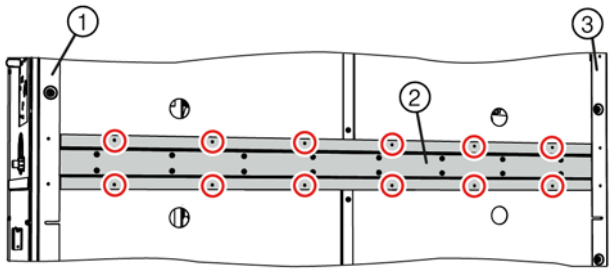
⇨ Fasten 2 arc protection walls at the bottom with self-tapping bolts M6x16.



① Front end cover
② Upper left arc protection wall
③ Right-hand arc protection wall
④ Rear end cover

Fig. 177: Fixing points for lower arc protection walls

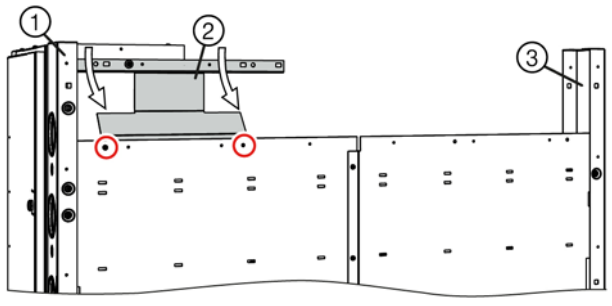
⇨ Slide the cross bracing between the end covers and the arc protection walls, and bolt together.



① Front end cover
② Cross bracing
③ Rear end cover

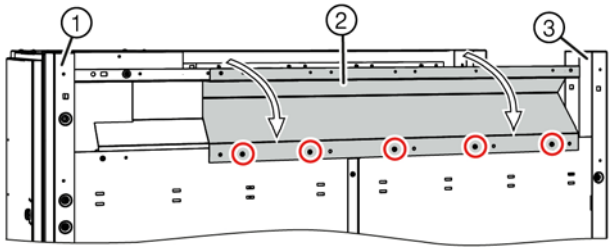
⇨ **Tighten the bolted joints of the upper and lower** arc protection walls.

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



① Front end cover
② Short air guide
③ Rear end cover

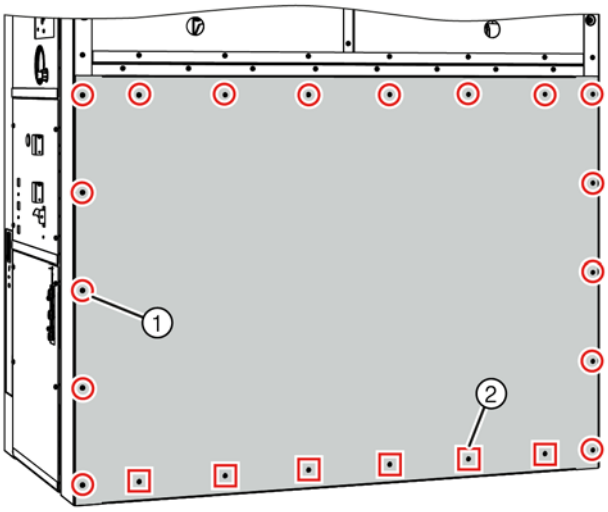
Fig. 178: Fixing points for short air guide



① Front end cover
② Long air guide
③ Rear end cover

Fig. 179: Fixing points for long air guide

⇨ Mount lower end wall.



① Self-tapping bolts M6x16 (16x)
② Close the holes with sealing stoppers (6x)

Fig. 180: Fixing points for lower end wall

⇨ Fasten the upper end wall with 22 self-tapping bolts.

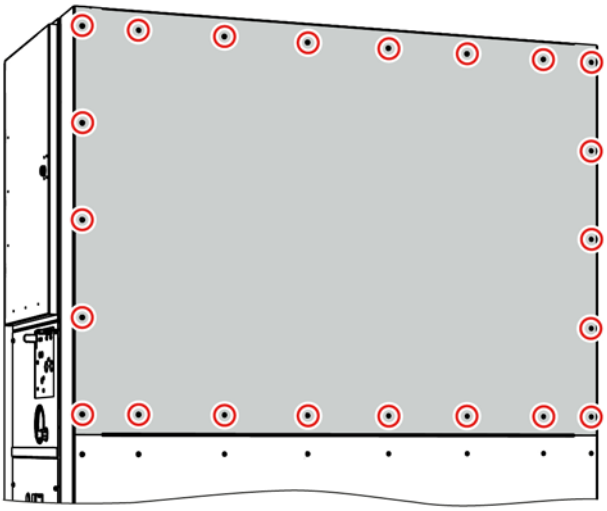


Fig. 181: Fixing points for upper end wall

33 Commissioning

33.1 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 40, "Installation").

33.2 Test operation

⚠WARNING

Hazardous voltage

Can cause death or injury.

⇨ Perform mechanical function test with primary part de-energized and without auxiliary voltage. Do not perform mechanical function test while energized.

⇨ Do not energize switchgear until mechanical function test has been successfully completed.

⚠WARNING

High speed moving parts

Can cause serious injury.

Do not remove the front cover of the operating mechanism until the following actions have been performed:

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

- Switch the auxiliary voltage supply of the motor.
- Trip the MCB.
- Disconnect the control cables from the low-voltage compartment.

⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:

- Actuate the manual OFF pushbutton.
- Actuate the manual ON pushbutton.
- Actuate the manual OFF pushbutton again.

⇨ Check if the "spring charged" indicator shows "spring charged".

⚠CAUTION

High speed moving parts

Using an incorrect hand crank can cause injury.

⇨ Use exclusively the hand crank provided with the switchgear accessories.

The hand crank supplied features a freewheel function. The freewheel function disconnects an inserted hand crank from the charging system when the motor charges the closing spring.

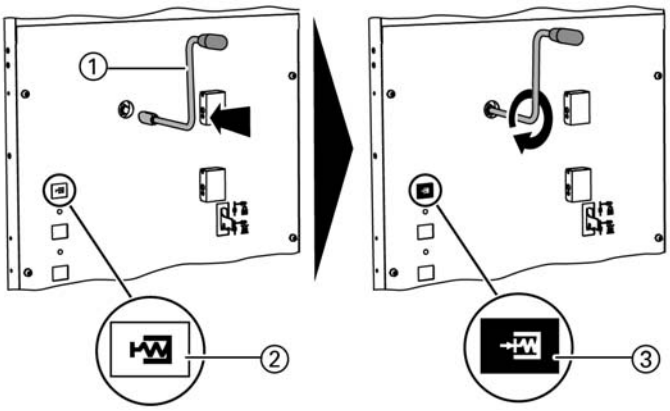
Read the operating instructions before the test operation. Test operation helps you to verify the proper operation of the switchgear **without high voltage**.

The work described below must be performed on each panel.

Mechanical operation of switching devices

⇨ 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 see page 193, "Operating the make-proof busbar earthing switch".

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.

Checking interlocks and indicators

⇨ Operate all switching devices for test to verify the proper 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 the undervoltage release

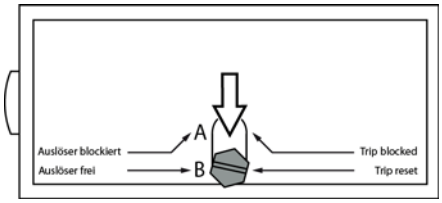
NOTICE
Blocked undervoltage release **Can cause property damage.** The undervoltage release will not function if its retaining bolt is inserted in position A. After test operation without auxiliary voltage, the undervoltage release must be activated. ⇨ Remove the retaining bolt from position A and insert it in position B.

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

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

⇨ Remove the front cover of the circuit-breaker.

⇨ To activate the undervoltage release, shift the retaining bolt of the striker from position A to position B.



⇨ Refit the front cover.

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

33.3 Checking the accessories

As standard, the switchgear accessories comprise:

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

⇨ 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).

33.4 Checking protection devices

⇨ Check the version of the firmware installed on the protection devices, and update if required, see page 9, "IT security".

33.5 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.

33.6 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

Internal arcing and explosion hazard

Will cause death, serious injury or property damage.

The switchgear may or may not be classified as arc-resistant switchgear.

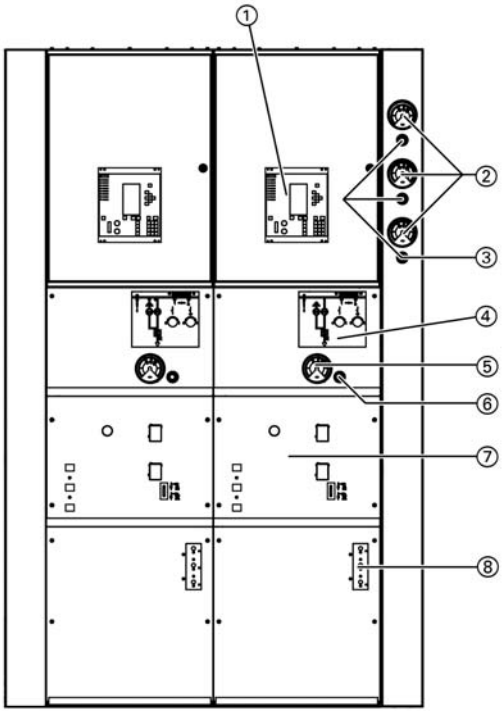
Check the information on the rating plate for the switchgear to determine if it has an internal arc classification. If the switchgear has internal arc classification IAC A FL, the area behind the switchgear is not tested to evaluate the effects of internal arcs. Personnel must be prevented from entering the area behind the switchgear when the switchgear is energized.

If the switchgear is classified as arc resistant, note that it is not arc resistant unless all of the following conditions are met:

- ⇨ All pressure relief devices are free to operate as designed.
- ⇨ The fault energy available to the switchgear does not exceed the internal arcing short-circuit current rating and rated arcing duration of the switchgear.
- ⇨ There are no obstructions around the switchgear that could direct the arcing exhaust products into an area intended to be protected.
- ⇨ The switchgear is installed in accordance with the information in the instruction manuals and drawings

34 Control elements and indicators

Overview



① SIPROTEC bay controller (option)
② Manometer for gas compartment monitoring of busbar gas compartments L1, L2, L3
③ Gas filling valve for busbar gas compartments L1, L2, L3
④ Control and indication board for three-position disconnector with position indicator for circuit-breaker
⑤ Manometer for gas compartment monitoring of feeder gas compartments
⑥ Gas filling valve for feeder gas compartments
⑦ Control and indication board for circuit-breaker
⑧ Sockets for LRM voltage detecting system

Fig. 182: Control elements and indicators of the circuit-breaker panel

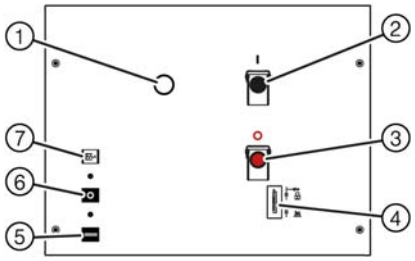
Indications and their meaning

Switching device	Indication of switch positions	
Disconnector	 CLOSED	 OPEN
Earthing switch	 READY-TO-EARTH	 OPEN
Circuit-breaker	 CLOSED	 OPEN

Switching device	Indication of faulty positions (examples)		
Disconnector			
Earthing switch			

Closing spring	 charged	 not charged
Operations counter	 00007	

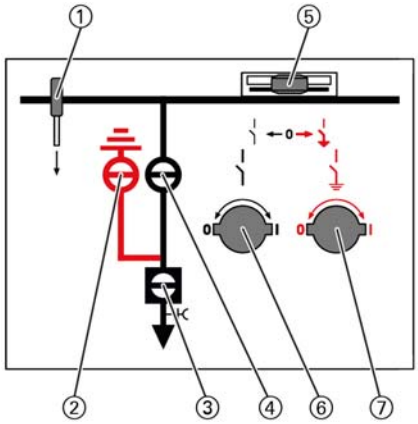
34.1 Control elements and indicators of the circuit-breaker



① Opening for charging the closing spring manually
② ON pushbutton
③ OFF pushbutton
④ "Feeder earthed" locking device
⑤ Operations counter
⑥ Position indicator for circuit-breaker
⑦ "Closing spring charged / not charged" indicator

34.2 Control elements and indicators of the three-position disconnector

Control board on the switchgear front



① Interrogation lever
② Position indicator for three-position disconnector (EARTHING/READY-TO-EARTH function)
③ Position indicator for circuit-breaker
④ Position indicator for three-position disconnector (DISCONNECTING function)
⑤ Control gate
⑥ Actuating opening for disconnector (DISCONNECTING function)
⑦ Actuating opening for earthing switch (EARTHING/READY-TO-EARTH function)

Fig. 183: Control board on the switchgear front

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 position indicator at the rear is located on the side of the outermost busbar housing, over the circuit-breaker housing.

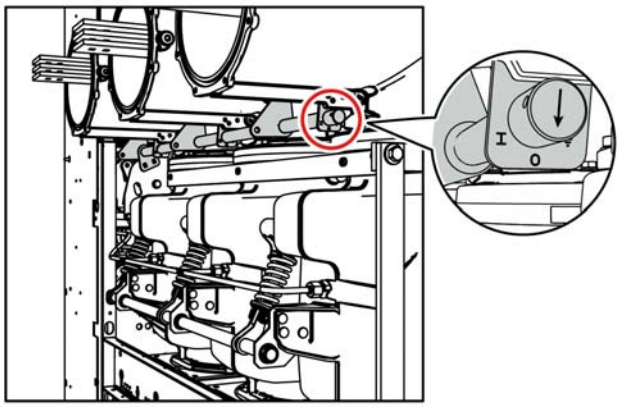
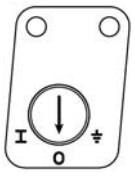
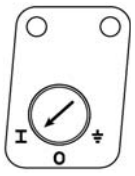


Fig. 184: Position indicator at the rear

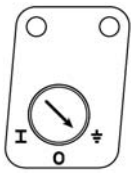
Switch positions



Three-position disconnector OPEN



Three-position disconnector CLOSED



Three-position disconnector READY-TO-EARTH

34.3 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 187, "Emergency operation of the three-position disconnector").

Fig. 185: Operating lever for DISCONNECTING function

Fig. 186: Operating lever for READY-TO-EARTH function (cross bar marked red)

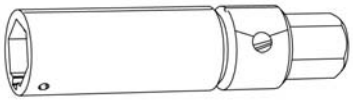


Fig. 187: Adapter for emergency operation (to be used only with motor operating mechanism)

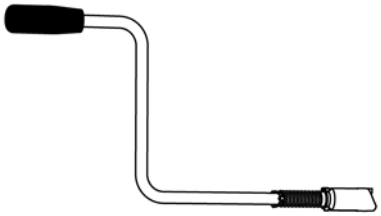


Fig. 188: Hand crank for charging the closing spring

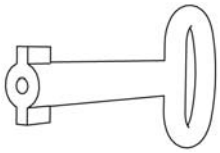


Fig. 189: Double-bit key 3 mm (door of low-voltage compartment)

35 Interlocks

Switching devices may only be controlled and operated in logical dependence on the switch position of other devices. Unpermissible switching operations must be blocked in order to:

- Provide full protection for the personnel.
- Prevent switchgear damages and power failures.

The interlocks are mainly of the mechanical type.

Mechanical interlocking

The circuit-breaker and the three-position disconnector are mechanically interlocked against each other.

Mechanical interlocking prevents,

- during manual operation, the circuit-breaker from being closed if the three-position disconnector is not in a defined end position (CLOSED/OPEN/EARTHED).
- during manual operation, the circuit-breaker from being closed if the operating lever is inserted.
- the three-position disconnector from being operated while the circuit-breaker is closed.

Interlocking conditions

Feeder and circuit-breaker panel of bus sectionalizer		
Switching operation	Switching operation only possible if	Type
Disconnector CLOSED/OPEN	circuit-breaker OPEN	mechanical
	earthing switch OPEN	mechanical
Earthing switch CLOSED/OPEN	circuit-breaker OPEN	mechanical
	disconnector OPEN	mechanical
Circuit-breaker CLOSED	disconnector or earthing switch not in intermediate position (shutter open)	mechanical
Circuit-breaker OPEN	not locked by a locking device	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

Bus riser of bus sectionalizer unit / Disconnectable busbar connection / Top-mounted busbar sectionalizer		
Switching operation	Switching operation is only possible if	Design
Disconnector CLOSED/OPEN	associated circuit-breaker OPEN	electromechanical
	Earthing switch OPEN	mechanical
Earthing switch CLOSED/OPEN	associated circuit-breaker OPEN	electromechanical
	Disconnector OPEN	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

Disconnectable busbar voltage transformer		
Switching operation	Switching operation is only possible if	Design
Disconnector CLOSED/OPEN	Earthing switch OPEN	mechanical
Earthing switch CLOSED/OPEN	Disconnector OPEN	mechanical
Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.		

Make-proof busbar earthing switch		
Switching operation	Switching operation is only possible if	Design
Earthing switch CLOSED/OPEN	Opening for operating lever open	mechanical

36 Operating the circuit-breaker

NOTICE

Do not lock the circuit-breaker in OPEN position.

Closing the circuit-breaker while being locked in OPEN position will damage the locking device.

⇨ Operate and lock the circuit-breaker locking device only under the following conditions:
- The circuit-breaker is in CLOSED position.
- The three-position disconnector is in READY-TO-EARTH position.

⇨ For the locking device, use a padlock with a shackle diameter of min. 6 mm.

36.1 Closing the circuit-breaker manually

If the control voltage fails, the circuit-breaker can only be closed mechanically by hand.

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.

Preconditions

- "Feeder earthed" locking device is open

⇨ Operate the OFF pushbutton in the circuit-breaker control board.

✔ The circuit-breaker is open.

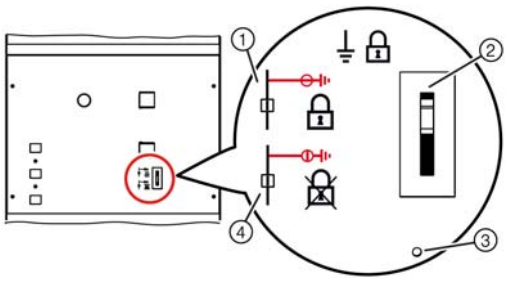
36.3 Emergency release of the circuit-breaker (with locking solenoid -Y16)

Possible interlocks of the "feeder earthed" function between circuit-breaker and three-position disconnector:

- In EARTHED position of the three-position disconnector (with locking solenoid -Y16).
- In all switch positions of the three-position disconnector.

If the auxiliary voltage fails, the "feeder earthed" locking device is blocked.

