

# SIEMENS

## Medium-Voltage Switchgear

Air-Insulated Switchgear NXAIR  
 $\leq 17.5$  kV / 50 kA /  $\leq 4000$  A Busbar Current

### OPERATING INSTRUCTIONS



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Siemens AG  
Energy Management Division  
Medium Voltage & Systems

Since  
1992

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

Since  
1995

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

Since  
2008

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

## About these Instructions

These instructions do not purport to cover all details or variations in equipment. They can also not provide for every possible contingency to be met in connection with installation or operation.

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

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

All dimensions are given in mm.

For further details, e.g. about additional equipment, please refer to catalog HA 25.71.

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

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

## 1 Safety instructions

Hazards are classified in accordance with ISO 3864-2 using the following keywords:

- DANGER, WARNING or CAUTION, in case of personal injury
- NOTICE for material damage

Hazards are classified and indicated in the Operating Instructions as follows:

### **DANGER**

Signal word indicates an immediate and imminent hazardous situation.  
If the hazard is not avoided, death or serious injury will be the consequence.

### **WARNING**

Signal word indicates a potentially hazardous situation.  
If the hazardous situation is not avoided, death or serious injury can be the consequence.

### **CAUTION**

Signal word indicates a potentially hazardous situation.  
If the hazardous situation is not avoided, minor or moderate injury can be the consequence.



## Definitions and symbols

### **NOTICE**

Indicates a potentially damaging situation.  
If the damaging situation is not avoided, the product or something in its vicinity may sustain damage.

### **HINT**

Provides additional information to clarify or simplify a procedure.  
Observe the hint.

Operation symbol:		Asks the operator to perform an operation.
Result symbol:		Identifies the result of an operation.

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# General instructions

## 2 General instructions

### 2.1 General instructions

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

Please do absolutely observe the following:

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

Any kind of modification on the product or alteration of the product must be coordinated with the manufacturer in advance. Non-coordinated 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 Part 200) may not be guaranteed anymore. This applies especially though not exclusively to the following actions:

- Original Siemens spare parts were not used.
- Service technicians performing replacement were not trained and certified by Siemens.
- Parts were fitted or adjusted incorrectly.
- Settings were not made in accordance with Siemens specifications.
- After installation and setting, no final check was performed by a service technician approved by Siemens, including documentation of the test results.
- Maintenance was not done according to the Operating Instructions of the Siemens products.

The edition of the standard is only mentioned in the test report applicable at the time of switchgear manufacture.

These Operating Instructions should be used jointly with the Operating Instructions for circuit-breaker type 3AK7 and/or Operating Instructions for contactor type 3TM3.

### 2.2 Five Safety Rules of Electrical Engineering

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

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

### 2.3 Hazardous substances

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

## 2.4 Personal protective equipment (PPE)

For switchgear with proven internal arc classification according to IEC 62271 Part 200, no protective equipment is required **for operation of the switchgear**.

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

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

The protective equipment consists of:

- Protective clothing such as bib overall and long-arm jacket from NOMEX material (see Internet: NOMEX work clothes)
- Safety shoes
- Gloves
- Helmet and face protection
- Ear protection

## 2.5 Due application

The air-insulated medium-voltage switchgear type NXAIR is a type-tested and metal-clad switchgear for indoor installation, with type of accessibility A and internal arc classification (IAC): IAC A FLR 50 kA 1 s or IAC A FL 50 kA 1 s according to IEC 62271 Part 200.

The switchgear can be used as indoor installation according to IEC 61936 (Power Installations exceeding AC 1 kV) in lockable electrical service locations. A lockable electrical service location is a room or a place that is exclusively used for operating electrical equipment and which is kept under lock and key. Access to such a room is restricted to skilled electricians.

In the basic version, the degree of protection of the enclosure of NXAIR medium-voltage switchgear is IP3XD according to IEC 60529.

When the switchgear is operated within the technical parameters defined in these instructions, the air-insulated switchgear type NXAIR is suitable for rated voltages up to and  $U_r = 17.5$  kV and a maximum rated short-time withstand current of  $I_k = 50$  kA.

The circuit-breaker to be used in a circuit-breaker panel must only be the Siemens type 3AK7.

The air-insulated medium-voltage switchgear type NXAIR is suitable for operational switching of AC circuits in transformer substations of public power supply systems or in industrial plants.

The medium-voltage switchgear NXAIR is available with the panel versions:

- Circuit-breaker panel
- Disconnecting panel
- Metering panel
- Contactor panel
- Busbar current metering panel
- Bus sectionalizer
- Busbar connection panel

## 2.6 Qualified personnel

Qualified personnel in accordance with these Operating Instructions are persons who are familiar with operation and maintenance of the product and have appropriate qualifications for their work.

**Furthermore, qualified personnel must have the following training and instruction or authorization:**

- Training and instruction or authorization to switch on, switch off, earth and identify power circuits and equipment / systems as per the relevant safety standards
- Training and 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

### 2.7 Update of the firmware of protection relays

#### NOTICE

##### Old firmware versions

If the firmware of the protection relays is not updated, it is theoretically possible for third parties to access the protection relay through the Internet due to a weak point in the firmware of the protection relays.

- ⇒ Verify the latest version of the firmware of the protection relays on the specified website.
- ⇒ Update the firmware of the protection relays with the latest firmware version.

Siemens protection relays are monitored for their firmware vulnerability. In case that any potential weak points are identified which might allow third parties to access to the protection relay, information concerning this will be distributed by newsletter.

Please visit below website to register to the SIPROTEC and SICAM security update report to receive latest news.

- [www.siemens.com/gridsecurity](http://www.siemens.com/gridsecurity)

Before commissioning please ensure that the firmware of protection relays is up-to-date. For latest firmware version for Siemens devices please visit below internet site.

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

For protection relays of other manufacturers please get in touch with the Original Equipment Manufacturer

## 3 Features

The air-insulated medium-voltage switchgear type NXAIR has the following features:

- Factory-assembled, type-tested, metal-enclosed and metal-clad switchgear for indoor installation
- Type of accessibility A
- Internal arc classification (IAC):  $IAC \ A \ FLR \leq 50 \text{ kA } 1 \text{ s}$  or  $IAC \ A \ FL \leq 50 \text{ kA } 1 \text{ s}$  according to IEC 62271 Part 200
- Loss of service continuity category: LSC 2B (metal-clad)
- Partition class: PM (metallic partition)
- All switching operations can be carried out at the panel front with the high-voltage door closed
- Standard degree of protection IP3XD for the metal enclosure according to IEC 60529
- Metallic, positively driven shutters protect against accidental contact with live parts inside the panel
- Logical interlock between actuation, circuit-breaker, disconnecting function and feeder earthing switch operating mechanism prevent maloperation
- Earthing of feeders by means of earthing switches with short-circuit making capacity
- Mechanical position indicators for the withdrawable part / switching-device truck and the feeder earthing switch integrated in the mimic diagram at the panel front
- Enclosure made of galvanized sheet steel
- Front doors and lateral switchgear end walls are powder-coated with resistant epoxy resin material
- Individual modular compartments in solid-wall design
- Modular compartments bolted together

Further information to design features and design options is given in catalog HA 25.71.

## 4 Technical data

### 4.1 Complete switchgear

Rated voltage	[kV]	7.2	12	17.5
Rated frequency	[Hz]	50/60	50/60	50/60
Rated power-frequency withstand voltage	[kV]	20 <sup>1)</sup>	28 <sup>1)</sup>	38
Rated lightning impulse withstand voltage	[kV]	60	75	95
Rated short-time withstand current, max.	[kA]	50	50	50
Rated duration of short circuit, max.	[s]	3	3	3
Rated peak withstand current	[kA]	125/130 <sup>3)</sup>	125/130 <sup>3)</sup>	125/130 <sup>3)</sup>

Rated voltage	[kV]	7.2	12	17.5
Rated normal current of busbar, max.	[A]	4000	4000	4000
Rated normal current of feeders, max.				
with circuit-breaker	[A]	4000	4000	4000
with disconnecter	[A]	4000	4000	4000
with contactor	[A]	400 <sup>2)</sup>	400 <sup>2)</sup>	—
as bus sectionalizer	[A]	4000	4000	4000

<sup>1)</sup> Available as special version: 32 kV at 7.2 kV, or except for contactor 42 kV at 12 kV

<sup>2)</sup> Depending on rated current of installed HV HRC fuse-links

<sup>3)</sup> Max. 137 kA in combination with generator circuit-breaker according to IEEE 62271-37-013

### 4.2 Basic prescriptions and standards

The indoor switchgear complies with the following prescriptions and standards:

		IEC / EN standard
<b>Switchgear</b>		62271-1
		62271-200
<b>Switching devices</b>	Circuit-breakers	62271-100
	Contactors	60470
	Disconnectors / earthing switches	62271-102
<b>Current limiting fuses</b>		60282-1
<b>Voltage detecting systems</b>		61243-5
<b>Insulation</b>		60071-1
<b>Degree of protection</b>		60529
<b>Instrument transformers</b>	Current transformers	61869-2
	Voltage transformers	61869-3
<b>Installation, erection</b>		61936-1

### 4.3 Electromagnetic compatibility - EMC

The a.m. standards as well as the "EMC Guide for Switchgear" <sup>1)</sup> are applied during design, manufacture and erection of the switchgear. Installation, connection and maintenance have to be performed in accordance with the stipulations of the operating instructions. For operation, the legal stipulations applicable at the place of installation have to be observed additionally. In this way, the switchgear assemblies of this type series fulfill the basic protection requirements of the EMC Guide.

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

<sup>1)</sup> Dr. Bernd Jäkel, Ansgar Müller; Medium-Voltage Systems - EMC Guide for Switchgear

### 4.4 Rating plates

Each panel has a rating plate fixed on the inside of the doors to the high-voltage and low-voltage compartment containing the following information:


SIEMENS					
Type: NXAIR			Year of manufacture: 2017		
Serial-no.: Y2 300930894/11			Functional unit no.: 11		
	$I_r = 2500\text{ A}$		IEC 62271-200		PM / LSC 2B
	$I_r = 1250\text{ A}$		$T = 40\text{ }^{\circ}\text{C}$		
			$f_r = 50\text{ Hz}$		
$U_r = 12\text{ kV}$		$U_p = 75\text{ kV}$		$U_d = 28\text{ kV}$	
$I_k = 50\text{ kA}$		$I_p = 125\text{ kA}$		$t_k = 3\text{ s}$	
$U_a = 110\text{ VDC}$					
IAC FLR as per IEC 62271-200					
Accessibility type A			Test current : 50 kA 1 s		
Operating instructions : 172-2013.9 / 172-2014.9					
Ratings of installed components must also be considered!					
MADE IN TÜRKIYE					

Fig. 1: Rating plate

- |                                 |  |
|---------------------------------|--|
| (1) Switchgear type             | (5) Number of operating instructions for the panel       |
| (2) Serial number               | (6) Year of manufacture                                  |
| (3) Technical data              | (7) Panel number   |
| (4) Internal arc classification | (8) Loss of service continuity category, partition class |

The block-type current transformers and the voltage transformers have their own type plates. A copy is provided on the inside of the high-voltage door.

### 4.5 IAC classification

The data (see fig. 1) describes the internal arc classification of the panel according to IEC 62271-200. The entries **IAC A FLR 50 kA 1 s** and accessibility type **A** in the example shown mean:

- **IAC:** Internal Arc Classification
- **F:** Internal arc classification for the front side (Front)
- **L:** Internal arc classification for the lateral sides (Lateral)
- **R:** Internal arc classification for the rear side (Rear)
- **50 kA:** Tested short-circuit current
- **1 s:** Test duration
- **A:** Type of accessibility A; for authorized personnel only

The IAC classification is referred to each panel. The data on the rating plate (see fig. 1) describes the areas classified for the corresponding panel.

## Technical data

### 4.6 Panel dimensions

#### Width

Panel type	I <sub>k</sub> [kA]	I <sub>r</sub> [A]	Width [mm]
Circuit-breaker panel, disconnecting panel	50	1250, 1600	800
		2500, 3150, 4000	1000
Metering panel		—	800
Bus sectionalizer		1250	2 × 800
		2500, 3150, 4000	2 × 1000 <sup>1)</sup>
Contactors panel		400	435

<sup>1)</sup> For 2500 A bus sectionalizer type 2 with optimized panel width (1 × 1000 mm + 1 × 800 mm)

#### Height

Panel version	Height [mm]
With standard low-voltage compartment	2500
With high low-voltage compartment	2550
With additional compartment for busbar components	2550
With pressure relief duct and arc absorber	2680
With forced ventilation	2650

#### Depth

Panel version	Size of CTs in connection compartment	Depth [mm]
All	Standard version	1650
All	Extended version	1800

### 4.7 Room planning

According to chapter 5 in the Installation Instructions with order number 172-2014.9.

### 4.8 Operating conditions

NXAIR switchgear is designed for normal indoor operating conditions according to IEC 62271-1.

In this respect, the following limit values for the ambient air temperature must be complied with:

Limit value	Temperature [°C]
Maximum value	+40*
Minimum value	−5*
Maximum value of 24-hour mean	+35*

The site altitude is maximum 1000 m above sea level as a standard level.

When NXAIR switchgear is used in regions with high air humidity or considerable temperature fluctuations, there is risk of condensation. The formation of condensation should be an exception under normal operating conditions. To prevent condensation, rusting or other serious consequences, the associated preventive measures must be taken by installing electrical heating equipment in the switchgear. The ambient air must not be significantly polluted by dust, smoke, corrosive and/or flammable gases, vapors or salt.

\* If NXAIR is used under other service conditions than normal service conditions acc. to IEC 62271 Part 1 regarding the ambient air temperature, the permissible current ratings of feeder and busbar can deviate. In this case please contact the regional Siemens representative to clarify permissible current values.

#### 4.9 Vacuum circuit-breaker type 3AK7

The vacuum circuit-breaker type 3AK7 is a 3-pole indoor circuit-breaker for ratings from 7.2 kV to 17.5 kV. A rating plate is provided on the operating mechanism unit of every circuit-breaker type 3AK7.



(1) Rating plate on circuit-breaker

Fig. 2: 3AK7 circuit-breaker

#### 4.10 Operating instructions for circuit-breaker type 3AK7

For circuit-breakers type 3AK7, separate operating instructions are available with detailed instructions and information. The operating instructions are supplied as standard with every circuit-breaker type 3AK7. Additional operating instructions in different languages can be ordered at the regional Siemens representative.

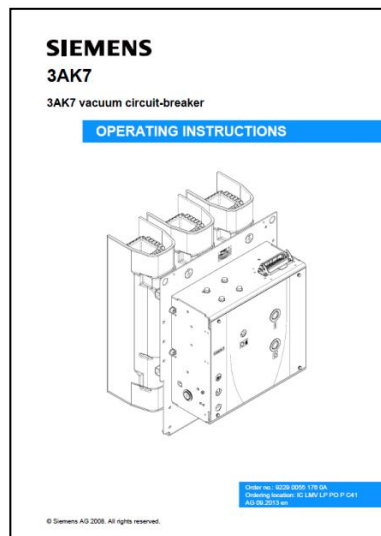


Fig. 3: Operating instructions for circuit-breaker type 3AK7

#### Available operating instructions for circuit-breaker type 3AK7:

Language	Order number of operating instructions
German	9229 0055 100 0A
Russian	9229 0055 156 0A
Italian	9229 0055 172 0A
English	9229 0055 176 0A
French	9229 0055 177 0A
Spanish	9229 0055 178 0A
Portuguese	9229 0055 179 0A

### 4.11 Operating instructions for contactor type 3TM3

For contactors type 3TM3, separate operating instructions are available with detailed instructions and information. The operating instructions are supplied as standard with every contactor type 3TM3. Additional operating instructions in different languages can be ordered at the regional Siemens representative.

#### Available operating instructions for contactor type 3TM3

Language	Order number of operating instructions
English	9229 0090 176 0A
German	9229 0090 100 0A
Russian	9229 0090 156 0A
Polish	9229 0090 155 0A

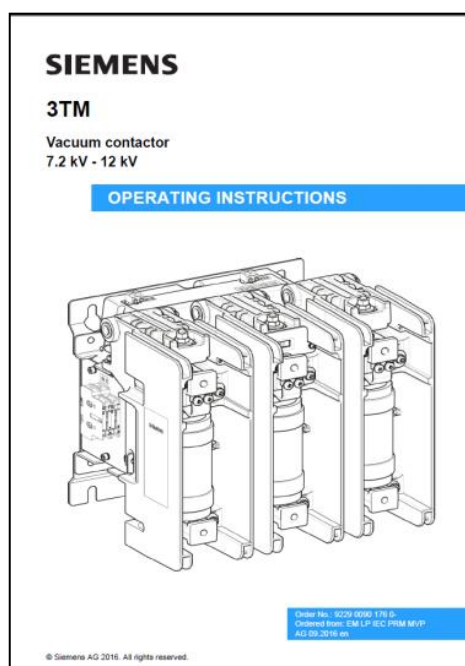


Fig. 4: Operating instructions for contactor type 3TM3

# Overview of panel versions

## 5 Overview of panel versions

The air-insulated medium-voltage switchgear NXAIR consists of various panel versions which can be freely combined according to the requirements.

The following panel versions are available:

- Circuit-breaker panel
- Disconnecting panel
- Metering panel
- Bus sectionalizer, type 1
  - 1 × circuit-breaker panel plus 1 × bus riser panel with disconnecter link
- Bus sectionalizer, type 2
  - 1 × circuit-breaker panel plus 1 × bus riser panel, optionally with metering part
- Busbar current metering panel
- Busbar connection panel
  - optionally with metering part
- Contactor panel

Further information to design features and design options is given in catalog HA 25.71.

### Overview of panel versions:

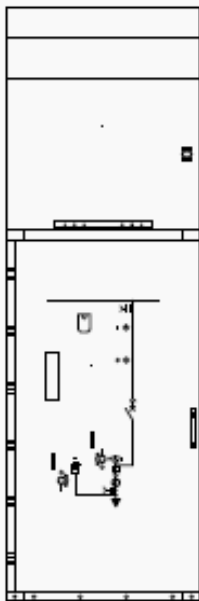


Fig. 5 Circuit-breaker panel

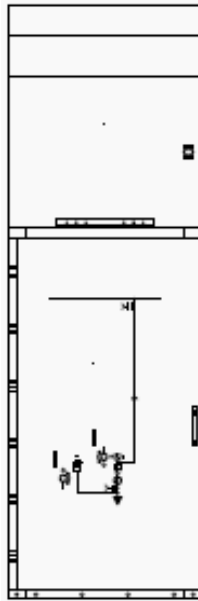


Fig. 6: Disconnecting panel

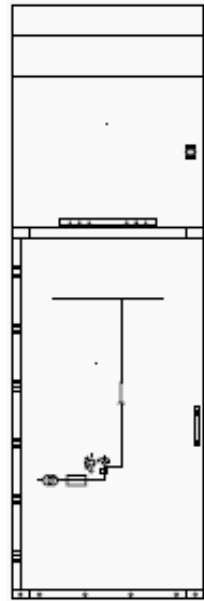


Fig. 7: Metering panel

## Overview of panel versions

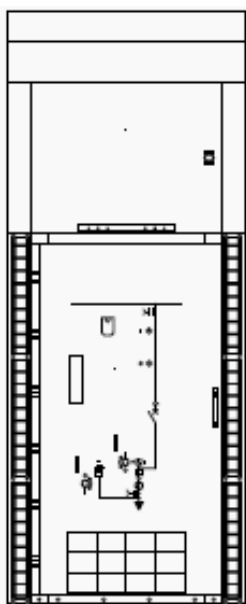


Fig. 8: Panel version with natural ventilation

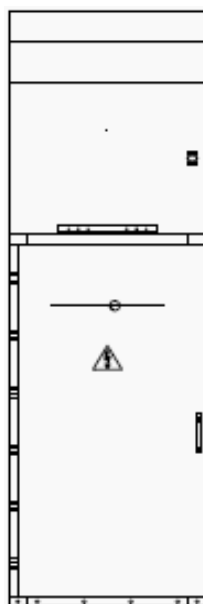


Fig. 9: Busbar current metering panel

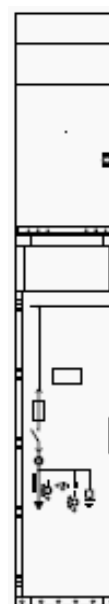


Fig. 10: Contactor panel

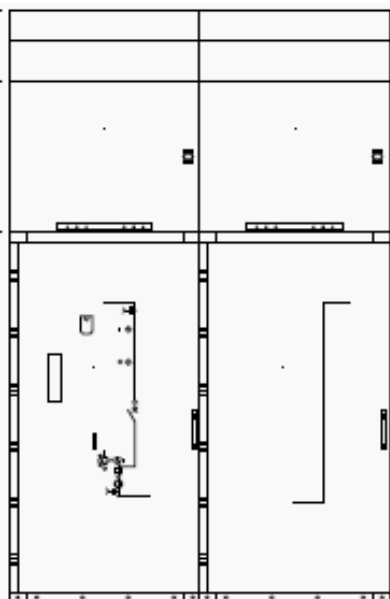


Fig. 11: Bus sectionalizer to the right <sup>1)</sup>, circuit-breaker and bus riser panel

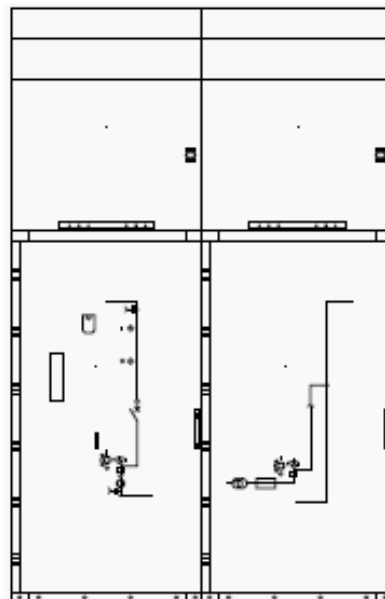


Fig. 12: Bus sectionalizer to the right <sup>1)</sup>, circuit-breaker and bus riser panel with withdrawable metering part / metering truck

<sup>1)</sup> Can also be designed as a mirror image to the left

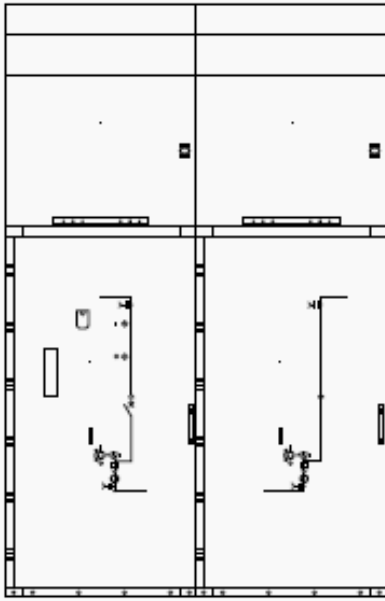


Fig. 13: Bus sectionalizer to the right <sup>1)</sup>, circuit-breaker and bus riser panel with withdrawable disconnecter link / disconnecter truck

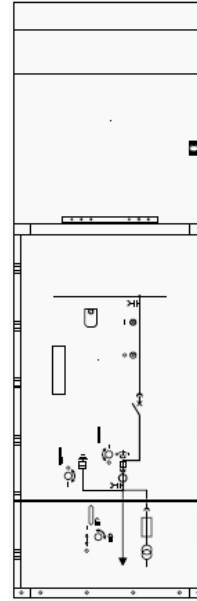


Fig. 14: Circuit-breaker panel with removable voltage transformers

<sup>1)</sup> Can also be designed as a mirror image to the left

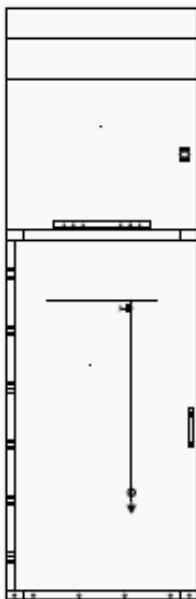


Fig. 15: Busbar connection panel without withdrawable metering part / metering truck

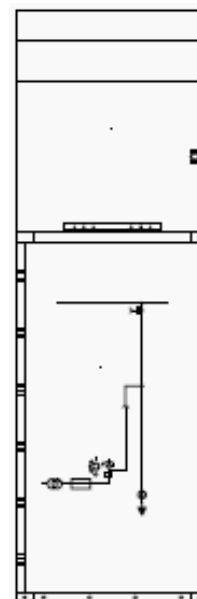


Fig. 16: Busbar connection panel with withdrawable metering part / metering truck

## 6 Panel design

### 6.1 Basic design

In the basic design, NXAIR is available both as withdrawable and as truck-type switchgear. In the basic design as withdrawable switchgear, the removable part is taken out of the panel or inserted in the panel by means of a service truck.

In the basic design as truck-type switchgear, the removable part is always positively combined with a service truck. For truck-type switchgear, this means that always the complete truck is taken out of the panel or inserted in the panel.

The basic operation or interlocking of the switching devices in the two basic designs, such as:

- Switching the circuit-breaker to CLOSED position or OPEN position
- Racking the withdrawable part / switching-device truck to service position or test position
- Switching the feeder earthing switch to CLOSED position or OPEN position
- Mechanical or electrical interlocking of the individual devices in the panel

is identical.



Fig. 17: Basic design as withdrawable switchgear



Fig. 18: Basic design as truck-type switchgear

## 6.2 Basic design circuit-breaker panel

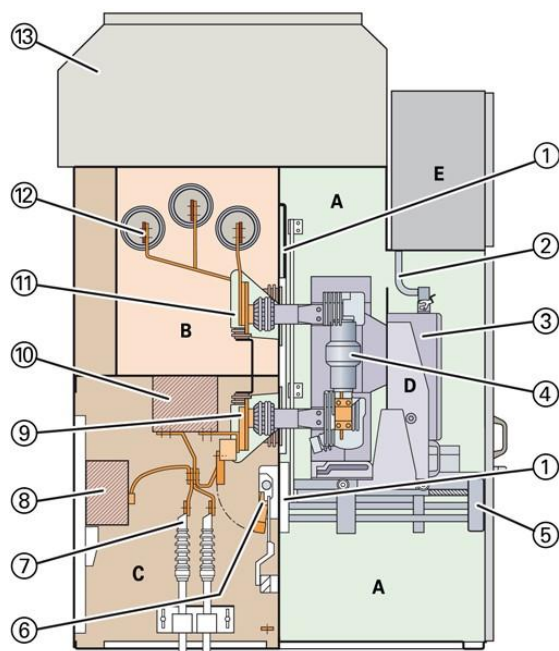


Fig. 19: Sectional view of circuit-breaker panel design

- A Switching-device compartment
- B Busbar compartment
- C Connection compartment
- D Withdrawable circuit-breaker / circuit-breaker truck
- E Low-voltage compartment
- (1) Metallic shutters
- (2) Low-voltage connection
- (3) Operating and interlocking unit for circuit-breaker
- (4) Vacuum interrupters
- (5) Operating and interlocking unit for racking the withdrawable circuit-breaker / circuit-breaker truck and for earthing
- (6) Feeder earthing switch
- (7) Connection for up to 6 cables / bars per phase
- (8) Voltage transformers (optional)
- (9) Contact systems
- (10) Block-type current transformers
- (11) Bushing-type insulators
- (12) Busbar
- (13) Pressure relief duct

## 6.3 Basic design contactor panel

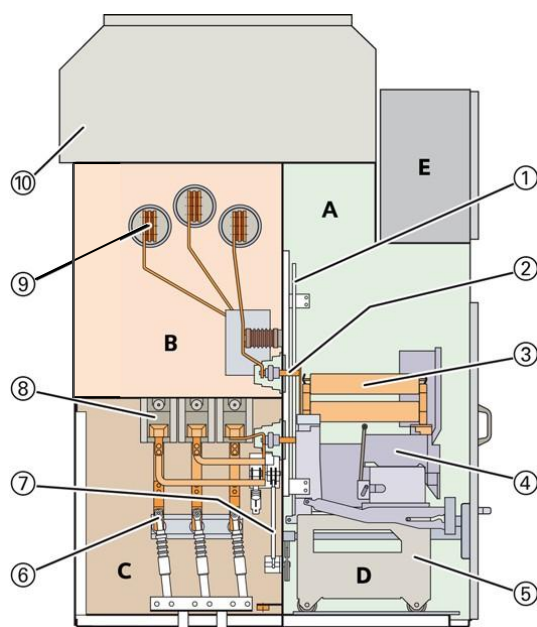


Fig. 20: Sectional view of contactor panel design

- A Switching-device compartment
- B Busbar compartment
- C Connection compartment
- D Contactor truck
- E Low-voltage compartment
- (1) Metallic shutters
- (2) Contact systems
- (3) HV HRC fuse-links
- (4) Vacuum contactor
- (5) Operating and interlocking unit for racking the contactor truck and for earthing
- (6) Connection for up to 2 cables per phase
- (7) Feeder earthing switch
- (8) Block-type current transformers
- (9) Busbar
- (10) Pressure relief duct

Further information to design features and design options is given in catalog HA 25.71.

## 7 Interlocks

### 7.1 Mechanical interlocks in panel versions with withdrawable parts

Action	Internal preconditions
Inserting the withdrawable part in the panel	Withdrawable part on the service truck
Pulling the withdrawable part out of the panel	None
Racking the withdrawable part to service position	Withdrawable part inserted and interlocked
	Low-voltage connector plugged on
	High-voltage door closed
	Circuit-breaker in OPEN position / contactor in OPEN position
	Feeder earthing switch in OPEN position
Plugging on the low-voltage connector	Consistent coding between connector and withdrawable part fulfilled <sup>1)</sup>
Racking the withdrawable part to test position	Circuit-breaker in OPEN position / contactor in OPEN position
Closing the circuit-breaker / closing the contactor	Withdrawable part in interlocked end position (test position or service position)
Closing the circuit-breaker	Undervoltage release not electrically operated
Opening the circuit-breaker / opening the contactor	None
Closing the contactor	HV HRC fuse-links not tripped
Operating the feeder earthing switch	Withdrawable part in test position
Operating the busbar earthing switch	None (see note below)
Opening the high-voltage door	Withdrawable part in test position
Closing the high-voltage door	Low-voltage connector plugged on

<sup>1)</sup> Not feasible with contactor panel



#### HINT

Contactor panel is not available with withdrawable switchgear.

## 7.2 Mechanical interlocks in panel versions with switching-device trucks

Action	Internal preconditions
Inserting the switching-device truck in the panel	Switching-device truck available
Pulling the switching-device truck out of the panel	None
Racking the switching-device truck to service position	Switching-device truck inserted and interlocked
	Low-voltage connector plugged on
	High-voltage door closed
	Circuit-breaker in OPEN position
	Feeder earthing switch in OPEN position
Plugging on the low-voltage connector	Consistent coding between connector and switching-device truck fulfilled
Racking the switching-device truck to test position	Circuit-breaker in OPEN position
Closing the circuit-breaker	Switching-device truck in interlocked end position (test position or service position)
Closing the circuit-breaker	Undervoltage release not electrically operated
Opening the circuit-breaker	None
Operating the feeder earthing switch	Switching-device truck in test position
Operating the busbar earthing switch	None (see note below)
Opening the high-voltage door	Switching-device truck in test position
Closing the high-voltage door	Low-voltage connector plugged on

## 7.3 Additional electromagnetic interlocks (optional)

Action	Additional preconditions
Racking the withdrawable part / switching-device truck	General or external release
Operating the feeder earthing switch	General or external release <sup>1)</sup>
Operating the busbar earthing switch	General or external release

<sup>1)</sup> Not feasible with contactor panel with panel width 435 mm

## HINT

Panel versions with electromagnetic interlock are identified on the high-voltage door with labels for interlocking the disconnecting and/or earthing function:

Racking the withdrawable part is interlocked by a solenoid interlock.

When auxiliary voltage is missing, racking the withdrawable part is completely interlocked.

Operation of the earthing switch is interlocked by a solenoid interlock.

When auxiliary voltage is missing, operation of the earthing switch is completely interlocked.

## HINT

The busbar earthing switch is secured against unintentional operation by means of a padlock or an electromagnetic interlock.

Panel version with electromagnetic interlock is identified on the door to the low-voltage compartment with a label:

Operation of the earthing switch is interlocked by a solenoid interlock.

When auxiliary voltage is missing, operation of the earthing switch is completely interlocked.

### 7.4 Additional padlock interlock (optional)

Action	Additional preconditions
Racking the withdrawable part / switching-device truck	Access to actuating openings only after removing the padlock
Operating the feeder earthing switch	Access to actuating openings only after removing the padlock
Operating the busbar earthing switch	Access to actuating openings only after removing the padlock
Opening the high-voltage door	Access to actuating openings only after removing the padlock

### 7.5 Additional key-operated interlock (optional)

Action	Additional preconditions
Racking the withdrawable part / switching-device truck to service position	Access to actuating openings only after opening the lock
Switching the feeder earthing switch to CLOSED position	Access to actuating openings only after opening the lock
Switching the feeder earthing switch to OPEN position	Access to actuating openings only after opening the lock
Switching the busbar earthing switch to CLOSED position	Access to actuating openings only after opening the lock
Switching the busbar earthing switch to OPEN position	Access to actuating openings only after opening the lock

# Accessories

## 8 Accessories

### 8.1 Operating tools



Fig. 21: Racking crank for moving the withdrawable part / switching-device truck



Fig. 22: Push rod for closing / opening the circuit-breaker manually and emergency opening the 3TM3 contactor manually

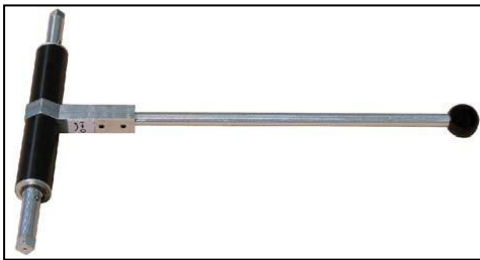


Fig. 23: Operating lever for operating the feeder earthing switch or busbar earthing switch



Fig. 24: Hand crank for manual charging of the spring energy store in the circuit-breaker



Fig. 25: Double-bit key with a diameter of 5 mm for unlocking and interlocking the withdrawable part / switching-device truck



Fig. 26: Double-bit key with a diameter of 3 mm for opening and closing the door to the low-voltage compartment

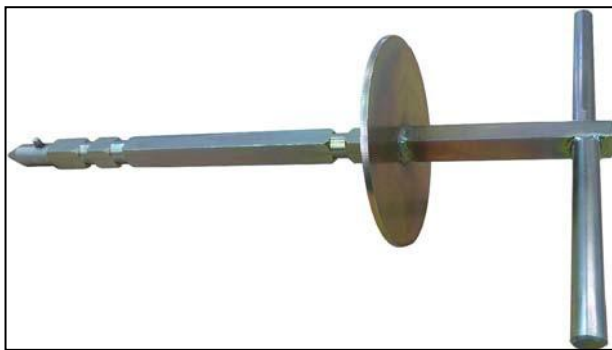


Fig. 27: Racking tool for the removable voltage transformers (optional)

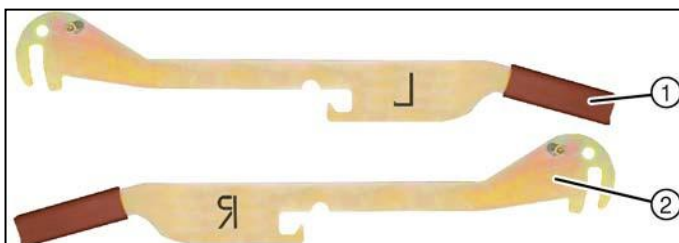


Fig. 28: Slip-on levers for opening the shutters (optional)  
(1) for use on left side in panel and (2) for use in right side in panel

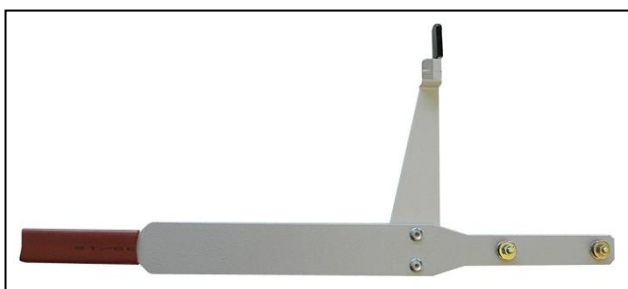


Fig. 29: Slip-on lever for opening the shutters of the contactor panel (optional)

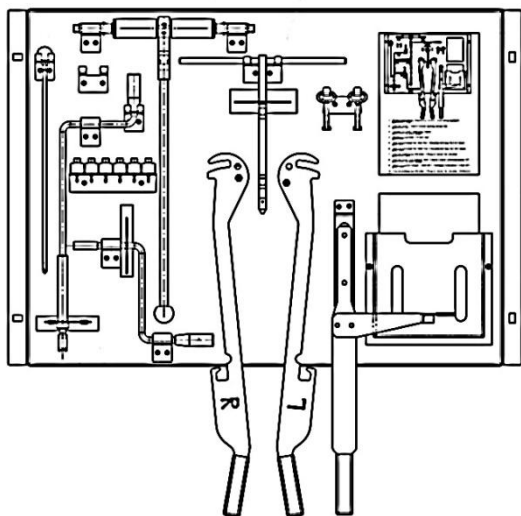


Fig. 30: Wall-mounting holder for storage of operating tools (optional)

## 8.2 Service truck

### ⚠ CAUTION

#### High weight

Due to the weights of the service truck and the withdrawable parts, careless handling can cause injuries by getting squeezed.

- ⇒ Move the service truck only if there is no withdrawable part on the service truck, or if a withdrawable part is interlocked in its end position on the service truck.
- ⇒ Move and operate the service truck only at the operating side.
- ⇒ Move the service truck only slowly and carefully.

### ⚠ CAUTION

#### Protruding parts

Protruding parts at the rear side of the service truck can cause injuries by cuts or impacts.

- ⇒ Always park the service truck in such a way that nobody can pass by at the rear side, e.g. move the rear side of the service truck close to a wall.

### Using the service trucks:

Service trucks are exclusively designed for:

- Transporting a corresponding withdrawable part
- Removing a withdrawable part from a panel
- Inserting a withdrawable part into a panel

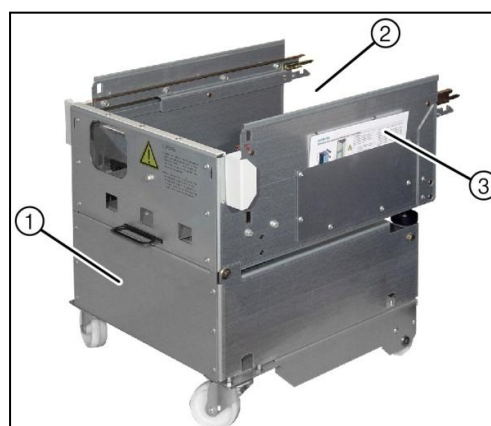
Service trucks are **not** designed for:

- Transporting people
- Transporting other objects than the corresponding withdrawable part

## 8.3 Service truck versions

Depending on the panel version, the following service trucks are included as accessories:

For panels with withdrawable circuit-breaker, withdrawable disconnecting link or withdrawable metering part:



- (1) Operating side
- (2) Rear side
- (3) Operating instructions for service truck

Fig. 31: Service truck to insert and remove a withdrawable part

On the right side of the service truck there is the pocket for the operating instructions:

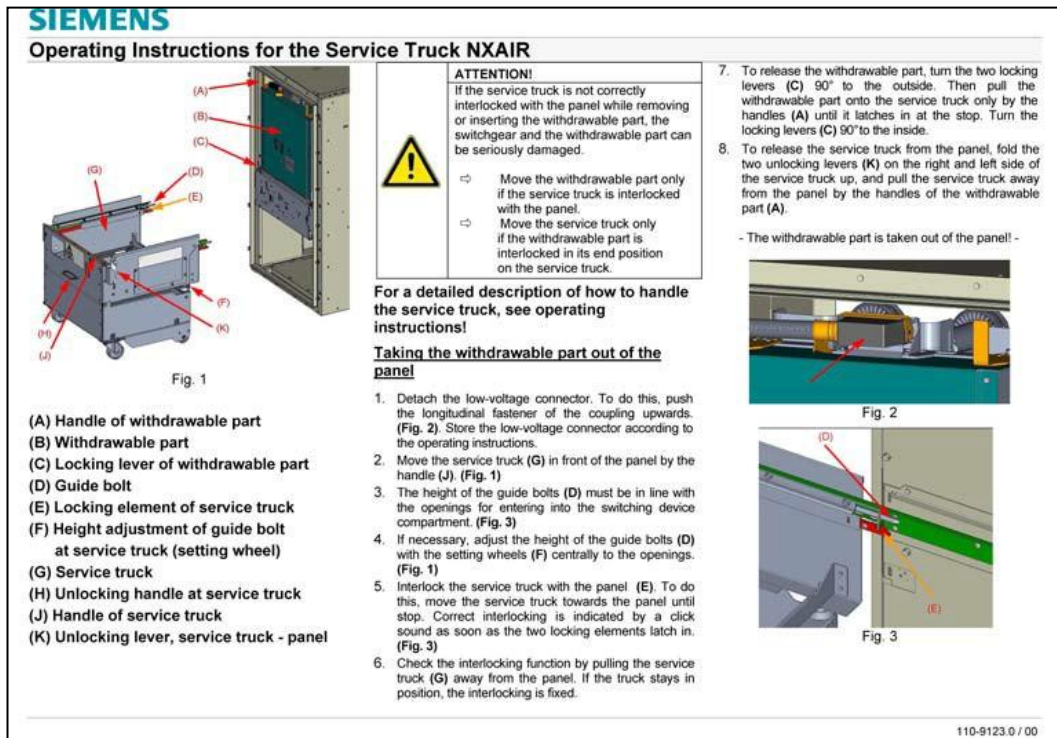


Fig. 32: Front page of operating instructions

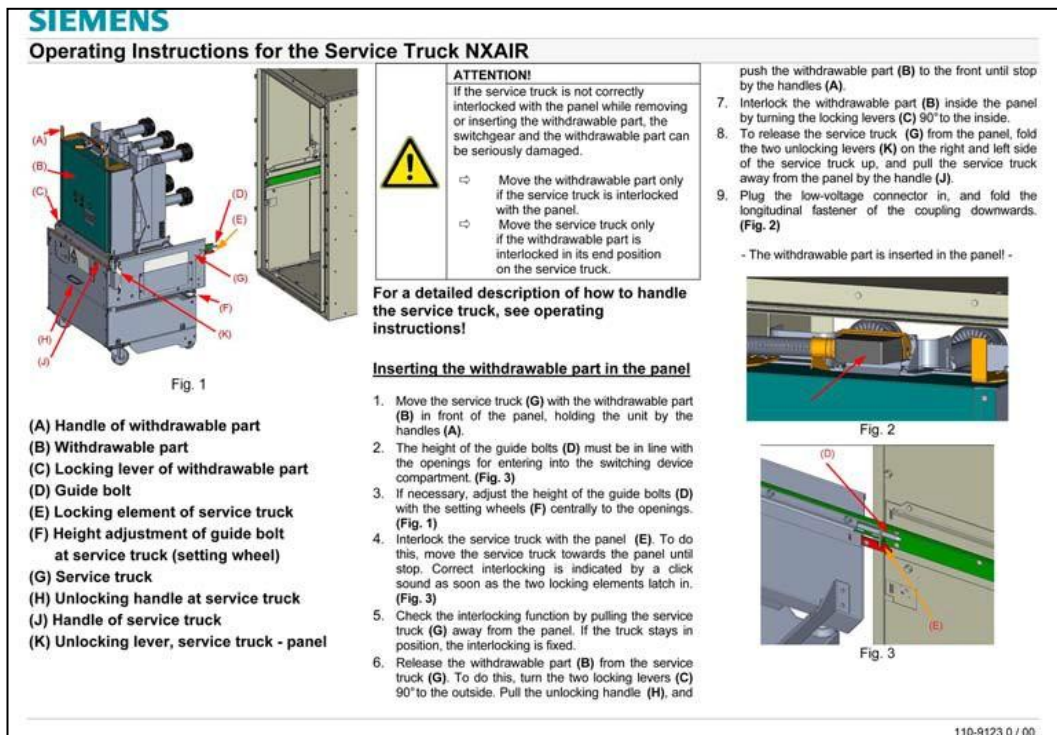


Fig. 33: Rear page of operating instructions

For panels with removable voltage transformers:

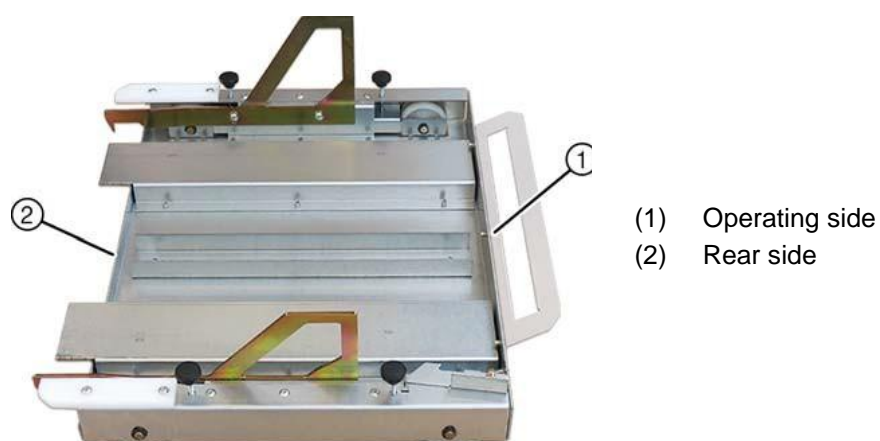


Fig. 34: Service truck to insert and remove the removable voltage transformers

## 9 Customer support

### 9.1 Service

If the NXAIR switchgear should not function as described, the Installation and Operating Instructions provide information for the avoidance and elimination of faults. For further support, contact the Siemens after-sales service.

### 9.2 Repairs

Repairs are carried out by fully trained Siemens technicians, who arrive equipped with original spare parts for the switchgear.

### 9.3 Before you call

To help us deal with your query more quickly, make sure that the following information is at hand:

- Switchgear type (1)
- Serial no. (2)
- Year of manufacture (3)
- Functional unit no. (4)

This information is available on the rating plate on the inside of the high-voltage door and of the door to the low-voltage compartment:


SIEMENS					
Type: NXAIR			Year of manufacture: 2017		
Serial- no.: Y2 300930894/11			Functional unit no.: 11		
	$I_r = 2500\text{ A}$		IEC 62271-200		PM / LSC 2B
	$I_r = 1250\text{ A}$		T = 40 °C		$f_r = 50\text{ Hz}$
$U_r = 12\text{ kV}$		$U_p = 75\text{ kV}$		$U_d = 28\text{ kV}$	
$I_k = 50\text{ kA}$		$I_p = 125\text{ kA}$		$t_k = 3\text{ s}$	
$U_a = 110\text{ VDC}$					
IAC FLR as per IEC 62271-200					
Accessibility type A			Test current : 50 kA 1 s		
Operating instructions : 172-2013.9 / 172-2014.9					
Ratings of installed components must also be considered!					
MADE IN TÜRKİYE					

Fig. 35: Rating plate

### 9.4 Service contact

**The Energy Customer Support Center is available:  
24 hours a day, 365 days a year.**

**Telephone: +49 180 5247000**  
**Fax: +49 180 5247001**  
**Mail to: support.energy@siemens.com**

# Operating the circuit-breaker panel

## 10 Operating the circuit-breaker panel



### HINT

Read and understand these instructions before attempting operating works.

### 10.1 Control elements at the front side of the panel

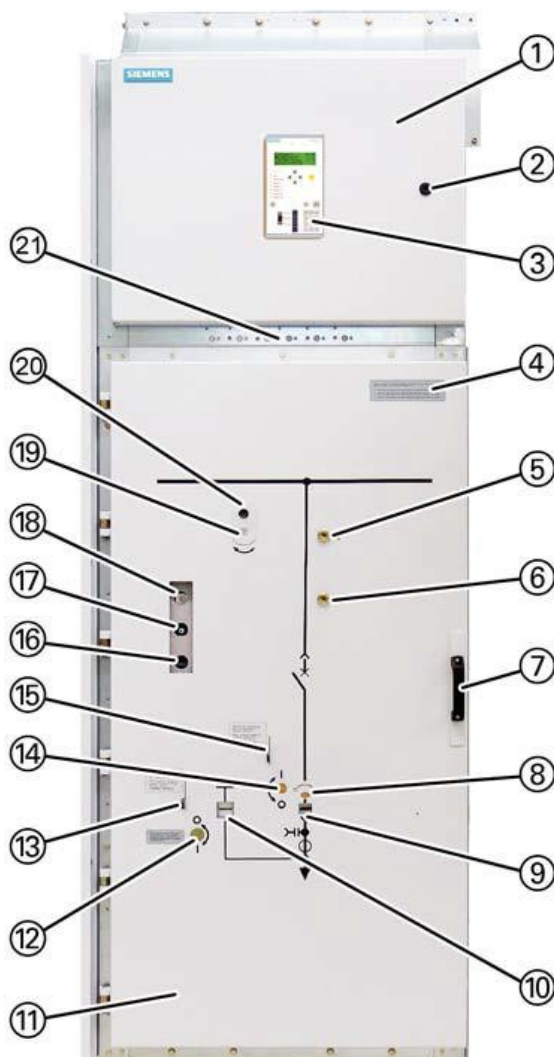














Fig. 36: Control elements on the panel front

- (1) Door to the low-voltage compartment
- (2) Locking device for the door to the low-voltage compartment
- (3) Protection device
- (4) Instruction label for closing the high-voltage door
- (5) Actuating opening for closing the circuit-breaker
- (6) Actuating opening for opening the circuit-breaker
- (7) Handle for opening the high-voltage door
- (8) Actuating opening for inserting the double-bit key to control racking of the withdrawable circuit-breaker / circuit-breaker truck
- (9) Mechanical position indicator for withdrawable circuit-breaker / circuit-breaker truck
- (10) Mechanical position indicator for feeder earthing switch
- (11) High-voltage door
- (12) Actuating opening for operating the feeder earthing switch
- (13) Operating slide for opening and closing the actuating opening for operating the feeder earthing switch
- (14) Actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck
- (15) Operating slide for opening and closing the actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck
- (16) Operations counter for circuit-breaker
- (17) CLOSED/OPEN indicator of the circuit-breaker
- (18) Spring state indicator for the closing spring
- (19) Opening for charging the spring energy store in the circuit-breaker manually (covered)
- (20) Rotary button to close and open the actuating opening located below
- (21) Test sockets for busbar voltage detecting system (type LRM) as additional component

## Operating the circuit-breaker panel

### 10.2 Position indicators visible on high-voltage door

Circuit-breaker: CLOSED position or OPEN position	CLOSED 	OPEN 	
Withdrawable circuit-breaker / circuit-breaker truck: Service position, intermediate position or test position	Service position 	Intermediate position 	Test position 
Spring state indicator: CHARGED position or NOT CHARGED position	CHARGED 	NOT CHARGED 	
Feeder earthing switch: CLOSED position or OPEN position	CLOSED 	OPEN 	

### 10.3 Access to compartments

Regarding accessibility to the individual compartments, NXAIR switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection between the individual compartments is IP2X in standard design.

The type of accessibility is provided as follows:

Compartment		Type of accessibility
Switching-device compartment		Interlock-controlled
Voltage transformer compartment		Tool-based
Busbar compartment		Tool-based
Connection compartment	Access from the front side	Interlock-controlled and tool-based
	Access from the rear side	Tool-based




### 10.4 Opening the high-voltage door

#### **WARNING**

##### **Reduced safety**

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the switching-device compartment, such as removing or inserting a withdrawable circuit-breaker / circuit-breaker truck.

Close the high-voltage door:

-  If an activity inside the switching-device compartment is interrupted.
-  Immediately after an activity inside the switching-device compartment was completed.
-  Before leaving the panel front.

## ⚠ CAUTION

### Injury

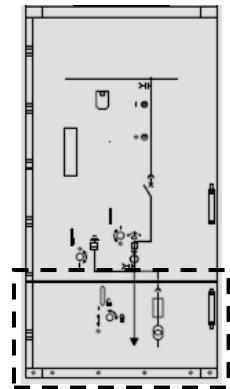
The mechanism inside the withdrawable circuit-breaker / circuit-breaker truck can cause injuries by getting squeezed, caught or cut.

- ⇒ No maintenance or installation work on withdrawable circuit-breakers / circuit-breaker trucks.
- ⇒ Do not undo or remove any bolts.
- ⇒ Do not remove any parts of the covering.

## 👉 HINT

Circuit-breaker panels with removable voltage transformers have an extra door to the separate voltage transformer compartment.

If the panel front shows this extra door, first read and understand the information regarding the handling of the removable voltage transformers; see chapter 17.



### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Spring energy store in the circuit-breaker discharged
- High-voltage door closed
- Padlock (optional) removed from door handle

### Procedure

- ⇒ Pull door handle upwards and open the high-voltage door.

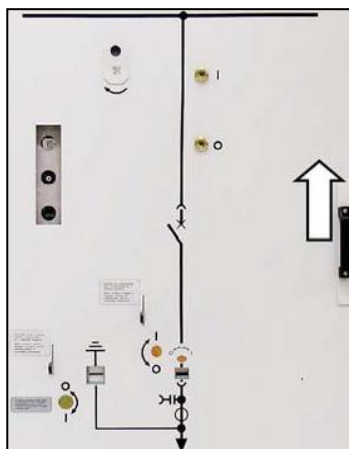


Fig. 37: Opening the high-voltage door of the circuit-breaker panel

- ✓ The high-voltage door is open.

### 10.5 Closing the high-voltage door

#### **WARNING**

##### **Reduced safety**

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the switching-device compartment, such as removing or inserting a withdrawable circuit-breaker / circuit-breaker truck.

Close the high-voltage door:

- ⇒ If an activity inside the switching-device compartment is interrupted.
- ⇒ Immediately after an activity inside the switching-device compartment was completed.
- ⇒ Before leaving the panel front.

#### **CAUTION**

##### **Injury**

The mechanism inside the withdrawable circuit-breaker / circuit-breaker truck can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.

#### **HINT**

##### **Unexpected motor noise and vibration**

When auxiliary voltage is applied, a motor inside the circuit-breaker starts immediately after plugging on the low-voltage connector in order to charge the spring energy store. This is a permissible operating state.

- ⇒ Expect motor noise and low vibration.

#### **Instruction label on high-voltage door:**

In addition to these instructions, an instruction label on the high-voltage door describes safe closing of the high-voltage door before executing a switching operation.

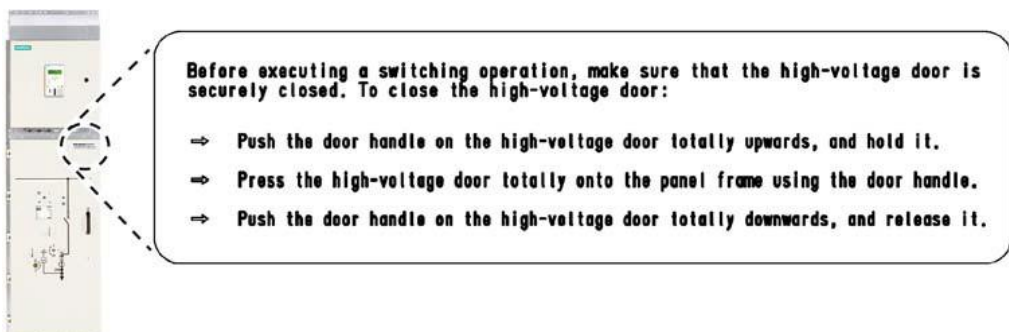


Fig. 38: Instruction label on high-voltage door

## Preconditions

Either without withdrawable circuit-breaker / circuit-breaker truck in the panel, or:

- Withdrawable circuit-breaker / circuit-breaker truck inserted in the panel in test position
- Low-voltage connector plugged on
- High-voltage door open
- For high-voltage doors with ventilation flap: Ventilation flap in operational position
- Padlock for door handle (optional) available

## Procedure

- ⇒ Push the door handle on the high-voltage door totally upwards, and hold it.
- ⇒ Press the high-voltage door totally onto the panel frame using the door handle.
- ⇒ Push the door handle on the high-voltage door totally downwards, and release it.

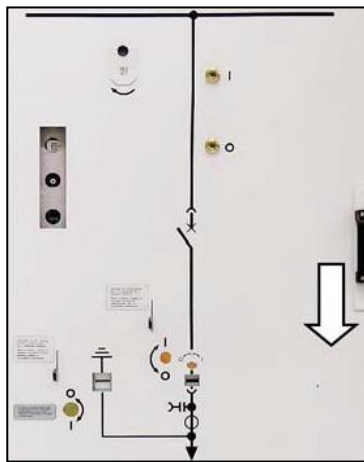


Fig. 39: Closing the high-voltage door of the circuit-breaker panel

- ⇒ Fit a padlock (optional) to the door handle and close it.
- ✓ The high-voltage door is closed.

## 10.6 High-voltage door with ventilation flap

On high-voltage doors with ventilation flap, a position indicator shows the position of the ventilation flap.

### NOTICE

#### Incorrect position of ventilation flap

Closing the high-voltage door when the ventilation flap is not in operational position could cause damage in the switching-device compartment.

- ⇒ The position indicator of the ventilation flap in the high-voltage door must indicate operational position.

## Operating the circuit-breaker panel

### Reading the position indicator

- ⇒ Read the position indicator for the ventilation flap in the high-voltage door:

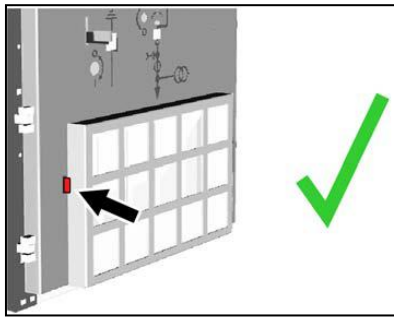


Fig. 40: Ventilation flap in operational position, positive indication

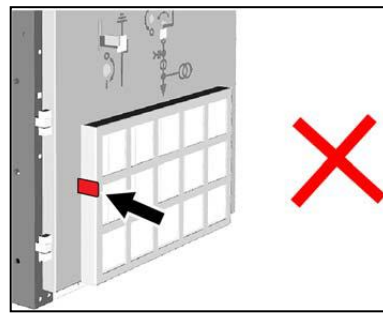


Fig. 41: Ventilation flap **not** in operational position, negative indication

### Ventilation flap in the high-voltage door in operational position

If the position indicator shows that the ventilation flap in the high-voltage door is not in operational position, bring the ventilation flap into operational position as described in the following.

#### Procedure

- ⇒ Open the high-voltage door.
- ⇒ Move the ventilation flap (1) on the inside of the high-voltage door from the center of the lower edge upwards away from the high-voltage door until the mechanism of the position indicator (2) reaches the end stop (3).

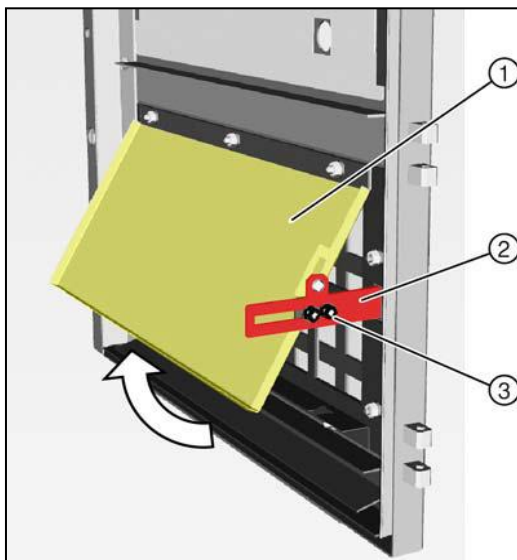


Fig. 42: Inside view of high-voltage door

- ⇒ Now the mechanism holds the ventilation flap in this position by itself.
- ⇒ Close the high-voltage door.
- ✓ The ventilation flap in the high-voltage door is in operational position.

## 10.7 Positions of the withdrawable circuit-breaker / circuit-breaker truck

### General description of positions of the withdrawable circuit-breaker / circuit-breaker truck:

#### Service position

The withdrawable circuit-breaker / circuit-breaker truck is connected with the busbar system and the outgoing feeder. The auxiliary circuit of the withdrawable circuit-breaker / circuit-breaker truck is connected through the low-voltage connector.

#### Test position





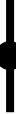


The withdrawable circuit-breaker / circuit-breaker truck is disconnected from the busbar system and the outgoing feeder. The auxiliary circuit of the withdrawable circuit-breaker / circuit-breaker truck is connected through the low-voltage connector.

#### Disconnected position








The withdrawable circuit-breaker / circuit-breaker truck is disconnected from the busbar system and the outgoing feeder. The auxiliary circuit is disconnected by pulling out the low-voltage connector.

### Short instruction for racking the withdrawable circuit-breaker / circuit-breaker truck:

Racking the withdrawable circuit-breaker / circuit-breaker truck manually from test position to service position:

Step 1 Insert and turn double-bit key			Step 2 Insert and turn racking crank as far as it will go and pull it off	Step 3 Turn and remove double-bit key		
from	by	to		from	by	to
						

Racking the withdrawable circuit-breaker / circuit-breaker truck manually from service position to test / disconnected position:

Step 1 Insert and turn double-bit key			Step 2 Insert and turn racking crank as far as it will go and pull it off	Step 3 Turn and remove double-bit key		
from	by	to		from	by	to
						

### 10.8 Racking the withdrawable circuit-breaker / circuit-breaker truck to service position

#### NOTICE

##### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck to service position is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check through the inspection window in the high-voltage door if the circuit-breaker is in OPEN position.
- ⇒ Switch the circuit-breaker to OPEN position, if required.



Fig. 43: Position indicator of circuit-breaker on high-voltage door

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Low-voltage connector plugged on
- High-voltage door closed
- Circuit-breaker in OPEN position
- Feeder earthing switch in OPEN position
- Racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck available
- Double-bit key available
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- For panels with removable voltage transformers (optional):
  - Door to voltage transformer compartment closed and screwed tight

The actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck is located on the control board of the high-voltage door.

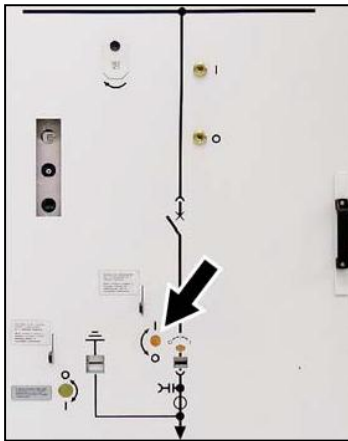


Fig. 44: Actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck

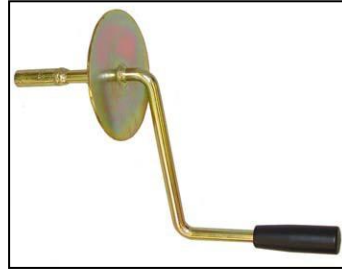


Fig. 45: Racking crank



Fig. 46: Double-bit key, diameter 5 mm

### Procedure

#### NOTICE

##### Maloperation

All interlocks are only released when the withdrawable circuit-breaker / circuit-breaker truck is in a stable end position.

⇒ Rack the withdrawable circuit-breaker / circuit-breaker truck absolutely until end position.

⇒ Lift the operating slide and hold it.

⇒ To release access to the withdrawable circuit-breaker / circuit-breaker truck, insert the double-bit key and turn clockwise as far as it will go (that is 90°).

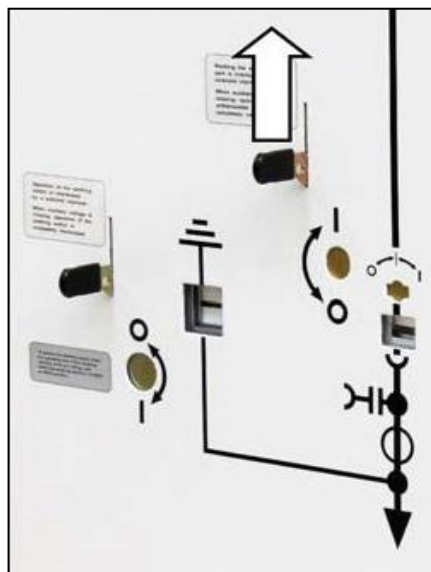


Fig. 47: Lifting the operating slide



Fig. 48: Turning the double-bit key clockwise

## Operating the circuit-breaker panel

- ⇒ Push the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck onto the operating shaft, and turn clockwise as far as it will go.
- ⇒ Remove the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.
- ⇒ Turn the double-bit key clockwise as far as it will go (that is 90°) to interlock the withdrawable circuit-breaker / circuit-breaker truck.



Fig. 49: Turning the racking crank clockwise



Fig. 50: Turning the double-bit key clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.

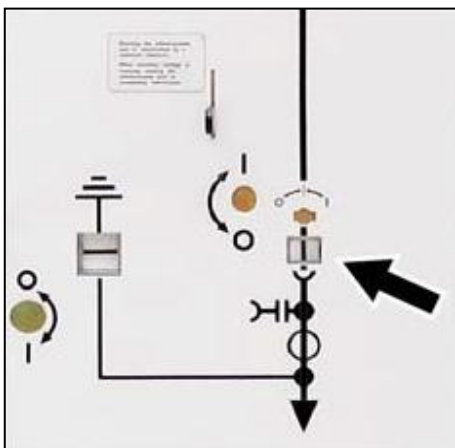


Fig. 51: Position indicator in service position

- ✓ The withdrawable circuit-breaker / circuit-breaker truck has been racked from test position to service position; the position indicator is in service position (vertical bar).

## 10.9 Racking the withdrawable circuit-breaker / circuit-breaker truck to test position

### NOTICE

#### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck to test position is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check through the inspection window in the high-voltage door if the circuit-breaker is in OPEN position.
- ⇒ Switch the circuit-breaker to OPEN position, if required.



Fig. 52: Position indicator of circuit-breaker on high-voltage door

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position
- Circuit-breaker in OPEN position
- Racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck available
- Double-bit key available
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- For panels with removable voltage transformers (optional):
  - Door to voltage transformer compartment closed and screwed tight

The actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck is located on the control board of the high-voltage door.

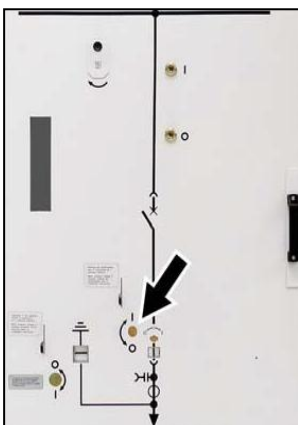


Fig. 53: Actuating opening for racking the withdrawable circuit-breaker / circuit-breaker truck



Fig. 54: Racking crank



Fig. 55: Double-bit key, diameter 5 mm

## Operating the circuit-breaker panel

### Procedure

#### NOTICE

##### Maloperation

All interlocks are only released when the withdrawable circuit-breaker / circuit-breaker truck is in a stable end position.

⇒ Always rack the withdrawable circuit-breaker / circuit-breaker truck completely up to the end position.

⇒ Lift the operating slide and hold it.

⇒ To release access to the withdrawable circuit-breaker / circuit-breaker truck, insert the double-bit key and turn counter-clockwise as far as it will go (that is 90°).

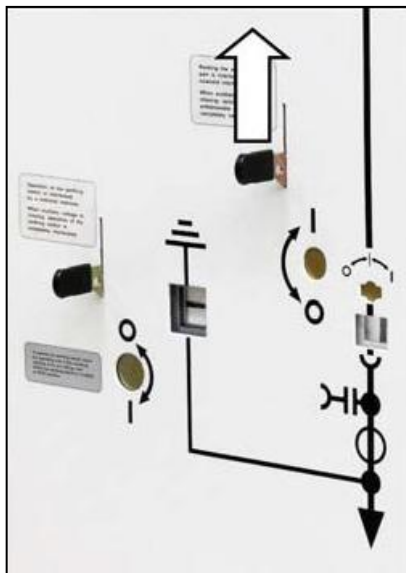


Fig. 56: Lifting the operating slide

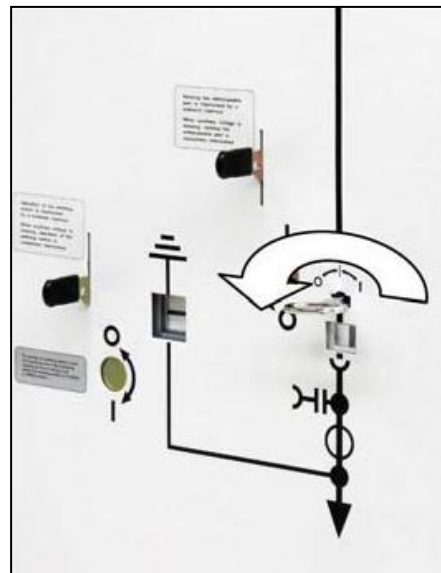


Fig. 57: Turning the double-bit key counter-clockwise

⇒ Push the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck onto the operating shaft, and turn counter-clockwise as far as it will go.

- ⇒ Remove the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.
- ⇒ Turn the double-bit key counter-clockwise as far as it will go (that is 90°) to interlock the withdrawable circuit-breaker / circuit-breaker truck.

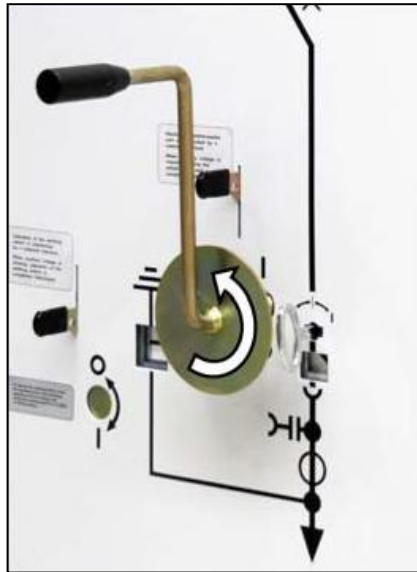


Fig. 58: Turning the racking crank counter-clockwise



Fig. 59: Turning the double-bit key counter-clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.

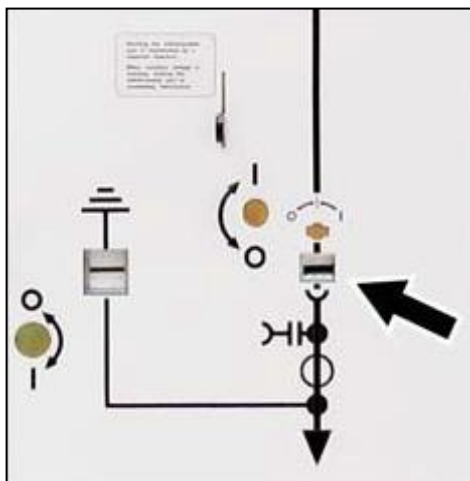


Fig. 60: Position indicator in test position

- ✓ The withdrawable circuit-breaker / circuit-breaker truck has been racked from service position to test position; the position indicator is in test position (horizontal bar).

### 10.10 Closing the circuit-breaker electrically

#### NOTICE

##### Conflicting operation

Operating the circuit-breaker electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.



Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).



#### HINT

If an undervoltage release is fitted, it must be connected to the auxiliary voltage for the switching operation, as otherwise closing is not possible.



#### HINT

##### Unexpected switching noise and vibration

Operating the circuit-breaker discharges and/or charges the spring energy store abruptly. This causes a short loud noise and low vibration.



Expect switching noise and low vibration from inside the circuit-breaker.



#### HINT

The opening spring is charged during the closing operation.

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Circuit-breaker in OPEN position
- Spring state indicator for the closing spring shows CHARGED
- High-voltage door closed
- Auxiliary voltage for the panel connected
- Remote or local control

#### Procedure



Close the circuit-breaker via central or local electrical control element.

After closing, the closing spring is immediately automatically charged by the motor and the spring state indicator changes to CHARGED.

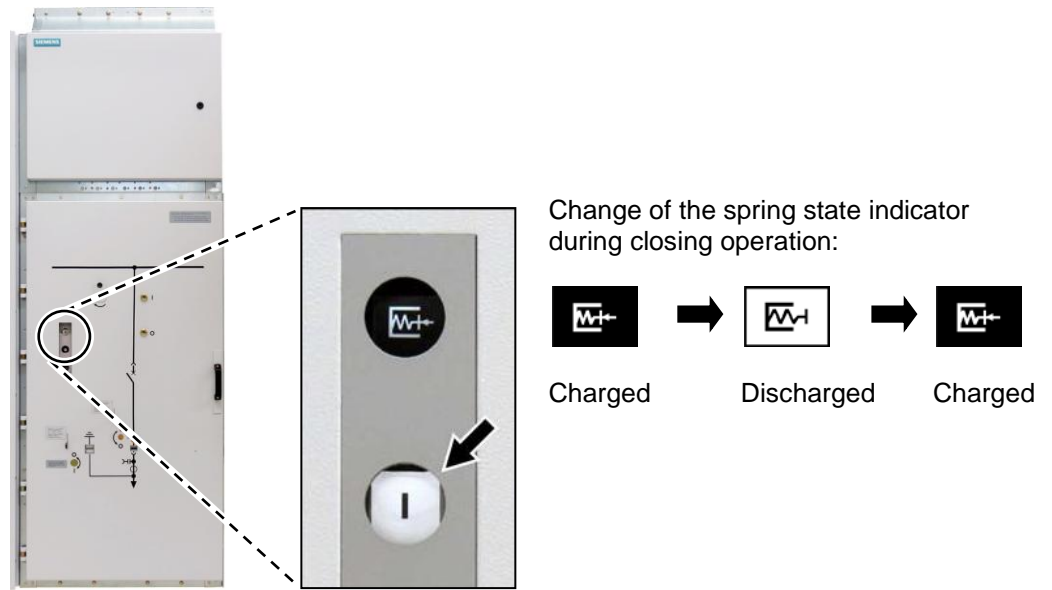


Fig. 61: Position indicator on the circuit-breaker, closed

- ✓ The position indicator on the circuit-breaker changes from 0 position to I position. The operations counter is increased by 1. The circuit-breaker is closed.