⇨ Operate emergency release.



① "Feeder earthed" locking device
② Locking device
③ Release opening
④ "Feeder open" locking device

Fig. 190: Position of the release opening at the circuit-breaker front cover

⇨ 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.

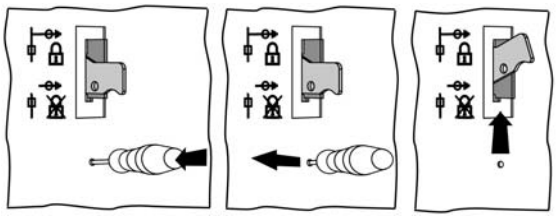


Fig. 191: Operating the emergency release

36.4 Test operation

Without auxiliary voltage

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

⇨ Charge the closing spring (see page 157, "Charging the closing spring manually").
⇨ Operate the ON pushbutton in the mechanical control board.
✔ The circuit-breaker is closed.
⇨ Operate the OFF pushbutton in the mechanical control board.
✔ The circuit-breaker is open.

On circuit-breakers with undervoltage release 3AX1103:

NOTICE

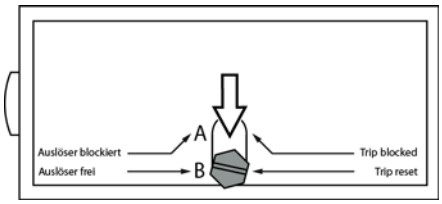
Blocked undervoltage release

Can cause property damage.

The undervoltage release will not function if its retaining bolt is inserted in position A. After test operation without auxiliary voltage, the undervoltage release must be activated.

⇨ Remove the retaining bolt from position A and insert it in position B.

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



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 "spring charged" indication appears.

⇨ Close the circuit-breaker.
✔ The closing spring is recharged automatically.
⇨ Check whether the position indication "circuit-breaker CLOSED" appears.
⇨ Open the circuit-breaker.
⇨ Check whether the position indication "circuit-breaker OPEN" appears.

36.5 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. 192: "Closing spring charged" indication

Fig. 193: "Closing spring not charged" indication

The hand crank is required to charge the closing spring manually if the control voltage fails.

⚠CAUTION

High speed moving parts

Using an incorrect hand crank can cause injury.

⇨ Use exclusively the hand crank provided with the switchgear accessories.

The hand crank supplied features a freewheel function. The freewheel function disconnects an inserted hand crank from the charging system when the motor charges the closing spring.

⇨ Remove cover from cutout.

⇨ Insert hand crank.

⇨ Turn hand crank clockwise approx. 48 turns until the indication "closing spring charged" appears.

⇨ Remove hand crank.

⇨ Close cutout with cover.

37 Operating the circuit-breaker and 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

37.1 Switching operations in the circuit-breaker panel

⚠CAUTION

Internal arcing and explosion hazard

Operating the three-position disconnector under load can cause injury or property damage.

A mechanical interlock prevents, as standard, the three-position disconnector from being operated under load. The switchgear can optionally be equipped in accordance with a customer-specific interlocking and control scheme.

⇨ If the customer-specific interlocking and control scheme requires that the panel be provided without electromechanical or mechanical interlocks, the three-position disconnector can be operated under load.

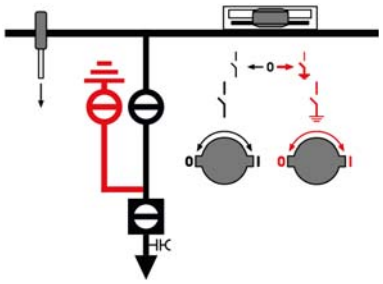
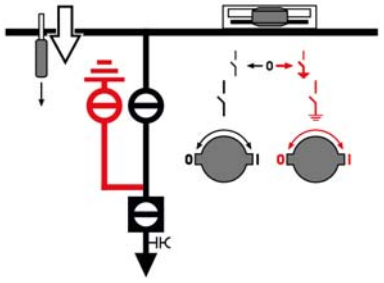
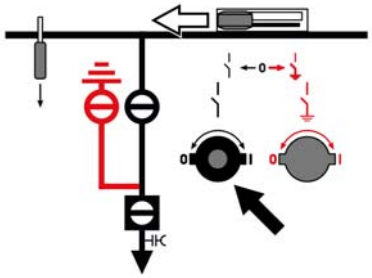
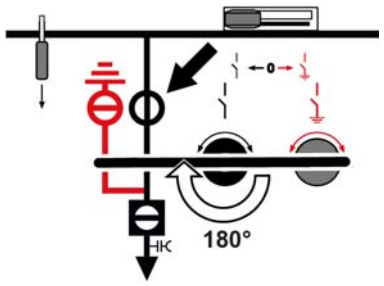
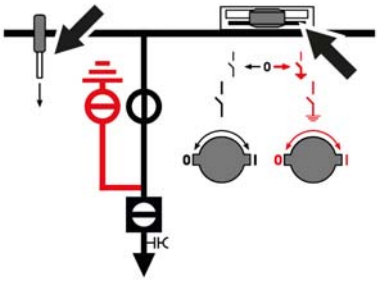
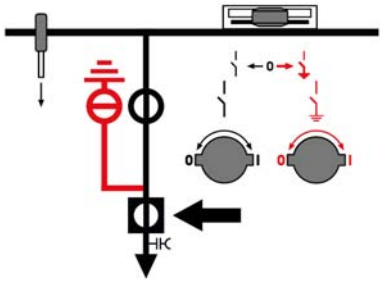
⇨ Do NOT operate the three-position disconnector under load.

☞INFORMATION

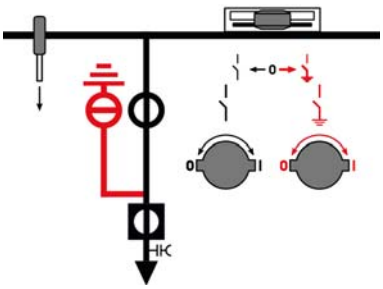
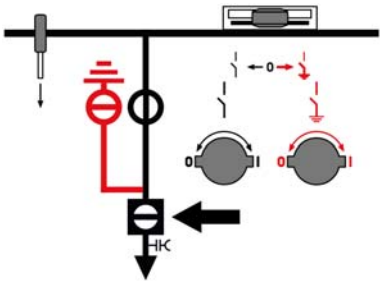
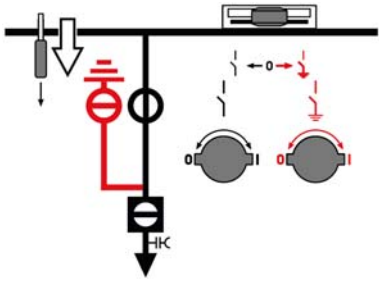
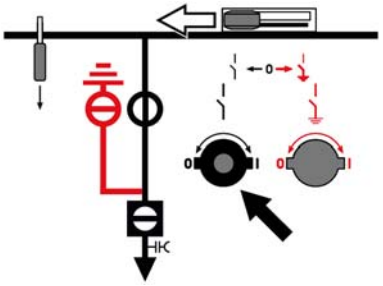
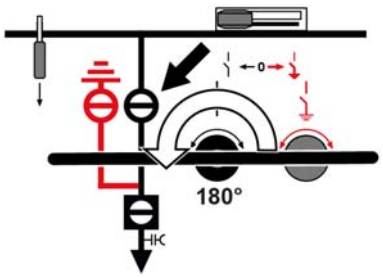
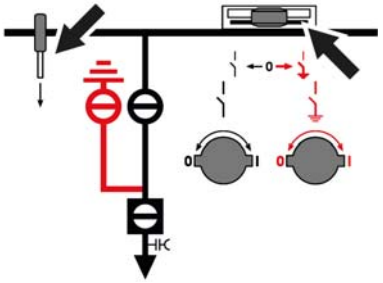
In circuit-breaker operating mechanisms with undervoltage release, the circuit-breaker trips automatically after removing the padlock if

⇨ no auxiliary voltage is available.

Connecting the feeder to the busbar

1  Initial situation	2  ⇨ Push the interrogation lever downwards.
3  ⇨ Push the 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 interrogation lever and the control gate return to their initial position.	6  ⇨ Close the circuit-breaker.

Disconnecting the feeder from the busbar

1  Initial situation	2  ⇨ Open the circuit-breaker.
3  ⇨ Push the interrogation lever downwards.	4  ⇨ Push the 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 interrogation lever and the control gate return to their initial position.

Earthing the feeder

⚠WARNING

Hazardous voltage

Can cause death or serious injury.

In panels with circuit-breaker, the earthing process is not completed as long as the circuit-breaker remains open.

⇨ Switch the three-position disconnector to READY-TO-EARTH position.

⇨ Close the circuit-breaker.

⚠CAUTION

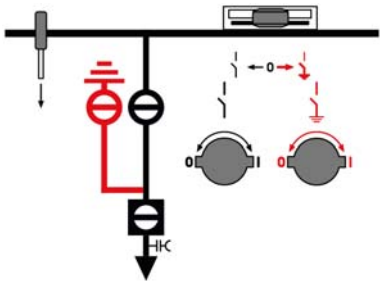
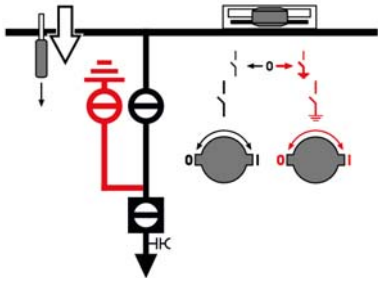
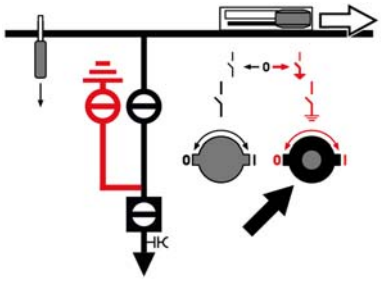
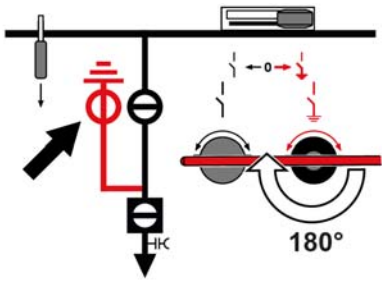
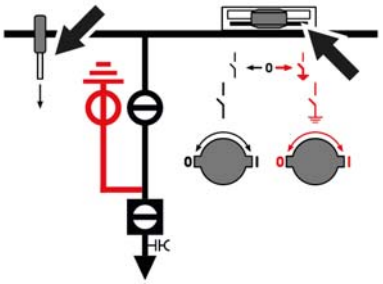
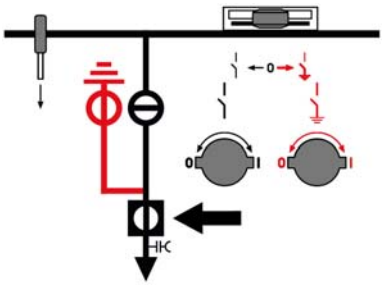
Internal arcing and explosion hazard

Operating the three-position disconnector under load can cause injury or property damage.

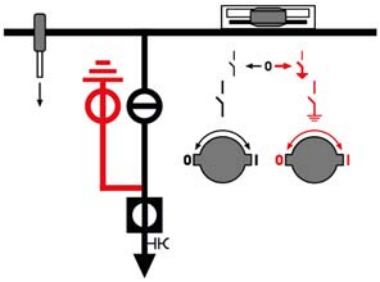
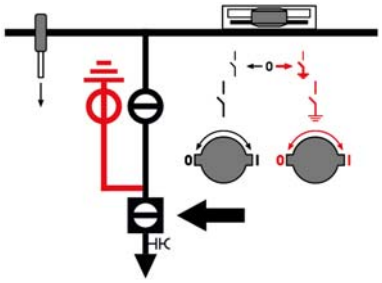
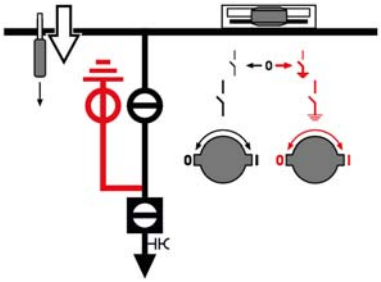
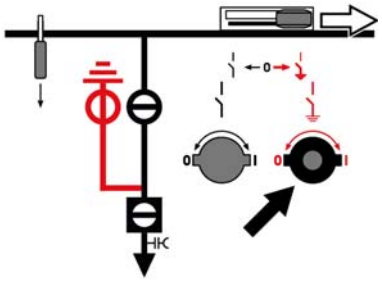
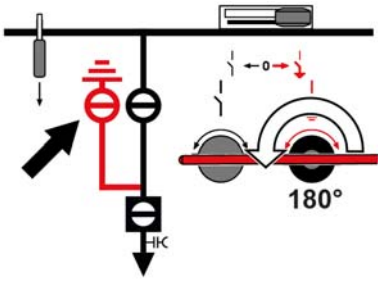
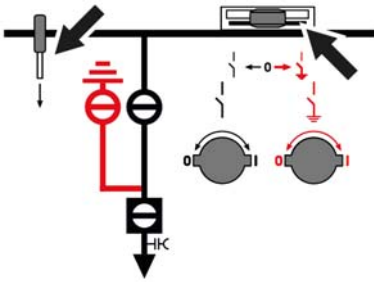
A mechanical interlock prevents, as standard, the three-position disconnector from being operated under load. The switchgear can optionally be equipped in accordance with a customer-specific interlocking and control scheme.

⇨ If the customer-specific interlocking and control scheme requires that the panel be provided without electromechanical or mechanical interlocks, the three-position disconnector can be operated under load.

⇨ Do NOT operate the three-position disconnector under load.

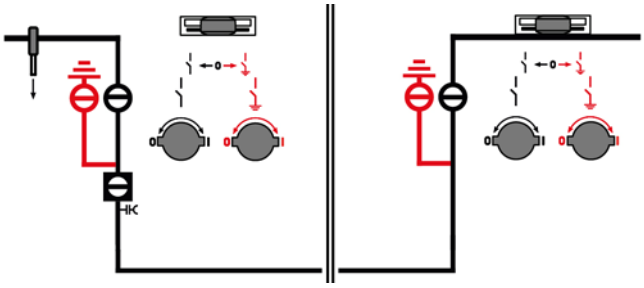
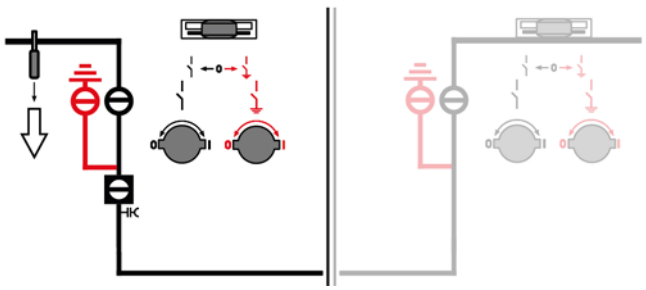
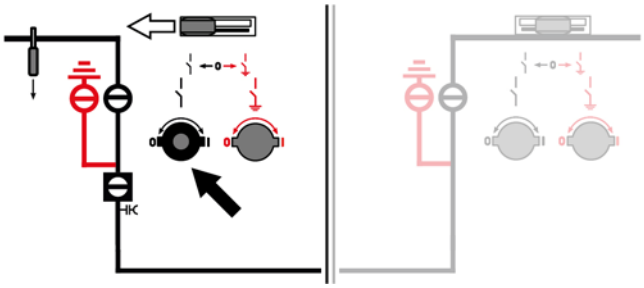
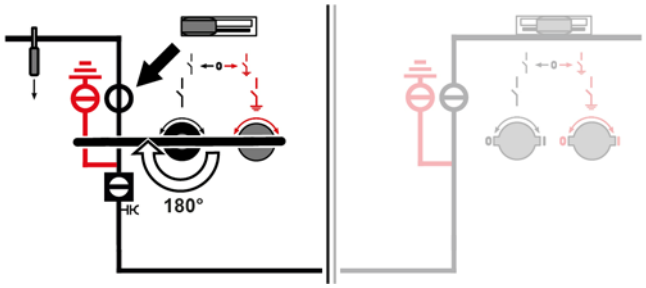
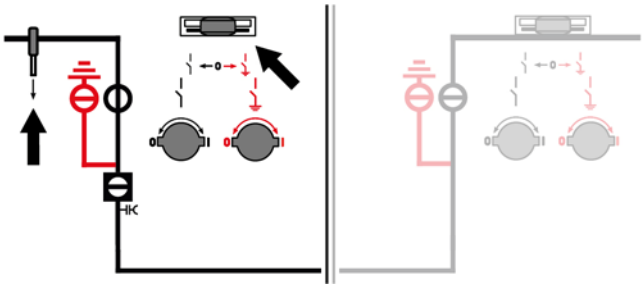
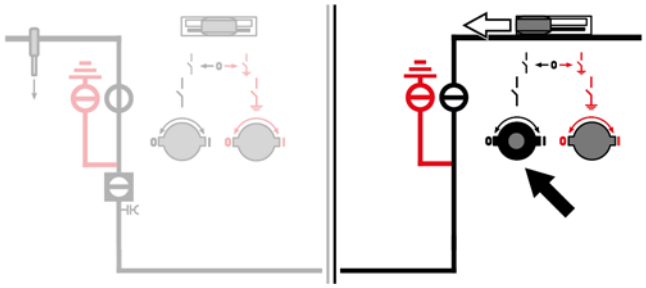
1  Initial situation	2  ⇨ Push the interrogation lever downwards.
3  ⇨ Push the control gate to the right.	4  ⇨ Switch the three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).
5  ⇨ Remove the operating lever for the READY-TO-EARTH function. The interrogation lever and the control gate return to their initial position.	6  ⇨ Close the circuit-breaker to earth the feeder. ⇨ Padlock the "feeder earthed" locking device.