### 10.11 Opening the circuit-breaker electrically

#### NOTICE

##### Conflicting operation

Operating the circuit-breaker electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

#### HINT

##### Unexpected switching noise and vibration

Operating the circuit-breaker discharges and/or charges the spring energy store abruptly. This causes a short loud noise and low vibration.

- ⇒ Expect switching noise and low vibration from inside the circuit-breaker.

#### HINT

The opening spring is charged during the closing operation.

## Operating the circuit-breaker panel

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Circuit-breaker in CLOSED position
- Spring state indicator for the closing spring shows CHARGED
- High-voltage door closed
- Auxiliary voltage for the panel connected
- Remote or local control

### Procedure

⇒ Open the circuit-breaker via central or local electrical control element.

The spring state indicator for the closing spring does not change.

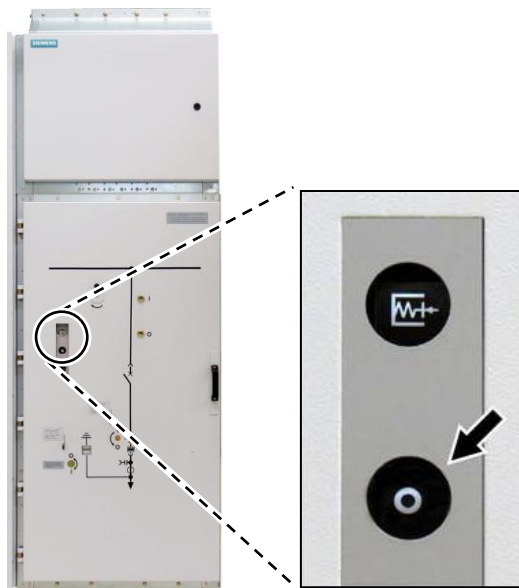


Fig. 62: Position indicator on the circuit-breaker, open

- ✓ The position indicator on the circuit-breaker changes from I position to 0 position. The circuit-breaker is open.

### 10.12 Closing the circuit-breaker manually

#### NOTICE

##### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For operating the circuit-breaker manually, set the panel to local control, for example by switching the local-remote switch to LOCAL position.

## HINT

### Auxiliary voltage for the panel connected

If the auxiliary voltage is disconnected when closing the circuit-breaker manually, the spring energy store for closing the circuit-breaker is no longer recharged automatically.

⇒ Connect the auxiliary voltage before closing the circuit-breaker manually. Otherwise the spring energy store must be recharged manually with a hand crank.

## HINT

If an undervoltage release is fitted, it must be connected to the auxiliary voltage for the switching operation, as otherwise closing is not possible.

## HINT

### Unexpected switching noise and vibration

Operating the circuit-breaker discharges and/or charges the spring energy store abruptly. This causes a short loud noise and low vibration.

⇒ Expect switching noise and low vibration from inside the circuit-breaker.

## HINT

The opening spring is charged during the closing operation.

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Circuit-breaker in OPEN position
- Spring state indicator for the closing spring shows CHARGED
- High-voltage door closed
- Panel set to local control
- Padlock (optional) removed from actuating opening
- Push rod available

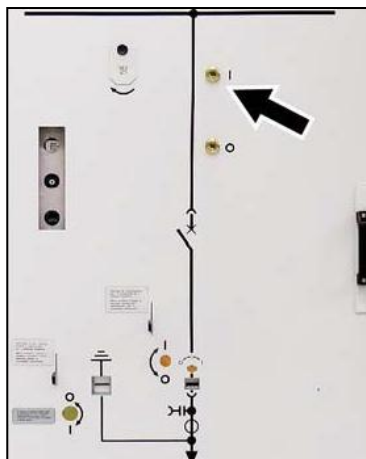


Fig. 63: High-voltage door with actuating opening



Fig. 64: Push rod

## Operating the circuit-breaker panel

To prevent unintentional switching, inserting the push rod into the actuating openings is made harder mechanically. By pushing the push rod strongly in horizontal position, the mechanical resistance is overcome. To indicate the overcome mechanical resistance, a stud appears at the top and at the bottom of the outer edge of the actuating opening.



Fig. 65: Actuating opening



Fig. 66: Push rod inserted

### Procedure



Insert the push rod through the actuating opening in the high-voltage door and operate the ON pushbutton until the switching noise of the circuit-breaker can be heard.



Fig. 67: High-voltage door with push rod in the actuating opening

After closing, the closing spring is immediately automatically charged by the motor and the spring state indicator changes to CHARGED.



Change of the spring state indicator during closing operation:



Charged



Discharged



Charged

Fig. 68: Position indicator on the circuit-breaker, closed

- ⇒ Take the push rod out of the actuating opening.
- ⇒ Optional: Fit a padlock with high shackle to the actuating opening. Close the padlock.
- ✓ The position indicator on the circuit-breaker changes from 0 position to I position.  
The operations counter is increased by 1. The circuit-breaker is closed.

### 10.13 Opening the circuit-breaker manually

#### NOTICE

##### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For operating the circuit-breaker manually, set the panel to local control, for example by switching the local-remote switch to LOCAL position.

#### HINT

##### Unexpected switching noise and vibration

Operating the circuit-breaker discharges and/or charges the spring energy store abruptly. This causes a short loud noise and low vibration.

- ⇒ Expect switching noise and low vibration from inside the circuit-breaker.

#### HINT

The opening spring is charged during the closing operation.

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or test position
- Circuit-breaker in CLOSED position
- High-voltage door closed
- Panel set to local control
- Padlock (optional) removed from actuating opening
- Push rod available

## Operating the circuit-breaker panel

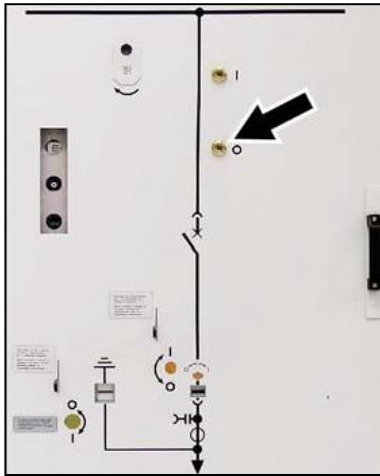


Fig. 69: High-voltage door with actuating opening



Fig. 70: Push rod

To prevent unintentional switching, inserting the push rod into the actuating openings is made harder mechanically. By pushing the push rod strongly in horizontal position, the mechanical resistance is overcome. To indicate the overcome mechanical resistance, a stud appears at the top and at the bottom of the outer edge of the actuating opening.



Fig. 71: Actuating opening



Fig. 72: Push rod inserted

### Procedure



Insert the push rod through the actuating opening in the high-voltage door and operate the OFF pushbutton until the switching noise of the circuit-breaker can be heard.



Fig. 73: High-voltage door with push rod in the actuating opening

The spring state indicator for the closing spring does not change.

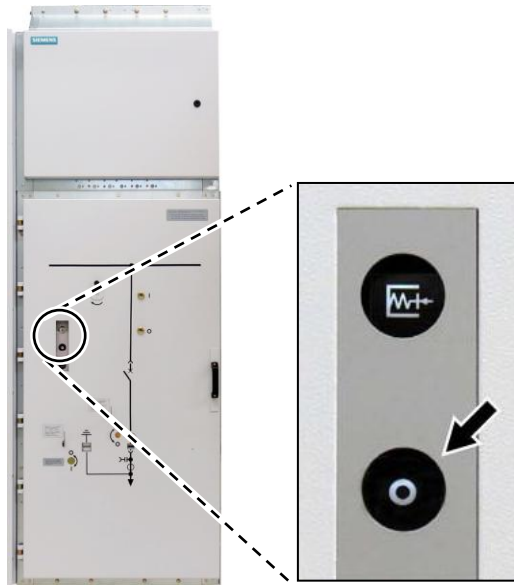


Fig. 74: Position indicator on the circuit-breaker, open

- ⇒ Take the push rod out of the actuating opening.
- ⇒ Optional: Fit a padlock with high shackle to the actuating opening. Close the padlock.
- ✓ The position indicator on the circuit-breaker changes from I position to 0 position. The circuit-breaker is open.

### 10.14 Locking the actuating openings for operating the circuit-breaker (optional)

The two actuating openings in the high-voltage door for operating the circuit-breaker can be secured with a padlock against inserting the push rod. For this purpose, the actuating openings are provided with a hole. Use a padlock with high shackle for locking the actuating openings.

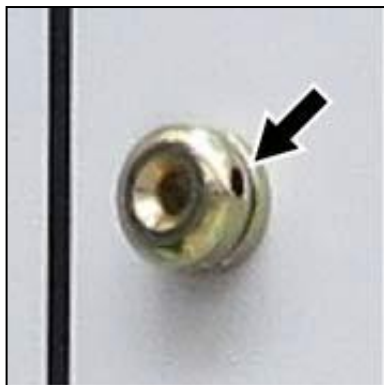


Fig. 75: Hole for padlock in the actuating opening



Fig. 76: Actuating opening with padlock

### 10.15 Discharging the spring energy store

#### NOTICE

##### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.



For operating the circuit-breaker manually, set the panel to local control, for example by switching the local-remote switch to LOCAL position.



#### HINT

Discharging the spring energy store can only be done manually.



#### HINT

##### Unexpected switching noise and vibration

The spring energy store is discharged abruptly. This causes a short loud noise and low vibration.



Expect noise and low vibration from inside the circuit-breaker.

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Circuit-breaker in CLOSED position
- Spring state indicator for the closing spring shows CHARGED
- High-voltage door closed
- Panel set to local control
- Auxiliary voltage for the panel disconnected
- Push rod available

#### Procedure

The operating sequence is OPEN-CLOSE-OPEN manually.



Open the circuit-breaker manually by using the push rod.



Close the circuit-breaker manually by using the push rod.



Open the circuit-breaker manually by using the push rod.

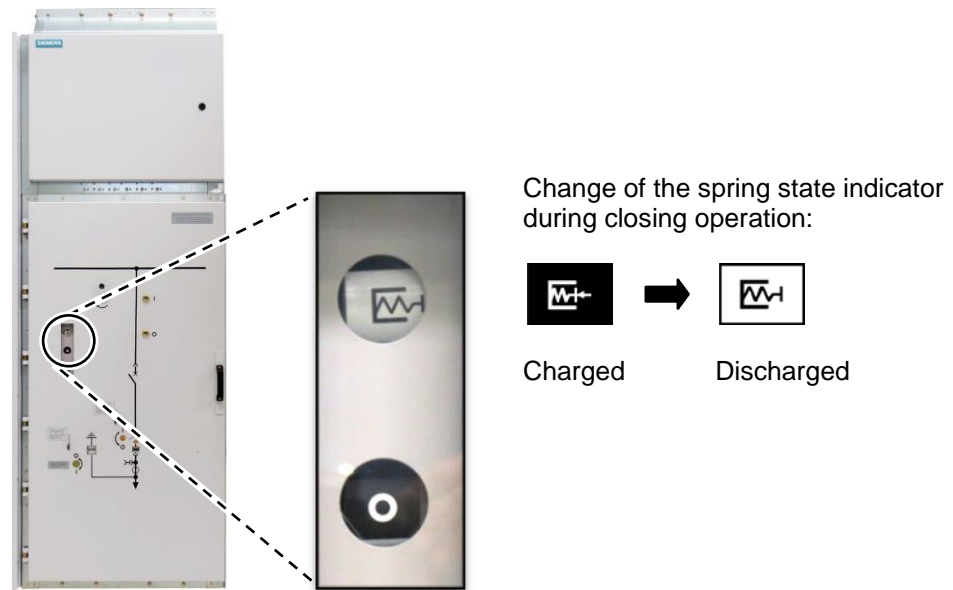


Fig. 77: Position indicator on the circuit-breaker, open

- ✓ The spring energy store for operating the circuit-breaker is discharged.

## 10.16 Charging the spring energy store manually

In order to operate the circuit-breaker, it is necessary that the spring energy store in the circuit-breaker is charged. If auxiliary voltage is connected, the spring energy store is recharged via a motor inside the circuit-breaker immediately after closing the circuit-breaker. The spring state indicator for the closing spring then changes from DISCHARGED to CHARGED. After that, the energy required for the operating sequence OPEN-CLOSE-OPEN is stored in the circuit-breaker.

If the auxiliary voltage is disconnected, the spring energy store for operating the circuit-breaker is no longer charged automatically by the motor after closing the circuit-breaker. To operate the circuit-breaker in spite of this, the spring energy store can be charged manually with a hand crank. This can be done both in test position and in service position.



Fig. 78: Hand crank for manual charging of the spring energy store in the circuit-breaker

### **WARNING**

#### **Injury when using inappropriate tool**

When the auxiliary voltage is connected, the motor immediately recharges the spring energy store after the closing operation. If the hand crank does not have a freewheel, the hand crank will rotate.

➡ Use only the original hand crank with freewheel.

### NOTICE

#### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck while the hand crank is inserted in the actuating opening can damage the circuit-breaker.

- ⇒ Remove the hand crank from the actuating opening immediately after manually charging of the spring energy store.
- ⇒ Never leave the hand crank in the actuating opening.

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For charging the spring energy store manually, set the panel to local control, for example by switching the local-remote switch to LOCAL position.

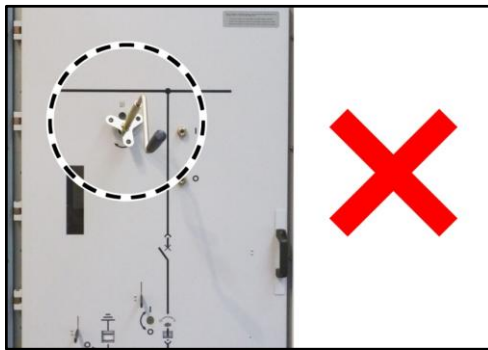


Fig. 79: Hand crank not removed

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Circuit-breaker in OPEN or CLOSED position
- Spring state indicator for the closing spring shows DISCHARGED
- High-voltage door closed
- Auxiliary voltage for the panel disconnected
- Hand crank available

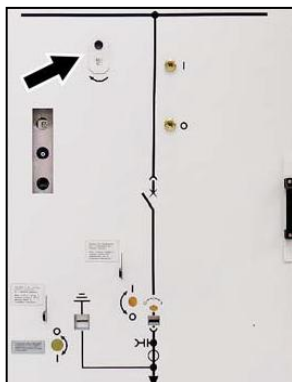


Fig. 80: Actuating opening on high-voltage door

### Procedure

- ⇒ Turn the access cover of operating shaft aside using the rotary button located over it.

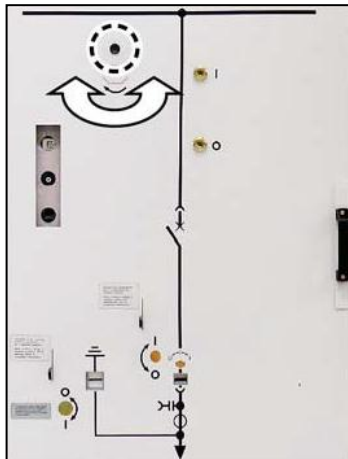


Fig. 81: Rotary button on high-voltage door

- ⇒ Push the hand crank onto the operating shaft.
- ⇒ Hold the freewheel (1) and turn the hand crank (2) clockwise approx. 50 turns until the CHARGED indication appears in the inspection window.



Fig. 82: Hand crank on high-voltage door

The closing spring is latched in automatically. The spring state indicator for the closing spring changes to CHARGED.

- ⇒ Remove the hand crank.
- ⇒ Close the access cover of operating shaft using the rotary button.
- ✓ Manual charging of the spring energy store is completed. The energy required for the operating sequence (OPEN-)CLOSE-OPEN is stored in the spring energy store.

## Operating the circuit-breaker panel

### 10.17 Operating lever for earthing switch

#### Operating lever for earthing switch:

- With the operating lever, the switching process at the feeder earthing switch can only be executed in turning direction.
- The turning movement into the opposite direction has a freewheel and does not move the feeder earthing switch; the operating lever works like a ratchet spanner.
- The feeder earthing switch is operated either clockwise or counter-clockwise according to the switching function.
- To use the operating lever, two instruction labels show the turning direction for the corresponding switching function.

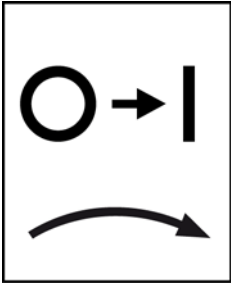
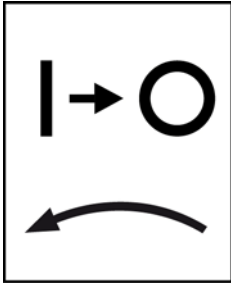
Switching function:	From OPEN to CLOSED position	From CLOSED to OPEN position
Turning direction of the operating lever:	Clockwise	Counter-clockwise
Instruction label on the operating lever:		



Fig. 83: Instruction labels on the operating lever

## 10.18 Earthing the feeder manually

### NOTICE

#### Maloperation

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.



Do not try to remove the operating lever at intermediate positions.

### NOTICE

#### Maloperation

If the operating lever is not inserted correctly, the feeder earthing switch may be damaged.



Insert the operating lever in the actuating opening as far as it will go.

#### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper handling of the operating lever for the feeder earthing switch.

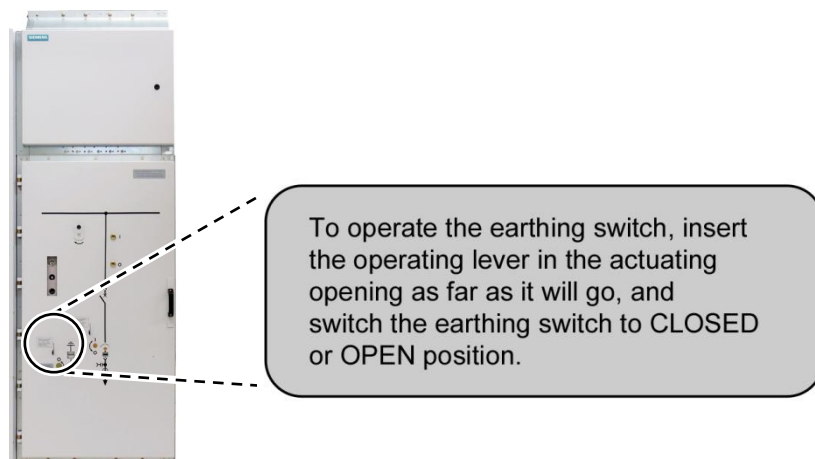


Fig. 84: Instruction label on high-voltage door

#### Preconditions

- High-voltage door closed
- Feeder to be earthed isolated
- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Operating lever available
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated

## Operating the circuit-breaker panel

### Procedure

- ⇒ Lift the operating slide to release the actuating opening.

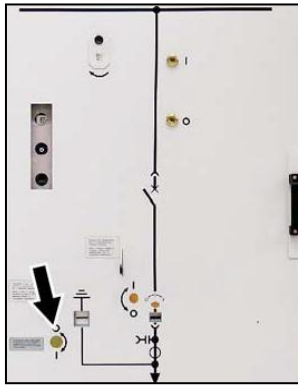


Fig. 85: Actuating opening on high-voltage door

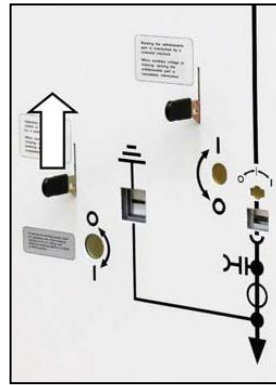


Fig. 86: Operating slide on high-voltage door

- ⇒ While keeping the operating slide lifted, insert the operating lever slightly into the actuating opening such that the instruction label for clockwise turning direction is visible.

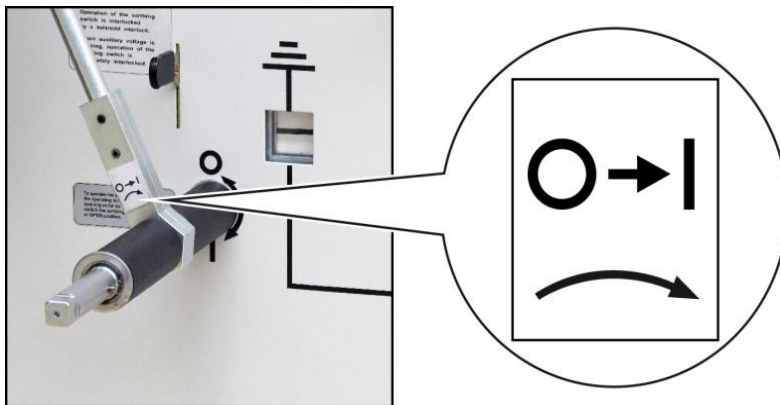


Fig. 87: Instruction label on operating lever

- ⇒ Adjust the position of the lever such that the pins on the lever are horizontal and parallel with the openings in the feeder earthing switch operating mechanism.

- ⇒ Insert the operating lever in the actuating opening as far as it will go.

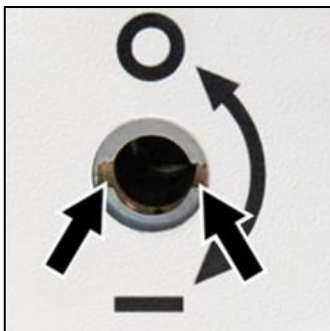


Fig. 88: Openings in operating mechanism



Fig. 89: Inserting lever with pins and openings parallel

- ⇒ Turn the operating lever to the right and left alternately and keep turning until the feeder earthing switch changes to CLOSED position.



Fig. 90: Turning the lever to the right and left alternately

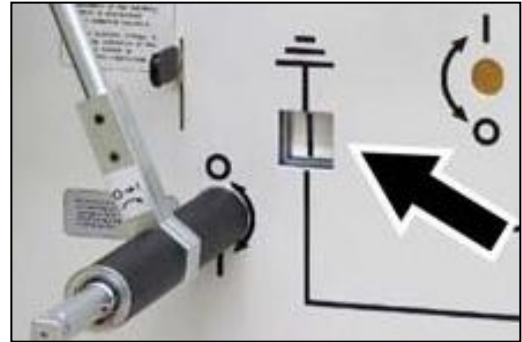


Fig. 91: Position indicator on high-voltage door in CLOSED position

- ⇒ Remove the operating lever.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The feeder is earthed.

### 10.19 De-earthing the feeder manually

#### NOTICE

##### Maloperation

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.



Do not try to remove the operating lever at intermediate positions.

#### NOTICE

##### Maloperation

If the operating lever is not inserted correctly, the feeder earthing switch may be damaged.



Insert the operating lever in the actuating opening as far as it will go.

#### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the operating lever for the feeder earthing switch.

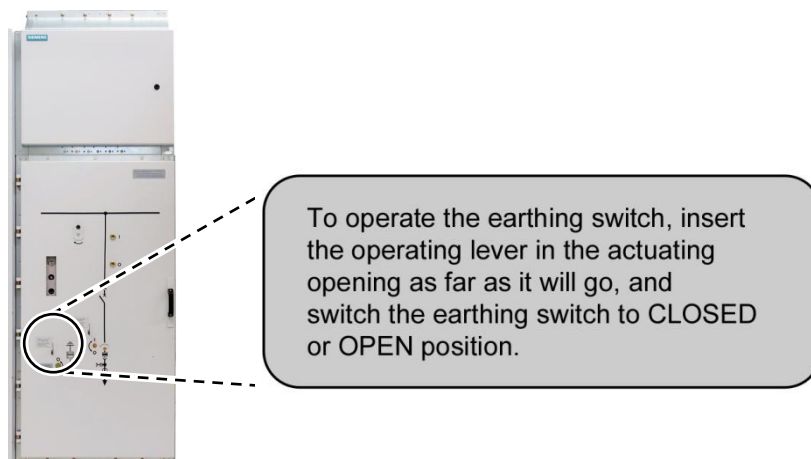


Fig. 92: Instruction label on high-voltage door

#### Preconditions

- High-voltage door closed
- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Operating lever available
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated

## Procedure

- ⇒ Lift the operating slide to release the actuating opening.

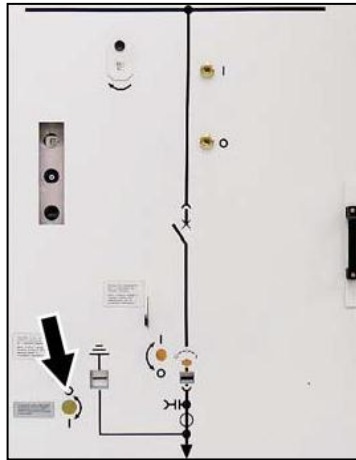


Fig. 93: Actuating opening on high-voltage door

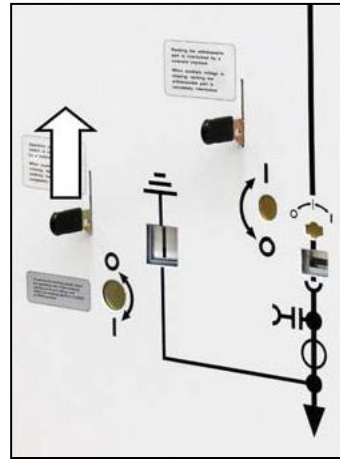


Fig. 94: Operating slide on high-voltage door

- ⇒ While keeping the operating slide lifted, insert the operating lever slightly into the actuating opening such that the instruction label for counter-clockwise turning direction is visible.

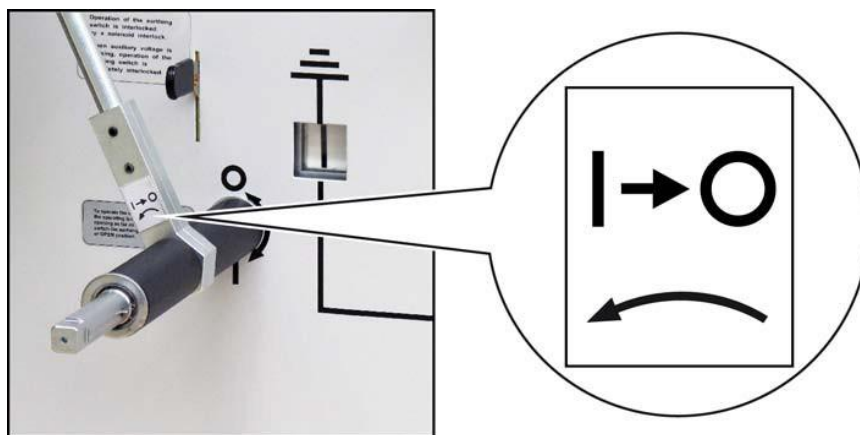


Fig. 95: Instruction label on operating lever

## Operating the circuit-breaker panel

- ⇒ Adjust the position of the lever such that the pins on the lever are horizontal and parallel with the openings in the feeder earthing switch operating mechanism.
- ⇒ Insert the operating lever in the actuating opening as far as it will go.

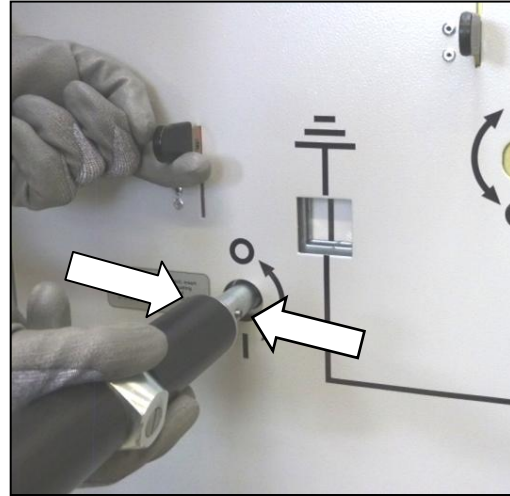
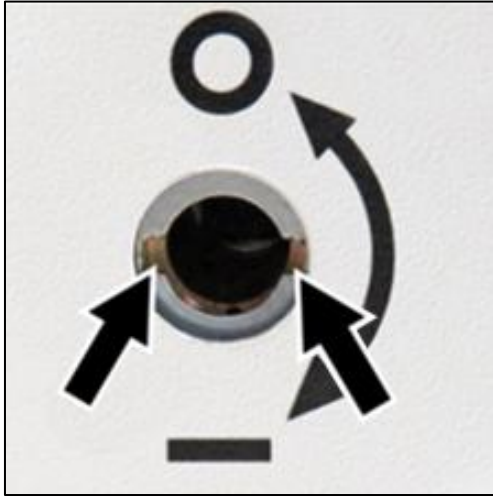


Fig. 96: Openings in operating mechanism      Fig. 97: Inserting the lever with pins and openings parallel

- ⇒ Turn the operating lever to the right and left alternately and keep turning until the feeder earthing switch changes to OPEN position.

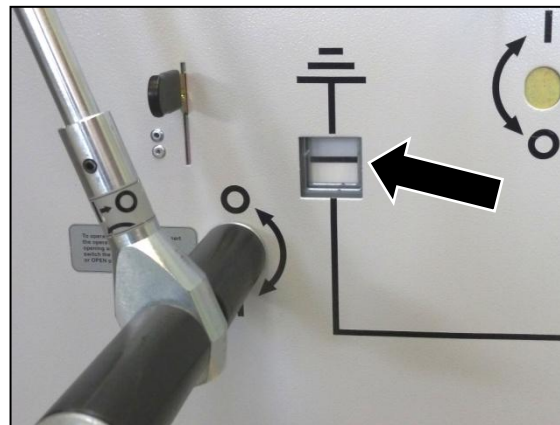


Fig. 98: Turning the lever to the right and left alternately      Fig. 99: Position indicator on high-voltage door in OPEN position

- ⇒ Remove the operating lever.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The feeder is de-earthed.

## 10.20 Removing the low-voltage connector

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Spring energy store in the circuit-breaker discharged
- Auxiliary voltage for the panel disconnected
- High-voltage door open
- Low-voltage connector plugged on

### Procedure

- ⇒ To detach the low-voltage connector, push the longitudinal fastener (1) of the coupling downwards.
- ⇒ Remove the low-voltage connector (2) carefully upwards.

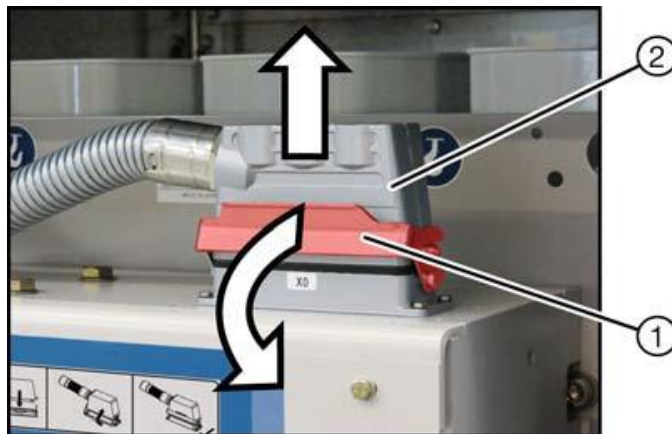


Fig. 100: Removing the low-voltage connector

- ⇒ Hang the low-voltage connector into the support located underneath the low-voltage compartment.



Fig. 101: Low-voltage connector stowed away

- ⇒ If no withdrawable circuit-breaker / circuit-breaker truck is inserted in the panel and no further operation is executed: Close the high-voltage door.
- ✓ The removed low-voltage connector is lying in the support located underneath the low-voltage compartment.

### 10.21 Plugging on the low-voltage connector

#### HINT

##### Unexpected motor noise and vibration

When auxiliary voltage is applied, a motor inside the circuit-breaker starts immediately after plugging on the low-voltage connector in order to charge the spring energy store. This is a permissible operating state.

⇒ Expect motor noise and low vibration.

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Spring energy store in the circuit-breaker discharged
- Auxiliary voltage for the panel disconnected
- High-voltage door open
- Low-voltage connector stowed away

#### Procedure

#### HINT

In addition to these instructions, an instruction label on the withdrawable circuit-breaker / circuit-breaker truck informs about plugging on the low voltage connector.

Follow the advice on the label (3) to push the longitudinal fastener.

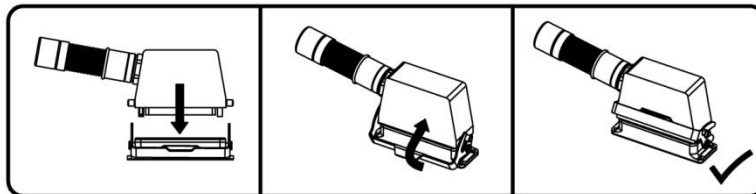


Fig. 102: Instruction label on the withdrawable circuit-breaker / circuit-breaker truck

⇒ Take the low-voltage connector out of the support located underneath the low-voltage compartment.

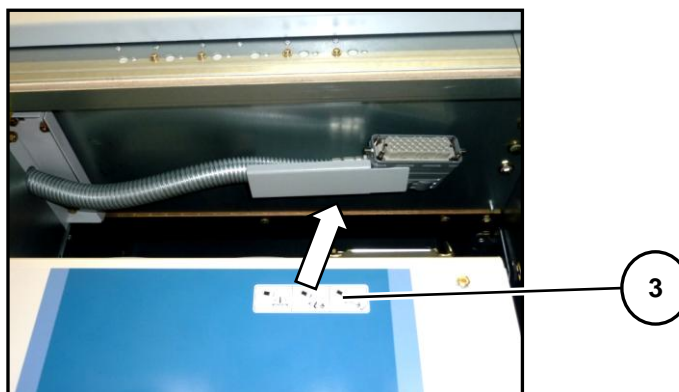


Fig. 103: Low-voltage connector stowed away

- ⇒ Carefully plug on the low-voltage connector (2) from above.
- ⇒ To secure the low-voltage connector, push the longitudinal fastener (1) of the coupling upwards.

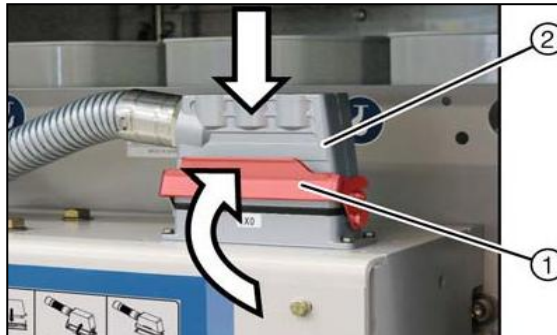


Fig. 104: Plugging on and securing the low-voltage connector

- ⇒ Close the high-voltage door.
- ⇒ Switch the auxiliary voltage on.

The motor in the circuit-breaker starts up and charges the spring energy store. The spring state indicator for the closing spring changes to CHARGED.

- ✓ The low-voltage connector is plugged on and secured by the longitudinal fastener.

### 10.22 Taking the withdrawable circuit-breaker out of the panel

#### CAUTION

##### **Injury**

The mechanism inside the withdrawable circuit-breaker can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.
- ⇒ Do not charge the spring energy store in the circuit-breaker.

#### CAUTION

##### **Heavy weight of withdrawable part**

Removing the withdrawable part without service truck can cause injuries.

- ⇒ Do not try to remove the withdrawable part while service truck is **not** interlocked with the panel.



Fig. 105: Circuit-breaker panel with high-voltage door open

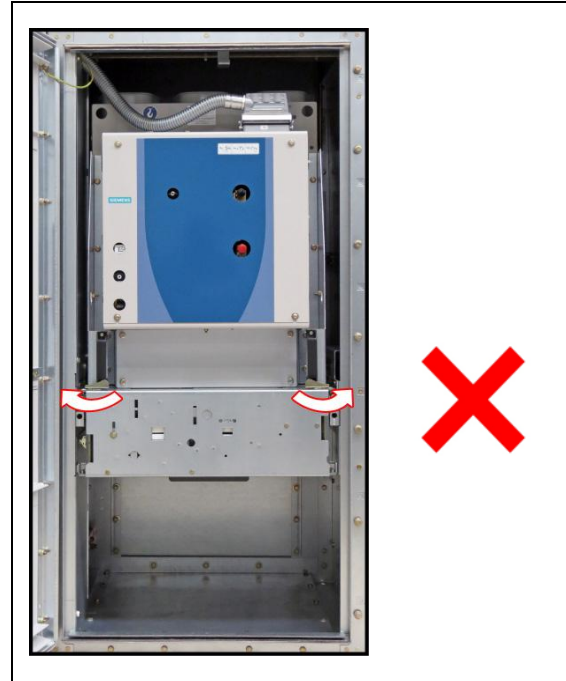


Fig. 106: Circuit-breaker panel without service truck

### Preconditions

- Service truck available
- Withdrawable circuit-breaker in test position
- Spring energy store in the circuit-breaker discharged
- High-voltage door open
- Low-voltage connector stowed away

### Positioning the service truck in front of the panel

#### CAUTION

##### Maloperation

Protruding parts such as locking elements at the service truck or at the rear of the withdrawable circuit-breaker can cause injuries.

- ⇒ Move and operate the service truck only at the front side.
- ⇒ Move the service truck only slowly and carefully.

#### CAUTION

##### Maloperation

Interlocks placed at the panel front prevent being injured when taking the withdrawable circuit-breaker out of the panel.

- ⇒ Make sure the service truck is correctly interlocked with the panel before moving the withdrawable circuit-breaker onto the service truck.
- ⇒ Observe the notes and the operating instructions on the service truck.

⇒ Move the service truck centrally in front of the panel.

⇒ Push the locking elements on the left and right side of the truck into the openings provided for this purpose in the panel frame. Observe that the guide rails of the panel and the service truck are horizontally aligned with each other.

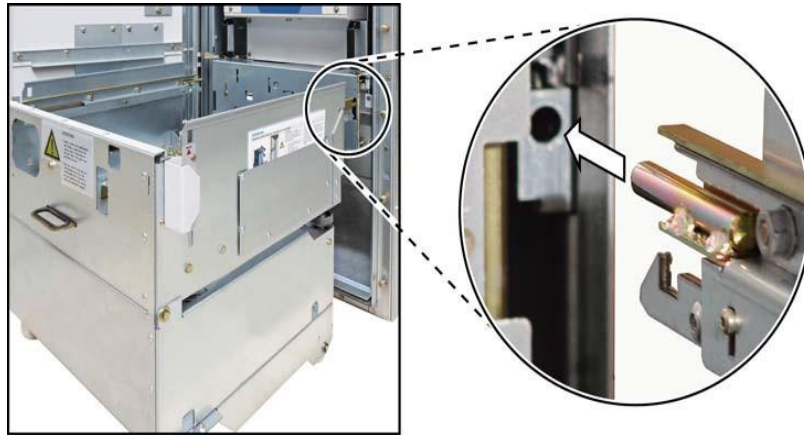


Fig. 107: Service truck in front of panel

⇒ If required, adjust the height of the guide rails at the service truck with the two setting wheels.

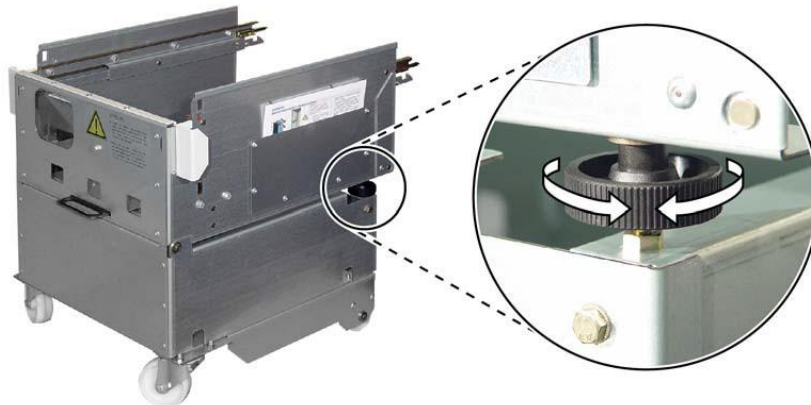


Fig. 108: Setting wheels on service truck

⇒ Check the position of the left and right unlocking levers at the service truck. Check whether the service truck is correctly interlocked with the panel by pulling it backwards.

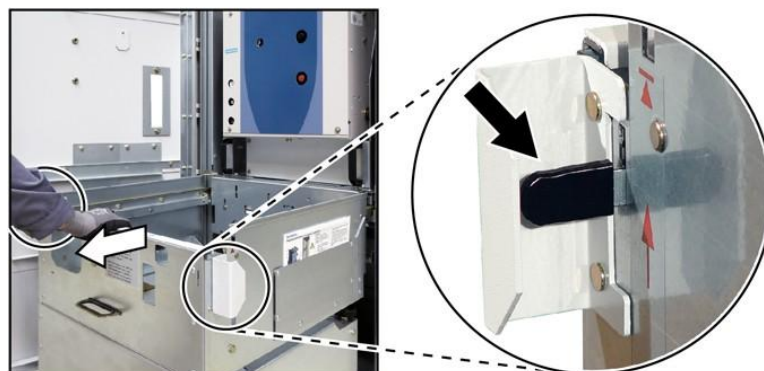


Fig. 109: Service truck interlocked

## Operating the circuit-breaker panel

### Unlocking the withdrawable circuit-breaker from the panel

- ⇒ To unlock the withdrawable circuit-breaker from the panel frame, turn the two locking levers at the withdrawable circuit-breaker to the outside.



Fig. 110: Unlocking the withdrawable circuit-breaker

### Pulling the withdrawable circuit-breaker onto the service truck

- ⇒ Pull the withdrawable circuit-breaker onto the service truck until the end position using the handles.

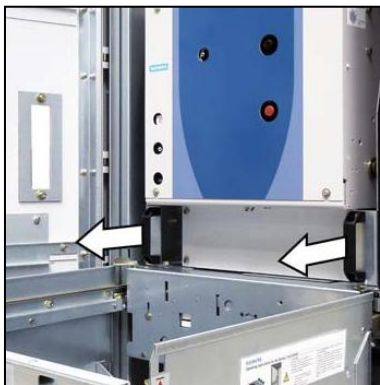


Fig. 111: Pulling out the withdrawable circuit-breaker

- ⇒ Turn the two locking levers at the withdrawable circuit-breaker to the inside in order to interlock the withdrawable circuit-breaker with the service truck.

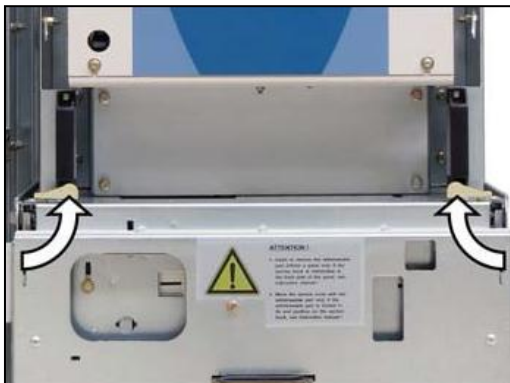


Fig. 112: Interlocking the withdrawable circuit-breaker

- ⇒ Pull the two unlocking levers on the left and right side of the service truck upwards to release the interlocking with the panel frame.

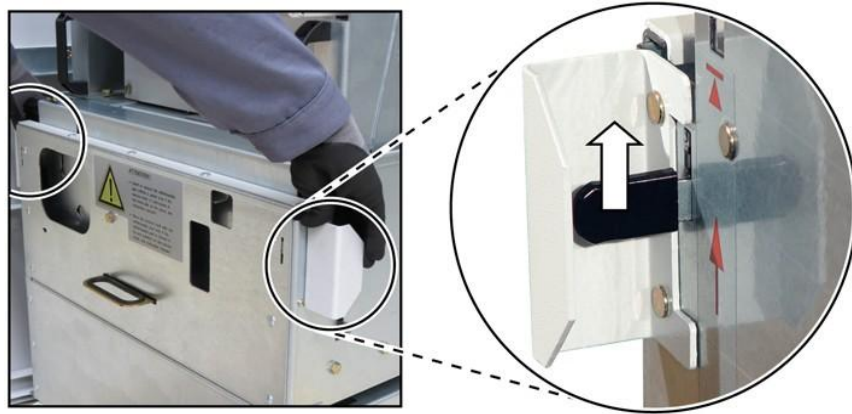


Fig. 113: Unlocking the service truck

### Moving the service truck away from the panel

#### ⚠ CAUTION

##### Maloperation

Interlocks placed on the service truck prevent being injured when moving the service truck with the withdrawable circuit-breaker on it away from the panel.

- ⇒ Move the service truck only if the withdrawable circuit-breaker is interlocked in its end position on the service truck.
- ⇒ Observe the notes and the operating instructions on the service truck.

#### ⚠ CAUTION

##### Maloperation

The service truck is designed exclusively for slow and careful driving on obstacle-free paths.

- ⇒ Before moving the service truck, check the path.
- ⇒ Keep the shunting area and paths free of obstacles and dry.
- ⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.
- ⇒ Move the service truck only slowly and constantly.
- ⇒ The service truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

## Operating the circuit-breaker panel

- ⇒ Move the service truck away from the panel using the handles.

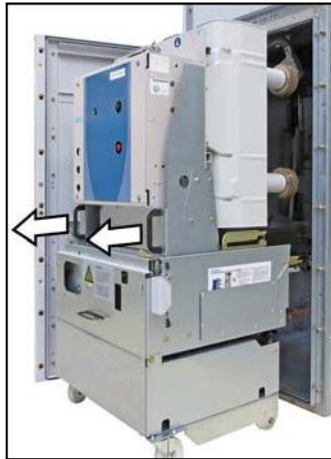


Fig. 114: Moving the service truck

- ⇒ If no further operation is executed: Close the high-voltage door.
- ✓ The withdrawable circuit-breaker can now be moved outside the panel on the service truck.

### 10.23 Inserting the withdrawable circuit-breaker in a panel

#### ⚠ CAUTION

##### Maloperation

The service truck is designed exclusively for slow and careful driving on obstacle-free paths.

- ⇒ Before moving the service truck, check the path.
- ⇒ Keep the shunting area and paths free of obstacles and dry.
- ⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.
- ⇒ Move the service truck only slowly and constantly.
- ⇒ The service truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

#### ⚠ CAUTION

##### Injury

The mechanism inside the withdrawable circuit-breaker can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.
- ⇒ Do not charge the spring energy store in the circuit-breaker.

## NOTICE

### Maloperation

Risk of damaging safety-relevant parts. Operating the switchgear with a withdrawable part version that is not suitable for the corresponding panel version can cause serious damage to the switchgear.



Do not change the mechanical coding or the coding symbols.

### Mechanical coding

The low-voltage connections are coded with regard to specific current ratings. In the case of circuit-breaker panels, the coding comprises also the specific control functions of a panel version.

The 4 coding pins (1) at the low-voltage plug connection prevent plugging on the low-voltage connector of a panel which is not suitable for the particular withdrawable part.



Fig. 115: Low-voltage plug connection

### Coding symbols

On the top side of every low-voltage connector (2) and on the top side of every withdrawable part there are 2 or 3 coding symbols respectively. A withdrawable part may only be inserted in a panel, if the coding symbols are identical in number and kind with those on the low-voltage connector.

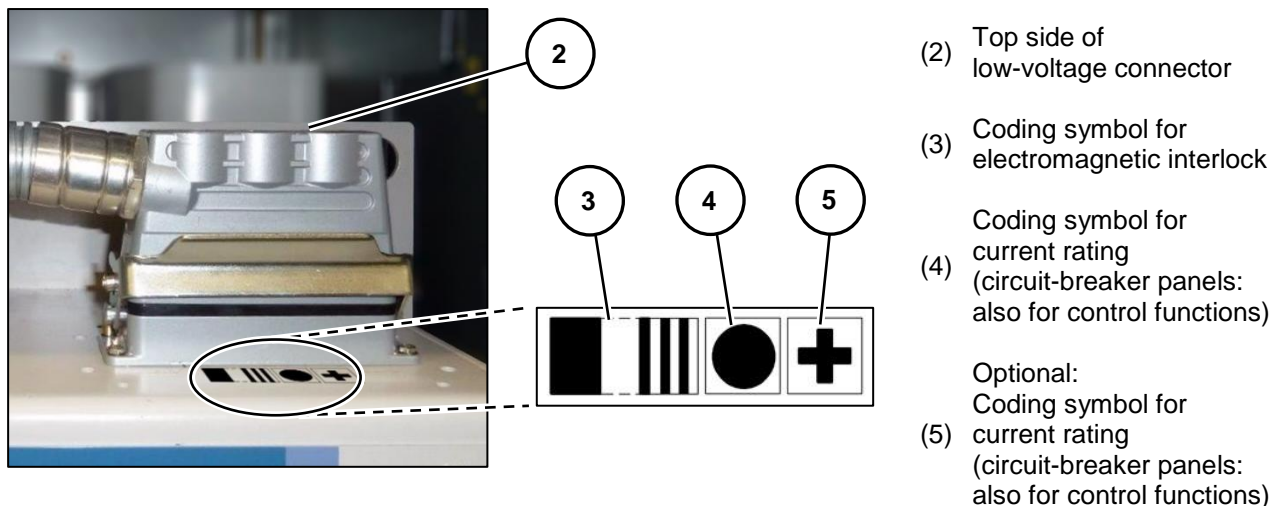









Fig. 116: Coding symbols on low-voltage connector and withdrawable part

The coding symbols characterize the functional properties of a panel version. The leftmost symbol (3) characterizes the functional properties as regards electromagnetic interlocks.

A second symbol or a combination of two further symbols (4; 5) characterizes the panel version as regards its current ratings.

In the case of circuit-breaker panels, the second symbol or the combination of two further symbols characterizes the panel version additionally as regards its specific control functions. Circuit-breaker panels with basic control functions are equipped with 1 shunt release and no other releases. Basic control functions are coded by one symbol only. Circuit-breaker panels with extended control functions are equipped with a second release (a second shunt release / a c.t.-operated release / an undervoltage release). Extended control functions are coded by a combination of two symbols.

## Operating the circuit-breaker panel

Position (left to right)	Panel type	Function coded	Symbols	
1 <sup>st</sup> symbol (3)	All types	Electromagnetic interlock		Without electromagnetic interlock
				With electromagnetic interlock: • For racking mechanism of withdrawable part • For operating mechanism of feeder earthing switch
				With electromagnetic interlock: For racking mechanism of withdrawable part
				With electromagnetic interlock: For operating mechanism of feeder earthing switch
2 <sup>nd</sup> symbol (4)	Circuit-breaker	Rated current and <b>basic</b> control functions	Examples:   	
	Other than circuit-breaker	Rated current		
3 <sup>rd</sup> symbol (5; optional)	Circuit-breaker	Rated current and <b>extended</b> control functions		
	Other than circuit-breaker	Rated current		

### Verifying correspondence of withdrawable part version and panel version

A withdrawable part may only be inserted in a panel, if the coding symbols are identical in number and kind with those on the low-voltage connector.

⇒ Carefully compare the coding symbols on the top side of the low-voltage connector (1) with the symbols on the top side of the withdrawable part (2).

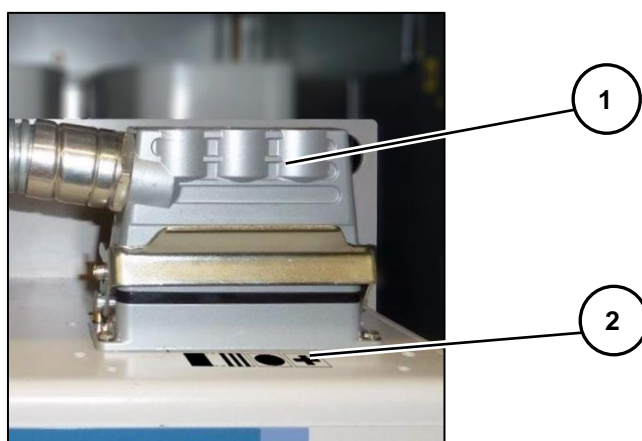


Fig. 117: Verifying correspondence of coding symbols on low-voltage connector and withdrawable part

### Preparing the operating shaft for the feeder earthing switch

- ⇒ Make sure that the coupling pin of the operating shaft for the feeder earthing switch at the withdrawable circuit-breaker and the coupling in the switching-device compartment are in vertical position.

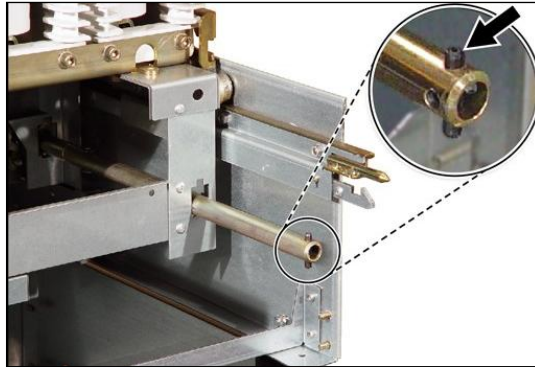


Fig. 118: Coupling pin of the operating shaft for the feeder earthing switch

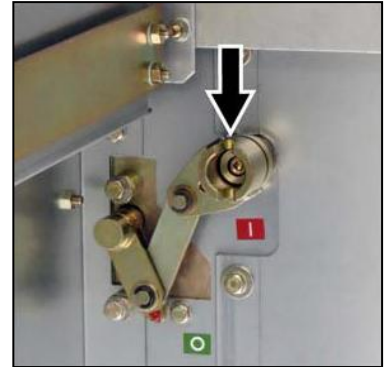


Fig. 119: Coupling of the feeder earthing switch in the switching-device compartment

- ⇒ If required, put the coupling pin of the feeder earthing switch operating shaft in vertical position using the operating lever.



Fig. 120: Operating the feeder earthing switch operating shaft

### Interlocking the service truck with the withdrawable circuit-breaker at the panel

#### CAUTION

##### Maloperation



Interlocks placed at the panel front prevent being injured when moving the withdrawable circuit-breaker into the panel.

- ⇒ Make sure the service truck is interlocked with the panel before moving the withdrawable circuit-breaker into the panel.
- ⇒ Observe the notes and the operating instructions on the service truck.

### CAUTION

#### Maloperation



Protruding parts such as locking elements at the service truck or at the rear of the withdrawable circuit-breaker can cause injuries.

-  Move and operate the service truck only at the front side.
-  Move the service truck only slowly and carefully.

#### Preconditions

- Panel prepared, no withdrawable circuit-breaker inserted
- Withdrawable circuit-breaker available on service truck
- Withdrawable circuit-breaker with the same coding as panel available
- Coupling pin of the operating shaft in vertical position
- Spring energy store in the circuit-breaker discharged
- High-voltage door open
- Low-voltage connector stowed away
- Auxiliary voltage for the panel disconnected

#### Procedure

-  Move the service truck centrally in front of the panel.
-  Push the locking elements on the left and right side of the service truck into the openings provided for this purpose in the panel frame. Observe that the guide rails of the panel and the service truck are horizontally aligned with each other.

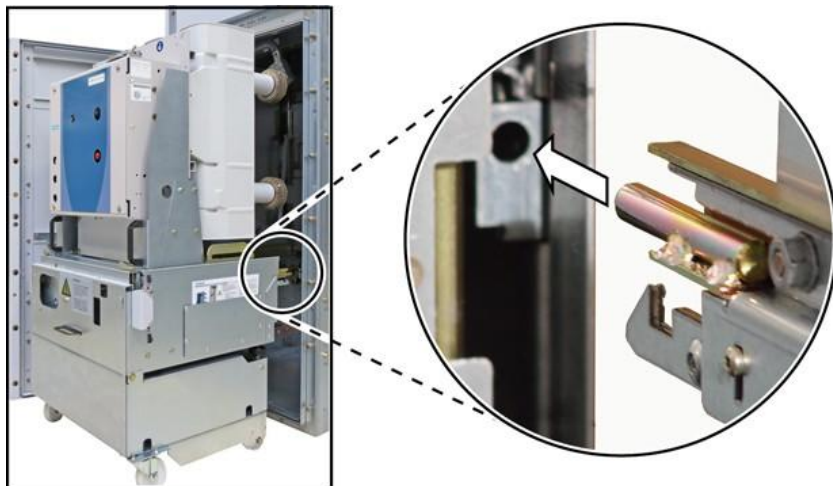


Fig. 121: Service truck in front of panel

- ⇒ If required, adjust the height of the guide rails at the service truck with the two setting wheels.

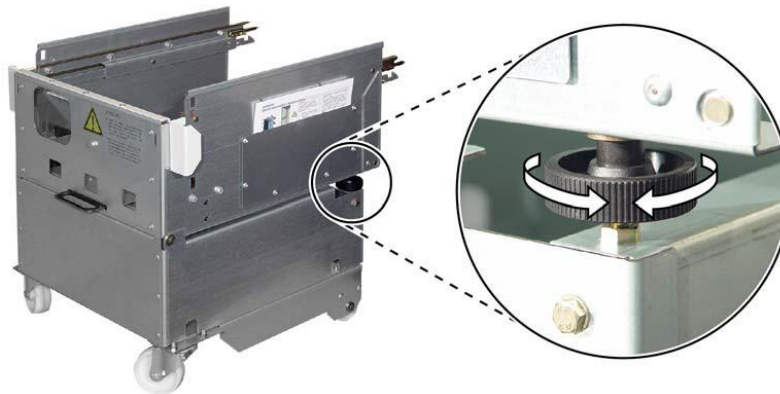


Fig. 122: Setting wheels on service truck

- ⇒ Check the position of the left and right unlocking levers at the service truck. Check whether the service truck is correctly interlocked with the panel by pulling it backwards.

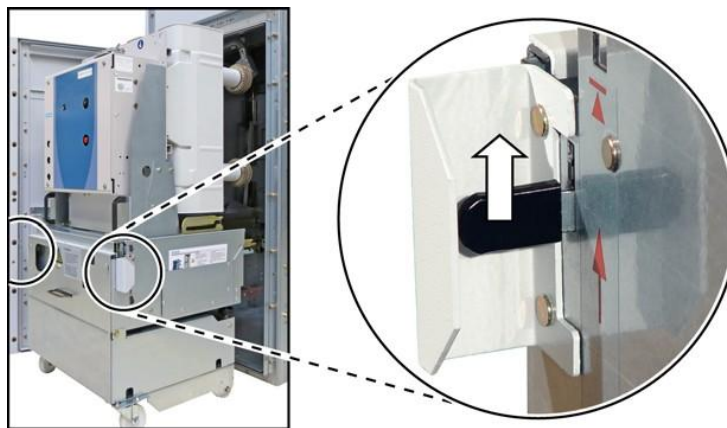


Fig. 123: Service truck interlocked with the panel

- ⇒ To release the interlocking of the withdrawable circuit-breaker with the service truck, turn the two locking levers at the withdrawable circuit-breaker to the outside.

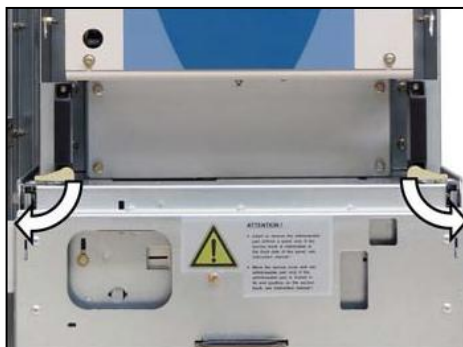


Fig. 124: Releasing the interlocking of the withdrawable circuit-breaker

## Operating the circuit-breaker panel

- ⇒ Pull the unlocking handle of the service truck out and hold it.

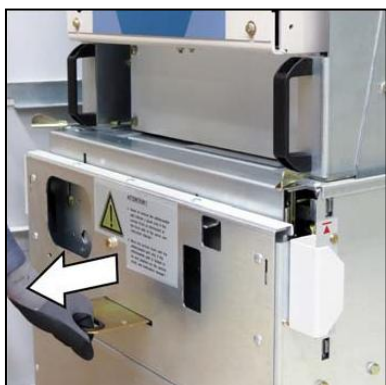


Fig. 125: Unlocking the handle of the service truck

- ⇒ Push the withdrawable circuit-breaker into the panel as far as it will go.



Fig. 126: Pushing the withdrawable circuit-breaker into the panel

### Unlocking the service truck from the panel

- ⇒ Pull the two unlocking levers on the left and right side of the service truck upwards to release the interlocking with the panel frame.

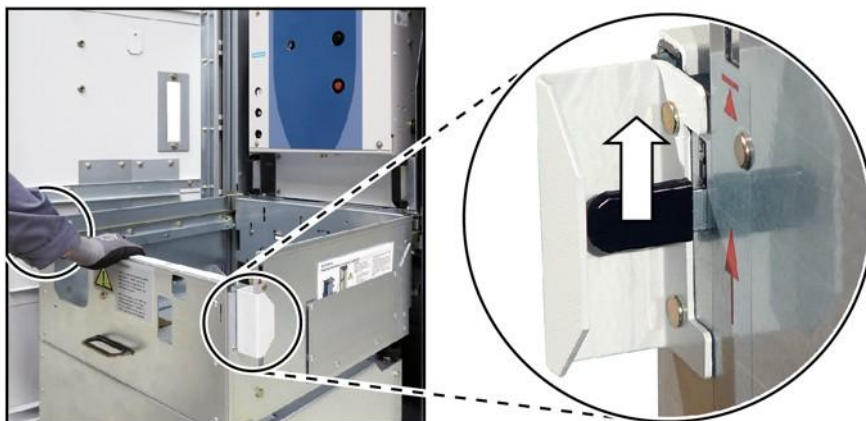


Fig. 127: Unlocking the service truck

- ⇒ Pull the service truck back at its upper edge, away from the panel.



Fig. 128: Pulling the service truck away

- ⇒ Interlock the withdrawable circuit-breaker with the panel by turning the two locking levers to the inside.  
The withdrawable part is correctly interlocked with the panel as soon as both locking levers latch tight inside.

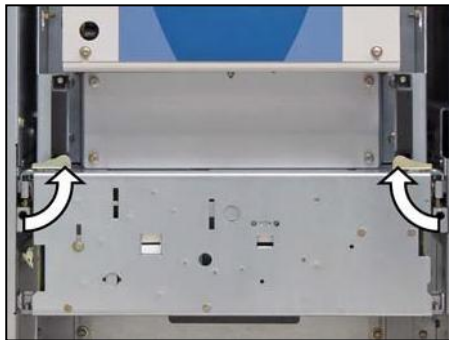


Fig. 129: Interlocking the withdrawable circuit-breaker

## Locking the low-voltage connector



### HINT

In addition to these instructions, an instruction label on the withdrawable circuit-breaker informs about plugging on the low-voltage connector.

Follow the advice on the label (3) to push the longitudinal fastener.

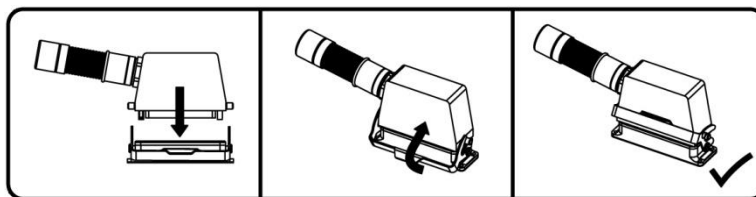


Fig. 130: Instruction label on the withdrawable circuit-breaker

## Operating the circuit-breaker panel

- ⇒ Take the low-voltage connector out of the support located underneath the low-voltage compartment.

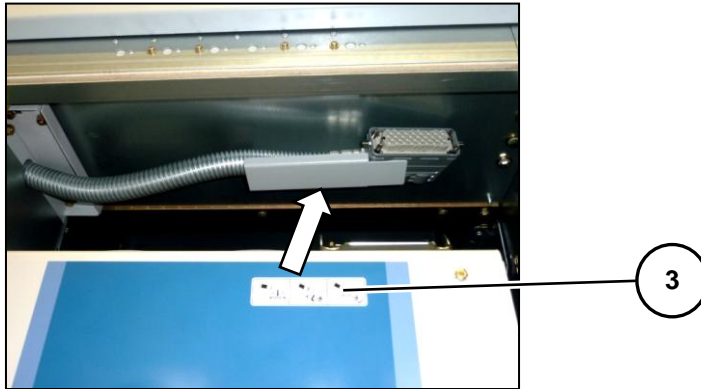


Fig. 131: Low-voltage connector stowed away

- ⇒ Carefully plug on the low-voltage connector (2) from above.
- ⇒ To secure the low-voltage connector, push the longitudinal fastener (1) of the coupling upwards.

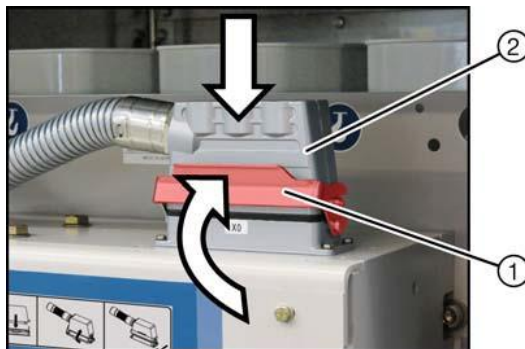


Fig. 132: Plugging on and securing the low-voltage connector

- ⇒ Close the high-voltage door.
- ⇒ Switch the auxiliary voltage on.

The motor in the circuit-breaker starts up and charges the spring energy store. The spring state indicator for the closing spring changes to CHARGED.

- ✓ The withdrawable circuit-breaker is inserted in the panel and the high-voltage door is closed.

## 10.24 Taking the circuit-breaker truck out of the panel

### CAUTION

#### Injury

The mechanism inside the circuit-breaker truck can cause injuries by getting squeezed, caught or cut.



-  Do not remove any parts of the covering.
-  Do not charge the spring energy store in the circuit-breaker.




Fig. 133: Circuit breaker panel with high-voltage door open

#### Preconditions

- Circuit-breaker truck in test position
- Spring energy store in the circuit-breaker discharged
- High-voltage door open
- Low-voltage connector stowed away

#### Unlocking the circuit-breaker truck from the panel

-  To unlock the circuit-breaker truck from the panel frame at the center, turn the two locking levers at the circuit-breaker truck to the outside.

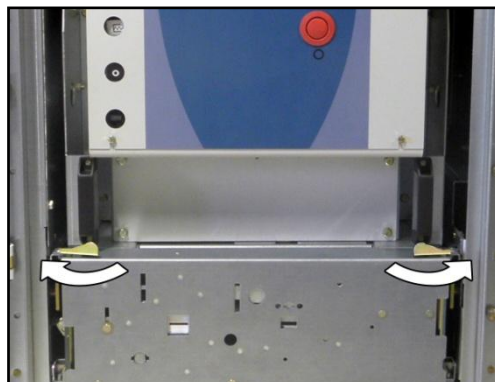


Fig. 134: Unlocking the circuit-breaker truck from the panel at the center

## Operating the circuit-breaker panel

- ⇒ To unlock the circuit-breaker truck from the panel frame at the bottom, pull the locking bracket (1) upwards until it latches into the retaining hook.

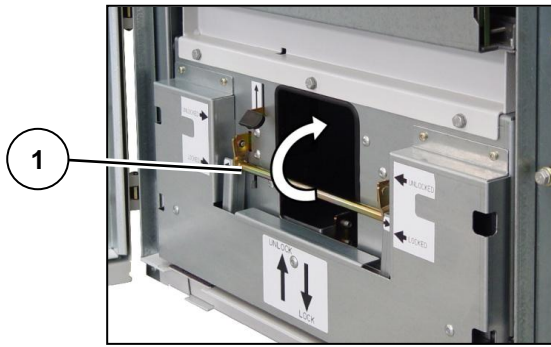


Fig. 135: Unlocking the circuit-breaker truck at the bottom

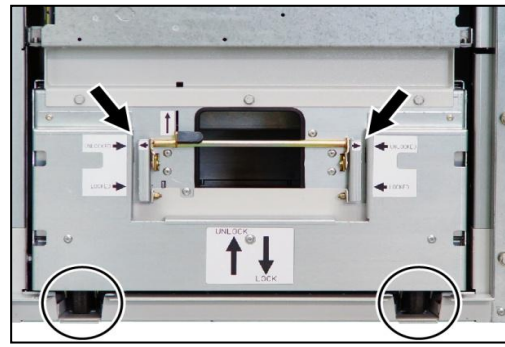


Fig. 136: Circuit-breaker truck ready to move

### Moving the circuit-breaker truck out of the panel

#### ⚠ CAUTION

##### Maloperation

The circuit-breaker truck is designed exclusively for slow and careful driving on obstacle-free paths.

- ⇒ Before moving the circuit-breaker truck, check the path.
- ⇒ Keep the shunting area and paths free of obstacles and dry.
- ⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.
- ⇒ Move the circuit-breaker truck only slowly and constantly.
- ⇒ The circuit-breaker truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

#### ⚠ CAUTION

##### Maloperation

Protruding parts at the rear of the circuit-breaker truck can cause injuries.

- ⇒ Move and operate the circuit-breaker truck only at the front side.

#### NOTICE

##### Maloperation

The locking bracket at the circuit-breaker truck is exclusively designed for interlocking the circuit-breaker truck with the switchgear frame.

- ⇒ Do **not** push the locking bracket downwards towards LOCK if the circuit-breaker truck is outside the panel.

- ⇒ Pull the circuit-breaker truck out of the panel using the handles.

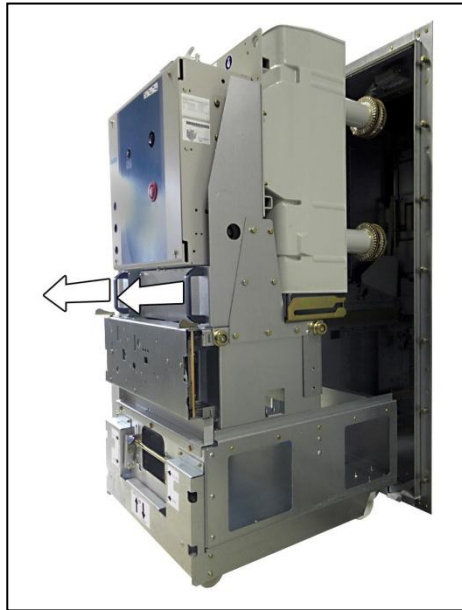


Fig. 137: Pulling out the circuit-breaker truck

- ⇒ If no further operation is executed: Close the high-voltage door.
- ✓ The circuit-breaker truck can now be moved away from the panel.

### 10.25 Inserting the circuit-breaker truck in a panel

#### CAUTION

##### Maloperation

The circuit-breaker truck is designed exclusively for slow and careful driving on obstacle-free paths.

- ⇒ Before moving the circuit-breaker truck, check the path.
- ⇒ Keep the shunting area and paths free of obstacles and dry.
- ⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.
- ⇒ Move the circuit-breaker truck only slowly and constantly.
- ⇒ The circuit-breaker truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

### ⚠ CAUTION

#### Injury

The mechanism inside the circuit-breaker truck can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.
- ⇒ Do not charge the spring energy store in the circuit-breaker.

### NOTICE

#### Maloperation

Risk of damaging safety-relevant parts. Operating the switchgear with a circuit-breaker truck version that is not suitable for the corresponding panel version can cause serious damage to the switchgear.

- ⇒ Do not change the mechanical coding or the coding symbols.

#### Mechanical coding

The low-voltage connections are coded with regard to specific current ratings. In the case of circuit-breaker panels, the coding comprises also the specific control functions of a panel version.

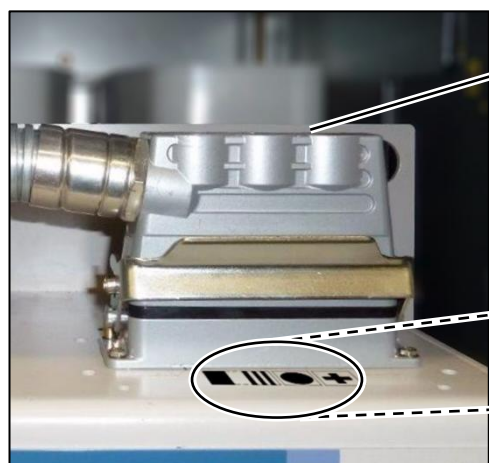
The 4 coding pins (1) on the low-voltage plug connection prevent plugging on the low-voltage connector of a panel which is not suitable for the particular switching-device truck.



Fig. 138: Low-voltage plug connection

#### Coding symbols

On the top side of every low-voltage connector (2) and on the top side of every switching-device truck there are 2 or 3 coding symbols respectively. A switching-device truck may only be inserted in a panel, if the coding symbols are identical in number and kind with those on the low-voltage connector.










- (2) Top side of low-voltage connector
- (3) Coding symbol for electromagnetic interlock
- (4) Coding symbol for current rating (circuit-breaker panels: also for control functions)
- (5) Optional: Coding symbol for current rating (circuit-breaker panels: also for control functions)

Fig. 139: Coding symbols on low-voltage connector and switching-device truck

The coding symbols characterize the functional properties of a panel version. The leftmost symbol (3) characterizes the functional properties as regards electromagnetic interlocks.

A second symbol or a combination of two further symbols (4; 5) characterizes the panel version as regards its current ratings.

In the case of circuit-breaker panels, the second symbol or the combination of two further symbols characterizes the panel version additionally as regards its specific control functions. Circuit-breaker panels with basic control functions are equipped with 1 shunt release and no other releases. Basic control functions are coded by one symbol only. Circuit-breaker panels with extended control functions are equipped with a second release (a second shunt release / a Ct release / an undervoltage release). Extended control functions are coded by a combination of two symbols.