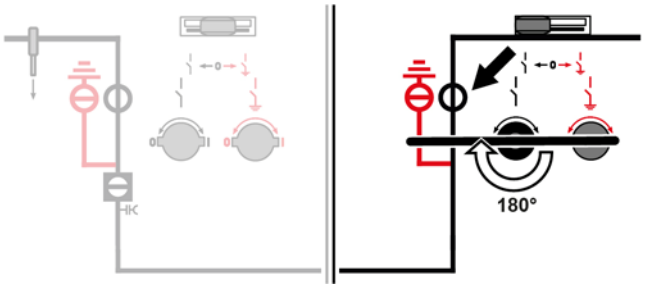
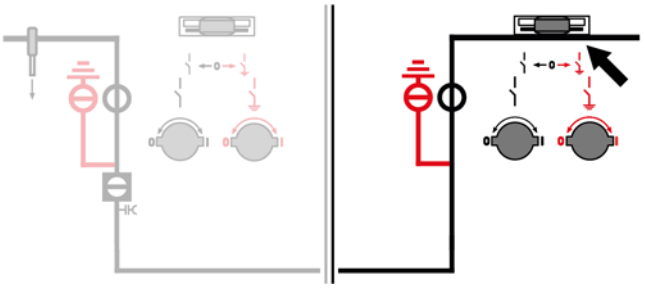
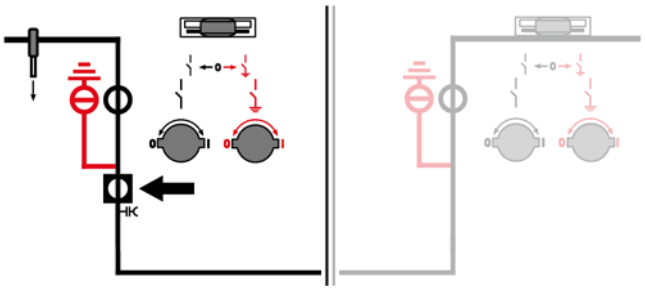
De-earthing the feeder

1  Initial situation	2  ⇨ Remove the padlock at the "feeder earthed" locking device. ⇨ Open the circuit-breaker to de-earth the feeder.
3  ⇨ Push the interrogation lever downwards.	4  ⇨ Push the control gate to the right.
5  ⇨ Switch the three-position disconnector from READY-TO-EARTH 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 interrogation lever and the control gate return to their initial position.

37.2 Switching operations in the bus sectionalizer panel

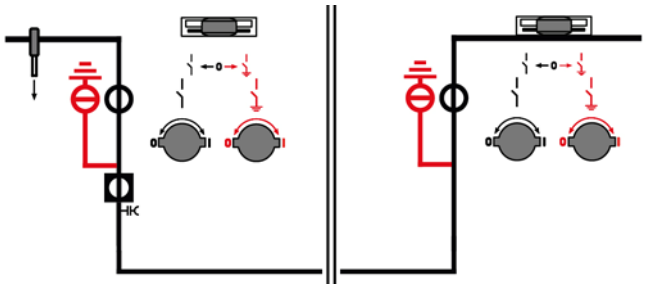
Coupling busbar sections

1  Initial situation	2  ⇨ Push the interrogation lever downwards.
3  ⇨ Push the left-hand control gate to the left.	4  ⇨ Switch the left-hand 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 interrogation lever and the left-hand control gate return to their initial position.	6  ⇨ Push the right-hand control gate to the left.

7  ⇨ Switch the right-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).	**8**  ⇨ Remove the operating lever for the DISCONNECTING function. The right-hand control gate returns to its initial position.
9  ⇨ Close the circuit-breaker.	

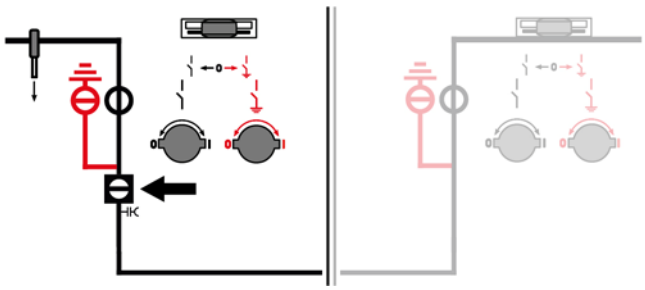
Decoupling busbar sections

1



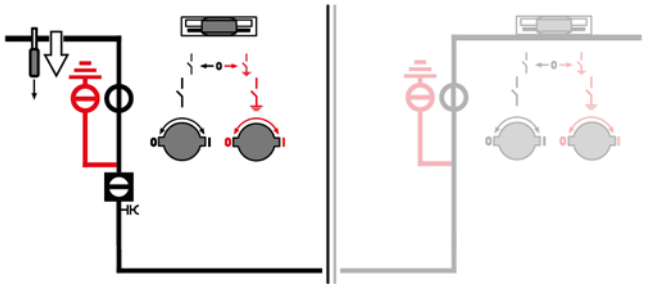
Initial situation

2



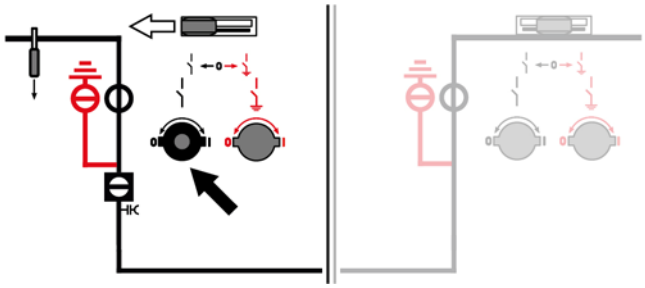
⇨ Open the circuit-breaker.

3



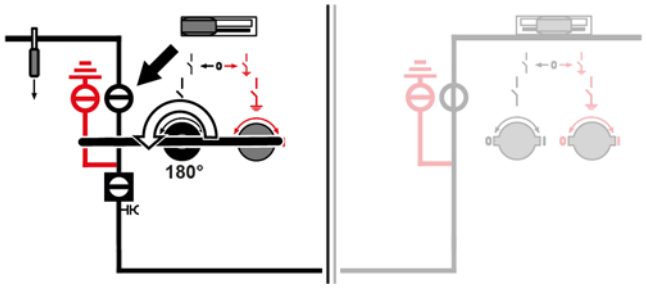
⇨ Push the interrogation lever downwards.

4



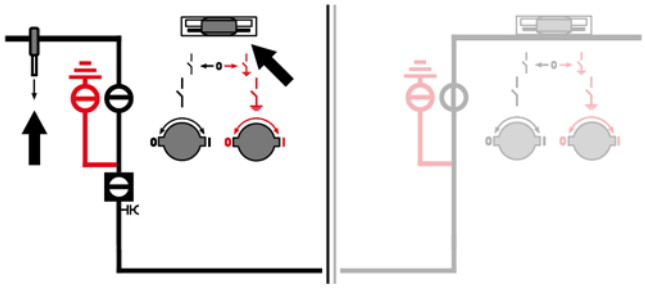
⇨ Push the left-hand control gate to the left.

5



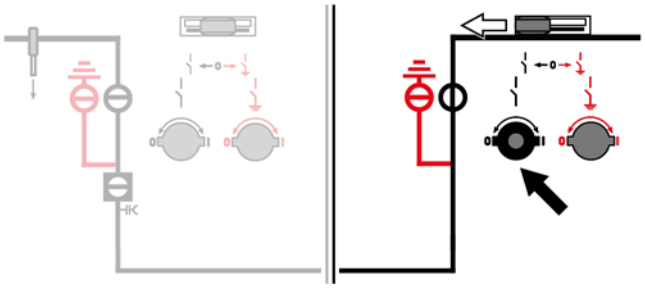
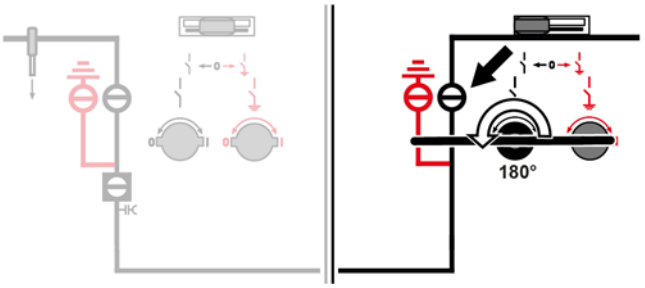
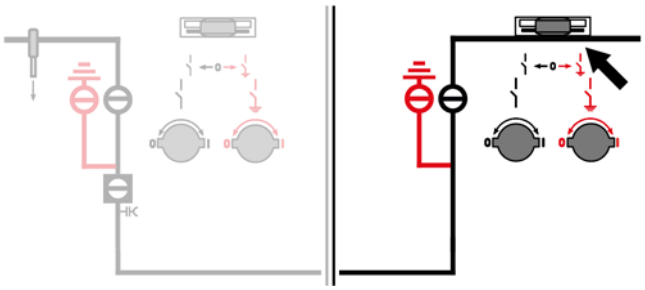
⇨ Switch the left-hand three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).

6



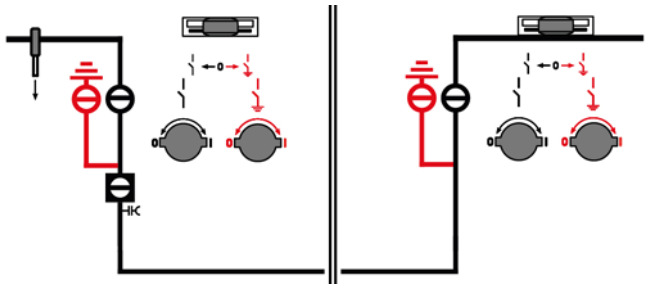
⇨ Remove the operating lever for the DISCONNECTING function.

The interrogation lever and the left-hand control gate return to their initial position.

7  ⇨ Push the right-hand control gate to the left.	**8**  ⇨ Switch the right-hand three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).
9  ⇨ Remove the operating lever for the DISCONNECTING function. The right-hand control gate returns to its initial position.	

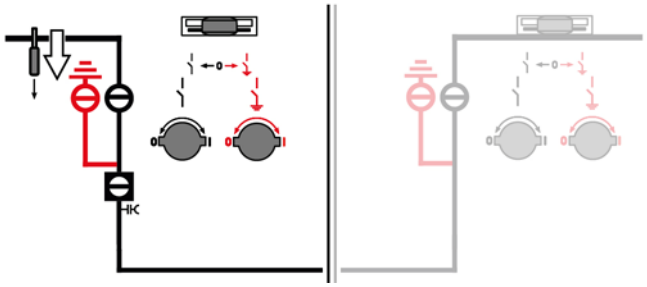
Earthing the busbar section in the left-hand panel

1



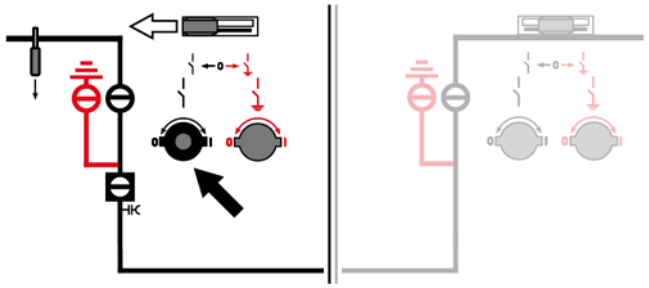
Initial situation

2



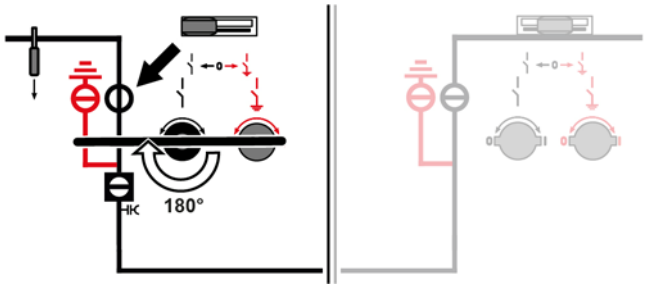
⇨ Push the interrogation lever downwards.

3



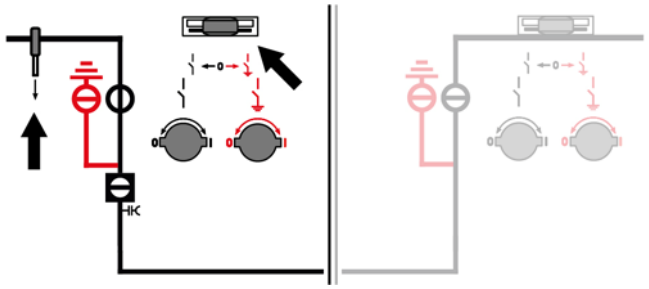
⇨ Push the left-hand control gate to the left.

4



⇨ Switch the left-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

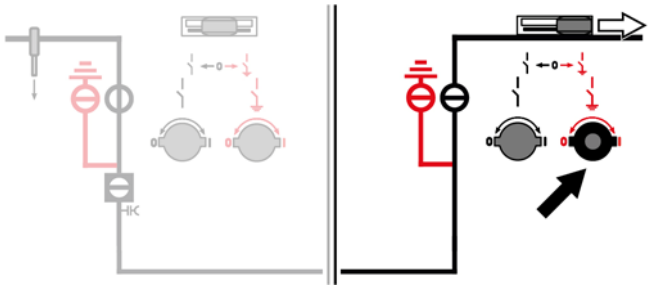
5



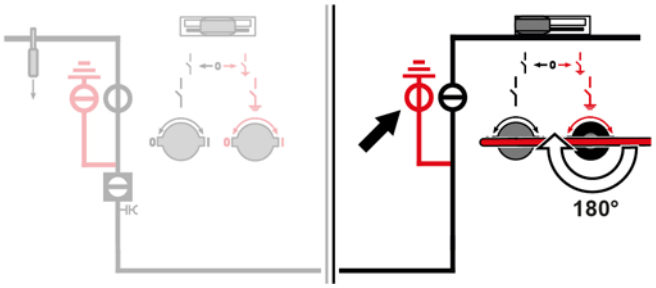
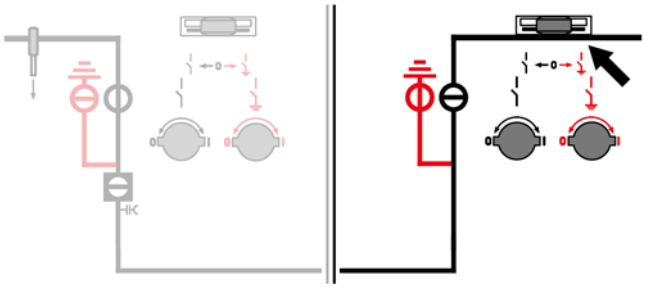
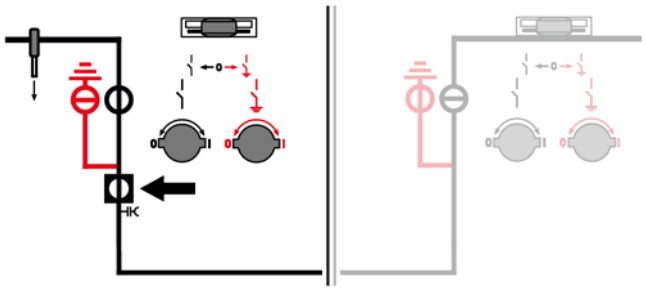
⇨ Remove the operating lever for the DISCONNECTING function.

The interrogation lever and the left-hand control gate return to their initial position.

6

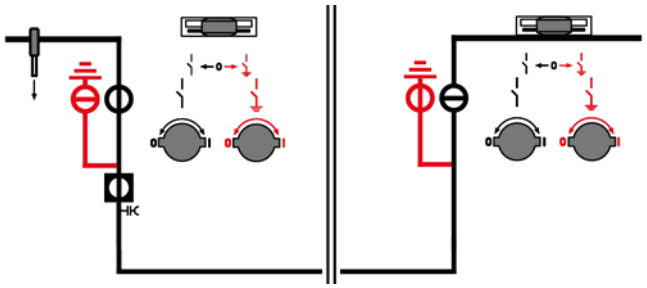


⇨ Push the right-hand control gate to the right.

7  ⇨ Switch the right-hand three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).	8  ⇨ Remove the operating lever for the READY-TO-EARTH function. The right-hand control gate returns to its initial position.
9  ⇨ Close the circuit-breaker to earth the busbar section in the left-hand panel. ⇨ Lock the circuit-breaker.	

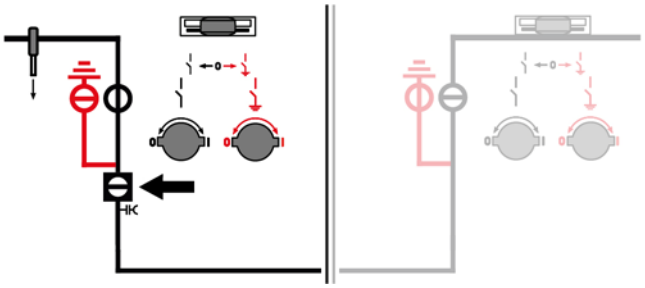
De-earthing the busbar section in the left-hand panel

1



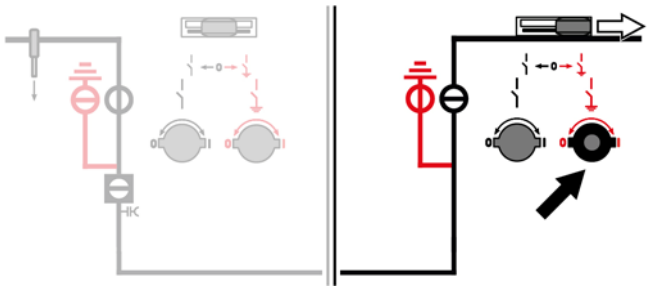
Initial situation

2



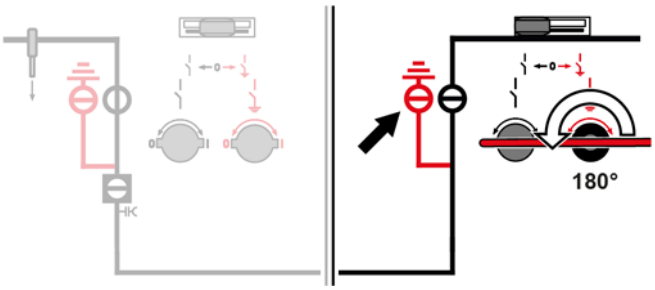
⇨ Open the circuit-breaker to de-earth the busbar section in the left-hand panel.

3



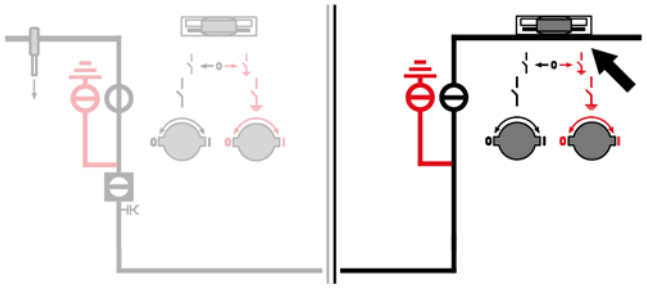
⇨ Push the right-hand control gate to the right.

4



⇨ Switch the right-hand three-position disconnector to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).