Position (left to right)	Panel type	Function coded	Symbols	
1 <sup>st</sup> symbol (3)	All types	Electromagnetic interlock		Without electromagnetic interlock
				With electromagnetic interlock: • For racking mechanism of switching-device truck • For operating mechanism of feeder earthing switch
				With electromagnetic interlock: For racking mechanism of switching-device truck
				With electromagnetic interlock: For operating mechanism of feeder earthing switch
2 <sup>nd</sup> symbol (4)	Circuit-breaker	Rated current and <b>basic</b> control functions	Examples:   	
	Other than circuit-breaker	Rated current		
3 <sup>rd</sup> symbol (5; optional)	Circuit-breaker	Rated current and <b>extended</b> control functions		
	Other than circuit-breaker	Rated current		

## Operating the circuit-breaker panel

### Verifying correspondence of switching-device truck version and panel version

A switching-device truck may only be inserted in a panel, if the coding symbols are identical in number and kind with those on the low-voltage connector.

- ⇒ Carefully compare the coding symbols on the top side of the low-voltage connector (1) with the symbols on the top side of the switching-device truck (2).

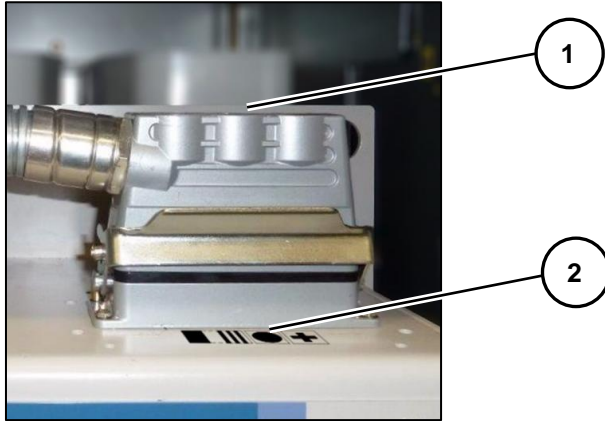


Fig. 140: Verifying correspondence of coding symbols on low-voltage connector and switching-device truck

### Preparing the operating shaft for the feeder earthing switch

- ⇒ Make sure that the coupling pin of the operating shaft for the feeder earthing switch at the circuit-breaker truck and the coupling in the switching-device compartment are in vertical position.

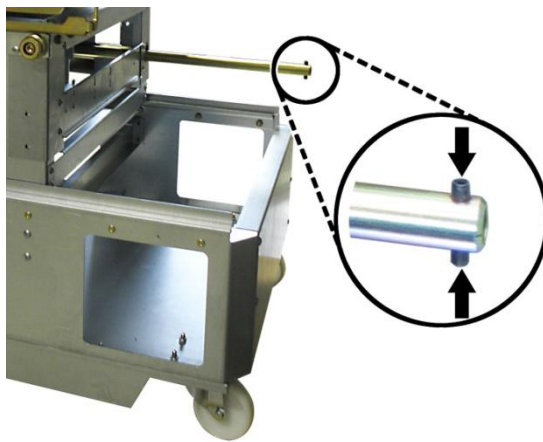


Fig. 141: Coupling pin of the operating shaft for the feeder earthing switch

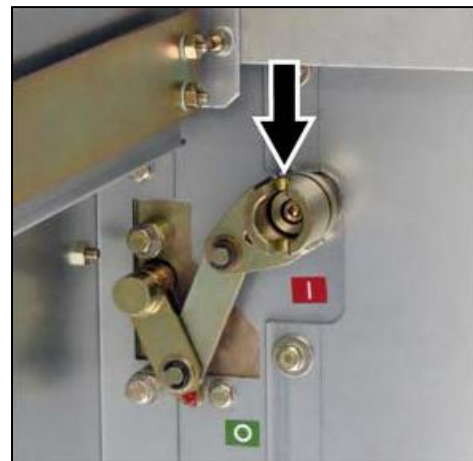


Fig. 142: Coupling of the feeder earthing switch in the switching-device compartment

- ⇒ If required, put the coupling pin of the feeder earthing switch operating shaft in vertical position using the operating lever.

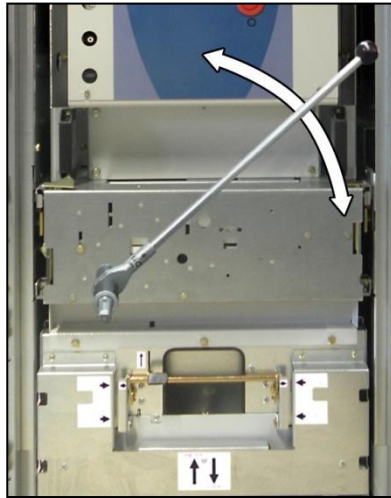


Fig. 143: Operating the feeder earthing switch operating shaft

### Inserting the circuit-breaker truck in a panel

#### CAUTION

##### Maloperation

Protruding parts at the rear of the circuit-breaker truck can cause injuries.

- ⇒ Move and operate the circuit-breaker truck only at the front side.

#### NOTICE

##### Maloperation

The locking bracket at the circuit-breaker truck is exclusively designed for interlocking the circuit-breaker truck with the switchgear frame.

- ⇒ As long as the circuit-breaker truck is not completely moved into the panel, the locking indication at the locking bracket must show UNLOCKED!
- ⇒ Operate the locking bracket only if the circuit-breaker truck has been completely moved into the panel.
- ⇒ Do **not** push the locking bracket downwards towards LOCK if
- the circuit-breaker truck is outside the panel.
  - the circuit-breaker truck is moved only partially into the panel.

## Operating the circuit-breaker panel

### Preconditions

- Panel prepared, no circuit-breaker truck inserted
- Circuit-breaker truck with the same coding as panel available
- Coupling pin of the operating shaft in vertical position
- Spring energy store in the circuit-breaker discharged
- High-voltage door open
- Low-voltage connector stowed away
- Auxiliary voltage for the panel disconnected



Fig. 144: Panel prepared to insert circuit-breaker truck

### Procedure

- ⇒ Move the circuit-breaker truck centrally in front of the panel. The rollers (1) of the circuit-breaker truck point towards the guide rails (2) at the bottom of the panel.
- ⇒ Push the circuit-breaker truck into the panel as far as it will go.

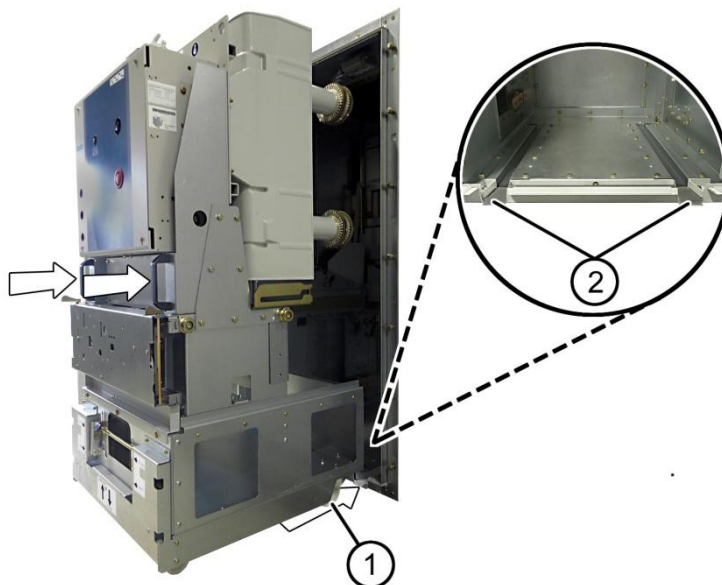


Fig. 145: Circuit-breaker truck in front of a panel



To interlock the circuit-breaker truck with the panel frame at the bottom, lift the locking hook (3) and pull the locking bracket (4) totally downwards until snap-in.

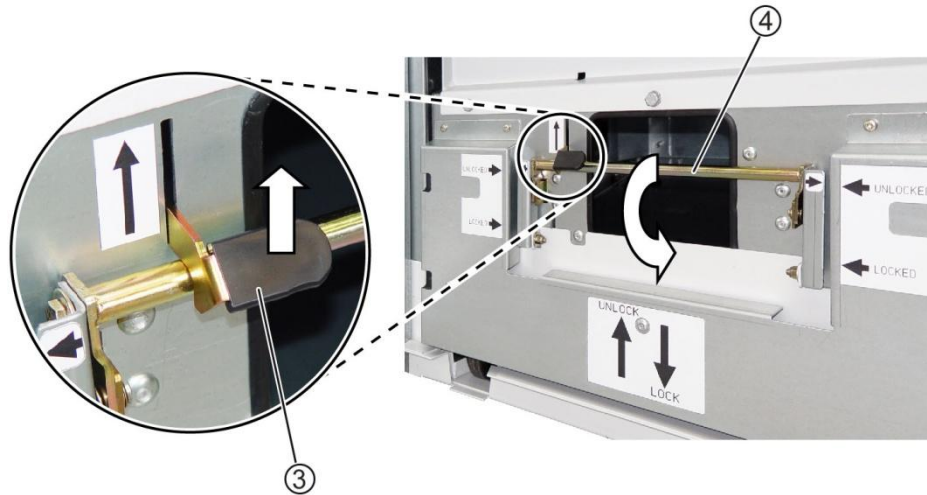


Fig. 146: Interlocking circuit-breaker truck at the bottom

The circuit-breaker truck is now interlocked with the panel frame at the bottom. The locking indicator at the locking bracket shows LOCKED.

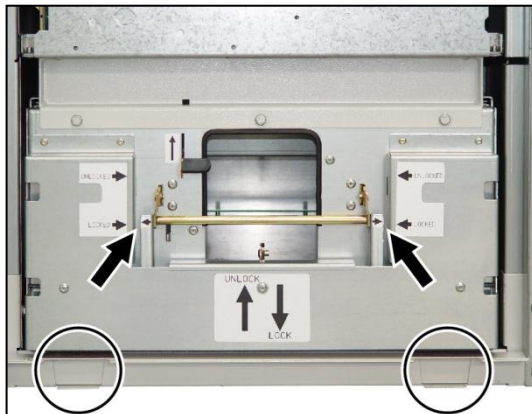


Fig. 147: Circuit-breaker truck interlocked with panel frame



To interlock the circuit-breaker truck with the panel frame at the center, turn the two locking levers to the inside.

The circuit-breaker truck is correctly interlocked with the panel as soon as both locking levers latch tight inside.

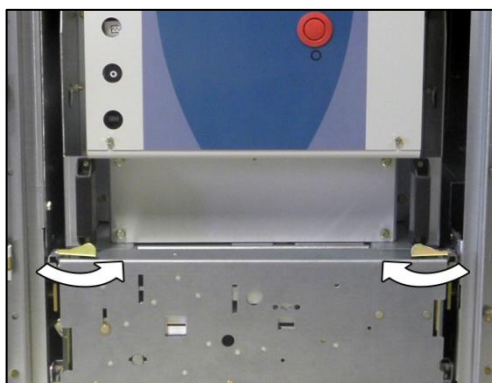


Fig. 148: Interlocking circuit-breaker truck at the center

## Operating the circuit-breaker panel

### Locking the low-voltage connector

#### HINT

In addition to these instructions, an instruction label on the circuit-breaker truck informs about plugging on the low-voltage connector.

Follow the advice on the label (3) to push the longitudinal fastener.

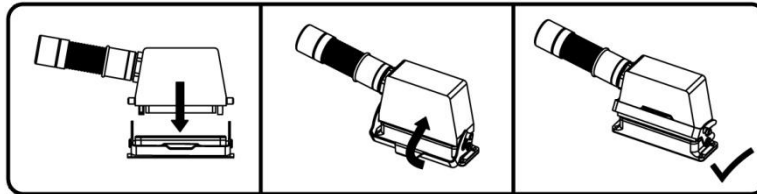


Fig. 149: Instruction label on the circuit-breaker truck

- ⇒ Take the low-voltage connector out of the support located underneath the low-voltage compartment.

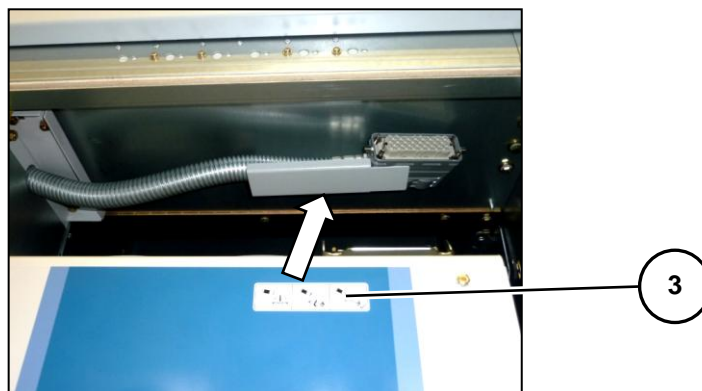


Fig. 150: Low-voltage connector stowed away

- ⇒ Carefully plug on the low-voltage connector (2) from above.
- ⇒ To secure the low-voltage connector, push the longitudinal fastener (1) of the coupling upwards.

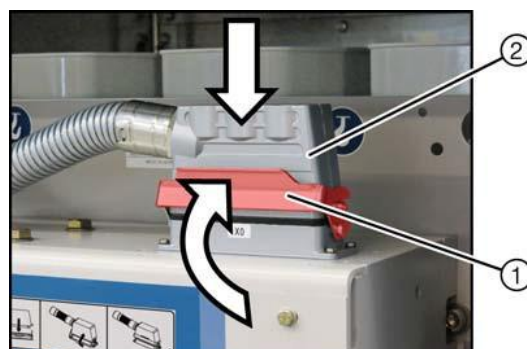


Fig. 151: Plugging on and securing the low-voltage connector

⇒ Close the high-voltage door.

⇒ Switch the auxiliary voltage on.

The motor in the circuit-breaker starts up and charges the spring energy store. The spring state indicator for the closing spring changes to CHARGED.

✓ The circuit-breaker truck is inserted in the panel and the high-voltage door is closed.

# Operating the disconnecting panel

## 11 Operating the disconnecting panel



### HINT

Read and understand these instructions before attempting operating works.

### 11.1 Control elements at the front side of the panel

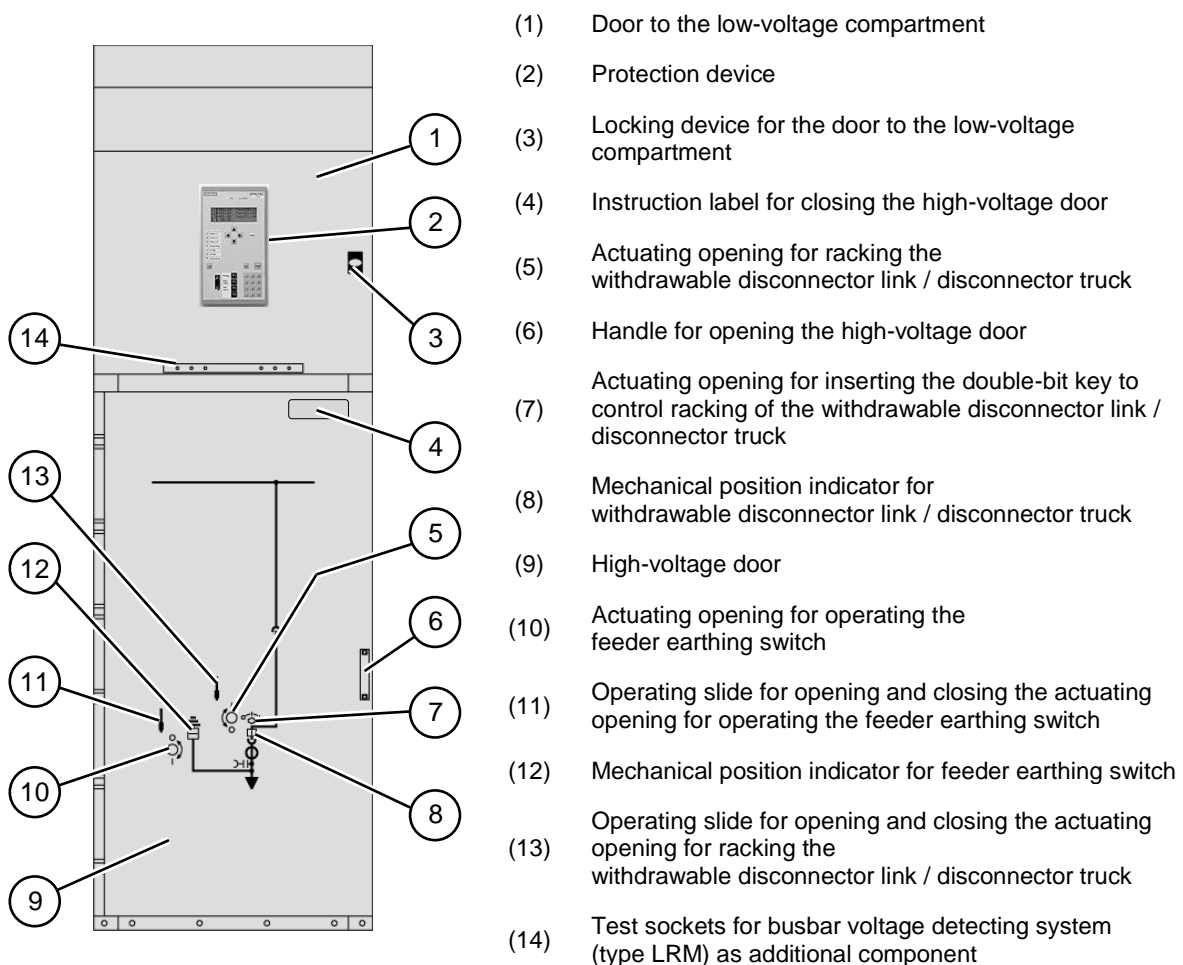


Fig. 152: Control elements on the panel front

### 11.2 Position indicators visible on high-voltage door

Withdrawable disconnecter link / disconnecter truck: Service position, intermediate position or test position	Service position 	Intermediate position 	Test position 
Feeder earthing switch: CLOSED position or OPEN position	CLOSED 	OPEN 	

## 11.3 Access to compartments

Regarding accessibility to the individual compartments, NXAIR switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection between the individual compartments is IP2X.

The type of accessibility is provided as follows:

Compartment		Type of accessibility
Switching-device compartment		Interlock-controlled
Voltage transformer compartment		Tool-based
Busbar compartment		Tool-based
Connection compartment	Access from the front side	Interlock-controlled and tool-based
	Access from the rear side	Tool-based

## 11.4 Opening or closing the high-voltage door

The procedure for opening and/or closing the high-voltage door at the disconnecting panel is identical with the procedure for opening and/or closing the high-voltage door at the circuit-breaker panel.

⇒ For opening and/or closing the high-voltage door at the disconnecting panel, see chapter 10.4 and/or 10.5.

## 11.5 Racking the withdrawable disconnecter link / disconnecter truck

### **WARNING**

#### Injury due to effects of high-voltage

Racking the withdrawable disconnecter link / disconnecter truck while busbar system and feeder are under operational high voltage can cause serious damages which may result in:

- Lightning
- Heat
- Loud noise
- Vibration

⇒ **Never** rack the withdrawable disconnecter link / disconnecter truck while the busbar system and feeder are under operational high voltage.

⇒ Get authorization from control station **before** racking the withdrawable disconnecter link / disconnecter truck.

⇒ To release access for racking the withdrawable disconnecter link / disconnecter truck, release the interlocking.

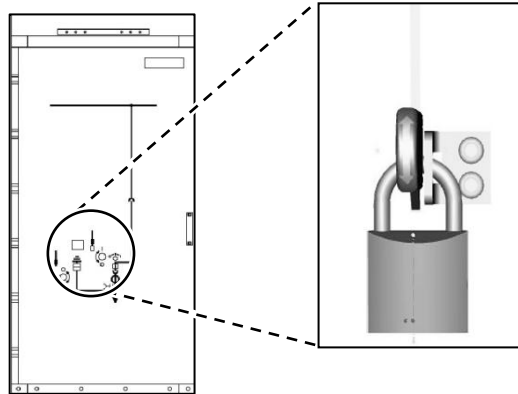
## Operating the disconnecting panel

### Interlocking for racking the withdrawable disconnecter link / disconnecter truck

On disconnecting panels racking the withdrawable disconnecter link or disconnecter truck is interlocked with mechanical interlock by padlock and optionally also with electromagnetic interlock by solenoid.

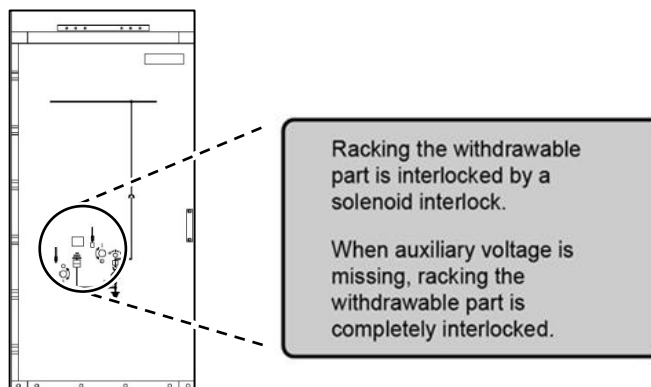
#### HINT

Releasing the mechanical interlock is only permissible to lift the operating slide for opening and closing the actuating opening. The operating slide must otherwise always be interlocked mechanically by padlock. This is also valid for panel versions with additional electromagnetic interlock:



#### HINT

Panel versions with electromagnetic interlock are identified on the high-voltage door with a label for interlocking the disconnecting function:



The procedure for racking the withdrawable disconnecter link / disconnecter truck to service position and/or test position is identical with the procedure for racking the withdrawable circuit-breaker / circuit-breaker truck to service position and/or test position.

⇒ For racking the withdrawable disconnecter link / disconnecter truck to service position and/or test position, see chapter 10.8 and/or 10.9.

## 11.6 Removing or plugging on the low-voltage connector

The procedure for removing and/or plugging on the low-voltage connector in the disconnecting panel is identical with the procedure for removing and/or plugging on the low-voltage connector in the circuit-breaker panel.

⇒ For removing and/or plugging on the low-voltage connector in the disconnecting panel, see chapter 10.20 and/or 10.21.

## 11.7 Taking the withdrawable disconnecter link / disconnecter truck out of a panel or inserting in a panel

The procedure for inserting and/or removing the withdrawable disconnecter link / disconnecter truck in the disconnecting panel is identical with the procedure for inserting and/or removing the withdrawable circuit-breaker / circuit-breaker truck in the circuit-breaker panel.

⇒ For inserting and/or removing the withdrawable disconnecter link in the disconnecting panel, see chapter 10.22 and/or 10.23.  
For inserting and/or removing the disconnecter truck in the disconnecting panel, see chapter 10.24 and/or 10.25.

## 11.8 Earthing or de-earthing the feeder manually

The procedure for earthing and/or de-earthing the feeder in the disconnecting panel is identical with the procedure for earthing and/or de-earthing the feeder in the circuit-breaker panel.

⇒ For earthing and/or de-earthing the feeder in the disconnecting panel, see chapter 10.18 and/or 10.19.

## 11.9 Design of the withdrawable disconnecter link / disconnecter truck

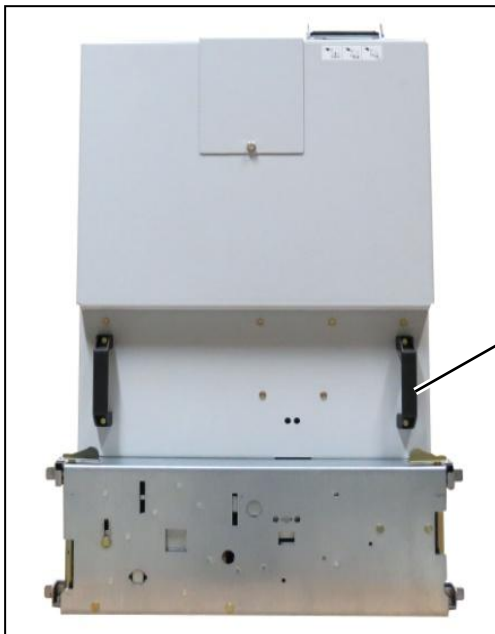


Fig. 153: Front view of withdrawable disconnecter link

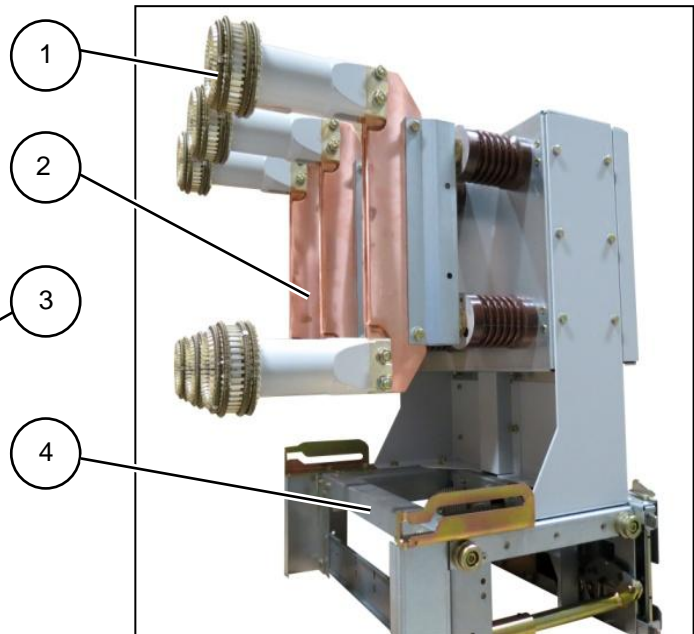


Fig. 154: Side view of withdrawable disconnecter link

(1) Contact arm assembly with tulip contact  
(3) Handle for pulling

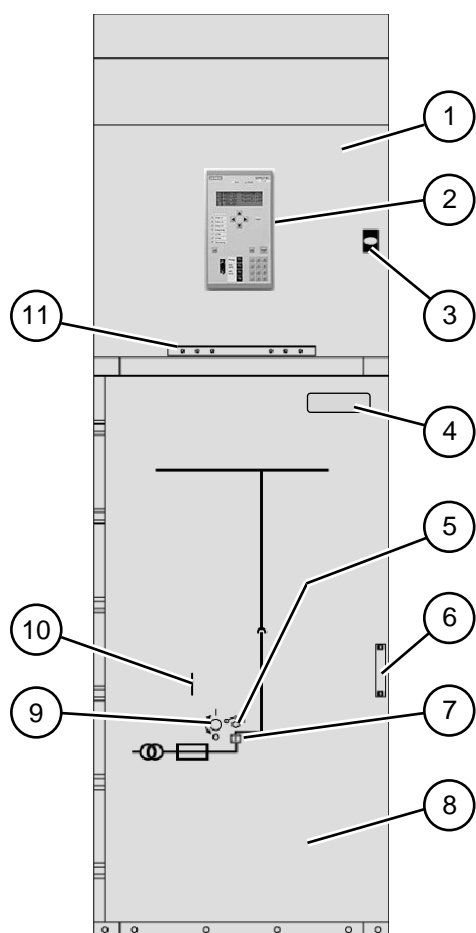
(2) Connection link  
(4) Racking mechanism

## 12 Operating the metering panel

### HINT

Read and understand these instructions before attempting operating works.




### 12.1 Control elements at the front side of the panel



- (1) Door to the low-voltage compartment
- (2) Protection device
- (3) Locking device for the door to the low-voltage compartment
- (4) Instruction label for closing the high-voltage door
- (5) Actuating opening for inserting the double-bit key to control racking of the withdrawable metering part / metering truck
- (6) Handle for opening the high-voltage door
- (7) Mechanical position indicator for withdrawable metering part / metering truck
- (8) High-voltage door
- (9) Actuating opening for racking the withdrawable metering part / metering truck
- (10) Operating slide for opening and closing the actuating opening for racking the withdrawable metering part / metering truck
- (11) Test sockets for busbar voltage detecting system (type LRM) as additional component

Fig. 155: Control elements on the panel front

### 12.2 Position indicator visible on high-voltage door

Indicator for position of withdrawable metering part / metering truck:			
Position indications for:	Service position	Intermediate position	Test position
			

### 12.3 Access to compartments

Regarding accessibility to the individual compartments, NXAIR switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection between the individual compartments is IP2X.

The type of accessibility is provided as follows:

Compartment:		Type of accessibility:
Switching-device compartment		Interlock-controlled
Busbar compartment		Tool-based
Connection compartment	Access from the front side	Interlock-controlled and tool-based
	Access from the rear side	Tool-based

### 12.4 Opening or closing the high-voltage door

The procedure for opening and/or closing the high-voltage door at the metering panel is identical with the procedure for opening and/or closing the high-voltage door at the circuit-breaker panel.

⇒ For opening and/or closing the high-voltage door at the metering panel, see chapter 10.4 and/or 10.5.

### 12.5 Racking the withdrawable metering part / metering truck

The procedure for racking the withdrawable metering part / metering truck to service position and/or test position is identical with the procedure for racking the withdrawable circuit-breaker / circuit-breaker truck to service position and/or test position.

⇒ For racking the withdrawable metering part / metering truck to service position and/or test position, see chapter 10.8 and/or 10.9.

### 12.6 Removing or plugging on the low-voltage connector

The procedure for removing and/or plugging on the low-voltage connector in the metering panel is identical with the procedure for removing and/or plugging on the low-voltage connector in the circuit-breaker panel.

### Control elements at the front side of the withdrawable metering part / metering truck

Access to the control elements at the front side of the withdrawable metering part / metering truck is given after opening the high-voltage door.

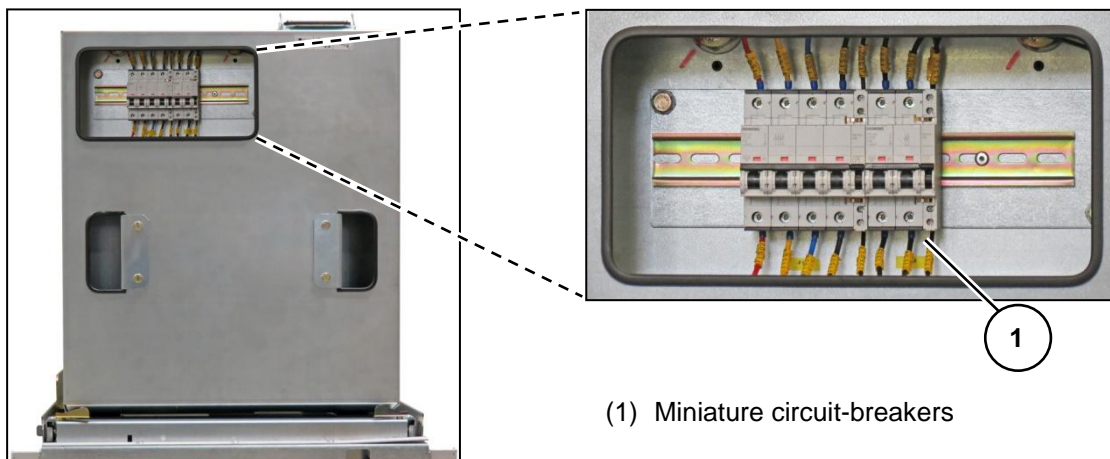


Fig. 156: Control elements at the front of the withdrawable metering part / metering truck, example

## Operating the metering panel

### Before removing the low-voltage connector:

- ⇒ Switch off all miniature circuit-breakers at the front of the withdrawable metering part / metering truck. The indicators change from red to green.



Fig. 157: Miniature circuit-breakers switched on, indicators red

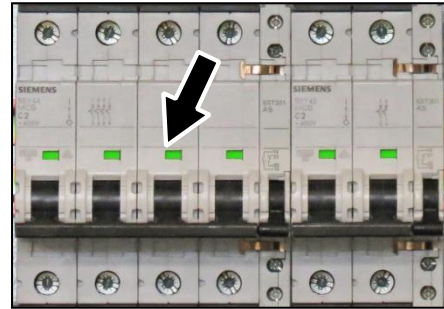


Fig. 158: Miniature circuit-breakers switched off, indicators green

### After plugging on the low-voltage connector:

- ⇒ Switch on all miniature circuit-breakers at the front of the withdrawable metering part / metering truck. The indicators change from green to red.

### Removing or plugging on the low-voltage connector:

- ⇒ For removing and/or plugging on the low-voltage connector in the metering panel, see chapter 10.20 and/or 10.21.

### 12.7 Taking the withdrawable metering part / metering truck out of a panel or inserting in a panel

The procedure for inserting and/or removing the withdrawable metering part / metering truck in the metering panel is identical with the procedure for inserting and/or removing the withdrawable circuit-breaker / circuit-breaker truck in the circuit-breaker panel.

- ⇒ For inserting and/or removing the withdrawable metering part in the metering panel, see chapter 10.22 and/or 10.23.  
⇒ For inserting and/or removing the metering truck in the metering panel, see chapter 10.24 and/or 10.25.

### 12.8 Replacing protection fuse-links

#### NOTICE

##### Maloperation

Withdrawable metering parts / metering trucks are exclusively designed for operation with specific protection fuse-links.

- ⇒ Use only the fuse-link types listed in the following table.  
⇒ Do not mount bridging links instead of protection fuse-links.

## NOTICE

### Undetected damage

A tripped protection fuse-link can cause hidden damages on the other protection fuse-links.



Always replace all protection fuse-links, even if only one protection fuse-link has tripped.

### Selection table for protection fuse-links:

Rated voltage $U_r$ [kV]	Supplier:	Order details:
7.2	SIBA	3037811.2/ 2 A / 195 mm
12	SIBA	3037811.2/ 2 A / 195 mm
17.5	Bussmann (a business of Eaton)	17.5CAV2 / 2 A / 220 mm
Supplier information: <a href="http://www.siba-fuses.com">www.siba-fuses.com</a> / <a href="http://www.eaton.com">www.eaton.com</a>		

### Preconditions

- Withdrawable metering part / metering truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- All voltage transformer MCBs switched to OPEN position
- Low-voltage connector stowed away
- Withdrawable metering part / metering truck taken out of the panel
- Set of proper protection fuse-links available

### Replacing protection fuse-links for rated voltage $\leq 12$ kV



Pull the upper end of the protection fuse-link off the clamp.



Pull the lower end of the protection fuse-link off the clamp and remove the protection fuse-link.



Fig. 159: Pulling off the upper end

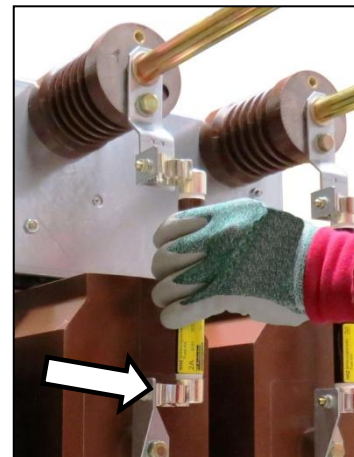


Fig. 160: Pulling off the lower end

## Operating the metering panel

- ⇒ Push the lower end of the new protection fuse-link into the clamp.
- ⇒ Push the upper end of the new protection fuse-link into the clamp.
- ⇒ Perform replacement with all other fuse-links.
- ✓ The protection fuse-links have been replaced.

### HINT

#### Final procedure steps

- ⇒ Next, insert the withdrawable metering part / metering truck into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

## Replacing protection fuse-links for rated voltage 17.5 kV

- ⇒ Remove the upper and lower bolt M8x12 with washer 8.4 completely from the three insulating covers.
- ⇒ Keep the 3 insulating covers, 6 bolts and 6 washers 8.4 for later reuse.

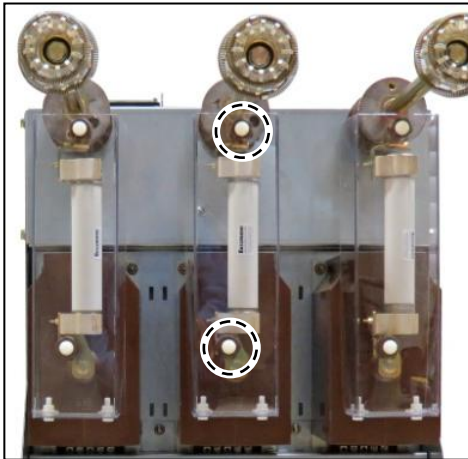


Fig. 161: 2 plastic bolts on insulating cover

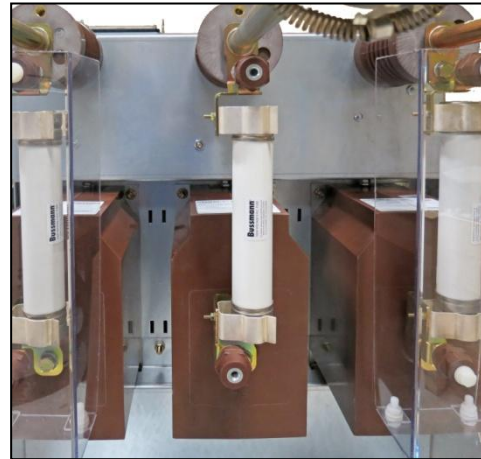


Fig. 162: Insulating cover removed

- ⇒ Pull the upper end of the protection fuse-link off the clamp.
- ⇒ Pull the lower end of the protection fuse-link off the clamp and remove the protection fuse-link.

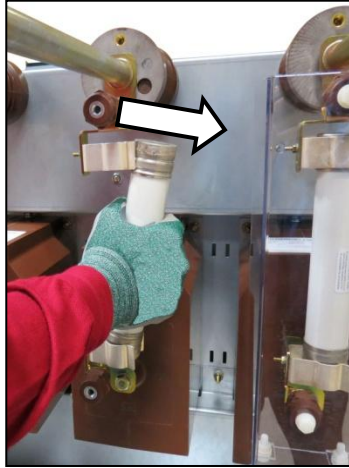


Fig. 163: Pulling off the upper end

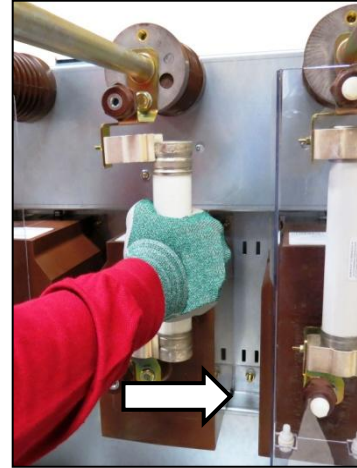


Fig. 164: Pulling off the lower end

- ⇒ Push the lower end of the new protection fuse-link into the clamp.
  - ⇒ Push the upper end of the new protection fuse-link into the clamp.
  - ⇒ Perform replacement with all other fuse-links.
  - ⇒ Fasten an insulating cover over each protection fuse-link at the upper and lower fixing point using a plastic bolt M8x12 and washer 8.4; to do this, turn the M8 bolt into the bolted joint with simple hand force.
- ✓ The protection fuse-links have been replaced.

### HINT

#### Final procedure steps

- ⇒ Next, insert the withdrawable metering part / metering truck into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

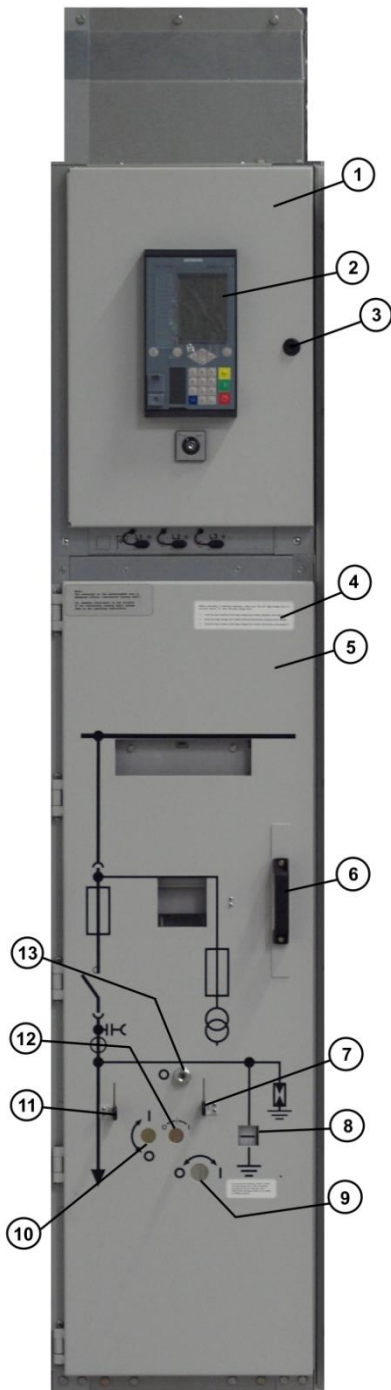
## 13 Operating the contactor panel



### HINT

Read and understand these instructions before attempting operating works.



### 13.1 Control elements at the front side of the panel



- (1) Door to the low-voltage compartment
- (2) Protection device
- (3) Locking device for the door to the low-voltage compartment
- (4) Instruction label for closing the high-voltage door
- (5) High-voltage door
- (6) Handle for opening the high-voltage door
- (7) Operating slide for opening and closing the actuating opening for operating the feeder earthing switch
- (8) Mechanical position indicator for feeder earthing switch
- (9) Actuating opening for operating the feeder earthing switch
- (10) Actuating opening for racking the contactor truck
- (11) Operating slide for opening and closing the actuating opening for racking the contactor truck
- (12) Actuating opening for inserting the double-bit key to control racking the contactor truck
- (13) Actuating opening for emergency opening contactor manually

Fig. 165: Control elements on the panel front

### 13.2 Position indicator visible on high-voltage door

Indicator for position of the feeder earthing switch:		
Position indications for:	CLOSED	OPEN
		

### 13.3 Access to compartments

Regarding accessibility to the individual compartments, NXAIR switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection between the individual compartments is IP2X in standard design.

The type of accessibility is provided as follows:

Compartment:		Type of accessibility:
Switching-device compartment		Interlock-controlled
Busbar compartment		Tool-based
Connection compartment	Access from the front side	Interlock-controlled and tool-based
	Access from the rear side	Tool-based




### 13.4 Opening the high-voltage door

#### WARNING

##### Reduced safety

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the switching-device compartment, such as removing or inserting a contactor truck.


Close the high-voltage door:

-  If an activity inside the switching-device compartment is interrupted.
-  Immediately after an activity inside the switching-device compartment was completed.
-  Before leaving the panel front.

#### CAUTION

##### Injury

The mechanism inside the contactor truck can cause injuries by getting squeezed, caught or cut.

-  Do not remove any parts of the covering.

## Operating the contactor panel

### Preconditions

- Contactor truck in test position
- High-voltage door closed
- Padlock (optional) removed from door handle

### Procedure

- ⇒ Pull door handle upwards and open the high-voltage door.

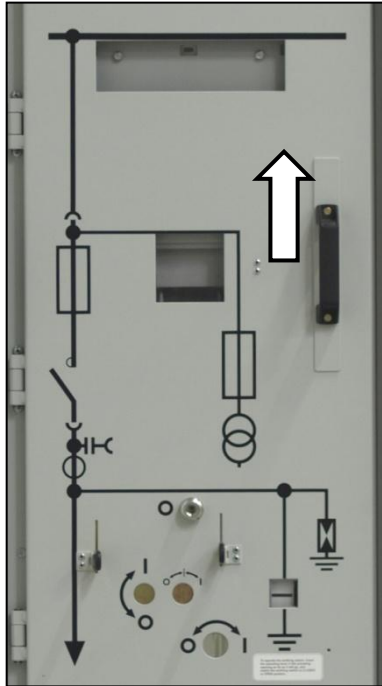


Fig. 166: Opening the high-voltage door

- ✓ The high-voltage door is open.

### 13.5 Closing the high-voltage door

#### **WARNING**

##### **Reduced safety**

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the switching-device compartment, such as removing or inserting a contactor truck.

Close the high-voltage door:

- ⇒ If an activity inside the switching-device compartment is interrupted.
- ⇒ Immediately after an activity inside the switching-device compartment was completed.
- ⇒ Before leaving the panel front.

## Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door describes safe closing of the high-voltage door before executing a switching operation.

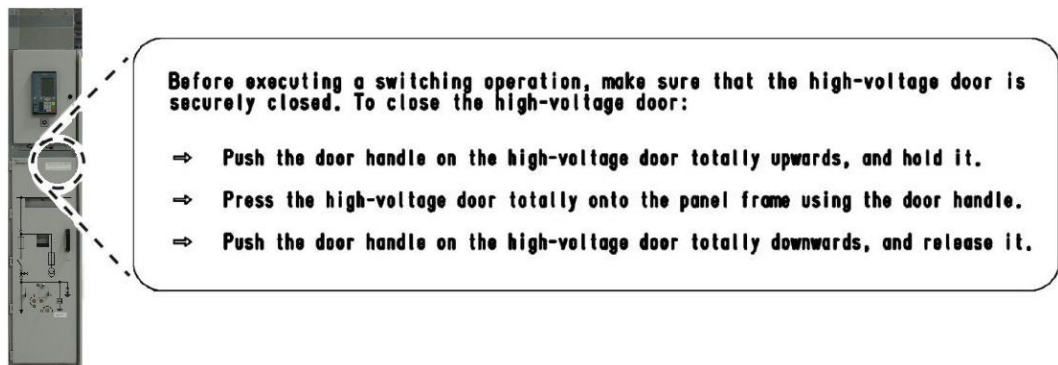


Fig. 167: Instruction label on high-voltage door

## Preconditions

- Contactor truck:
  - Contactor truck removed from the panel
  - or
  - Contactor truck inserted in test position
- High-voltage door open
- Padlock for door handle (optional) available

## Procedure

- ⇒ Push the door handle on the high-voltage door totally upwards, and hold it.
- ⇒ Press the high-voltage door totally onto the panel frame using the door handle.
- ⇒ Push the door handle on the high-voltage door totally downwards, and release it.

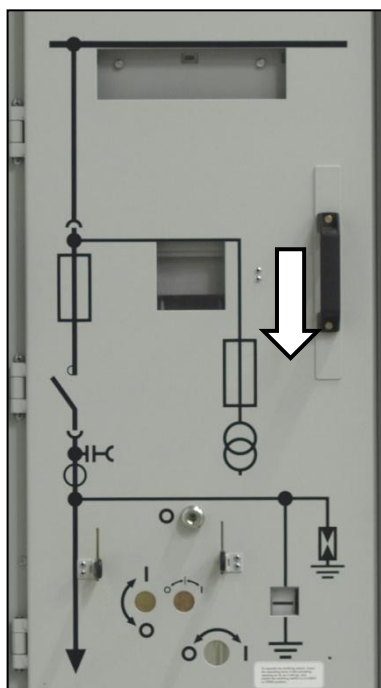


Fig. 168: Closing the high-voltage door

## Operating the contactor panel

⇒ Fit a padlock (optional) to the door handle and close it.

✓ The high-voltage door is closed.

### 13.6 Positions of the contactor truck

#### General description of positions of the contactor truck:

##### Service position

The contactor truck is connected with the busbar system and the outgoing feeder. The auxiliary circuit of the contactor truck is connected through the low-voltage connector.

##### Test position








The contactor truck is disconnected from the busbar system and the outgoing feeder. The auxiliary circuit of the contactor truck is connected through the low-voltage connector.

##### Disconnected position








The contactor truck is disconnected from the busbar system and the outgoing feeder. The auxiliary circuit is disconnected by pulling out the low-voltage connector.

#### Short instruction for racking the contactor truck:

Racking the contactor truck manually from test position to service position:

Step 1 Insert and turn double-bit key			Step 2 Insert and turn racking crank as far as it will go and pull it off	Step 3 Turn and remove double-bit key		
from	by	to		from	by	to
						

Racking the contactor truck manually from service position to test / disconnected position:

Step 1 Insert and turn double-bit key			Step 2 Insert and turn racking crank as far as it will go and pull it off	Step 3 Turn and remove double-bit key		
from	by	to		from	by	to
						

### 13.7 Racking the contactor truck to service position

#### NOTICE

##### Maloperation

Racking the contactor truck to service position is only permissible if the contactor is in OPEN position.



Switch the contactor to OPEN position, if required.

#### Preconditions

- Contactor truck in test position
- Low-voltage connector plugged on (automatically)
- High-voltage door closed
- Contactor in OPEN position
- Feeder earthing switch in OPEN position
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- Racking crank for moving the contactor truck available
- Double-bit key available
- Padlock (optional) removed from operating slide



Fig. 169: Racking crank



Fig. 170: Double-bit key with a diameter of 5 mm

#### Procedure

#### NOTICE

##### Maloperation

All interlocks are only released when the contactor truck is in a stable end position.



Rack the contactor truck absolutely until end position.

## Operating the contactor panel

- ⇒ To release the actuating opening for the double-bit key, lift the operating slide and hold it.
- ⇒ To release access to the contactor truck, insert the double-bit key and turn clockwise as far as it will go (that is 90°).

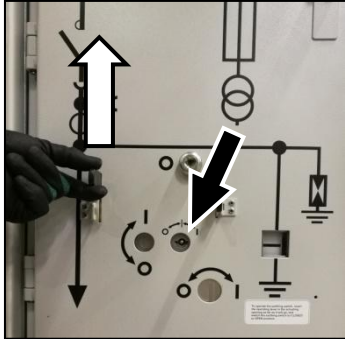


Fig. 171: Lifting the operating slide

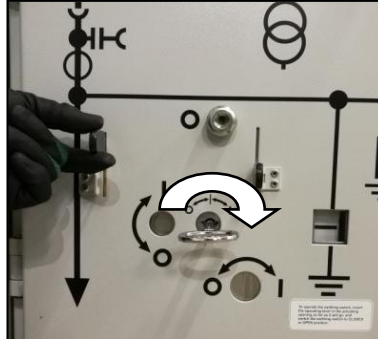


Fig. 172: Turning the double-bit key clockwise



Fig. 173: Operating shaft for racking crank

- ⇒ Push the racking crank for moving the contactor truck onto the operating shaft, and turn clockwise as far as it will go.
- ⇒ Remove the racking crank for moving the contactor truck.
- ⇒ Turn the double-bit key clockwise as far as it will go (that is 90°) to interlock the contactor truck.



Fig. 174: Turning the racking crank clockwise

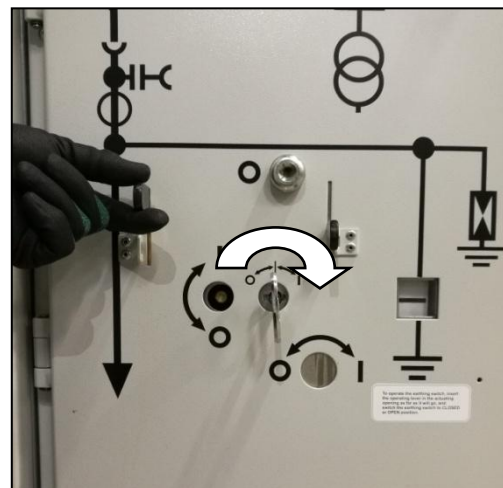


Fig. 175: Turning the double-bit key clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The contactor truck has been racked from test position to service position.

### 13.8 Racking the contactor truck to test position

#### NOTICE

##### Maloperation

Racking the contactor truck to test position is only permissible if the contactor is in OPEN position.

⇒ Switch the contactor to OPEN position, if required.

#### Preconditions

- Contactor truck in service position
- Contactor in OPEN position
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- Racking crank for moving the contactor truck available
- Double-bit key available
- Padlock (optional) removed from operating slide



Fig. 176: Racking crank



Fig. 177: Double-bit key with a diameter of 5 mm

#### Procedure

#### NOTICE

##### Maloperation

All interlocks are only released when the contactor truck is in a stable end position.

⇒ Rack the contactor truck absolutely until end position.

## Operating the contactor panel

- ⇒ To release the actuating opening for the double-bit key, lift the operating slide and hold it.
- ⇒ To release access to the contactor truck, insert the double-bit key and turn counter-clockwise as far as it will go (that is 90°).

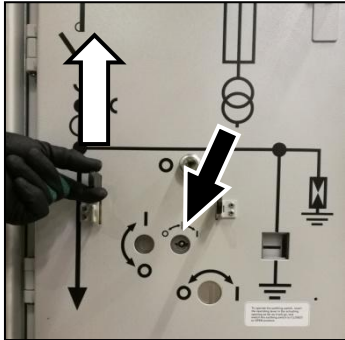


Fig. 178: Lifting the operating slide



Fig. 179: Turning the double-bit key counter-clockwise



Fig. 180: Operating shaft for racking crank

- ⇒ Push the racking crank for moving the contactor truck onto the operating shaft, and turn counter-clockwise as far as it will go.
- ⇒ Remove the racking crank for moving the contactor truck.
- ⇒ Turn the double-bit key counter-clockwise as far as it will go (that is 90°) to interlock the contactor truck.



Fig. 181: Turning the racking crank counter-clockwise



Fig. 182: Turning the double-bit key counter-clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The contactor truck has been racked from service position to test position.

### 13.9 Closing the contactor electrically

#### NOTICE

##### Conflicting operation

Operating the contactor electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

#### HINT

##### Unexpected switching noise and vibration

Operating the contactor causes a short loud noise and low vibration.

⇒ Expect switching noise and low vibration from inside the contactor.

#### Preconditions

- Contactor truck in service position or in test position
- Contactor in OPEN position
- High-voltage door closed
- Auxiliary voltage for the panel connected
- Remote or local control

#### Procedure

⇒ Close the contactor via central or local electrical control command element.

✓ The contactor is closed.

### 13.10 Opening the contactor electrically

#### NOTICE

##### Conflicting operation

Operating the contactor electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

#### HINT

##### Unexpected switching noise and vibration

Operating the contactor causes a short loud noise and low vibration.

⇒ Expect switching noise and low vibration from inside the contactor.

### HINT

#### **Contactor truck version with mechanical closing latch**

Opening the contactor also opens the closing latch.

#### **Preconditions**

- Contactor truck in service position or in test position
- Contactor in CLOSED position
- High-voltage door closed
- Auxiliary voltage for the panel connected
- Remote or local control

#### **Procedure**

⇒ Open the contactor via central or local electrical control command element.

✓ The contactor is open.

### **13.11 Opening the contactor manually**

#### **NOTICE**

##### **Conflicting operation**

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For operating the contactor manually, set the panel to local control, for example by switching the local-remote switch to LOCAL position.

### HINT

#### **Unexpected switching noise and vibration**

Operating the contactor causes a short loud noise and low vibration.

⇒ Expect switching noise and low vibration from inside the contactor.

### HINT

Manual operation of the contactor is limited to manual opening of the contactor. Manual closing of the contactor is not possible.

### HINT

#### **Contactor truck version with mechanical closing latch**

Opening the contactor also opens the closing latch.

## Preconditions

- Contactor truck in service position or in test position
- Contactor in CLOSED position
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- High-voltage door closed
- Panel set to local control
- Double-bit key available

## Procedure

⇒ To release the actuating opening for the double-bit key, lift the operating slide and hold it.

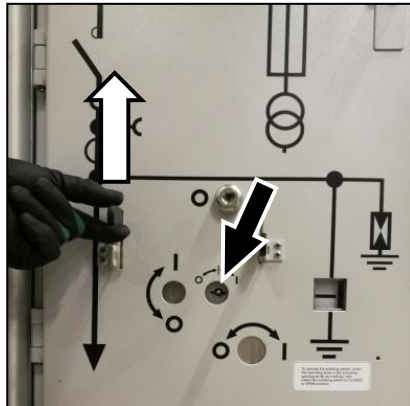


Fig. 183: Operating slide lifted

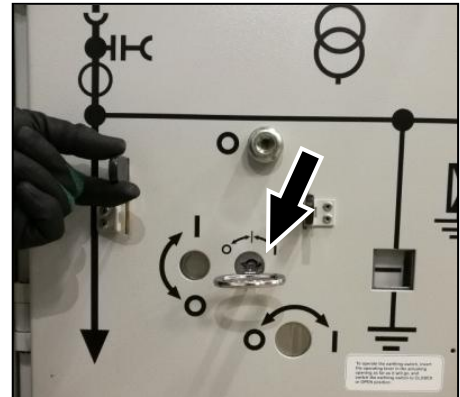


Fig. 184: Double-bit key to turn

To open the contactor manually, insert the double-bit key and turn as far as it will go:

- ⇒
- Contactor truck in service position: 90° counter-clockwise
  - Contactor truck in test position: 90° clockwise

✓ The contactor is open.

## HINT

### Final procedure steps

- ⇒ You may now go on to insert the crank for racking the contactor truck.
- ⇒ Otherwise remove the double-bit key, push the operating slide down, and fit a padlock (optional) to the operating slide and close it.

### 13.12 Emergency opening the contactor manually

#### NOTICE

##### Maloperation

Emergency opening the contactor manually is only permissible in case of emergency (for example the electrical malfunction of the contactor).

- ⇒ Perform the following activities in case of emergency.
- ⇒ For operating the contactor manually, use the push rod only in the way described hereafter.

#### Preconditions

- Contactor truck in service position or in test position
- Contactor in CLOSED position
- High-voltage door closed
- Push rod available

#### Procedure

- ⇒ Insert the push rod through the actuating opening in the high-voltage door and press it to the frame as far as it will go.

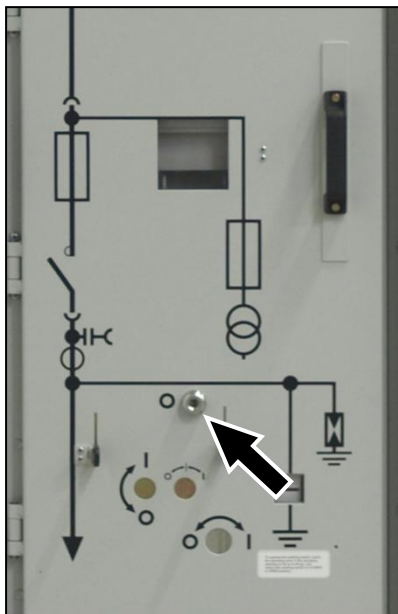


Fig. 185: High-voltage door with actuating opening



Fig. 186: Push rod inserted



The contactor is open.

### 13.13 Operating conditions without auxiliary voltage

Contactor panels with electromagnetic interlock for racking the contactor truck (optional) plus mechanical closing latching for the contactor (optional) are equipped with an additional feature.

In case the auxiliary voltage is disconnected, the electromagnetic interlock can be unlocked manually. This manual unlocking is operated on the high-voltage door with a lever. This lever is padlocked during standard operating conditions.

#### NOTICE

##### Maloperation

Without auxiliary voltage, turning the double-bit key for opening the contactor manually is mechanically interlocked.

- ⇒ Do **not** try to turn the double-bit key while the mechanical interlock is active.
- ⇒ Perform manual unlocking of the electromagnetic interlock to release turning of the double-bit key.

In addition to these instructions, instruction labels on the high-voltage door inform about the operation of the manual unlocking:



Fig. 187: Manual unlocking, padlocked

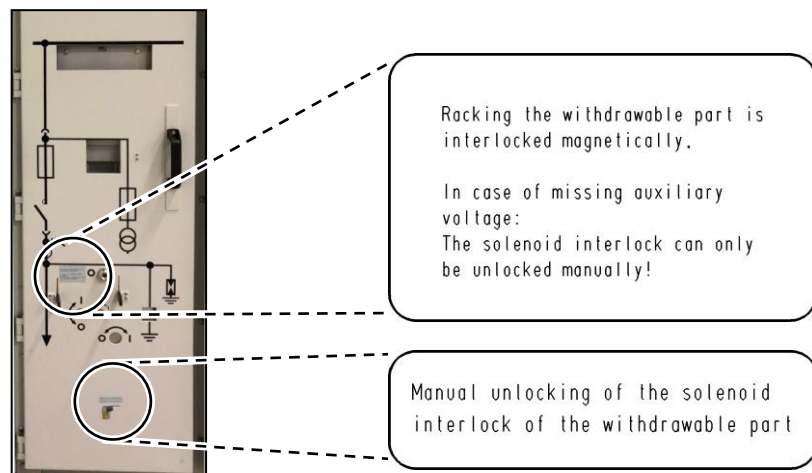


Fig. 188: Instruction labels on high-voltage door

### Racking the contactor truck to test position

#### HINT

##### Unexpected switching noise and vibration

If the contactor is in CLOSED position before starting the procedure, turning the double-bit key 90° opens the contactor. This causes a short loud noise and low vibration.

- ⇒ Expect switching noise and low vibration from inside the contactor when turning the double-bit key.

## Operating the contactor panel

### Preconditions

- Authorization to operate the manual unlocking available
- Auxiliary voltage for the panel disconnected
- High-voltage door closed
- Contactor truck in service position
- Contactor in CLOSED or OPEN position
- Key for padlock available
- Double-bit key available
- Racking crank available

### Procedure

- ⇒ Make sure to operate the particular contactor panel authorization is given for.
- ⇒ To release the actuating opening for the double-bit key, lift the operating slide and hold it.

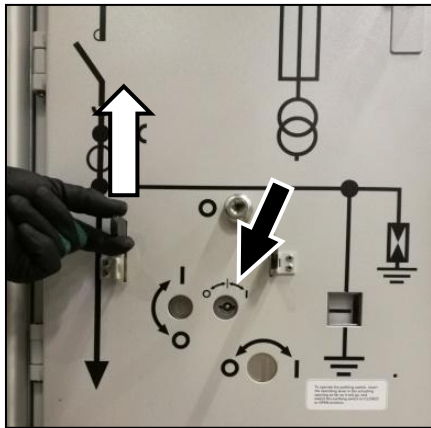


Fig. 189: Lifting the operating slide

- ⇒ Insert the double-bit key without turning.

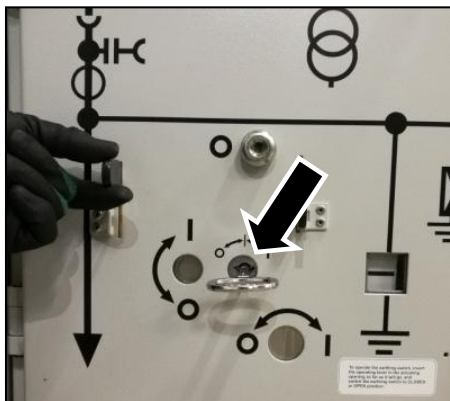


Fig. 190: Double-bit key inserted

- ⇒ Remove the padlock from the manual unlocking.

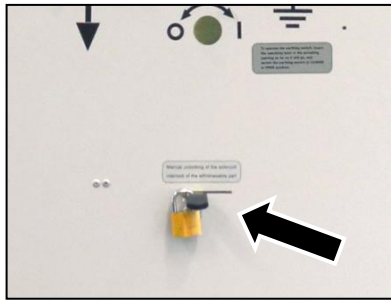


Fig. 191: Manual unlocking, padlocked

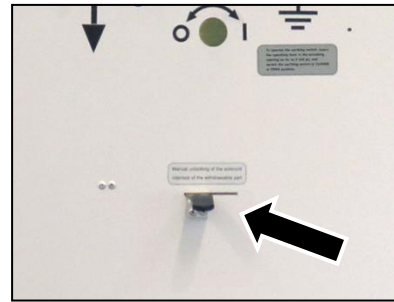


Fig. 192: Manual unlocking, padlock removed

⇒ Move the lever for the manual unlocking to the right as far as it will go and hold it.

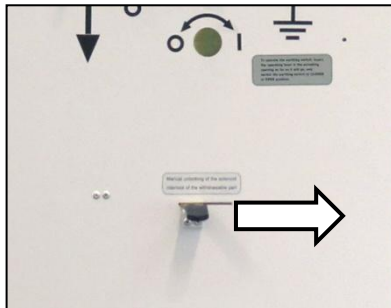


Fig. 193: Moving the lever to the right

⇒ To release access to the contactor truck, turn the double-bit key counter-clockwise as far as it will go (that is 90°).



Fig. 194: Turning the double-bit key counter-clockwise

⇒ Move the lever for the manual unlocking to the left as far as it will go. Fit the padlock to the lever and close the padlock.

⇒ Push the racking crank for moving the contactor truck onto the operating shaft, and turn counter-clockwise as far as it will go.

⇒ Remove the racking crank for moving the contactor truck.

## Operating the contactor panel

- ⇒ Turn the double-bit key counter-clockwise as far as it will go (that is 90°) to interlock the contactor truck.

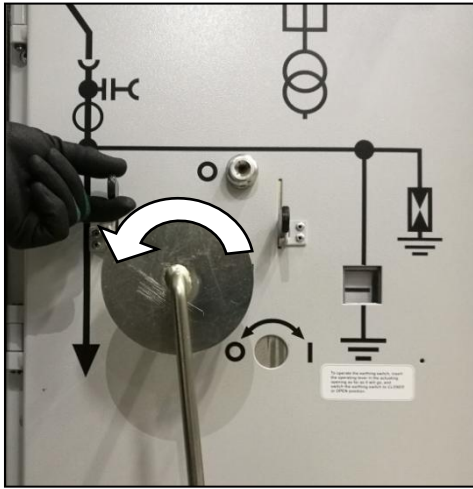


Fig. 195: Turning the racking crank counter-clockwise

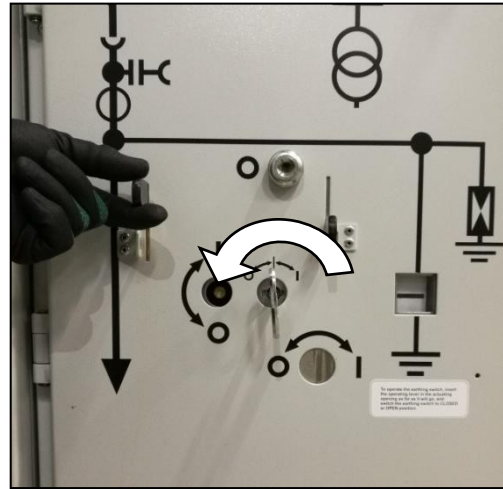


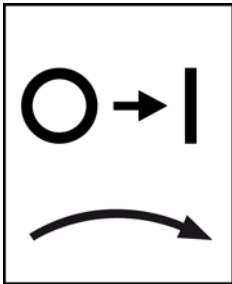
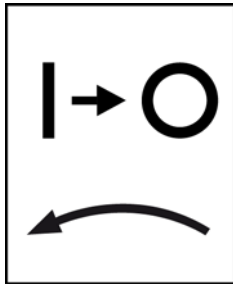
Fig. 196: Turning the double-bit key counter-clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The contactor truck has been racked from service position to test position.

### 13.14 Operating lever for earthing switch

#### Operating lever for earthing switch:

- With the operating lever, the switching process at the feeder earthing switch can only be executed in turning direction.
- The turning movement into the opposite direction has a freewheel and does not move the feeder earthing switch; the operating lever works like a ratchet spanner.
- The feeder earthing switch is operated either clockwise or counter-clockwise according to the switching function.
- To use the operating lever, two instruction labels show the turning direction for the corresponding switching function.

Switching function:	From OPEN to CLOSED position	From CLOSED to OPEN position
Turning direction of the operating lever:	Clockwise	Counter-clockwise
Instruction label on the operating lever:		

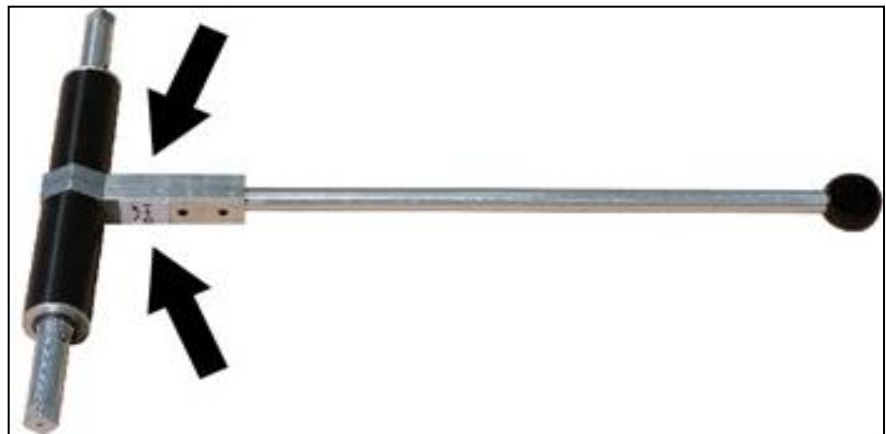


Fig. 197: Instruction labels on the operating lever

### 13.15 Earthing the feeder manually

#### NOTICE

##### Maloperation

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.

⇒ Do not try to remove the operating lever at intermediate positions.

#### NOTICE

##### Maloperation

If the operating lever is not inserted correctly, the feeder earthing switch may be damaged.

⇒ Insert the operating lever in the actuating opening as far as it will go.

#### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the operating lever for the feeder earthing switch.

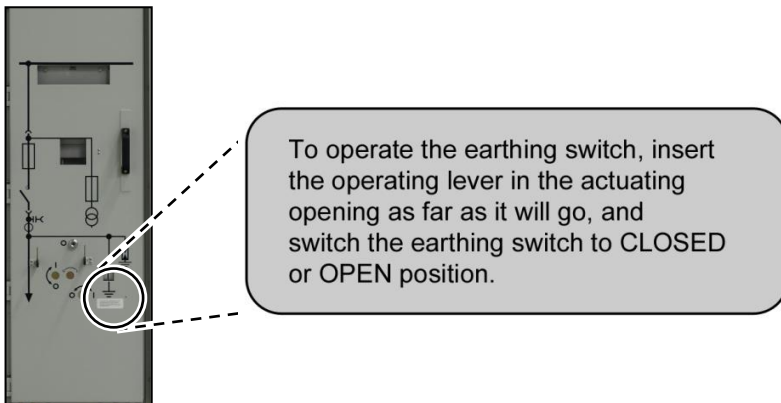


Fig. 198: Instruction label on high-voltage door

#### Preconditions

- Release to earth the feeder available
- High-voltage door closed
- Contactor truck in test position
- Feeder to be earthed isolated
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- Operating lever available

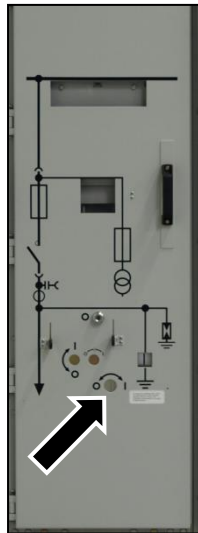


Fig. 199: Actuating opening on high-voltage door

### Procedure

- ⇒ To release the actuating opening, lift the operating slide and hold it.

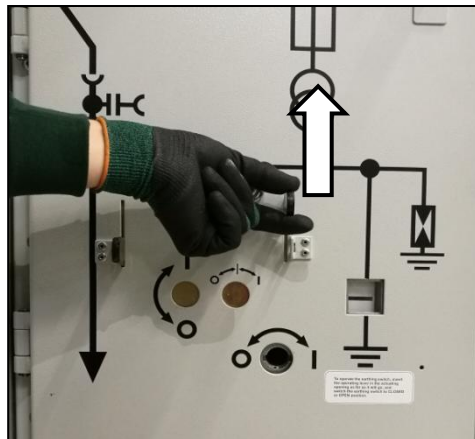


Fig. 200: Lifting the operating slide

- ⇒ Insert the operating lever slightly into the actuating opening such that the instruction label for clockwise turning direction is visible.

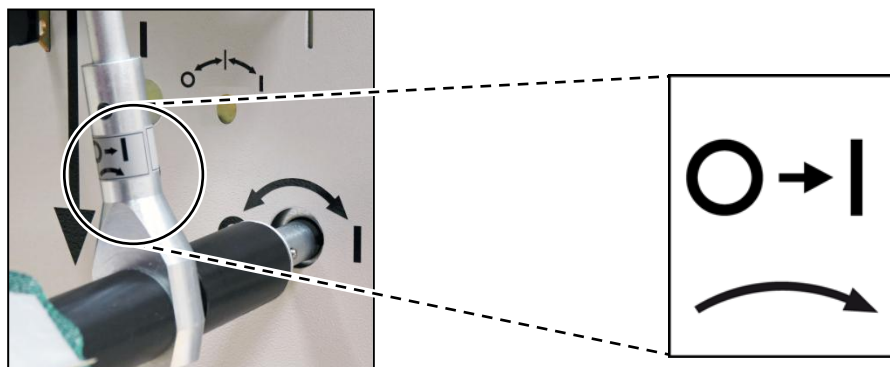


Fig. 201: Instruction label on operating lever

## Operating the contactor panel

- ⇒ Adjust the position of the lever such that the pins on the lever are horizontal and parallel with the openings in the feeder earthing switch operating mechanism.
- ⇒ Insert the operating lever in the actuating opening as far as it will go.

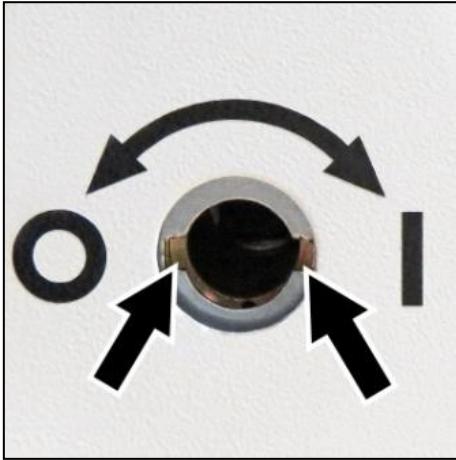


Fig. 202: Openings in operating mechanism

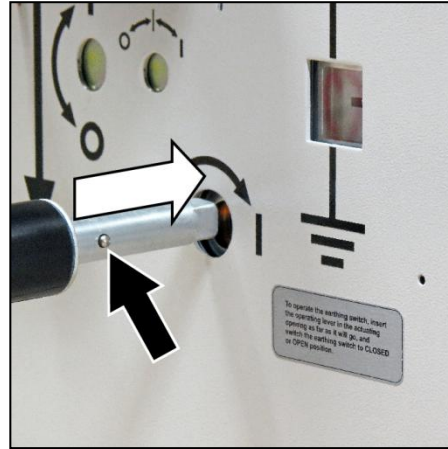


Fig. 203: Inserting the lever with pins and openings parallel

- ⇒ Turn the operating lever to the right and left alternately and keep turning until the feeder earthing switch changes to CLOSED position.