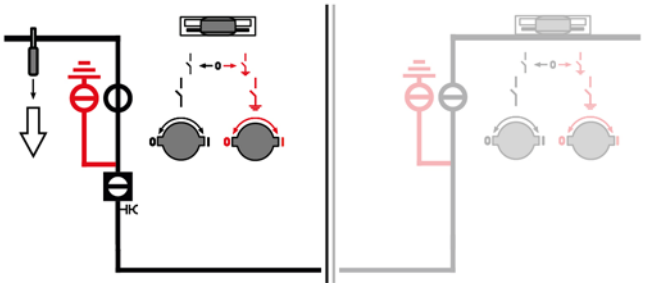
5



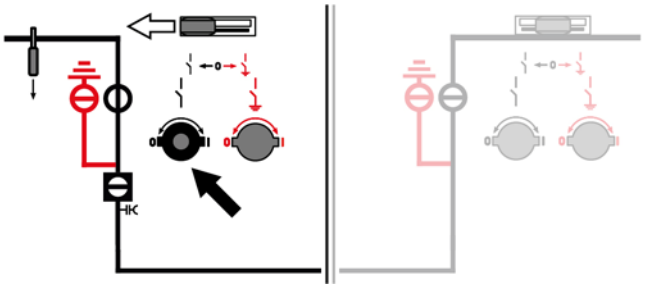
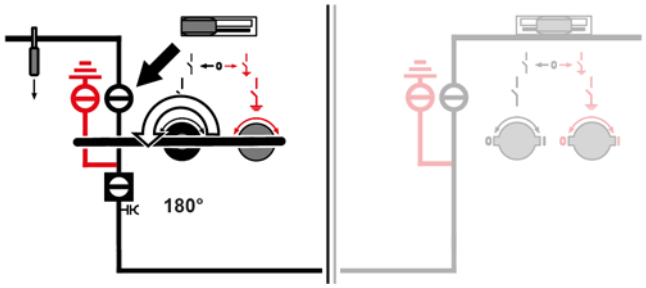
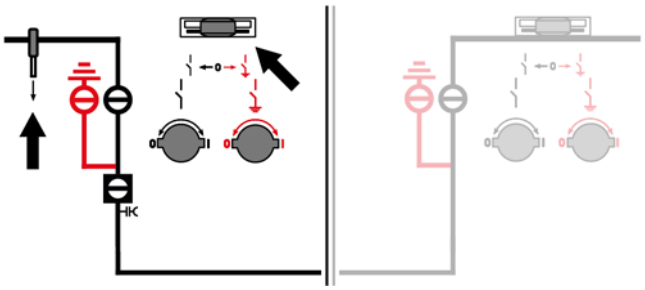
⇨ Remove the operating lever for the READY-TO-EARTH function.

The interrogation lever and the right-hand control gate return to their initial position.

6

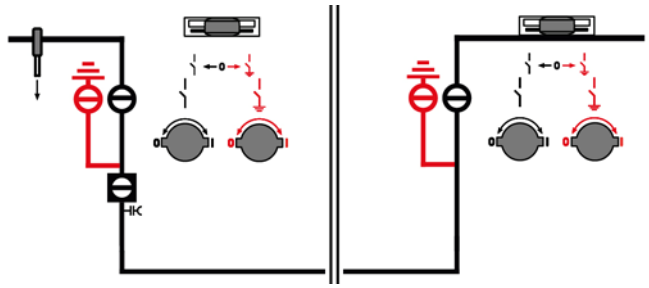


⇨ Push the interrogation lever downwards.

7  ⇨ Push the left-hand control gate to the left.	8  ⇨ Switch the left-hand three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).
9  ⇨ Remove the operating lever for the DISCONNECTING function. The interrogation lever and the left-hand control gate return to their initial position.	

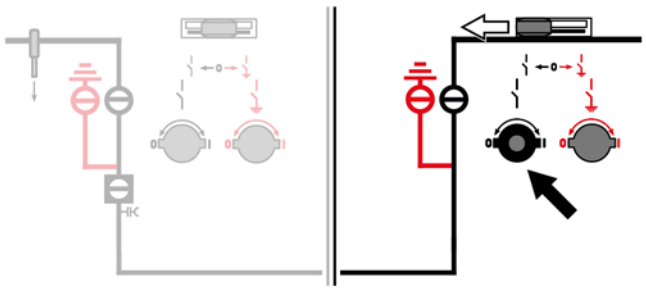
Earthing the busbar section in the right-hand panel

1



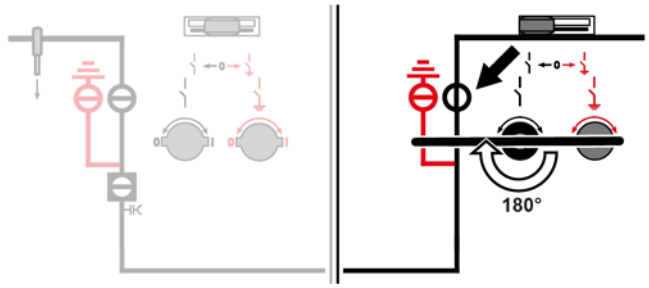
Initial situation

2



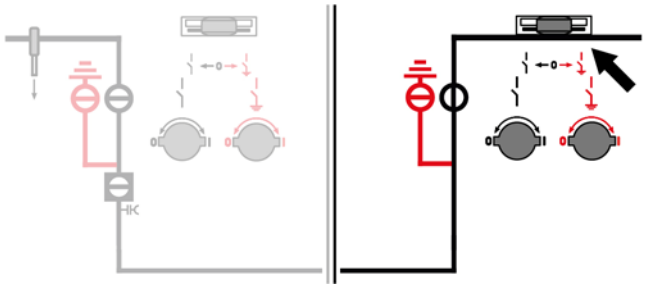
⇨ Push the right-hand control gate to the left.

3



⇨ Switch the right-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

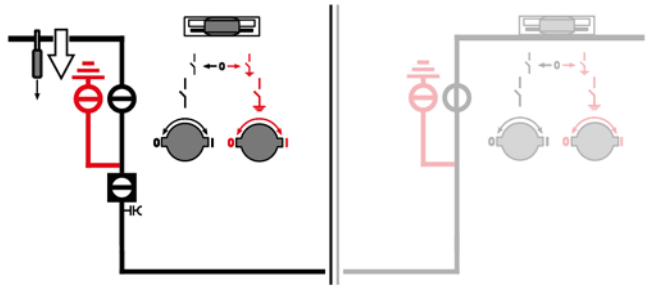
4



⇨ Remove the operating lever for the DISCONNECTING function.

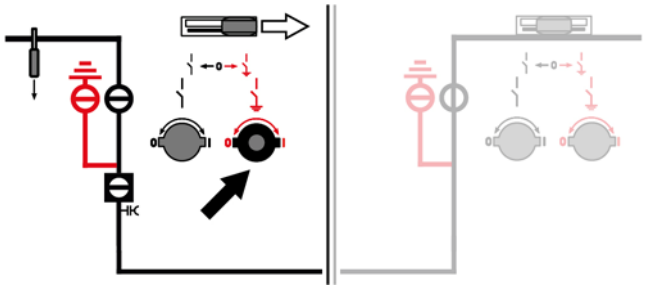
The interrogation lever and the right-hand control gate return to their initial position.

5

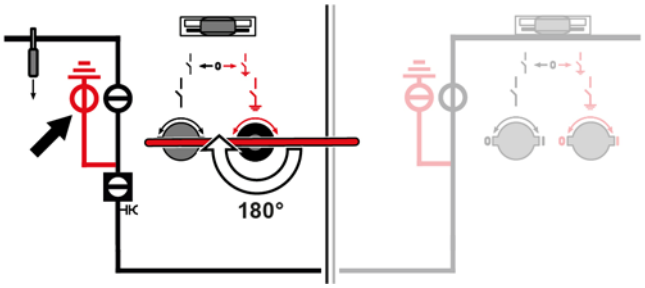
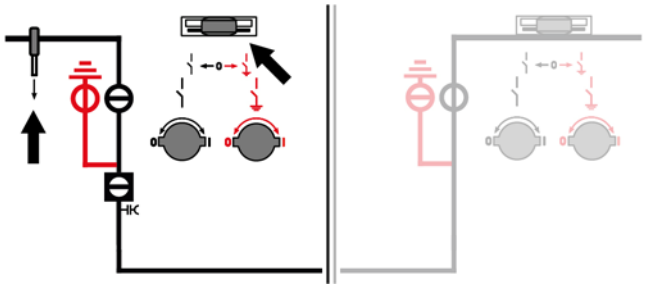
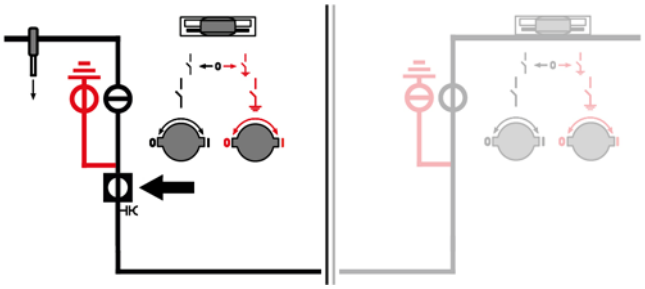


⇨ Push the interrogation lever downwards again.

6

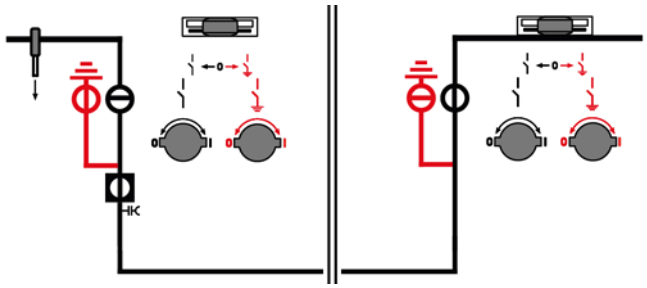


⇨ Push the left-hand control gate to the right.

7  ⇨ Switch the left-hand three-position disconnector to READY-TO-EARTH position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).	8  ⇨ Remove the operating lever for the READY-TO-EARTH function. The interrogation lever and the left-hand control gate return to their initial position.
9  ⇨ Close the circuit-breaker to earth busbar section 2. ⇨ Lock the circuit-breaker.	

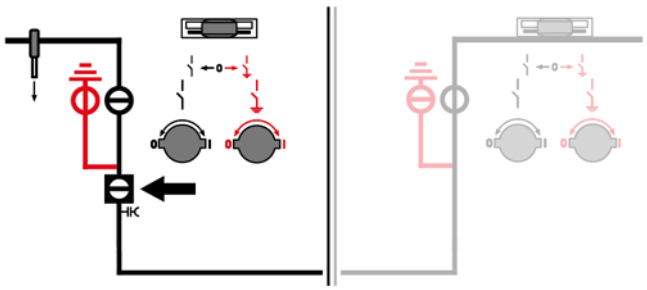
De-earthing the busbar section in the right-hand panel

1



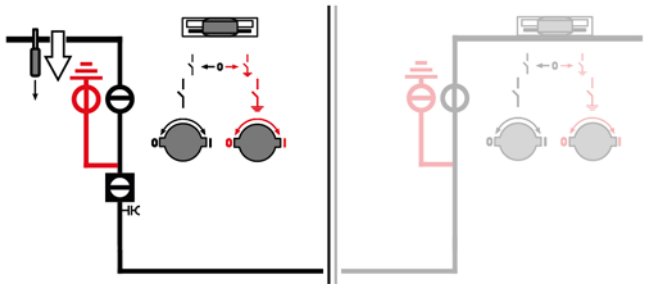
Initial situation

2



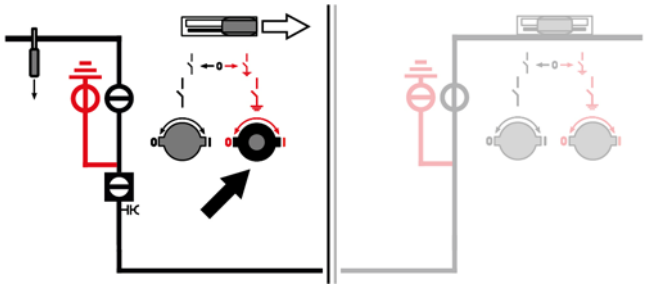
⇨ Open the circuit-breaker to de-earth the right-hand panel.

3



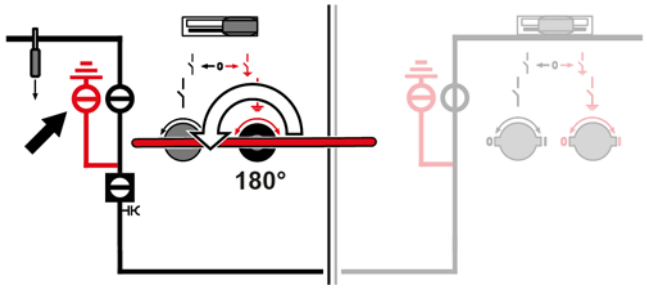
⇨ Push the interrogation lever downwards.

4



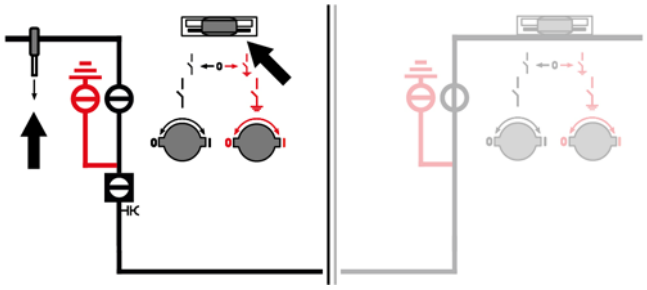
⇨ Push the left-hand control gate to the right.

5



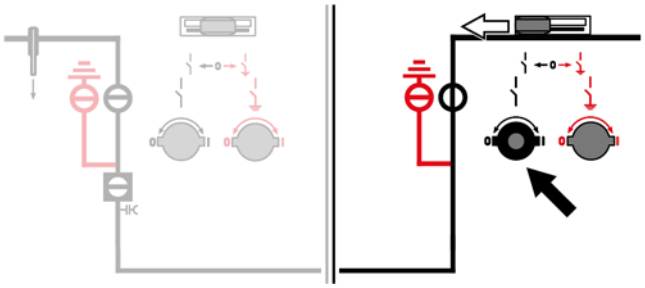
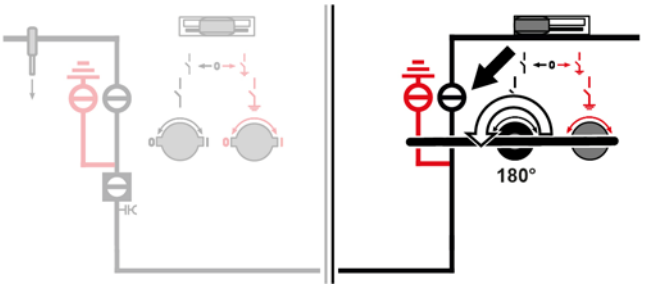
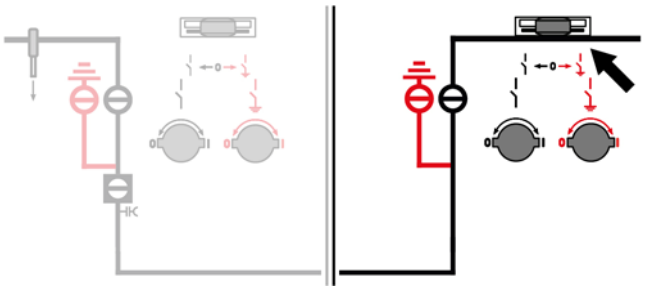
⇨ Switch the left-hand three-position disconnector from READY-TO-EARTH to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).

6



⇨ Remove the operating lever for the READY-TO-EARTH function.

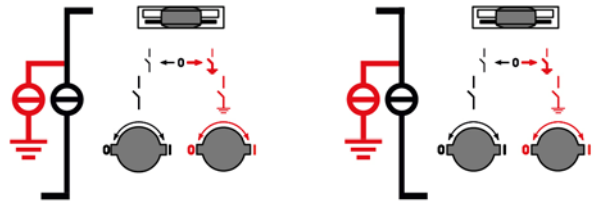
The interrogation lever and the left-hand control gate return to their initial position.

7  ⇨ Push the right-hand control gate to the left.	**8**  ⇨ Switch the right-hand three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).
9  ⇨ Remove the operating lever for the DISCONNECTING function. The interrogation lever and the right-hand control gate return to their initial position.	

37.3 Switching operations in top-mounted bus sectionalizer (without additional panel)

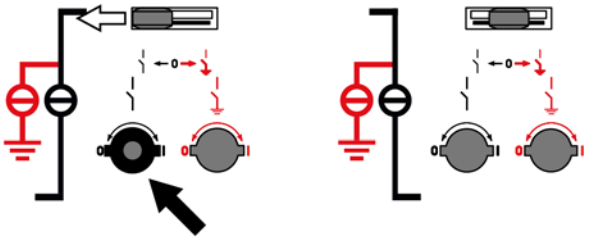
Coupling busbar sections

1



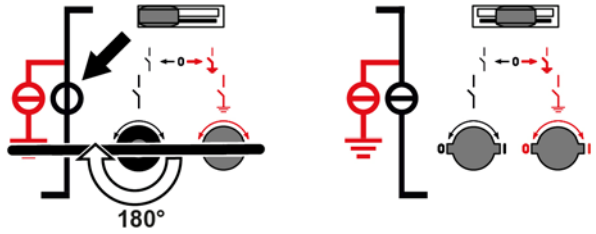
Initial situation

2



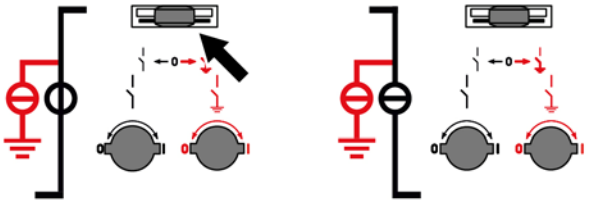
⇨ Push the left-hand control gate to the left.

3



⇨ Switch the left-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

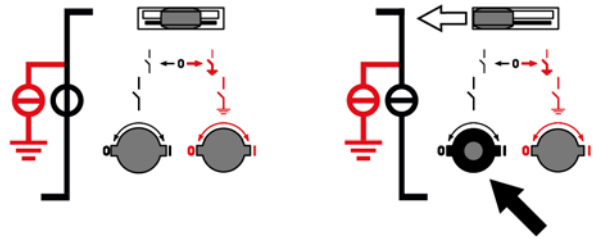
4



⇨ Remove the operating lever for the DISCONNECTING function.

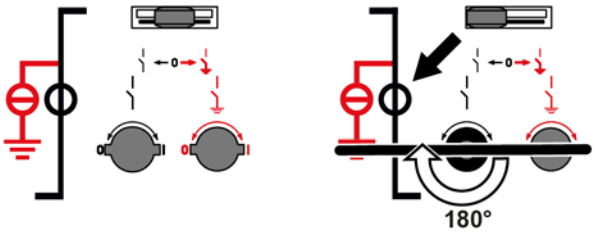
The left-hand control gate returns to its initial position.

5



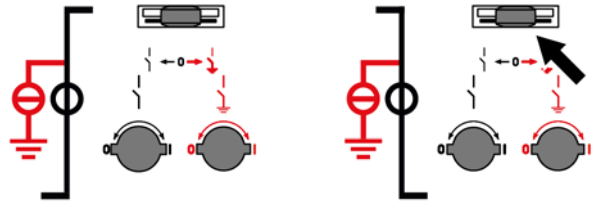
⇨ Push the right-hand control gate to the left.

6



⇨ Switch the right-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

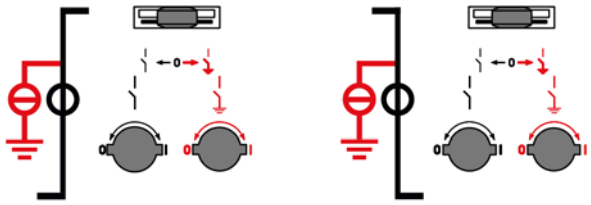
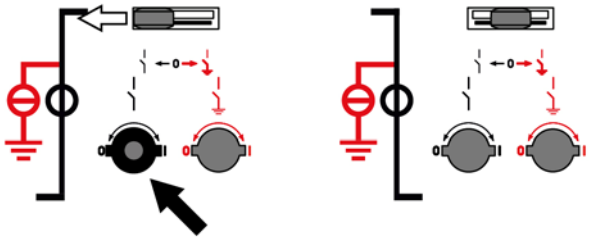
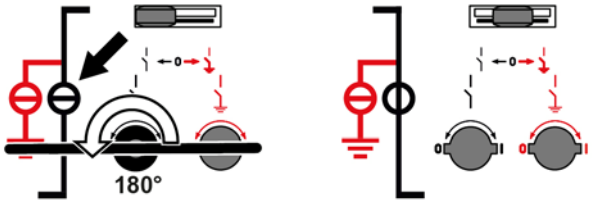
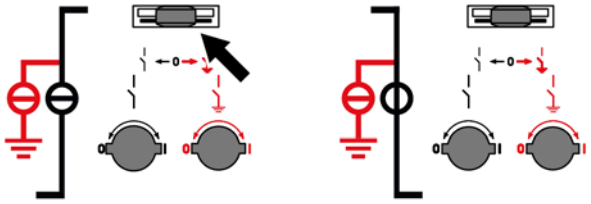
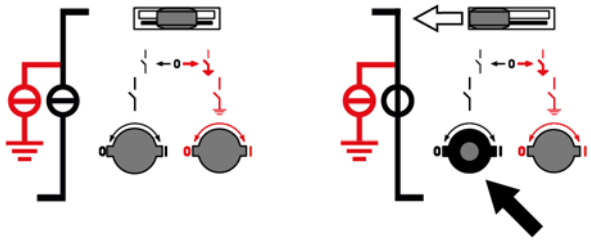
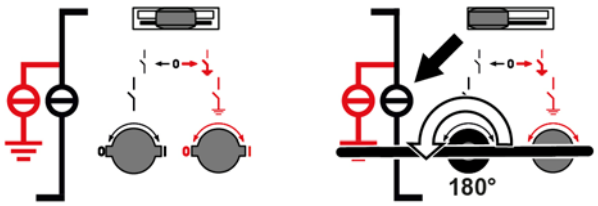
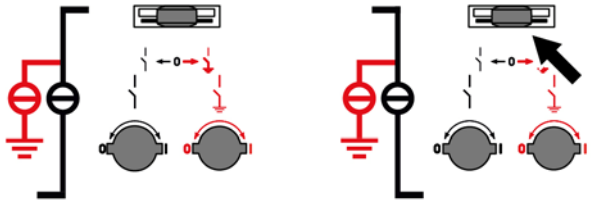
7



⇨ Remove the operating lever for the DISCONNECTING function.

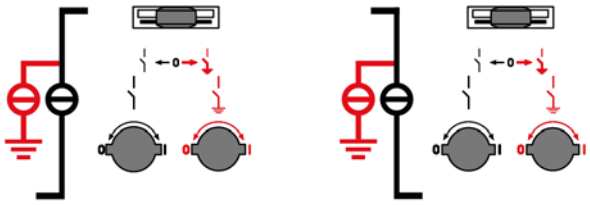
The right-hand control gate returns to its initial position.

Decoupling busbar sections

1  Initial situation	2  ⇨ Push the left-hand control gate to the left.
3  ⇨ Switch the left-hand 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 right-hand 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.	

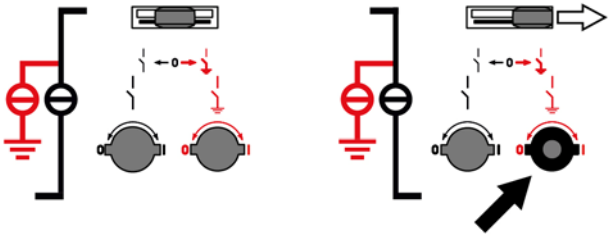
Earthing busbar section 1

1



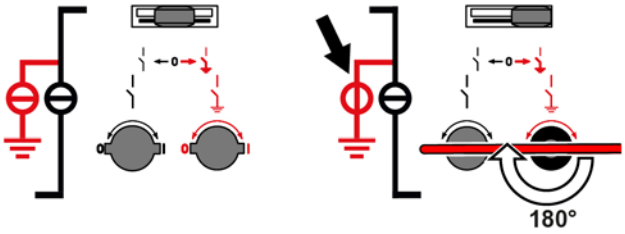
Initial situation

2



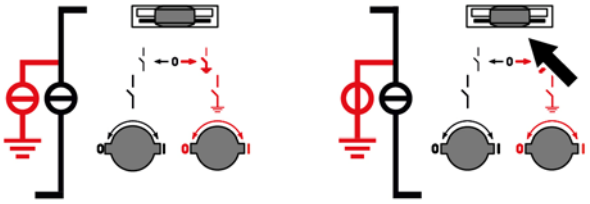
⇨ Push the right-hand control gate to the right.

3



⇨ Switch the right-hand three-position disconnector to EARTHED position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).

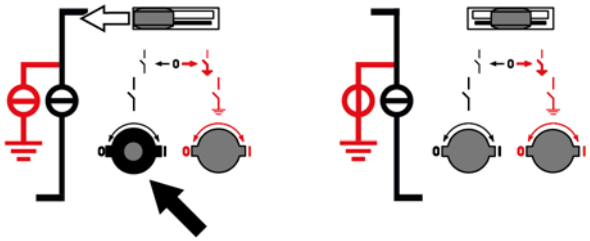
4



⇨ Remove the operating lever for the READY-TO-EARTH function.

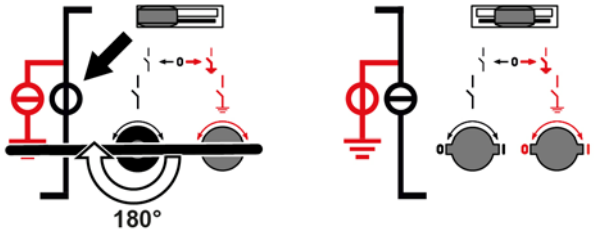
The right-hand control gate returns to its initial position.

5



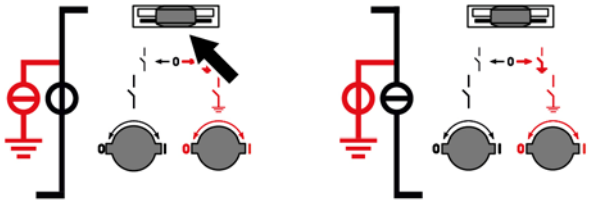
⇨ Push the left-hand control gate to the left.

6



⇨ Switch the left-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

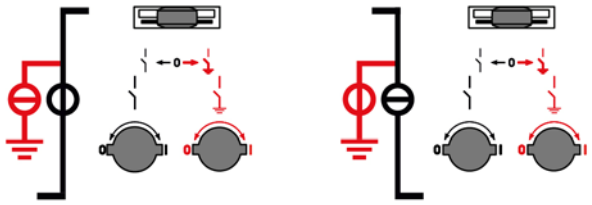
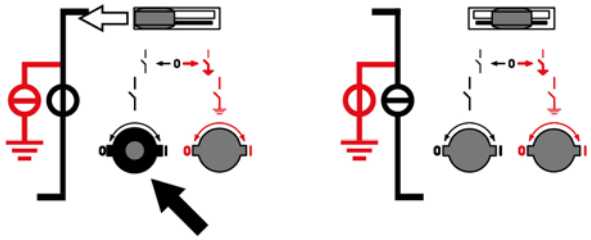
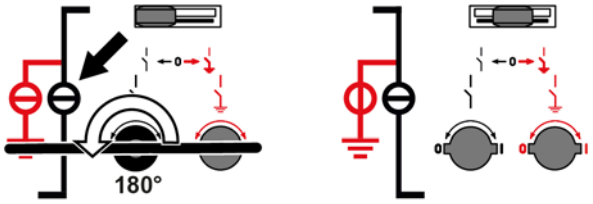
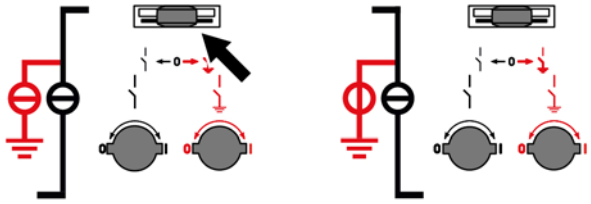
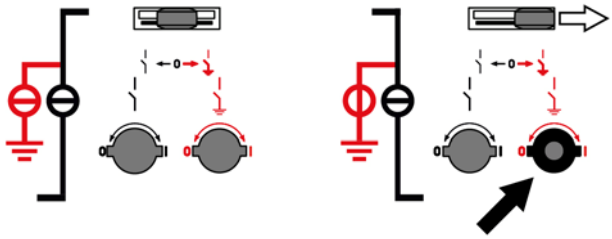
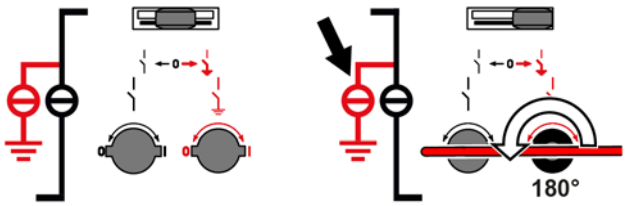
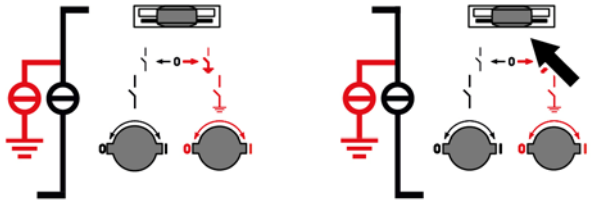
7



⇨ Remove the operating lever for the DISCONNECTING function.

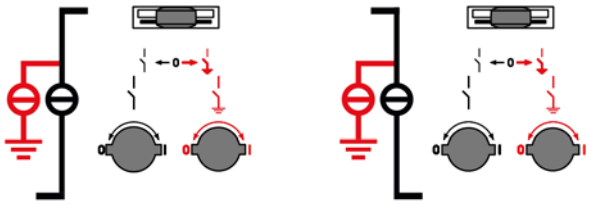
The left-hand control gate returns to its initial position.

De-earthing busbar section 1

1  Initial situation	2  ⇨ Push the left-hand control gate to the left.
3  ⇨ Switch the left-hand 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 right.	6  ⇨ Switch the right-hand three-position disconnector from EARTHED to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).
7  ⇨ Remove the operating lever for the READY-TO-EARTH function. The right-hand control gate returns to its initial position.	

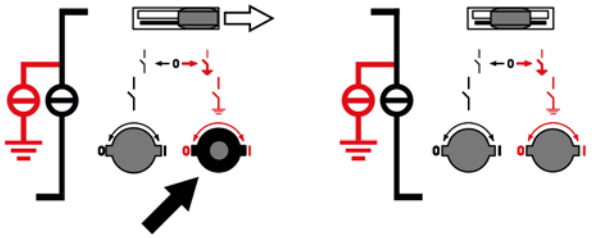
Earthing busbar section 2

1



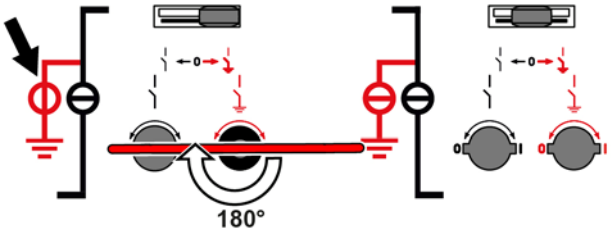
Initial situation

2



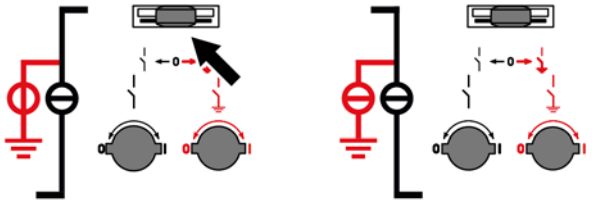
⇨ Push the left-hand control gate to the right.

3



⇨ Switch the left-hand three-position disconnector to EARTHED position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).

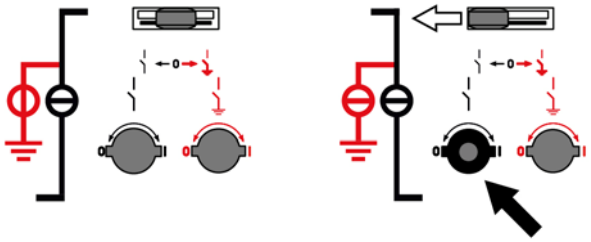
4



⇨ Remove the operating lever for the READY-TO-EARTH function.

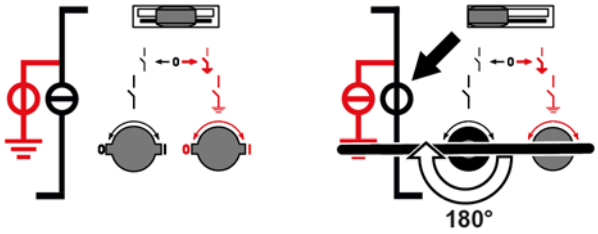
The left-hand control gate returns to its initial position.

5



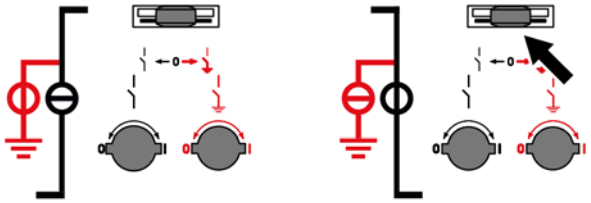
⇨ Push the right-hand control gate to the left.

6



⇨ Switch the right-hand three-position disconnector to CLOSED position (insert the operating lever for the DISCONNECTING function and turn 180° clockwise).

7

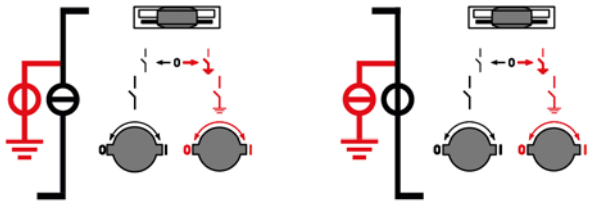


⇨ Remove the operating lever for the DISCONNECTING function.

The right-hand control gate returns to its initial position.

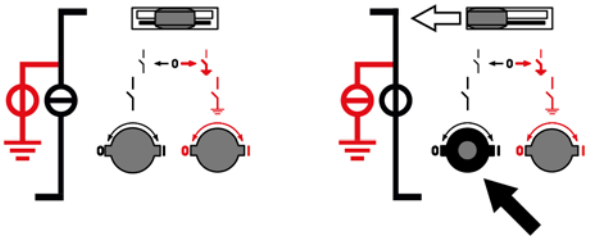
De-earthing busbar section 2

1



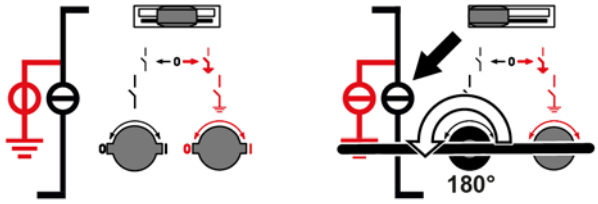
Initial situation

2



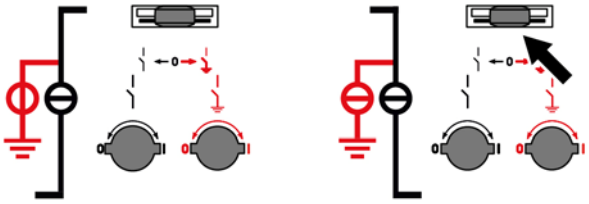
⇨ Push the right-hand control gate to the left.

3



⇨ Switch the right-hand three-position disconnector to OPEN position (insert the operating lever for the DISCONNECTING function and turn 180° counter-clockwise).

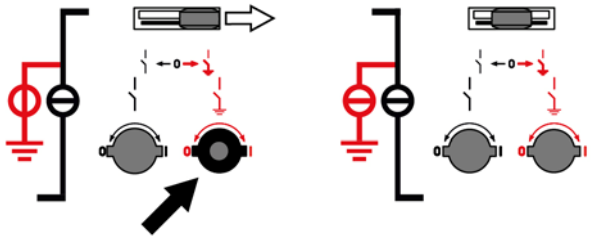
4



⇨ Remove the operating lever for the DISCONNECTING function.

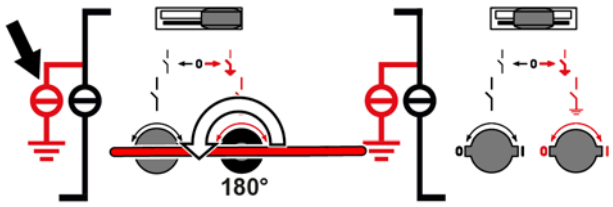
The right-hand control gate returns to its initial position.