Fig. 204: Turning the lever to the right and left alternately

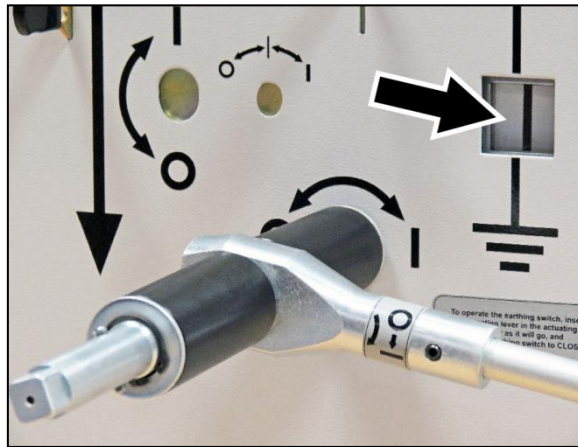


Fig. 205: Position indicator on high-voltage door in CLOSED position

- ⇒ Remove the operating lever.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock (optional) to the operating slide and close it.
- ✓ The feeder is earthed.

### 13.16 De-earthing the feeder manually

#### NOTICE

##### Maloperation

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.

⇒ Do not try to remove the operating lever at intermediate positions.

#### NOTICE

##### Maloperation

If the operating lever is not inserted correctly, the feeder earthing switch may be damaged.

⇒ Insert the operating lever in the actuating opening as far as it will go.

#### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the operating lever for the feeder earthing switch.

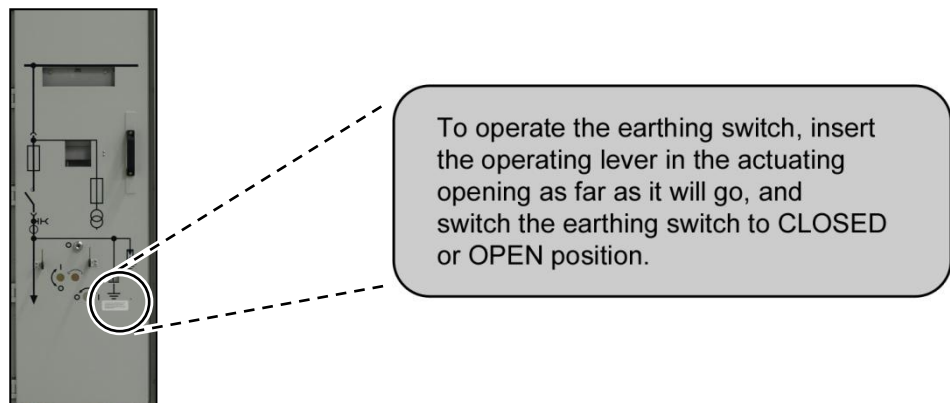


Fig. 206: Instruction label on high-voltage door

#### Preconditions

- High-voltage door closed
- Contactor truck in test position
- Padlock (optional) removed from operating slide
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- Operating lever available



Fig. 207: Actuating opening  
on high-voltage door

### Procedure

- ⇒ To release the actuating opening, lift the operating slide and hold it.



Fig. 208: Lifting the operating slide

- ⇒ Insert the operating lever slightly into the actuating opening such that the instruction label for counter-clockwise turning direction is visible.

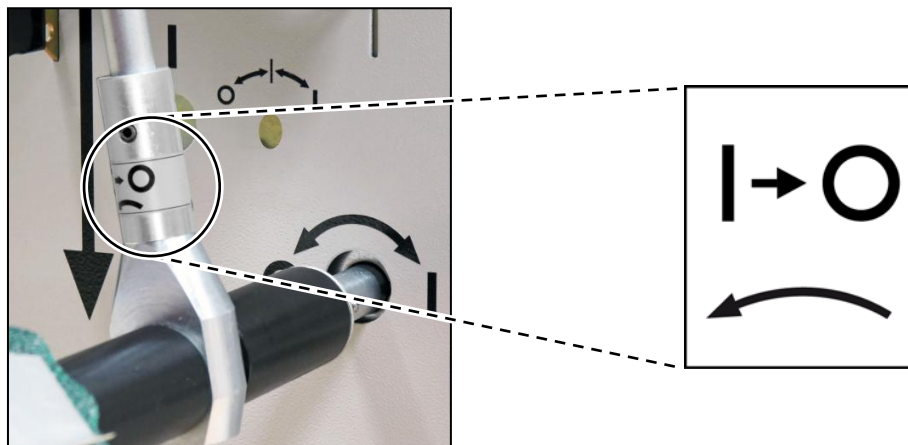


Fig. 209: Instruction label on operating lever

⇒ Adjust the position of the lever such that the pins on the lever are horizontal and parallel with the openings in the feeder earthing switch operating mechanism.

⇒ Insert the operating lever in the actuating opening as far as it will go.

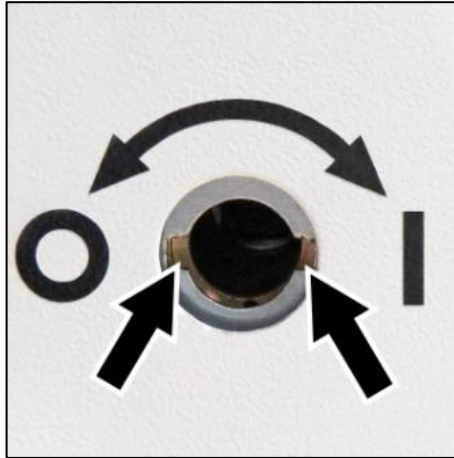


Fig. 210: Openings in operating mechanism

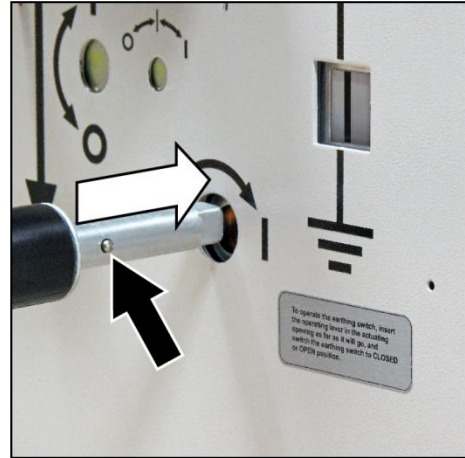


Fig. 211: Inserting the lever with pins and openings parallel

⇒ Turn the operating lever to the right and left alternately and keep turning until the feeder earthing switch changes to OPEN position.



Fig. 212: Turning the lever to the right and left alternately

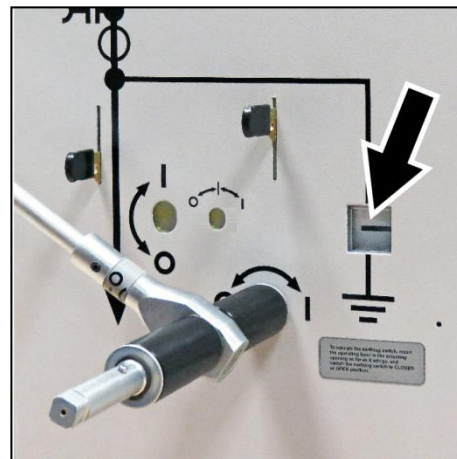


Fig. 213: Position indicator on high-voltage door in OPEN position

⇒ Remove the operating lever.

⇒ To close the actuating opening, push the operating slide down as far as it will go.

⇒ Fit a padlock (optional) to the operating slide and close it.

✓ The feeder is de-earthed.

### 13.17 Taking the contactor truck out of the panel

#### CAUTION

##### Injury

The mechanism inside the contactor truck can cause injuries by getting squeezed, caught or cut.



Do not remove any parts of the covering.

#### HINT

##### Plugging on the low-voltage connector

The low-voltage connection decouples automatically when taking out the contactor truck.

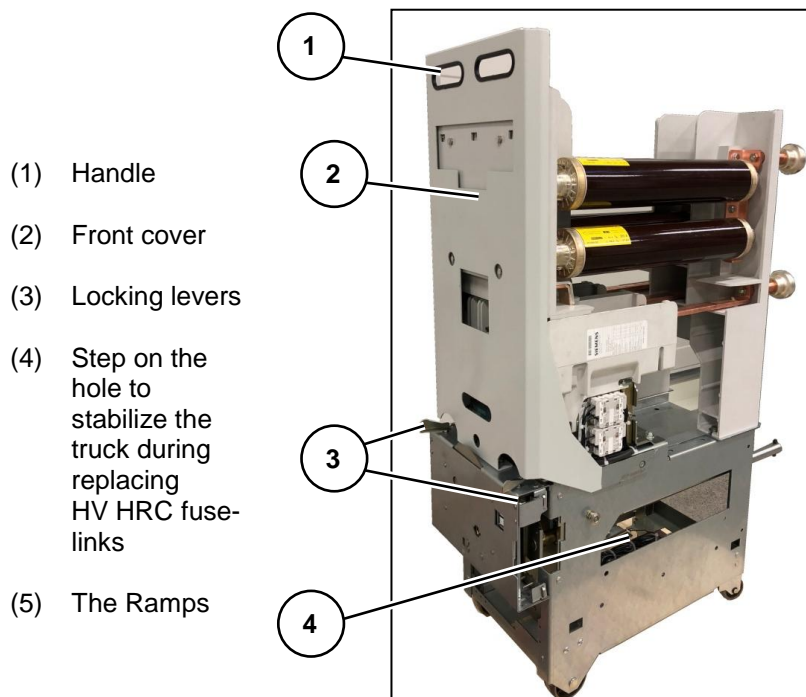


Fig. 214: Contactor truck



Fig. 215: Contactor panel with high-voltage door open

#### Preconditions

- Contactor truck available
- Contactor truck in test position
- High-voltage door open


## Procedure

### Pulling the ramp downwards

#### CAUTION

##### Protruding parts


Protruding parts such as locking elements at the contactor truck or at the rear of the contactor truck can cause injuries.

 Move the contactor truck only at the front side.

#### CAUTION

##### Sharp edges

The metal parts of the contactor truck may have sharp edges.

 Put on personal protective equipment.

 Pull the ramps (1) downwards from the panel base.

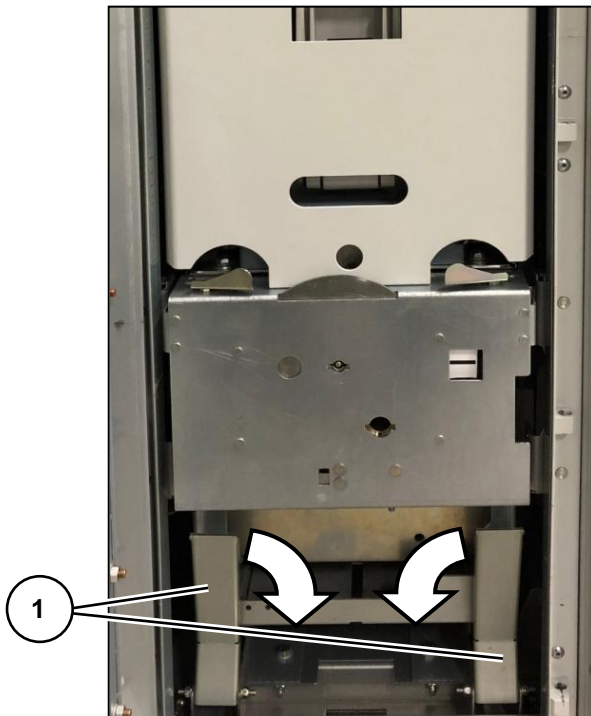


Fig. 216: Pulling the ramps downwards

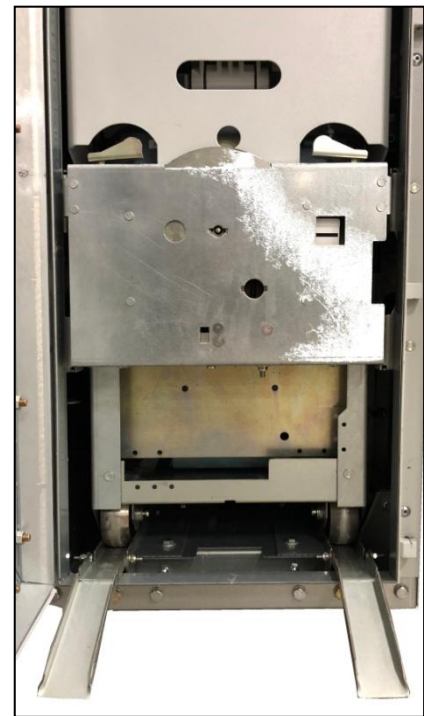


Fig. 217: The ramps in open position

## Operating the contactor panel

### Unlocking the contactor truck from the panel

- ⇒ Release the interlocking with the panel by turning the two locking levers at the contactor truck to the outside.



Fig. 218: Releasing the interlocking with the panel



Fig. 219: Contactor truck unlocked

### Moving contactor truck outside of the panel

#### **CAUTION**

##### **Maloperation**

The contactor truck is designed exclusively for slow and careful driving on obstacle-free paths.

- ⇒ Before moving the contactor truck, check the path and the ramps.
- ⇒ Keep the shunting area, paths and ramps free of obstacles and dry.
- ⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.
- ⇒ Move the contactor truck only slowly and constantly.
- ⇒ The contactor truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

#### **CAUTION**

##### **Protruding parts**

Protruding parts such as locking elements at the contactor truck or at the rear of the contactor truck can cause injuries.

- ⇒ Move the contactor truck only at the front side.

- ⇒ To move the contactor truck outside of the panel, use two handle.



Fig. 220: The handle on contactor truck



Fig. 221: Moving the contactor truck using two handle

⇒ Pull the contactor truck at the top of the front cover (1) onto the ramps (2).

⇒ Keep pulling the contactor truck until it is outside of the panel. By doing so, the low-voltage connection is separated automatically.

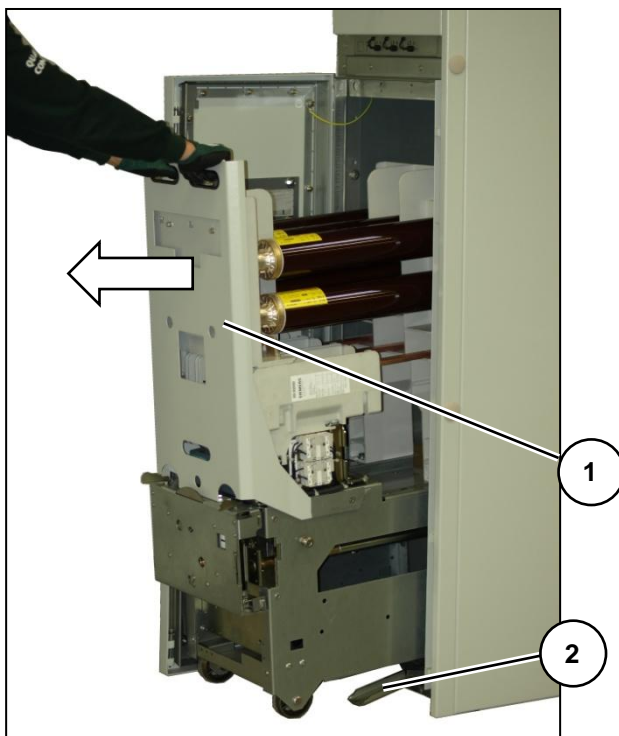


Fig. 222: Pulling the contactor truck

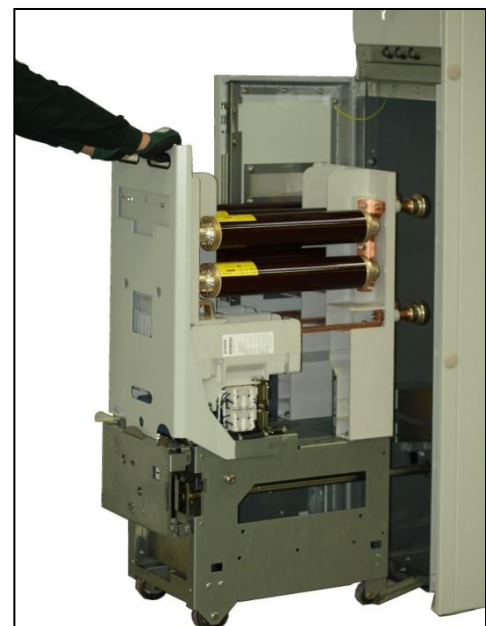


Fig. 223: Contactor truck is taken out of the panel

## Operating the contactor panel

⇒ If no further operation is executed: Close the high-voltage door.

✓ The contactor truck is taken out of the panel.

### 13.18 Inserting the contactor truck in a panel

#### **CAUTION**

##### **Injury**

The mechanism inside the contactor truck can cause injuries by getting squeezed, caught or cut.

⇒ Do not remove any parts of the covering.

#### **CAUTION**

##### **Maloperation**

Protruding parts such as locking elements at the contactor truck or at the rear of the contactor truck can cause injuries.

⇒ Move contactor truck only at the front side.

#### **CAUTION**

##### **Maloperation**

The contactor truck is designed exclusively for slow and careful driving on obstacle-free paths.

⇒ Before moving the contactor truck, check the path and the ramps.

⇒ Keep the shunting area, paths and the ramps free of obstacles and dry.

⇒ Remove objects such as small parts, installation material or tools from the floor in the travel area.

⇒ Move the contactor truck only slowly and constantly.

⇒ The contactor truck is not suitable for unsteady floor, such as stairs, deepening or floor joints.

#### **NOTICE**

##### **Maloperation**

A contactor truck may only be operated in a panel if the HV HRC fuse-links installed match the particular panel version. However, there is no coding on the contactor truck to prevent inserting it in a panel not suitable for the particular contactor version.

⇒ Do absolutely observe the rated currents of the HV HRC fuse-links.

## Preconditions

- Panel prepared, no contactor truck inserted
- High-voltage door open
- Contactor truck available
- HV HRC fuse-links in the contactor correspond to the particular panel

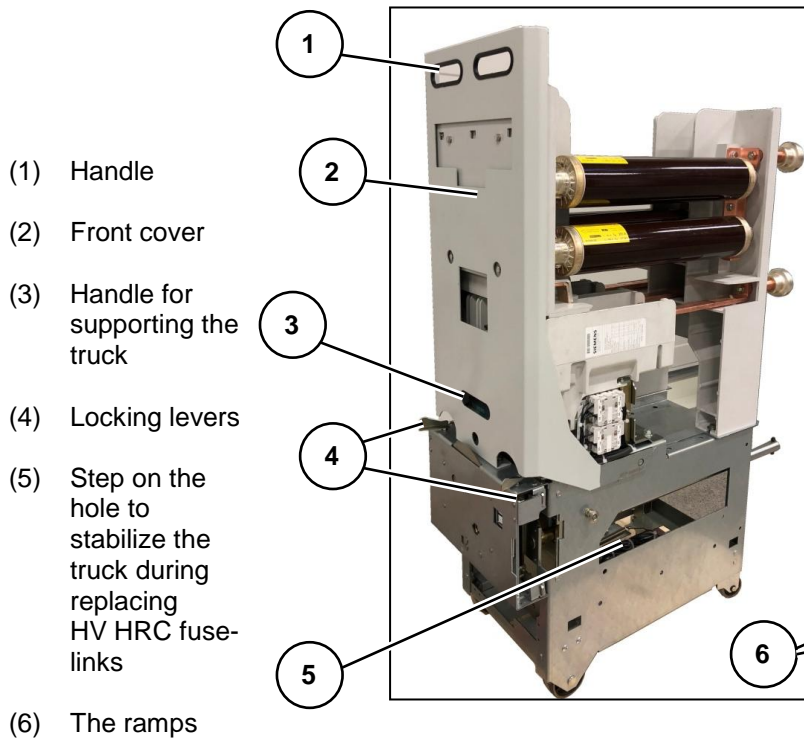


Fig. 224: Contactor truck



Fig. 225: Contactor panel with high-voltage door open

## Preparing the operating shaft for the feeder earthing switch



Make sure that the coupling pin of the operating shaft for the feeder earthing switch at the contactor truck and the coupling in the switching-device compartment are in vertical position.

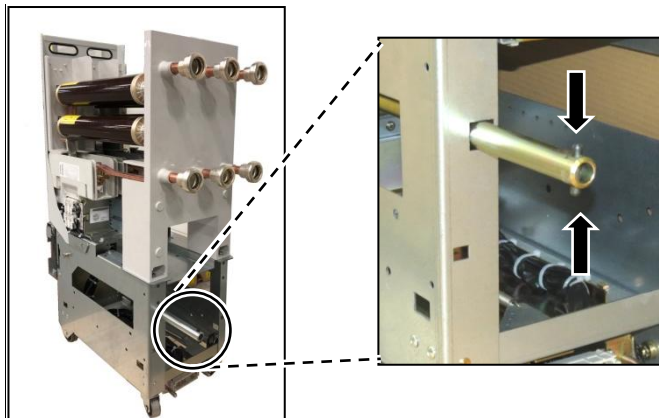


Fig. 226: Coupling pin of the operating shaft at the contactor truck

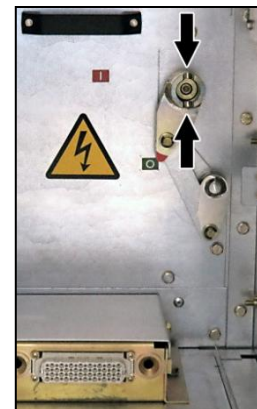


Fig. 227: Coupling in the switching-device compartment



If required, put the coupling pin of the feeder earthing switch operating shaft in vertical position. To do so, reinsert the contactor truck into the corresponding panel and operate the feeder earthing switch accordingly.

## Operating the contactor panel

### Checking if mechanical closing latch is needed

Depending on the number of fuse-links and their rated currents it may be necessary that a contactor truck is equipped with a mechanical closing latch. Contactor trucks with mechanical closing latch have no corresponding label. Contactor trucks without mechanical closing latch are labelled accordingly on the front side:

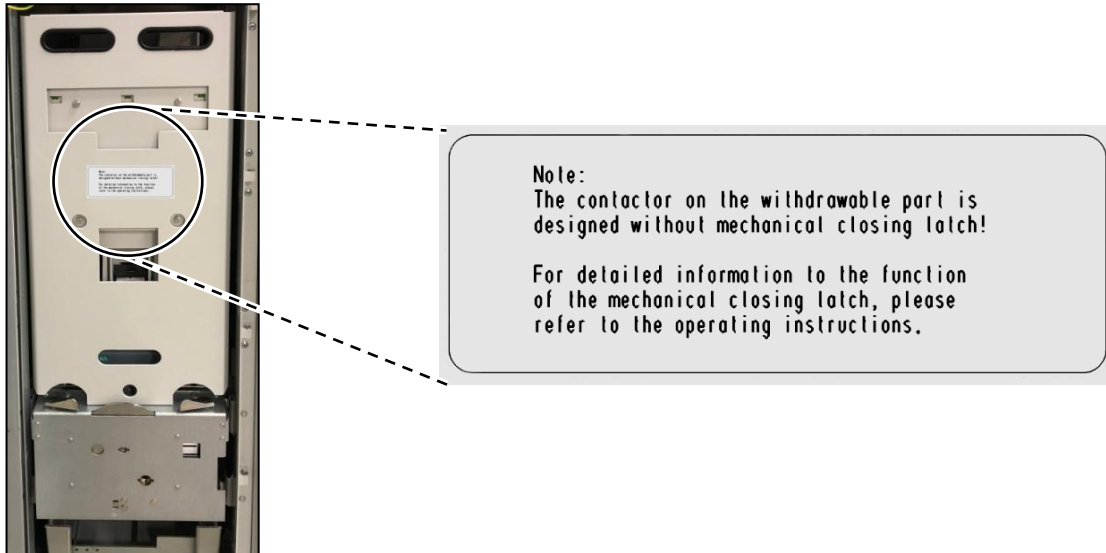


Fig. 228: Label on the front side of the contactor truck

- ⇒ First, check if the panel requires a contactor truck with/without mechanical closing latch to be inserted. Second, check the front side of the contactor truck for the corresponding label.

### Positioning the contactor truck in front of the panel

#### **HINT**

##### **Plugging on the low-voltage connector**

The low-voltage connection couples automatically when the contactor truck is inserted.

- ⇒ Move the contactor truck centrally in front of the contactor panel. The front wheels (1) of the contactor truck point towards the ramps (2) at the bottom of the panel.

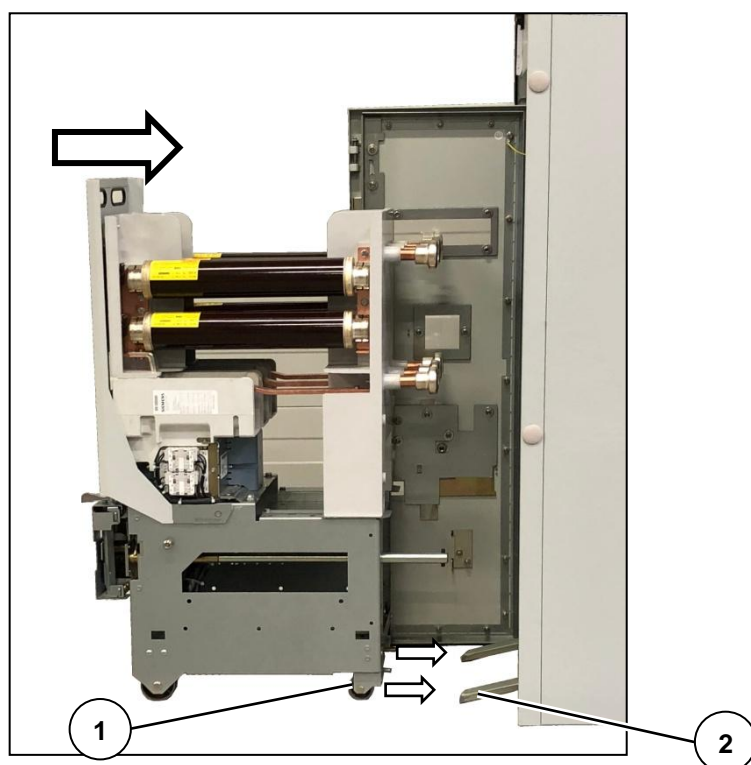


Fig. 229: Positioning the contactor truck in front of the panel

⇒ If required, support the contactor truck to move onto the ramps with the handle (3).

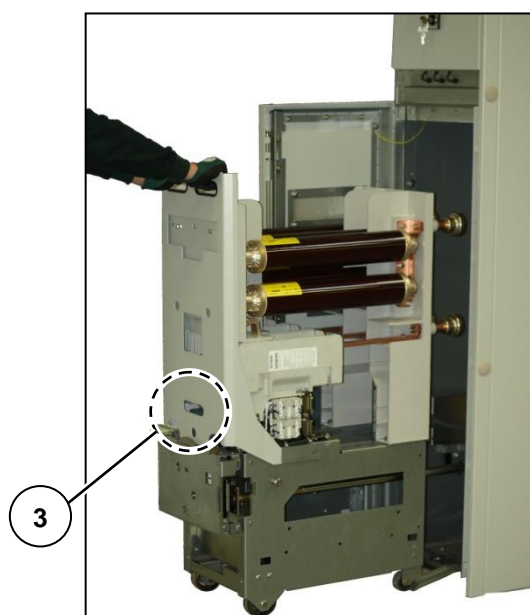


Fig. 230: Moving the contactor truck into the panel

## Operating the contactor panel

### Pushing the contactor truck into the panel

- ⇒ Push the contactor truck at the top into the panel as far it will go.
- ⇒ Lift the ramps (1) at the panel base upwards.



Fig. 231: Pushing the contactor truck at the top into the panel



Fig. 232: Lifting the ramps

- ⇒ Check whether the contactor truck is correctly placed into the panel by pulling it backwards.

### Interlocking the contactor truck with the panel

- ⇒ Interlock the contactor truck with the panel by turning the two locking levers to the inside.

The contactor truck is correctly interlocked with the panel as soon as both locking levers latch tight inside.



Fig. 233: Interlocking the contactor truck



Fig. 234: Contactor truck locked



The contactor truck is inserted in the panel and the high-voltage door is closed.

### 13.19 Replacing HV HRC fuse-links

According to IEC 60282-1 (2009) Clause 6.6, the breaking capacity of HV HRC fuse-links is tested within the scope of the type test at 87% of their rated voltage.

In three-phase systems with resonance-earthed or isolated neutral, under double earth fault and other conditions, the full phase-to-phase voltage may be available at the HV HRC fuse-link during breaking. Depending on the size of the operational voltage of such a system, this applied voltage may then exceed 87% of the rated voltage.



It must therefore already be ensured during configuration of the switching devices and selection of the HV HRC fuse-link that only such fuse-links are used, which either satisfy the above operating conditions, or whose breaking capacity was tested at least with the maximum system voltage.

In case of doubt, a suitable HV HRC fuse-link must be selected together with the fuse-link manufacturer.

#### **CAUTION**

##### **Burns**


After tripping, the surfaces of HV HRC fuse-links are hot. Touching hot HV HRC fuse-links may cause burns.

-  Put on personal protective equipment.
-  Let hot HV HRC fuse-links cool down before replacing.

#### **NOTICE**

##### **Undetected damage**

Even if the contactor truck shows no visible damages of a fault, the HV HRC fuse-link may have tripped due to a fault.

-  Check the switching-device compartment for deformations when a fuse-link has tripped.

### **Arrangement of HV HRC fuse-links**

Depending on the panel version, contactors are equipped with either single or double fuse-link arrangement per phase. Below, replacing HV HRC fuse-links is shown using the example of a double fuse-link arrangement.

When inserting a new HV HRC fuse-link, its striker must always point to the operating side of the contactor truck (1). The position of the striker is identified with a triangle (2) representing an arrow on the rating plate of the HV HRC fuse-link.

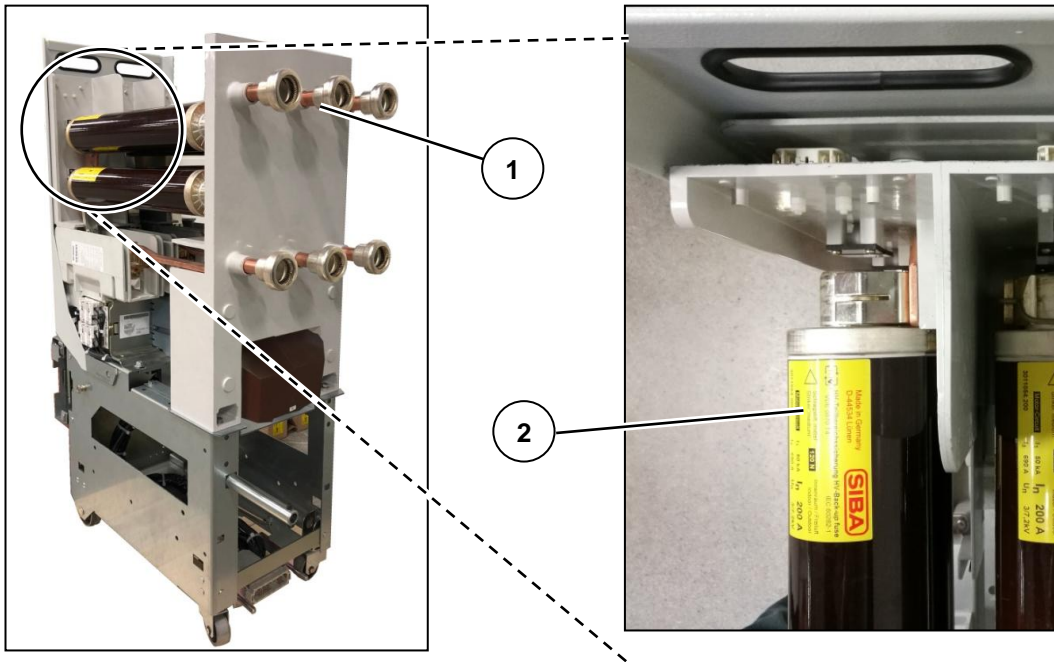


Fig. 235: Arrangement of HV HRC fuse-links (example with double fuse-link arrangement)

- (3) Outer phase L1 with double fuse-link arrangement
- (4) Outer phase L3 with double fuse-link arrangement
- (5) Middle phase L2 with double fuse-link arrangement
- (6) Front side of the contactor truck



Fig. 236: Seen from top: Arrangement of HV HRC fuse-links (example with double fuse-link arrangement)

### Permissible HV HRC fuse-links

The specified SIBA HV HRC fuse-links are motor protection back-up fuse-links according to IEC 60282-1. The dimensions of the HV HRC fuse-links correspond to DIN 43625.

## NOTICE

### Maloperation

Contactor trucks are exclusively designed for operation with specific HV HRC fuse-links. Using the different type of fuse-links may cause damages on the panel.

- ⇒ Use only the fuse-link types listed in the following table.
- ⇒ Do not mount bridging links instead of HV HRC fuse-links.

Selection table for HV HRC fuse-links

Rated voltage $U_r$ [kV]	Rated current $I_r$ [A]	Dimension "e" [mm]	Number of fuse-links permitted per phase	Order details
7.2	50	442	1	3010853.50
	63	442	1	3010853.63
	80	442	1	3010853.80
	100	442	1	3010853.100
	125	442	1	3010953.125
	160	442	1 or 2	3010953.160
	200	442	1 or 2	3011054.200
	250	442	1 or 2	3011054.250
	315	442	1	3011054.315
Supplier information: <a href="http://www.siba-fuses.com">www.siba-fuses.com</a>				

Rated voltage $U_r$ [kV]	Rated current $I_r$ [A]	Dimension "e" [mm]	Number of fuse-links permitted per phase	Order details
12	50	442	1	3010153.50
	63	442	1	3010153.63
	80	442	1	3010253.80
	100	442	1	3010253.100
	125	442	2	3010253.125
	160	442	1 or 2	3010353.160
Supplier information: <a href="http://www.siba-fuses.com">www.siba-fuses.com</a>				

### Replacing HV HRC fuse-links

#### NOTICE

##### Undetected damage

Tripped HV HRC fuse-links can cause hidden damages on the other HV HRC fuse-links.



Always replace all HV HRC fuse-links, even if only one HV HRC fuse-link has tripped.



#### HINT

##### Number of installed fuse-links

Usually the contactor truck is equipped with two HV HRC fuse-links per phase.



If only one HV HRC fuse-link per phase is installed, use the upper position at the clamps.



#### HINT

##### Electrical indication of tripped fuse-links

Electrical indications at the panel or in the remote control room are automatically reset to operating mode by replacing the HV HRC fuse-links.



#### HINT

##### Recommended order of action

The HV HRC fuse-links in the middle phase L2 are only accessible after removing the HV HRC fuse-links from the neighboring phase L3.



First, remove the HV HRC fuse-links from the outer phases L1 and L3 on the left and right side of the contactor truck. Then go on to remove the HV HRC fuse-links from the middle phase L2.

### Preconditions

- Set of proper HV HRC fuse-links available
- Contactor truck taken out of the panel
- High-voltage door closed

### Procedure



Step on the bottom side of the truck to stabilize the contactor truck during the replacing HV HRC fuse-links.

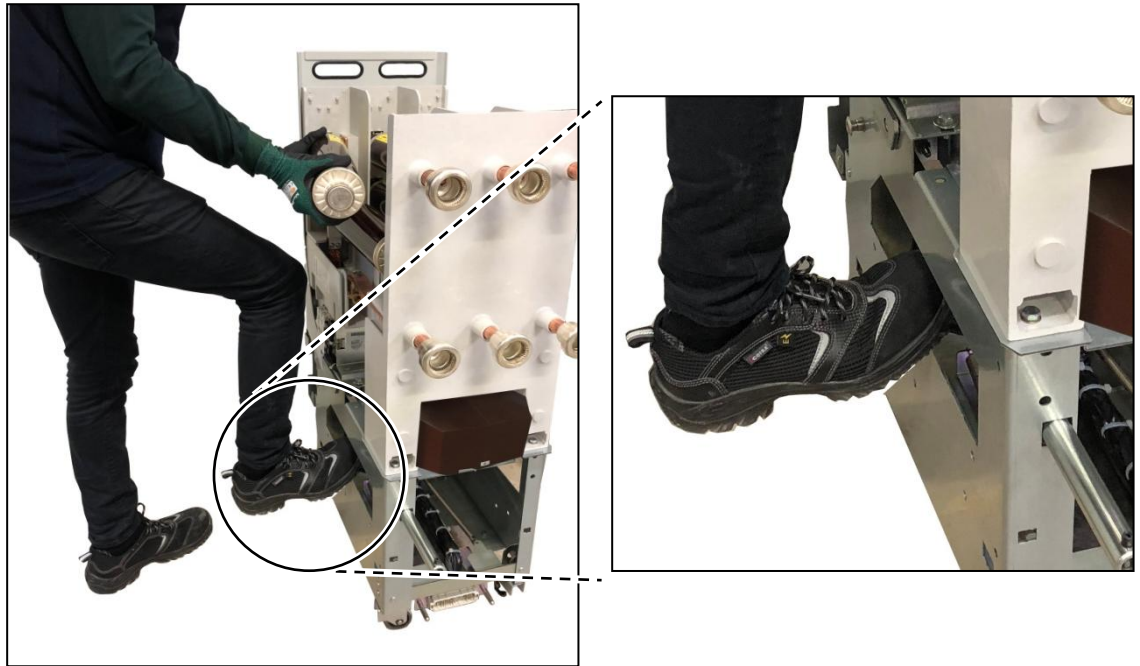


Fig. 237: Step on the bottom side of the truck

### Outer phases L1 and L3



Select one of the phases. Release the HV HRC fuse-link by turning while pulling it out of the clamps.