5



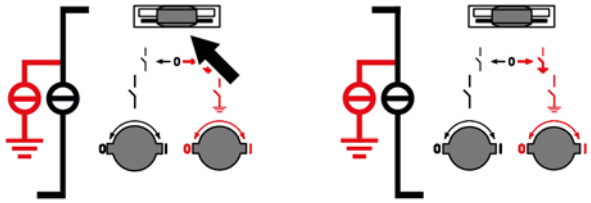
⇨ Push the left-hand control gate to the right.

6



⇨ Switch the left-hand three-position disconnector from EARTHED to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).

7



⇨ Remove the operating lever for the READY-TO-EARTH function.

The left-hand control gate returns to its initial position.

37.4 Switching operations with busbar components

The switching operations for the following disconnectable busbar components are identical:

- Busbar voltage transformer with three-position disconnector
- Busbar connection with three-position disconnector

The marking in the illustration represents possible busbar components.

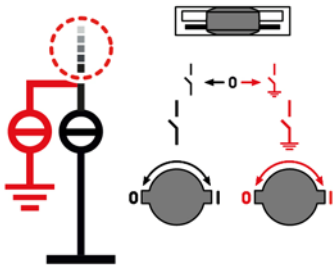
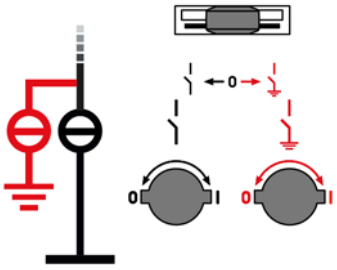
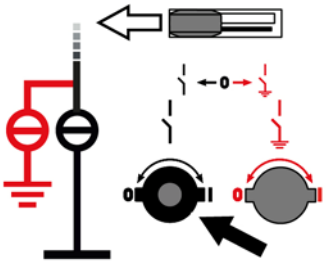
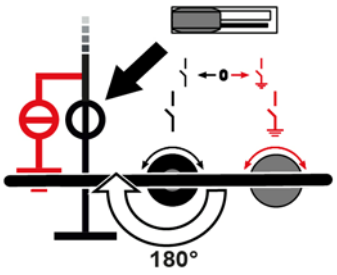
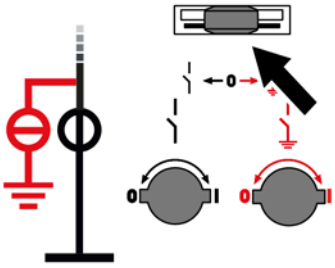
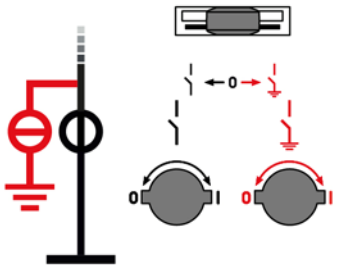
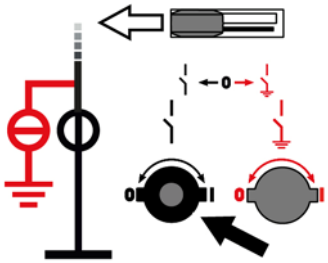
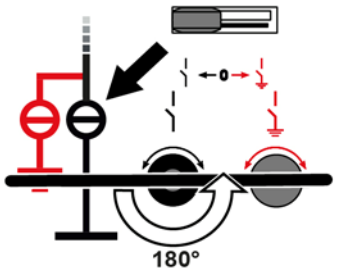
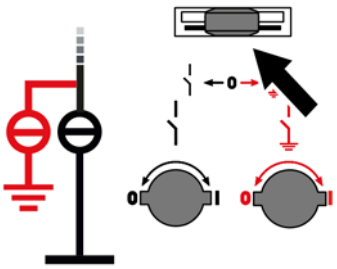


Fig. 194: Basic scheme for switching operations of busbar components

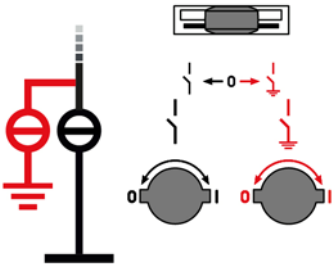
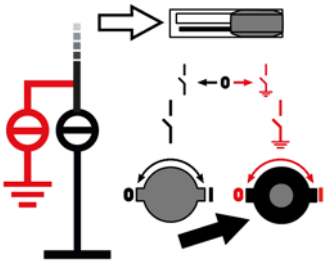
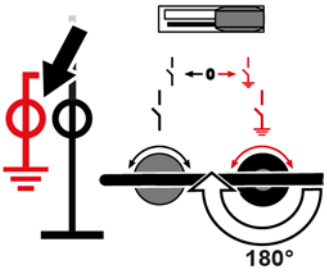
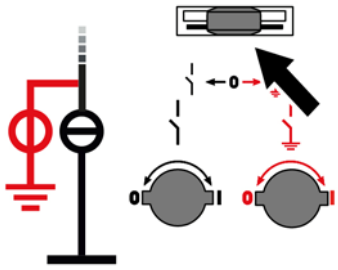
Connecting the voltage transformers or the busbar connection to the busbar

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.

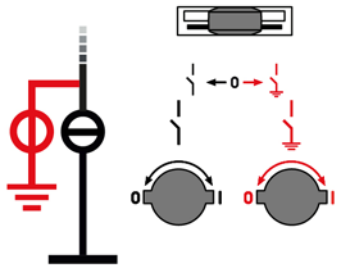
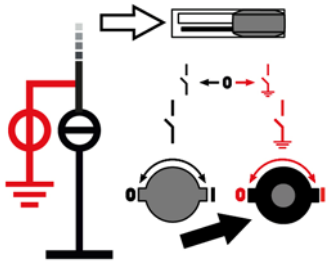
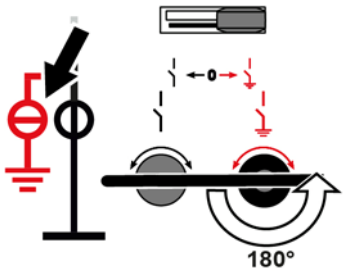
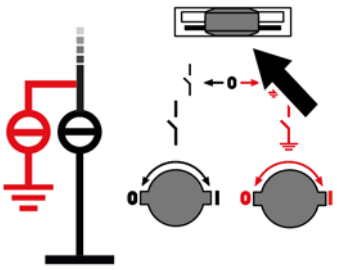
Disconnecting the voltage transformers from the busbar

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 the voltage transformers

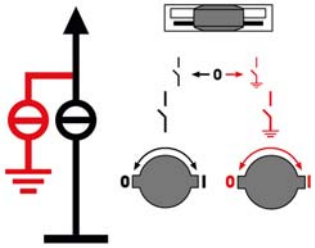
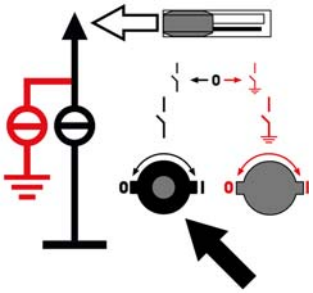
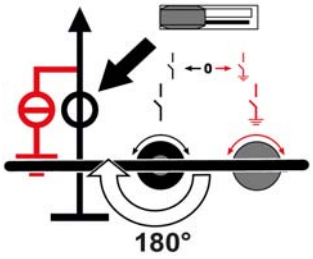
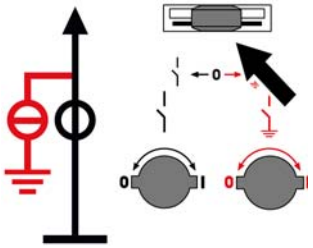
1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector to EARTHED position (insert the operating lever for the READY-TO-EARTH function and turn 180° clockwise).	4  ⇨ Remove the operating lever for the READY-TO-EARTH function. The control gate returns to its initial position.

De-earthing the voltage transformers

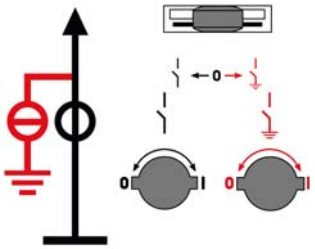
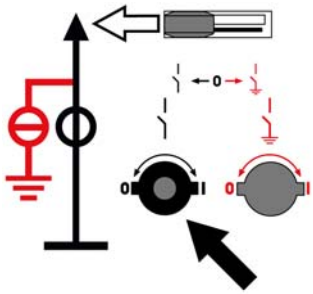
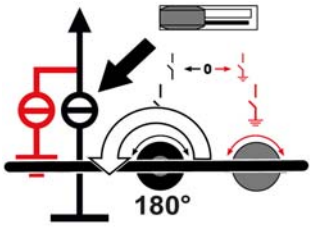
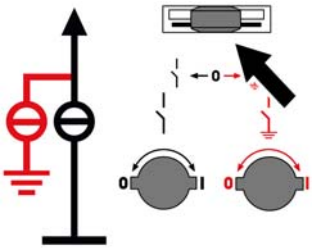
1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector from EARTHED to OPEN position (insert the operating lever for the READY-TO-EARTH function and turn 180° counter-clockwise).	4  ⇨ Remove the operating lever for the READY-TO-EARTH function. The control gate returns to its initial position.

37.5 Switching operations for busbar connection with three-position disconnector

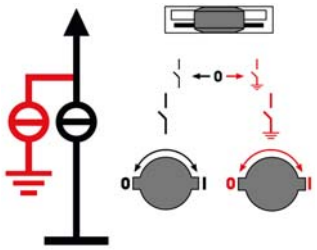
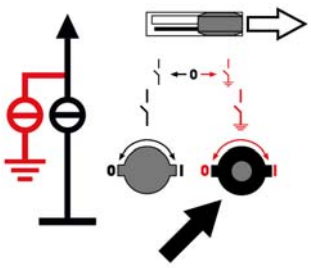
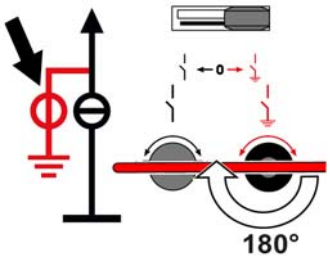
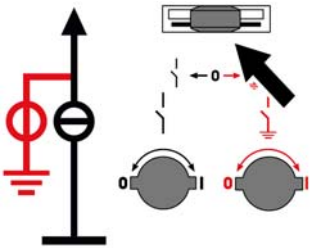
Connecting the busbar to the feeder

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.

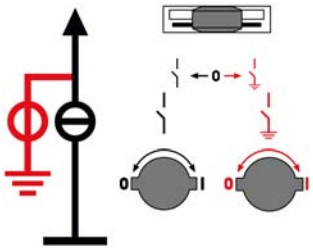
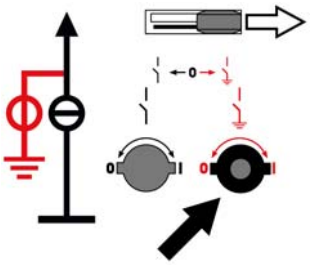
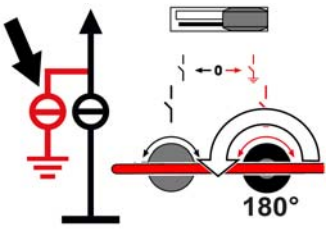
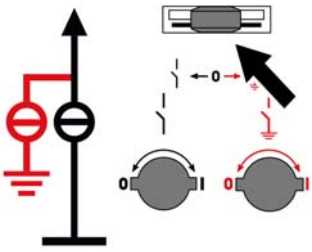
Disconnecting the busbar from the feeder

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 the feeder

1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector to EARTHED 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 the feeder

1  Initial situation	2  ⇨ Push the control gate to the right.
3  ⇨ Switch the three-position disconnector from EARTHED 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.

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 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.

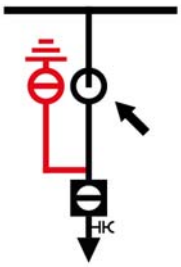


Fig. 195: Example: Position indicator for DISCONNECTING in faulty position

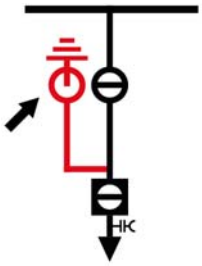
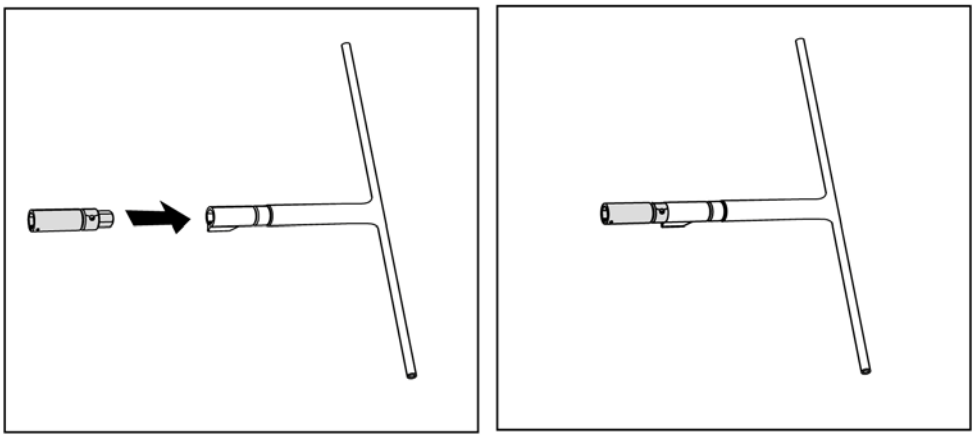


Fig. 196: Example: Position indicator for EARTHING in faulty position

Adapter for emergency operation

⇨ Push emergency operation adapter on operating lever for three-position disconnector.



NOTICE

Incorrect alignment of the operating lever

The noses of the operating lever can damage the position indicator or the operating mechanism of the three-position switch.

⇨ Align the operating lever with pushed-on adapter by the slots of the adapter.

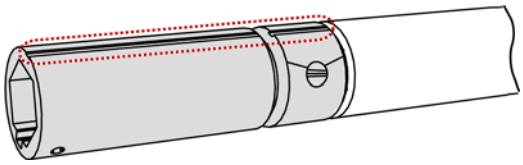


Fig. 197: Marking (long slot) on operating lever with pushed-on adapter

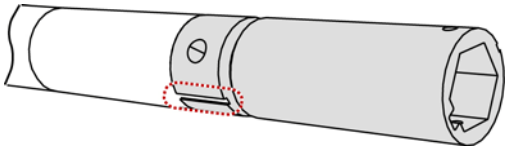


Fig. 198: Marking (short slot) on operating lever with pushed-on adapter

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

NOTICE

The operating lever does not have a stop.

Switching beyond the end position of the three-position switch will damage the three-position switch if the adapter is pushed on.

⇨ 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.

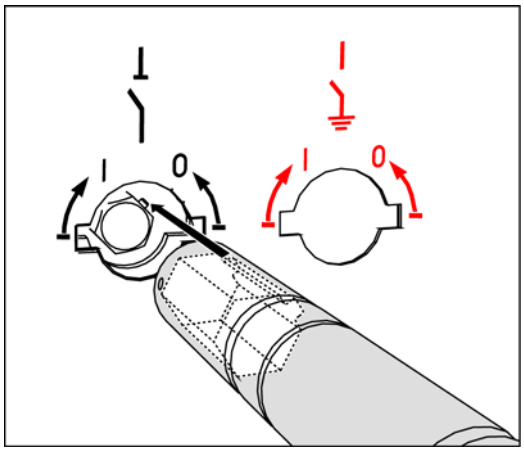
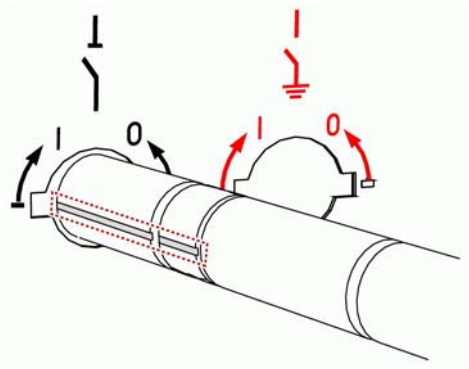
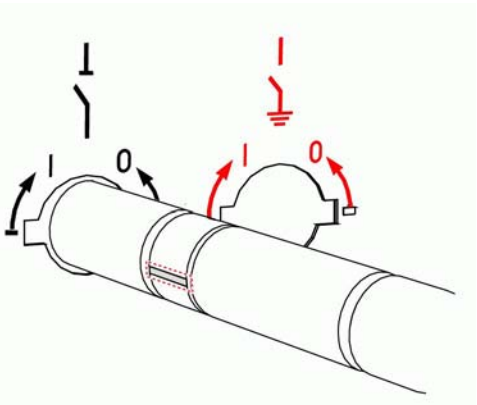
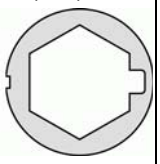
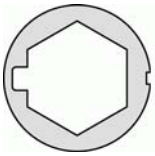
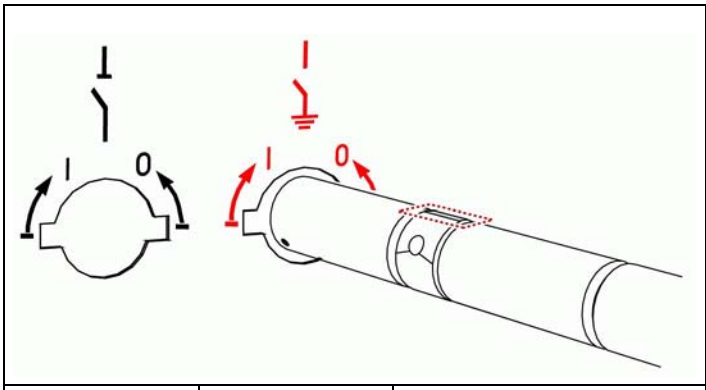
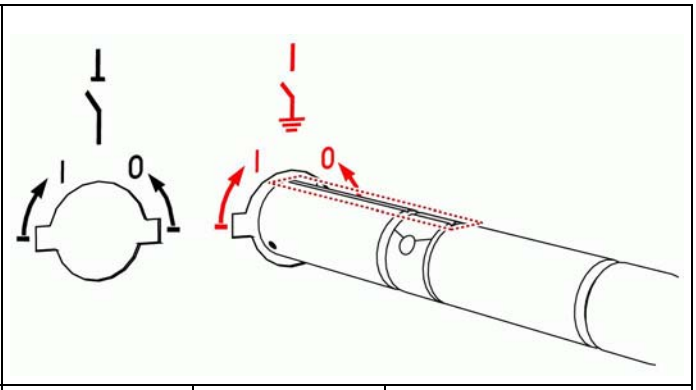
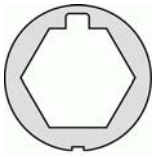
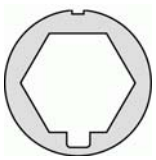


Fig. 199: Inserting the operating lever with pushed-on adapter

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>  </td>
<td>  </td>
</tr>
<tr>
<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.

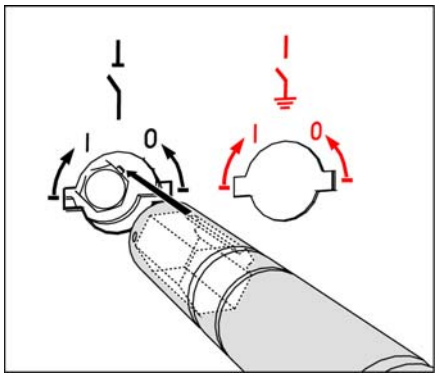


Fig. 200: Inserting the operating lever with pushed-on adapter (DISCONNECTING function)

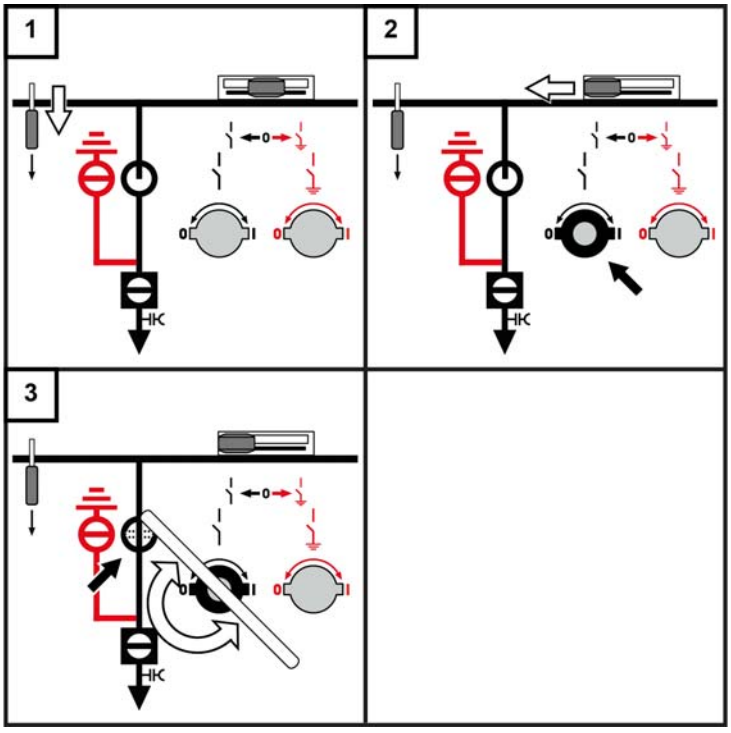


Fig. 201: Emergency operation of the DISCONNECTING function of the three-position disconnector

⇨ Push the interrogation lever downwards.

⇨ 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	bottom	CLOSED
	top	OPEN

⇨ Remove the emergency operating lever again.

✔ The control gate returns to its initial position.

✔ The opening for the DISCONNECTING function is closed.

⇨ Check the correct end position of the operating shaft with the standard operating lever.

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.

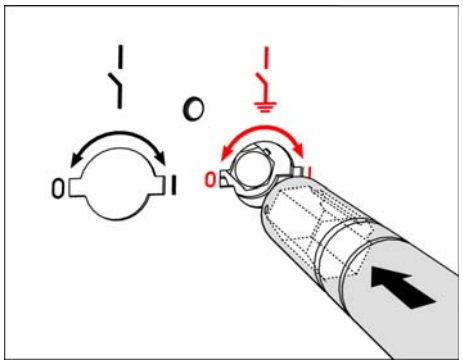


Fig. 202: Inserting the operating lever with pushed-on adapter (READY-TO-EARTH function)

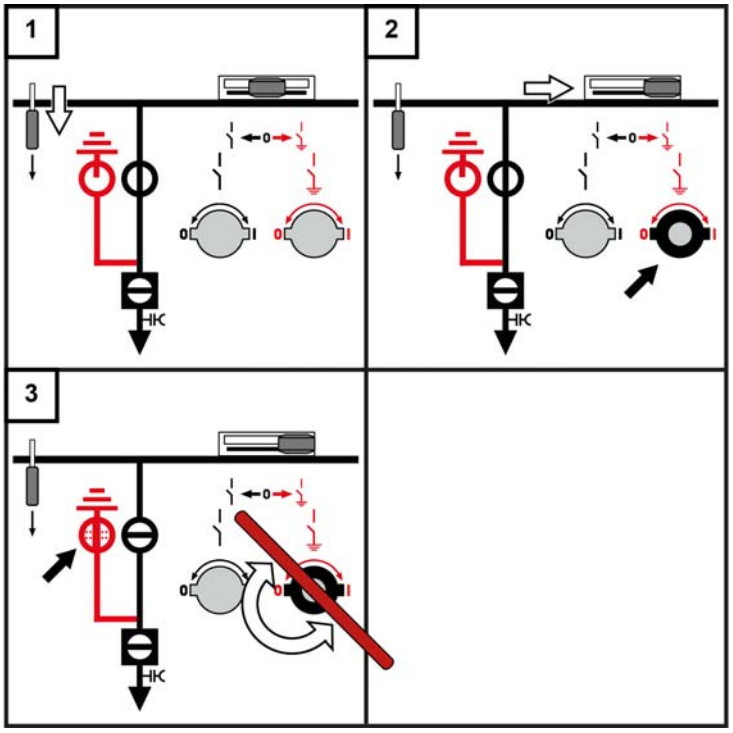


Fig. 203: Emergency operation of the READY-TO-EARTH function of the three-position disconnector

⇨ Push the interrogation lever downwards.

⇨ 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 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 Operating the make-proof busbar earthing switch

38.1 Control elements and indicators

Basic scheme for the busbar earthing switch

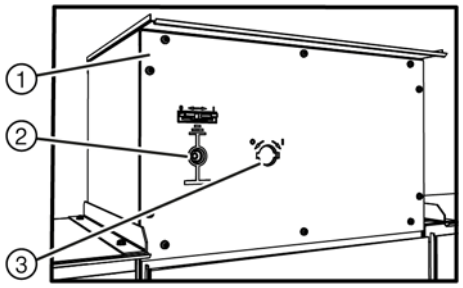


Fig. 204: Manual operating mechanism

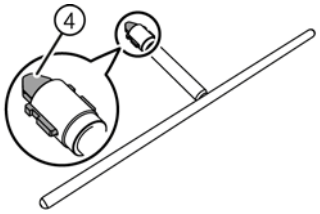


Fig. 205: Operating lever

① Additional compartment for the operating mechanism
② Position indicator
③ Actuating opening
④ Operating spindle

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.

⚠CAUTION

Hazardous voltages and high currents

Can cause injury or property damage.

Repeated switching under load impairs the function of the busbar earthing switch.

➪ Observe the Five Safety Rules (see page 7, "General instructions").

➪ Disconnect the incoming and outgoing feeders in all panels.

NOTICE

Damage to the busbar earthing switch

The control gate can only be moved for a switching operation that is permissible at this moment.

➪ Perform only a permissible switching operation in accordance with the switch position of the position indicator.

NOTICE

Damage to the busbar earthing switch

A switching operation once started must be completed totally. Turning back the operating lever is blocked. The operating lever cannot be removed at intermediate positions.

➪ Do not remove the operating lever by force at intermediate positions.

➪ Do not turn back the operating lever by force.

38.2 Closing

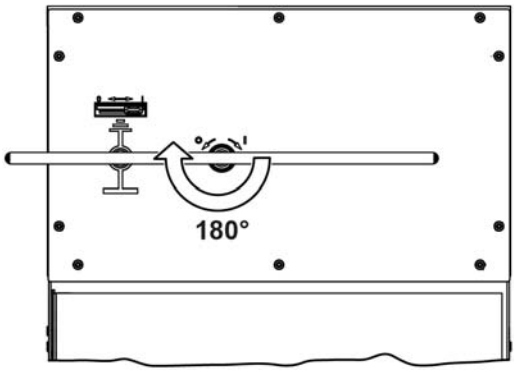


Fig. 206: Closing the busbar earthing switch

⇨ 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 position indicator changes from faulty position to CLOSED position.
✔ The control gate returns to its initial position.
✔ The busbar earthing switch is closed.
⇨ Optionally: Padlock the control gate.

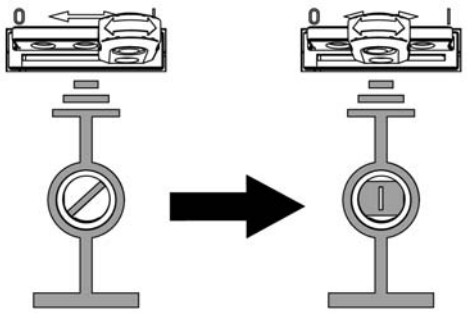


Fig. 207: Position indicator at the make-proof busbar earthing switch

38.3 Opening

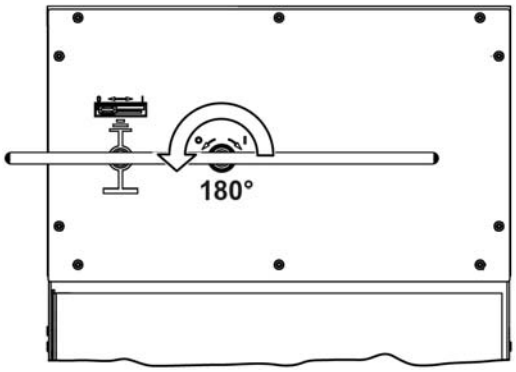


Fig. 208: Opening the busbar earthing switch

⇨ 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 position indicator changes from faulty position to OPEN position.
✔ The control gate returns to its initial position.
✔ The busbar earthing switch is open.
⇨ Optionally: Padlock the control gate.

38.4 Emergency release of the interlock with solenoids at the busbar earthing switch

⚠WARNING

Explosion hazard due to internal arc

Can cause serious injury or property damage. When the interlocking of the control gate is eliminated, switching operations are possible that can cause an arc fault.

⇨ Do only eliminate the interlocking of the control gate when the three-position disconnector is in no-load condition.
⇨ Use a screwdriver suitable for the diameter of the openings.

To push the control gate from center position to right position:

⇨ Remove the left-hand plastic split rivet.
⇨ Insert the screwdriver into the left-hand opening and push the solenoid back.
⇨ Push the control gate to the right.
⇨ Pull out the screwdriver.
⇨ Push the control gate to the right as far as it will go.
⇨ Reinstall the left-hand plastic split rivet.
✔ The left-hand solenoid is released again, blocking further movements.

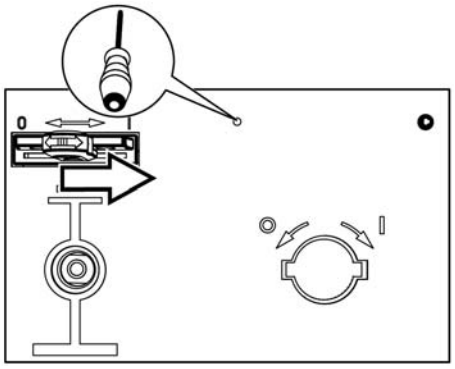


Fig. 209: Pushing the control gate to the right position

To push the control gate from center position to left position:

⇨ Remove the right-hand plastic split rivet.
⇨ Insert the screwdriver into the right-hand opening and push the solenoid back.
⇨ Push the control gate to the left.
⇨ Pull out the screwdriver.
⇨ Push the control gate to the left as far as it will go.
⇨ Reinstall the right-hand plastic split rivet.
✔ The right-hand solenoid is released again, blocking further movements.

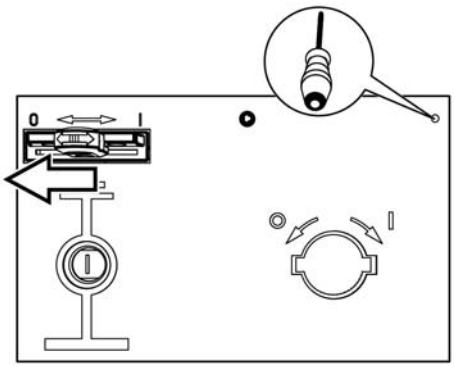


Fig. 210: Pushing the control gate to the left position

To push the control gate from the right or left position to the center position again:

⇨ Remove the plastic split rivet (according to the position of the control gate).
⇨ Push the solenoid back using the screwdriver.
⇨ Push the control gate to the center position.
⇨ Pull out the screwdriver.
⇨ Reinstall the plastic split rivet.
✔ The solenoid is released again, blocking further movements.

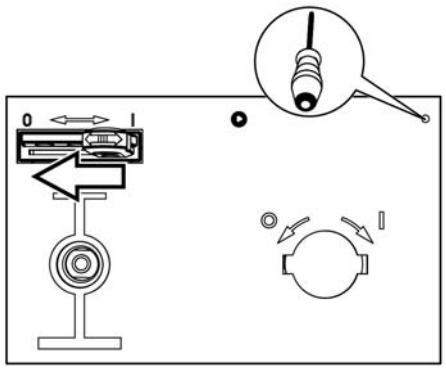


Fig. 211: Pushing the control gate to the center position

39 Verification of safe isolation from supply

☞INFORMATION
The following descriptions do not substitute reading the manufacturer documentation.
⇨ Before using the voltage detecting systems, read the supplied manufacturer documentation.

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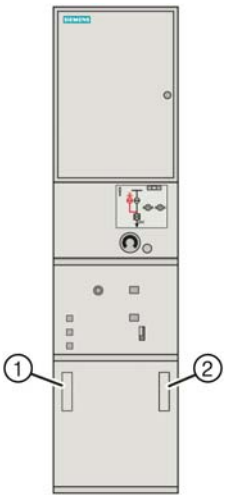
The following descriptions do not substitute reading the manufacturer documentation.
⇨ Before using the voltage detecting systems, read the supplied manufacturer documentation.

Mounting locations for voltage indicator and voltage detecting system

Example: Circuit-breaker panel 2300 A

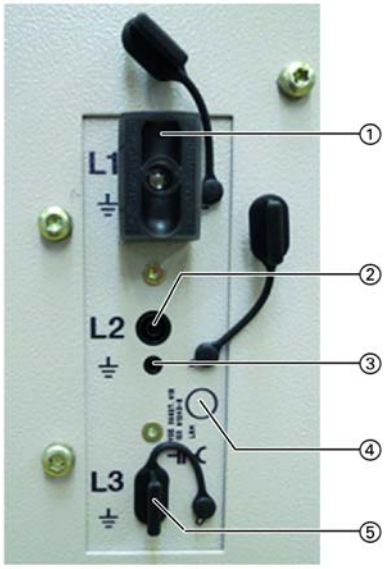


① Voltage indicator / voltage detecting system at the busbar (option)

② Voltage indicator / voltage detecting system at the panel connection (standard)

39.1 LRM plug-in sockets

⚠DANGER
Hazardous voltage **Will cause death, serious injury or considerable property damage.** Verify safe isolation from supply. ⇨ 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 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 61243-5 / IEC 61243-5 / 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 provided if short-circuiting jumpers are used.



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. 212: Verification of safe isolation from supply

⇨ Remove the covers from the plug-in sockets (interfaces of phases L1, L2 and L3).
⇨ Insert the LRM voltage indicator consecutively into the plug-in sockets of the phases L1, L2 and L3.
✔ If the LRM voltage indicator does **not** flash or light up in any of the 3 phases, the phases are not live.
⇨ Refit the covers on the plug-in sockets.

Indication of LRM voltage indicator		Description of the indication
✳	Indication flashes	Phase not isolated from supply
☀	Indication lights up	Phase not isolated from supply
○	No lighting up or flashing of the indication	Phase isolated from supply

39.2 VOIS and CAPDIS indications

⚠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+.
  Attention: 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

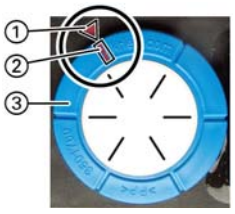


Fig. 213: Marking of the factory setting on the C2 module

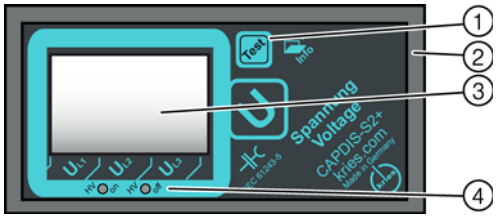


Fig. 214: CAPDIS-S2+: Cover closed

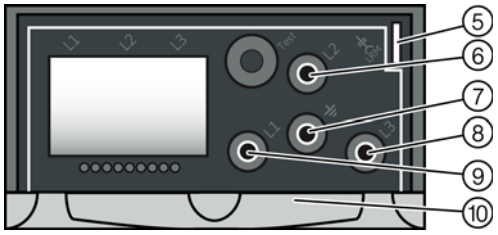


Fig. 215: CAPDIS-S2+: Cover opened

① "Test" button
② Cover
③ LC display
④ LEDs red and green (state of the relay contacts)
⑤ Duct for signaling cables CAPDIS-M
⑥ Test socket L2
⑦ Earth socket
⑧ Test socket L3
⑨ Test socket L1
⑩ Short instructions

Indication	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+					Description of the indication
	L1	L2	L3	L1	L2	L3	L1	L2	L3	State of the relay contacts[1]		
										Red	Green	
A0							000			U ≠ 0 ○	U = 0 ●	Operating voltage not present.
A1	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	Operating voltage present.
A2										U ≠ 0 ○	U = 0 ○	• Operating voltage not present. • Auxiliary voltage not available (only CAPDIS-S2+).
A3			ϟ			ϟ			ϟ	U ≠ 0 ●	U = 0 ●	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication).
A4	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	Voltage (**not** operating voltage) present.
A5	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "Test" passed (lights up shortly).
A6	-			ϟ ERROR	ϟ	ϟ	ϟ ERROR	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "Test" not passed (lights up shortly).
A7	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ●	Overvoltage present (lights up permanently).
A8	-			-			ϟ ERROR	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "ERROR" e.g. in case of missing auxiliary voltage.

[1] ○ ○ LED does not light up, ● ● LED lights up

39.3 WEGA indications

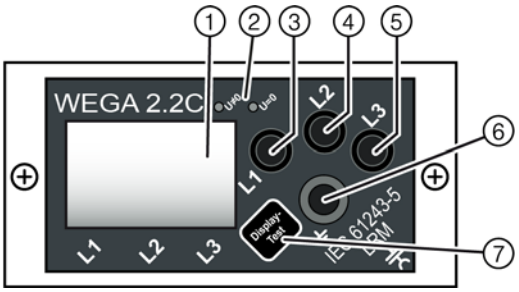
⚠DANGER

Life-endangering high voltage

Risk of death, injury or considerable property damage. Verify safe isolation from supply unambiguously.

⇨ 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 61243-5 / IEC 61243-5 / 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.



① Display (illuminated for WEGA 2.2C)
② LEDs green and red (state of the relay contacts)
③ Test socket L1
④ Test socket L2
⑤ Test socket L3
⑥ Earth socket
⑦ "Display Test" button

Fig. 216: Operating elements WEGA

Indication	WEGA 1.2C			WEGA 2.2C					Description of the indication
	L1	L2	L3	L1	L2	L3	State of the relay contacts[1]		
							Red	Green	
A0							U ≠ 0 ○	U = 0 ●	• Operating voltage not present.
A1	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	• Operating voltage present. • Integrated repeat test passed.
A2							U ≠ 0 ○	U = 0 ○	• Operating voltage not present.
A3	ϟ	ϟ		ϟ	ϟ		U ≠ 0 ●	U = 0 ●	• Failure of the operating voltage at phase L1 • Operating voltage present at phases L2 and L3. • Integrated repeat test passed (L2 and L3).
A4	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	• Voltage present, current monitoring of coupling section below limit value.
A5	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	If "Display Test" button is pressed: • Display test passed.
A6	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ○	U = 0 ●	In operation: • Voltage present and integrated repeat test passed. • Voltage signal too high.
A7				ϟ	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	• Auxiliary voltage missing.

[1] ○ ○ LED does not light up, ● ● LED lights up

40 Cable testing

40.1 Safety instructions

⚠DANGER

Life-endangering high voltage

Can cause death, serious injury and property damage. DC voltage applied to the cable and overvoltages at the busbar can cause flashover.

- ⇨ Keep safety distances.
- ⇨ Install barriers.
- ⇨ Switch on warnings.

⚠DANGER

High voltage and explosion hazard

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.

- ⇨ Switch disconnectable voltage transformers to EARTHED position before testing the cables, and secure them.
- ⇨ Remove non-disconnectable voltage transformers.

NOTICE

Voltage indicators may be damaged by test voltage during cable tests.

May cause property damage.

- ⇨ Short-circuit the voltage indicators with short-circuit plugs at the earthing points of the test sockets.

40.2 Test voltage

Two possibilities for cable testing are described hereafter.

Test voltages

Rated voltage of the switchgear [kV]	DC test voltage		AC test voltage VLF[1] 0.1 Hz	
	Maximum value [kV]	Test duration [min]	Maximum value [kV]	Test duration [min]
7.2	22	15	11	60
12	38	15	19	60
15	52	15	28	60
17.5	52	15	28	60
24	72	15	38	60
25	72	15	38	60
36	72	15	57	60
38.5	72	15	57	60
40.5	72	15	57	60

[1] Very low frequency

⚠CAUTION

Can cause injury or property damage.

Before starting the cable test, the suitability of the cables must be verified regarding the selected test voltage.

- ⇨ If a test duration different from the duration stated above is applied, please contact the regional Siemens representative.

40.3 Function test

Cable testing with dismantled cable

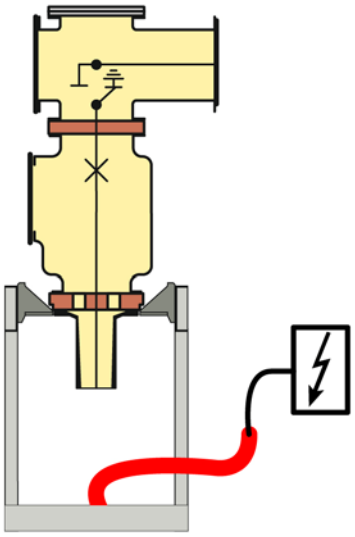


Fig. 217: Test arrangement with dismantled cable

- ⇨ Earth the feeder (see page 161, "Earthing the feeder").
- ⇨ 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

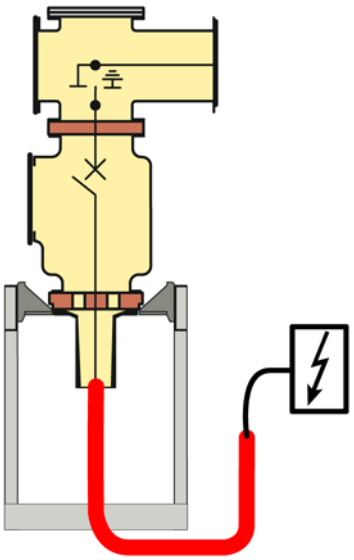


Fig. 218: Test arrangement with connected cable

- ⇨ Earth the feeder (see page 161, "Earthing the feeder").
- ⇨ Remove non-disconnectable voltage transformers.
- ⇨ Short-circuit capacitive test sockets and test sockets on integrated voltage detecting systems (e. g. CAPDIS).
- ⇨ Open the circuit-breaker (see page 155, "Opening the circuit-breaker manually").
- ⇨ Switch three-position disconnector to OPEN position (see page 160, "Disconnecting the feeder from the busbar").
- ⇨ Screw test adapter onto cable termination.
- ⇨ Connect test lead.
- ⇨ Perform voltage test.
- ⇨ After voltage test, earth the feeder (see page 161, "Earthing the feeder").

Servicing

41 Maintenance

Under normal operating conditions, the fixed-mounted circuit-breaker switchgear 8DA10 and the vacuum circuit-breaker 3AH49 are maintenance-free.

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.

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 204, "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.	

Maintenance recommendation

Visual inspection	Status inspection	Maintenance	
X	X	X	Check and document SF_6 gas pressure (see page 35, "Insulating gas")
	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	**In all gas compartments, if gas has to be exchanged or upon reaching the number of operating cycles:** ⇨ Evacuate SF_6 gas. ⇨ Replace desiccant bags. ⇨ Replace toroidal sealing rings. ⇨ Fill in SF_6 gas. ⇨ Check and document gas pressure. ⇨ Check tightness.

41.1 Maintenance of the vacuum circuit-breaker operating mechanism

Under normal operating conditions the fixed-mounted circuit-breaker switchgear 8DA10 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.

⚠DANGER

Hazardous voltage.

Will cause death, serious injury and property damage.

Always observe the Five Safety Rules:

⇨ Isolate.

⇨ Secure against reclosing.

⇨ Verify safe isolation from supply.

⇨ Earth and short-circuit.

⇨ Cover or barrier adjacent live parts.

⚠DANGER

Life-endangering voltage

Can cause death, injury or property damage. If the operating mechanism cover is removed, do not touch any live parts.

⇨ Switch off auxiliary voltage.

⚠WARNING

High speed moving parts

Can cause serious injury.

Do not remove the front cover of the operating mechanism until the following actions have been performed:

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

- Switch the auxiliary voltage supply of the motor.
- Trip the MCB.
- Disconnect the control cables from the low-voltage compartment.

⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:

- Actuate the manual OFF pushbutton.
- Actuate the manual ON pushbutton.
- Actuate the manual OFF pushbutton again.

⇨ Check if the "spring charged" indicator shows "spring charged".

Before starting the maintenance work, see page 158 „Operating the circuit-breaker and the three-position disconnector.

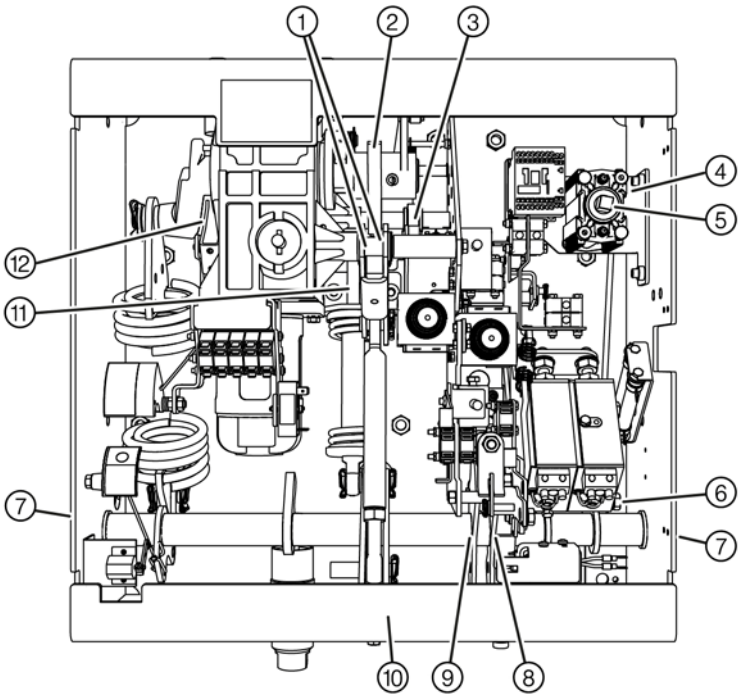


Fig. 219: Lubrication chart for 3AH49 operating mechanism

①	Bearing for deflection lever	⑧	Opening latch
②	Curve contour	⑨	Curve for opening latch
③	Closing latch	⑩	End stop
④ , ⑥	Deflection of auxiliary switch	⑪	Guide of opening spring
⑤	Auxiliary switch	⑫	Crank pin for pushbutton operation
⑦	Bearing of operating shaft		

NOTICE

Contact by cleaning agents

Can cause property damage. Joints and bearings which cannot be dismantled may be damaged by cleaning agents.

➪ Do not use cleaning agents to clean joints and bearings which cannot be dismantled.

Permissible lubricants:

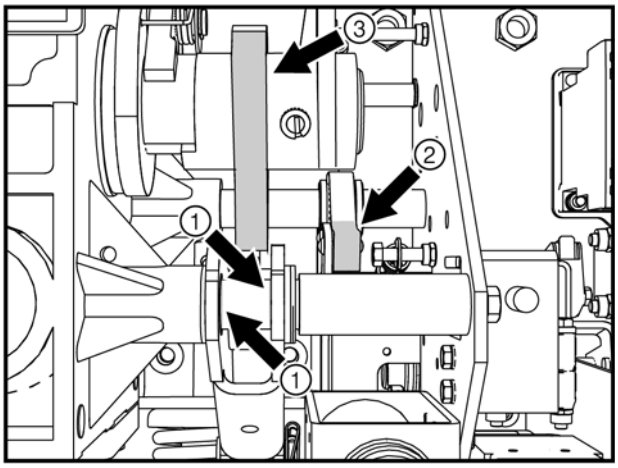
For bearings, sliding surfaces:

Isoflex Topas L 32
Klüber - Lubrication KG
Geisenhauer Str. 7
Postfach 70 10 47
D-81310 Munich

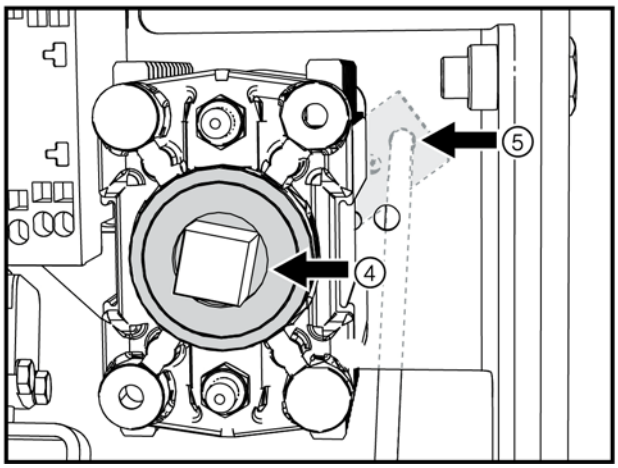
For bearings that are inaccessible for grease, and bearings of the auxiliary switch S1:

Tellus Oil 32
Shell Direct GmbH
Suhrenkamp 71
D-22335 Hamburg

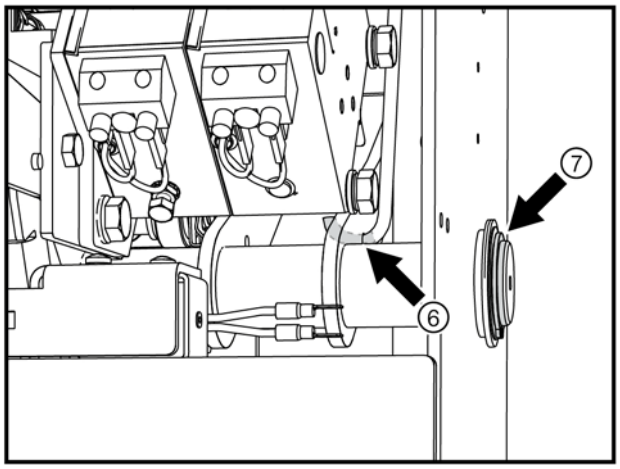
⇨ Renew the anti-corrosion protection greasing.
⇨ Operate the circuit-breaker several times mechanically by hand for test.



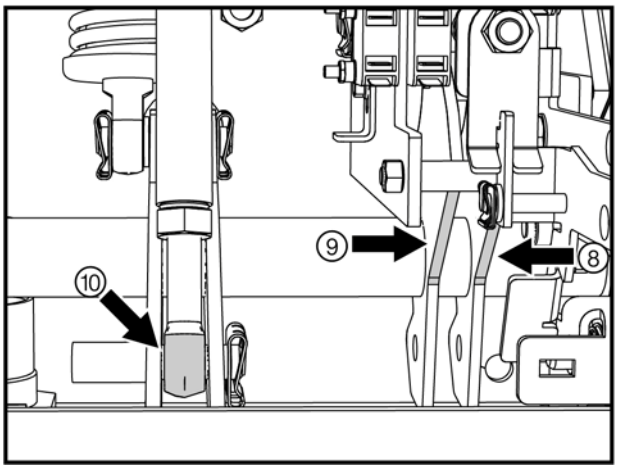
① Bearing for deflection lever (Shell Tellus Oil 32)
② Curve contour (Isoflex Topas L 32)
③ Closing latch (Isoflex Topas L 32)



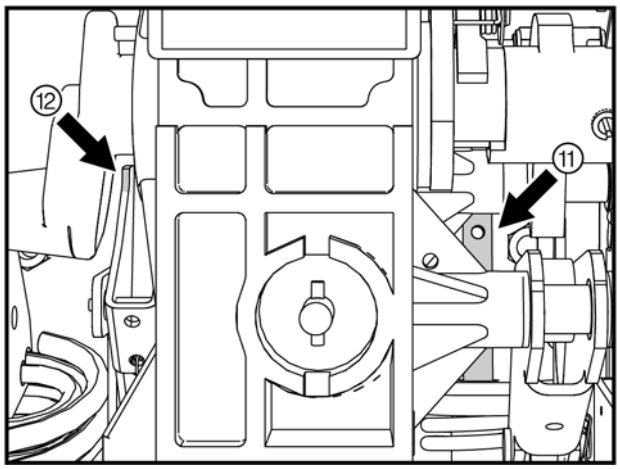
④ Deflection of auxiliary switch (Isoflex Topas L 32)
⑤ Auxiliary switch (Shell Tellus Oil 32)



⑥ Deflection of auxiliary switch (Isoflex Topas L 32)
⑦ Bearing of operating shaft (Shell Tellus Oil 32)



⑧ Opening latch (Isoflex Topas L 32)
⑨ Curve for opening latch (Isoflex Topas L 32)
⑩ Stop (Isoflex Topas L 32)



⑪ Guide of opening spring (Isoflex Topas L 32)
⑫ Crank pin for pushbutton operation (Isoflex Topas L 32)

41.2 Procedure for bolted joints and seals

Please observe the following for the maintenance of switchgear parts with bolted joints:

⇨ Always replace the retaining elements on loosened bolted joints.

Procedure for maintenance of switchgear parts with seals:

⇨ Always replace removed toroidal sealing rings (O-rings) by new ones. Procure the toroidal sealing rings from the 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.
⇨ Fasten the flanges crosswise using the hexagon head bolts M8 and new retaining elements. Tightening torque: 20 Nm.

41.3 Cleaning agents and cleaning aids

☞INFORMATION
For protection of personnel and environment:
⇨ Read the instructions for use of cleaning agents and aids carefully.
⇨ Observe the safety instructions of the cleaning agents.

Activity	Cleaning agents or aids
Cleaning the front covers, cast-resin components, instrument transformers	Mild, customary household cleaner for general degreasing work and cleaning work **(solvent-free)**
Cleaning electrostatically stressed insulation (e.g. epoxy resin)	Dry wiping cloths; plastic cleaner containing alcohol if there is a lot of dirt
Applying and wiping off liquid cleaning agent (single use)	Lint-free cleaning paper
Removing dust	Brush
Damp cleaning, drying	Lint-free wiping cloths
Suction of drilling chips, construction waste, dust	Vacuum cleaner with plastic tip for sensitive components

41.4 Lubricants

Designation	Manufacturer	Application	Remark
Polylub GLY 801	Klüber	Mounting paste for flanges with toroidal sealing rings	No lubricating effect
Barrierta GTE 403	Klüber	Contact lubricating paste for 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	Lubricating paste for bearings of the operating linkage	Not suitable for greasing points on the circuit-breaker operating mechanism
Cold cleaner Haku 1025-975	Kluthe	Degreasing and cleaning paste for sealing surfaces of flanges	
ISOFLEX TOPAS L 32	Klüber	Lubricating paste for bearings of the circuit-breaker operating mechanism	
TELLUS OIL 32	Shell	Lubricating paste for bearings of the circuit-breaker operating mechanism	
KORASILON paste AA-S 250	Obermeier	Mounting paste for silicone adapter and inside-cone cast-resin bush to be used for instrument transformer installation	

41.5 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

41.6 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.

42 End of service life

Service life

Under normal operating conditions, the expected service life of gas-insulated switchgear 8DA10 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 circuit-breakers installed is 10000 (optionally 30000). The current number of operating cycles can be checked on the mechanical operations counter.

SF_6 gas

The equipment contains the fluorinated greenhouse gas SF_6 registered by the Kyoto Protocol with a global warming potential (GWP) of 22 800[2] .

⚠CAUTION

Danger of suffocation and risk of environmental damages

A high concentration of SF_6 in the air can cause suffocation.
Larger amounts of SF_6 in the atmosphere can cause environmental damages.

⇨ 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 (SF_6) has to be observed.

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 Siemens Service Hotline.

[2] Source: "Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16th April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006"

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