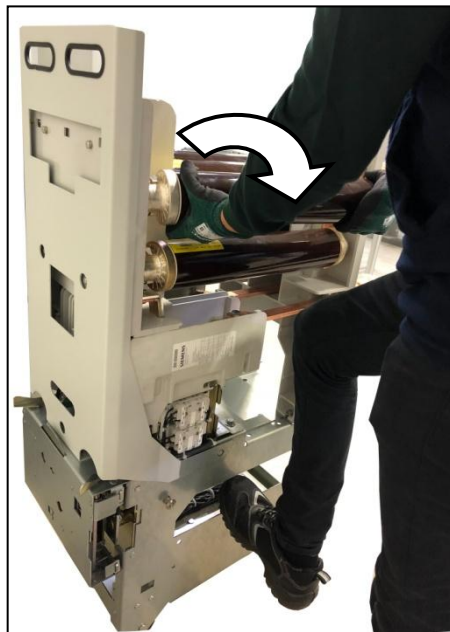


Fig. 238: Opening the fuse-link bracket in the striker area (operating side of contactor truck)

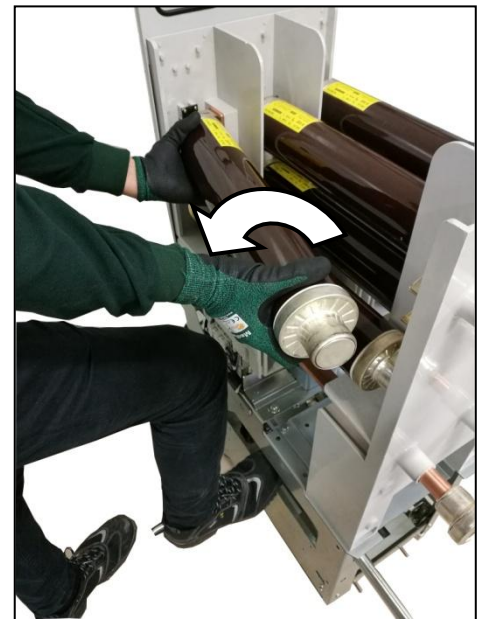


Fig. 239: Opening the fuse-link bracket on the opposite side of striker area (contact tulip side of contactor truck)



Fig. 240: HV HRC fuse-link removed in the striker area



Fig. 241: HV HRC fuse-link removed on the opposite side of the striker area



Insert the HV HRC fuse-link by turning while pushing it into the clamps. The position of the striker is identified with a triangle representing an arrow on the rating plate of the HV HRC fuse-link.

If only one HV HRC fuse-link is to be installed in the phase, use the upper position at the clamps.

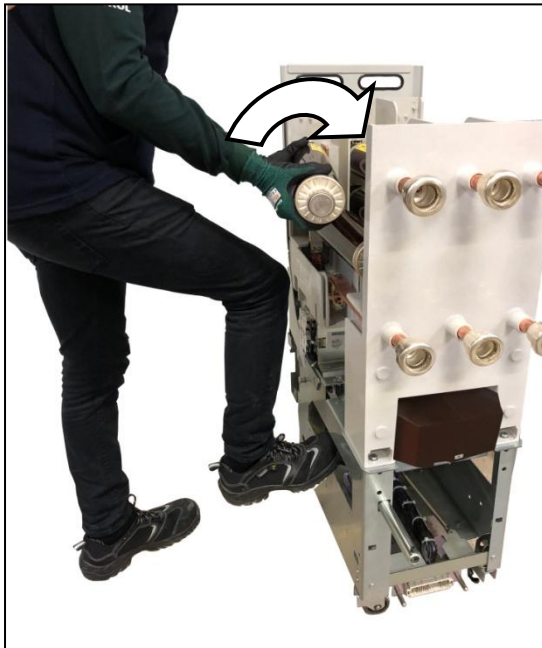


Fig. 242: Inserting the HV HRC fuse-link in the striker area



Fig. 243: Inserting the HV HRC fuse-link on the opposite side of the striker area



Fig. 244: HV HRC fuse-link inserted and fuse-link bracket closed in the striker area



Fig. 245: HV HRC fuse-link inserted and fuse-link bracket closed on the opposite side of striker area

⇒ Proceed in the same way with the other HV HRC fuse-links at the L1 and L3 phases.

### Middle phase L2

⇒ After removing the HV HRC fuse-links from the outer phases L1 or L3, the fuse-links in the middle phase L2 are accessible from the right or left side of the contactor truck. Open both fuse-link brackets of the phase manually or with a suitable tool, for example a screwdriver.

⇒ First remove the HV HRC fuse-link by pulling it upwards out of the clamps. If a second fuse-link is installed in the phase, remove it too.



Fig. 246: Opening the fuse-link bracket in the striker area (operating side of contactor truck)

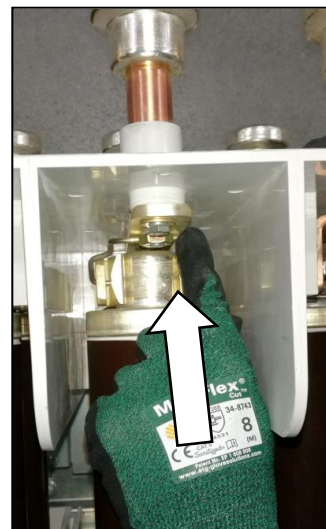


Fig. 247: Opening the fuse-link bracket on the opposite side of striker area (contact tulip side of contactor truck)

## Operating the contactor panel



Fig. 248: HV HRC fuse-link removed in the striker area



Fig. 249: HV HRC fuse-link removed on the opposite side of the striker area

⇒ Insert the HV HRC fuse-link with the striker pointing to the operating side of the contactor truck. The position of the striker is identified with a triangle representing an arrow on the rating plate of the HV HRC fuse-link.  
If only one HV HRC fuse-link is to be installed in the phase, use the upper position at the clamps.

⇒ Close both fuse-link brackets.



Fig. 250: HV HRC fuse-link inserted and fuse-link bracket closed in the striker area

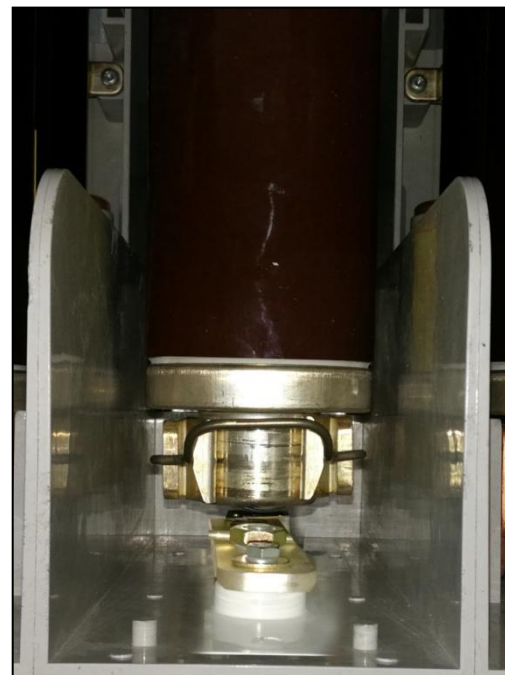


Fig. 251: HV HRC fuse-link inserted and fuse-link bracket closed on the opposite side of striker area

✓ The HV HRC fuse-links have been replaced.

## HINT

### Final procedure steps



Next, insert the contactor truck into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

### 13.20 Motor starting currents

Due to the arising motor starting current, the instant when the motor starts represents the maximum stress for the HV HRC fuse-link. Motor starting currents are dependent on the starting time and the starting frequency.

The latest motor protection tables with HV HRC fuse-links type HHM are available in the download area of the SIBA company: [www.siba-fuses.com](http://www.siba-fuses.com)

These motor protection tables show the correspondence between the maximum permissible starting currents of downstream HV motors (depending on the starting time and the starting frequency) and the associated HV HRC fuse-links.

### 13.21 Coordinating the components of the motor circuit

The illustration below shows the coordination of a HV HRC fuse-link characteristic with a motor characteristic as an example:

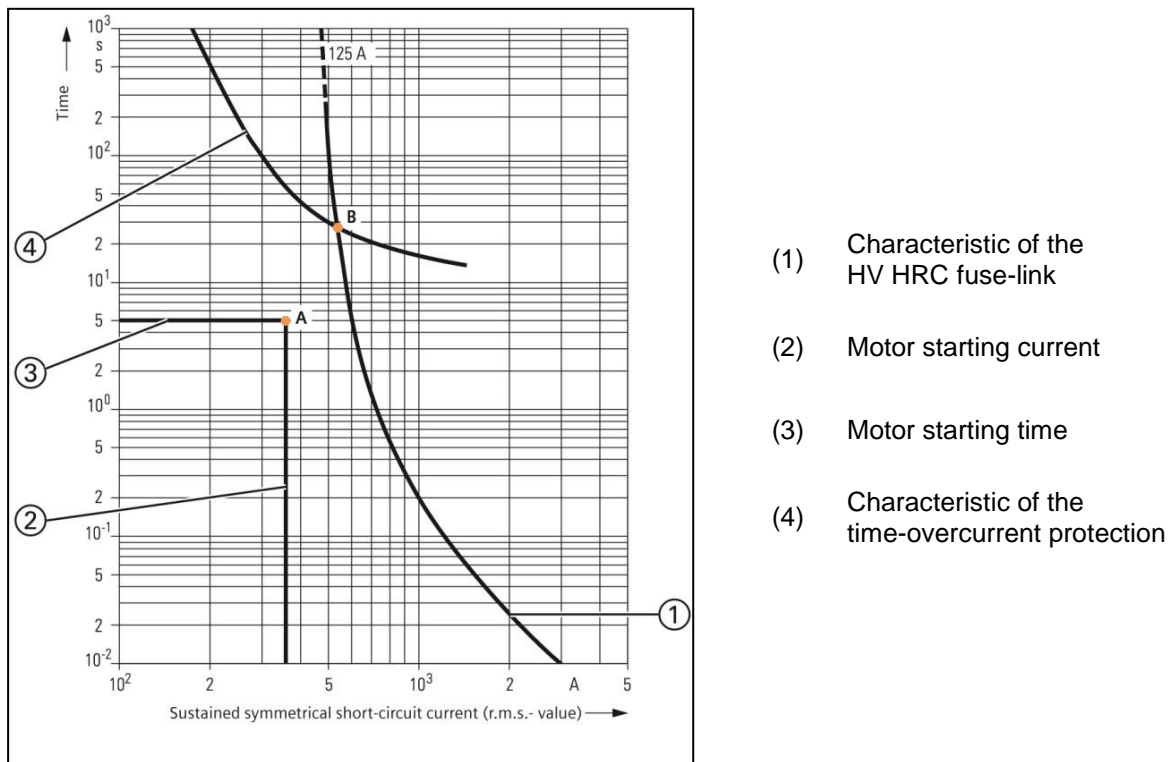


Fig. 252: Example for the coordination of a HV HRC fuse-link characteristic 125 A with a motor characteristic

The latest time-current characteristics for HV HRC fuse-links type HHM are available in the download site of the SIBA company: [www.siba-fuses.com](http://www.siba-fuses.com)

### Coordination

Rules for coordinating the components of the motor circuit:

- The time-current characteristic must be located on the right of the motor starting current (point A).
- The rated current of the HV HRC fuse-link must exceed the normal current of the motor.
- The current corresponding to the intersection B of the HV HRC fuse-link characteristic and the characteristic of the time-overcurrent protection must be higher than the minimum breaking current of the HV HRC fuse-link.

## Operating the contactor panel

- If this is not feasible, it must be ensured that overload currents that are smaller than the minimum breaking current of the HV HRC fuse-link are interrupted by the switching device via the striker. This prevents thermal overloading of the HV HRC fuse-link, which would otherwise be destroyed.
- The selected HV HRC fuse-link limits the sustained symmetrical short-circuit current  $I_K$  to the let-through current  $I_D$ , shown in the diagram for the current-limiting characteristics ( $I_D$  as a function of  $I_K$  for HV HRC fuse-links with different rated currents). The maximum permissible let-through current is  $I_D = 46$  kA.

### Requirements

The coordination of the components of the motor circuit requires the following:

- The let-through current  $I_D$  must not exceed 46 kA at 7.2 kV/12 kV.
- In case of low-voltage supply via a control transformer, short-circuit currents ranging above the limit breaking capacity must be interrupted within 80 ms. This requirement does not apply if
  - the mechanical latch is provided
- **or**
  - the opening times have been extended so much that – in the a.m. current range – the contactor can only open when the fuse-link has interrupted the current.
- Due to the arising motor starting current, the instant when the motor starts represents the maximum stress for the HV HRC fuse-link. This stress must neither operate nor pre-damage the fuse-link.
- Other factors of influence on the stress of the HV HRC fuse-links are the starting time and the starting frequency of the motors.

# Operating the busbar connection panel type I

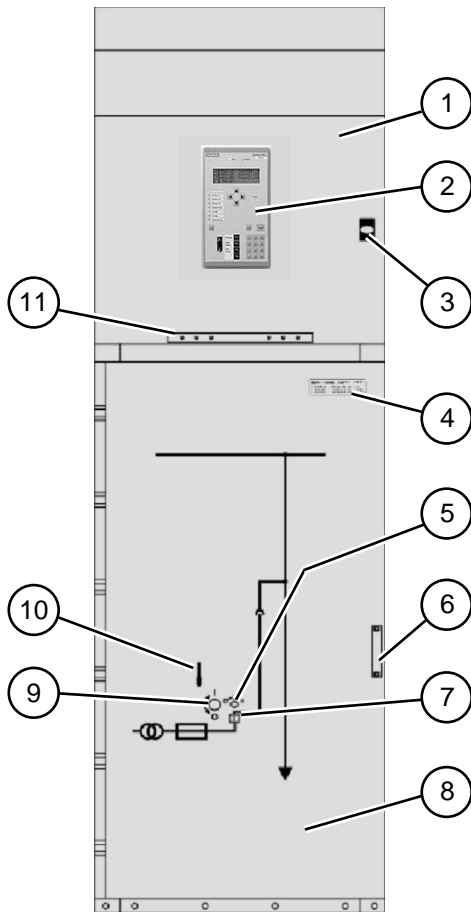
## 14 Operating the busbar connection panel type I



### HINT

Read and understand these instructions before attempting operating works.

### 14.1 Control elements at the front side of the panel



- (1) Door to the low-voltage compartment
- (2) Protection device
- (3) Locking device for the door to the low-voltage compartment
- (4) Instruction label for closing the high-voltage door
- (5) Actuating opening for inserting the double-bit key to control racking of the withdrawable metering part / metering truck
- (6) Handle for opening the high-voltage door
- (7) Mechanical position indicator for withdrawable metering part / metering truck
- (8) High-voltage door
- (9) Actuating opening for racking the withdrawable metering part / metering truck
- (10) Operating slide for opening and closing the actuating opening for racking the withdrawable metering part / metering truck
- (11) Test sockets for busbar voltage detecting system (type LRM) as additional component

Fig. 253: Control elements on the panel front

### 14.2 Position indicator visible on high-voltage door

Indicator for position of withdrawable metering part / metering truck:			
	Service position	Intermediate position	Test position
Position indications for:			

## Operating the busbar connection panel type I

### 14.3 Access to compartments

Regarding accessibility to the individual compartments, NXAIR switchgear fulfills the loss of service continuity category LSC 2B according to IEC 62271-200.

The degree of protection between the individual compartments is IP2X.

The type of accessibility is provided as follows:

Compartment:		Type of accessibility:
Switching-device compartment		Interlock-controlled
Busbar compartment		Tool-based
Connection compartment	Access from the front side	Interlock-controlled and tool-based
	Access from the rear side	Tool-based

### 14.4 Opening or closing the high-voltage door

The procedure for opening and/or closing the high-voltage door at the busbar connection panel type I is identical with the procedure for opening and/or closing the high-voltage door at the circuit-breaker panel.

⇒ For opening and/or closing the high-voltage door at the busbar connection panel type I, see chapter 10.4 and/or 10.5.

### 14.5 Racking the withdrawable metering part / metering truck

The procedure for racking the withdrawable metering part / metering truck to service position and/or test position is identical with the procedure for racking the withdrawable circuit-breaker / circuit-breaker truck to service position and/or test position.

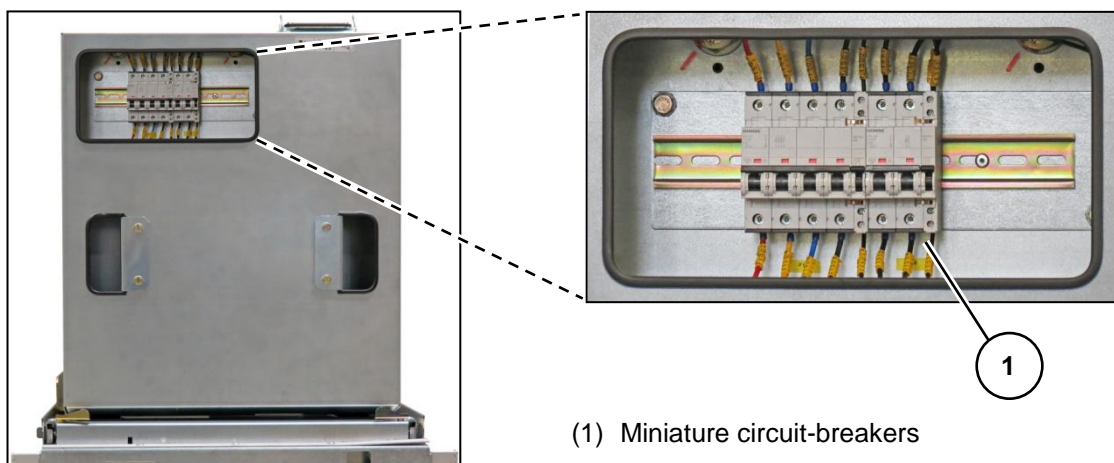
⇒ For racking the withdrawable metering part / metering truck to service position and/or test position, see chapter 10.8 and/or 10.9.

### 14.6 Removing or plugging on the low-voltage connector

The procedure for removing and/or plugging on the low-voltage connector in the busbar connection panel type I is identical with the procedure for removing and/or plugging on the low-voltage connector in the circuit-breaker panel.

#### Control elements at the front side of the withdrawable metering part / metering truck

Access to the control elements at the front side of the withdrawable metering part / metering truck is given after opening the high-voltage door.



(1) Miniature circuit-breakers

Fig. 254: Control elements at the front of the withdrawable metering part / metering truck, example

### Before removing the low-voltage connector:

- ⇒ Switch off all miniature circuit-breakers at the front of the withdrawable metering part / metering truck. The indicators change from red to green.

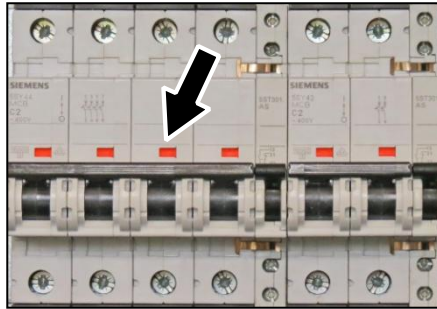


Fig. 255: Miniature circuit-breakers switched on, indicators red

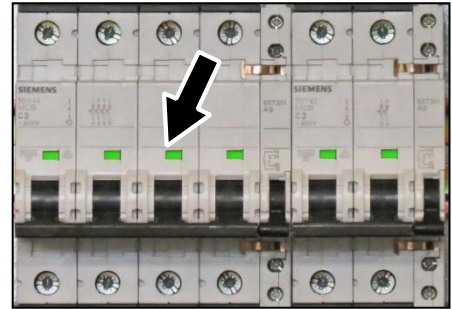


Fig. 256: Miniature circuit-breakers switched off, indicators green

### After plugging on the low-voltage connector:

- ⇒ Switch on all miniature circuit-breakers at the front of the withdrawable metering part / metering truck. The indicators change from green to red.

### Removing or plugging on the low-voltage connector:

- ⇒ For removing and/or plugging on the low-voltage connector in the busbar connection panel type I, see chapter 10.20 and/or 10.21.

### 14.7 Taking the withdrawable metering part / metering truck out of a panel or inserting in a panel

The procedure for inserting and/or removing the withdrawable metering part / metering truck in the busbar connection panel type I is identical with the procedure for inserting and/or removing the withdrawable circuit-breaker / circuit-breaker truck in the circuit-breaker panel.

- ⇒ For inserting and/or removing the withdrawable metering part in the busbar connection panel type I, see chapter 10.22 and/or 10.23.  
 ⇒ For inserting and/or removing the withdrawable metering truck in the busbar connection panel type I, see chapter 10.24 and/or 10.25.

### 14.8 Replacing protection fuse-links

#### NOTICE

#### **Maloperation**

Withdrawable metering parts / metering trucks are exclusively designed for operation with specific protection fuse-links.

- ⇒ Use only the fuse-link types listed in the following table.  
 ⇒ Do not mount bridging links instead of protection fuse-links.

### NOTICE

#### Undetected damage

A tripped protection fuse-link can cause hidden damages on the other protection fuse-links.



Always replace all protection fuse-links, even if only one protection fuse-link has tripped.

#### Selection table for protection fuse-links:

Rated voltage $U_r$ [kV]	Supplier:	Order details:
7.2	SIBA	3037811.2/ 2 A / 195 mm
12	SIBA	3037811.2/ 2 A / 195 mm
17.5	Bussmann (a business of Eaton)	17.5CAV2 / 2 A / 220 mm
Supplier information: <a href="http://www.siba-fuses.com">www.siba-fuses.com</a> / <a href="http://www.eaton.com">www.eaton.com</a>		

#### Preconditions

- Withdrawable metering part / metering truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- All voltage transformer MCBs switched to OPEN position
- Low-voltage connector stowed away
- Withdrawable metering part / metering truck taken out of the panel
- Set of proper protection fuse-links available

#### Replacing protection fuse-links for rated voltage $\leq 12$ kV



Pull the upper end of the protection fuse-link off the clamp.



Pull the lower end of the protection fuse-link off the clamp and remove the protection fuse-link.



Fig. 257: Pulling off the upper end

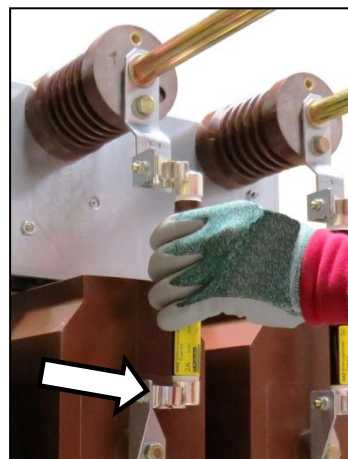


Fig. 258: Pulling off the lower end

- ⇒ Push the lower end of the new protection fuse-link into the clamp.
- ⇒ Push the upper end of the new protection fuse-link into the clamp.
- ⇒ Perform replacement with all other fuse-links.
- ✓ The protection fuse-links have been replaced.

### HINT

#### Final procedure steps

- ⇒ Next, insert the withdrawable metering part / metering truck into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

### Replacing protection fuse-links for rated voltage 17.5 kV

- ⇒ Remove the upper and lower bolt M8x12 with washer 8.4 completely from the three insulating covers.
- ⇒ Keep the 3 insulating covers, 6 bolts and 6 washers 8.4 for later reuse.

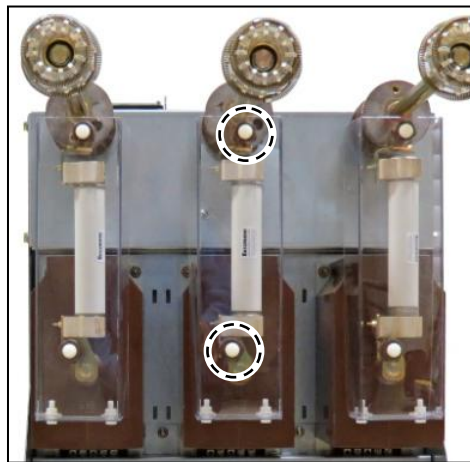


Fig. 259: 2 plastic bolts on insulating cover

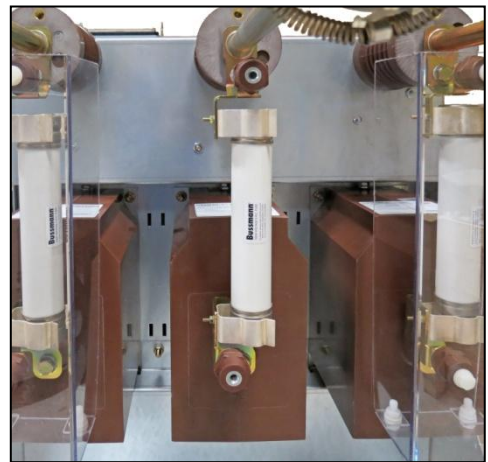


Fig. 260: Insulating cover removed

## Operating the busbar connection panel type I

- ⇒ Pull the upper end of the protection fuse-link off the clamp.
- ⇒ Pull the lower end of the protection fuse-link off the clamp and remove the protection fuse-link.



Fig. 261: Pulling off the upper end

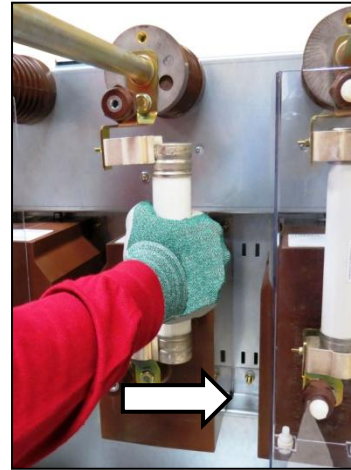


Fig. 262: Pulling off the lower end

- ⇒ Push the lower end of the new protection fuse-link into the clamp.
  - ⇒ Push the upper end of the new protection fuse-link into the clamp.
  - ⇒ Perform replacement with all other fuse-links.
  - ⇒ Fasten an insulating cover over each protection fuse-link at the upper and lower fixing point using a plastic bolt M8x12 and washer 8.4; to do this, turn the M8 bolt into the bolted joint with simple hand force.
- ✓ The protection fuse-links have been replaced.

### HINT

#### Final procedure steps

- ⇒ Next, insert the withdrawable metering part / metering truck into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

# Operating the busbar connection panel type II

## 15 Operating the busbar connection panel type II



### HINT

Read and understand these instructions before attempting operating works.

### 15.1 Panel front



### HINT

The busbar connection panel type II is not equipped with any kind of withdrawable part / switching-device truck.

No switching operations must be executed at the busbar connection panel type II. For revision and maintenance, the high-voltage door at the panel front can be opened. For opening and closing the high-voltage door, **do absolutely** observe the following notes.

### 15.2 Opening the high-voltage door



## DANGER

### Electric shock

If the busbars in the switchgear have not been isolated, the contacts in the panel will be live at operational high voltage.

- ⇒ Isolate the busbars in the switchgear.
- ⇒ Do **not** open the high-voltage door at the busbar connection panel type II unless the busbars have been isolated.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.



## WARNING

### Reduced safety

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the busbar connection panel type II.

Close the high-voltage door:

- ⇒ If an activity inside the compartment behind the high-voltage door is interrupted.
- ⇒ Immediately after an activity inside the compartment behind the high-voltage door was completed.
- ⇒ Before leaving the panel front.

## Operating the busbar connection panel type II

### Preconditions

- Permission for opening the high-voltage door available
- High-voltage door closed

### Procedure

- ⇒ Remove the padlock (1), and store it.
- ⇒ Pull door handle totally upwards and open the high-voltage door.

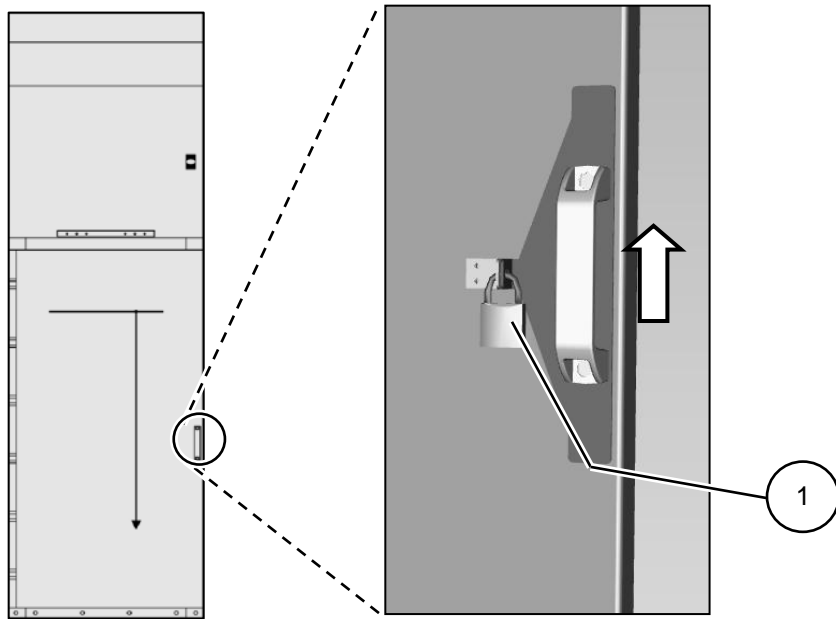


Fig. 263: Opening the high-voltage door

- ✓ The high-voltage door is open.

### 15.3 Closing the high-voltage door

#### **WARNING**

##### **Reduced safety**

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the busbar connection panel type II.

Close the high-voltage door:

- ⇒ If an activity inside the compartment behind the high-voltage door is interrupted.
- ⇒ Immediately after an activity inside the compartment behind the high-voltage door was completed.
- ⇒ Before leaving the panel front.

### Preconditions

- High-voltage door open

### Procedure

- ⇒ Push the door handle on the high-voltage door totally upwards, and hold it.
- ⇒ Press the high-voltage door totally onto the panel frame using the door handle.
- ⇒ Push the door handle on the high-voltage door totally downwards, and release it.
- ⇒ Fit padlock to the door handle and close it (1).

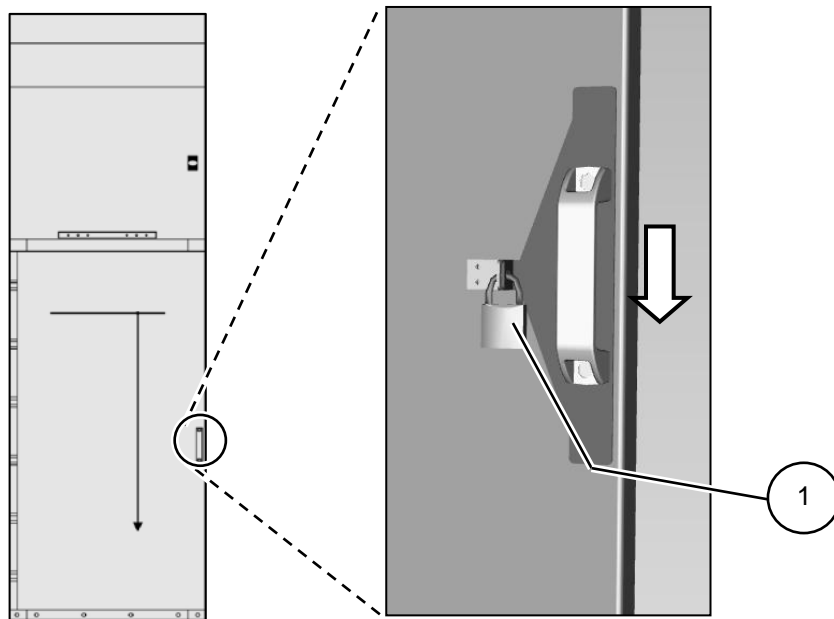


Fig. 264: Closing the high-voltage door

- ✓ The high-voltage door is closed.

# Operating the busbar current metering panel

## 16 Operating the busbar current metering panel

### HINT

Read and understand these instructions before attempting operating works.

### 16.1 Panel front





No switching operations must be executed at the busbar current metering panel. For revision and maintenance, the high-voltage door at the panel front can be opened. For opening and closing the high-voltage door, **do absolutely** observe the following notes.

### 16.2 Opening the high-voltage door

### DANGER

#### Electric shock

If the busbars in the switchgear have not been isolated, the contacts in the panel will be live at operational high voltage.




-  Isolate the busbars in the switchgear.
-  Do **not** open the high-voltage door at the busbar current metering panel unless the busbars have been isolated.
-  Observe the **Five Safety Rules**.
-  Verify safe isolation from supply.

### WARNING

#### Reduced safety

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the busbar current metering panel.

Close the high-voltage door:

-  If an activity inside the compartment behind the high-voltage door is interrupted.
-  Immediately after an activity inside the compartment behind the high-voltage door was completed.
-  Before leaving the panel front.

## Preconditions

- Permission for opening the high-voltage door available
- Hexagon socket head key size 6 available
- Personal protective equipment put on

## Procedure

- ⇒ Undo 7 hexagon socket head bolts size 6 (1). The bolts remain permanently in the high-voltage door.

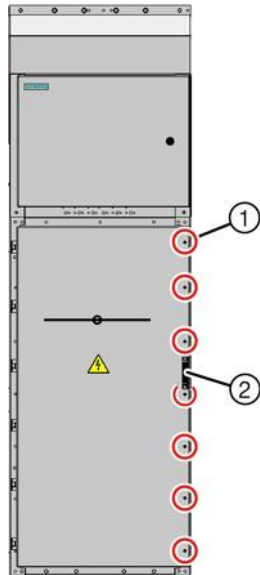


Fig. 265: High-voltage door at the busbar current metering panel

- ⇒ Open the high-voltage door by the handle (2).

- ✓ The high-voltage door is open.

## 16.3 Closing the high-voltage door

### **WARNING**

#### Reduced safety

The closed high-voltage door is an important safety element of the switchgear. The high-voltage door is exclusively opened for performing operational activities inside the busbar current metering panel.

Close the high-voltage door:

- ⇒ If an activity inside the compartment behind the high-voltage door is interrupted.
- ⇒ Immediately after an activity inside the compartment behind the high-voltage door was completed.
- ⇒ Before leaving the panel front.

## Operating the busbar current metering panel

### Preconditions

- High-voltage door open
- Hexagon socket head key size 6 available

### Procedure

⇒ Close the high-voltage door by the handle (2).

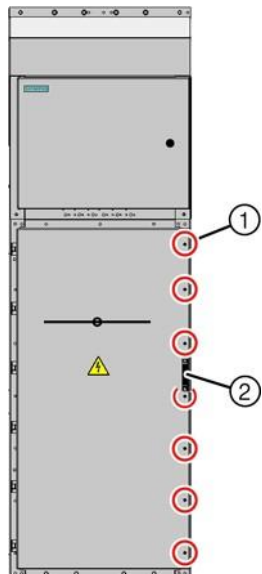


Fig. 266: High-voltage door at the busbar current metering panel

⇒ Screw in 7 hexagon socket head bolts size 6 (1) by hand force. This corresponds to a tightening torque of approx. 20 Nm.

✓ The high-voltage door is closed.

# Operating the removable voltage transformers

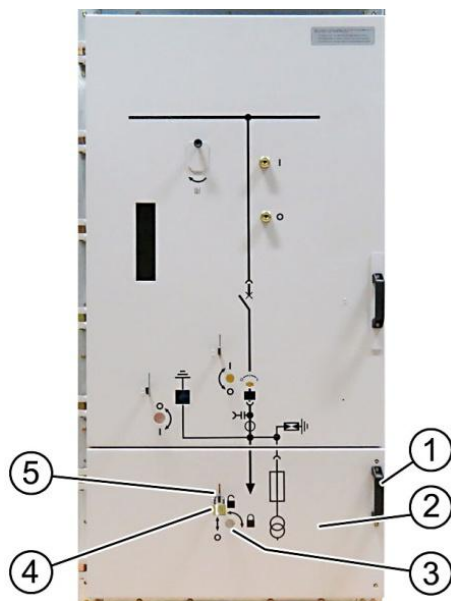
## 17 Operating the removable voltage transformers



### HINT

Read and understand these instructions before attempting operating works.

### 17.1 Control elements on the door to the voltage transformer compartment



- (1) Handle for opening and closing the door to the voltage transformer compartment
- (2) Door to voltage transformer compartment
- (3) Actuating opening for racking the removable voltage transformers
- (4) Padlock for securing the operating slide
- (5) Operating slide for opening and closing the actuating opening for racking the removable voltage transformers

Fig. 267: Control elements on the door to the voltage transformer compartment

### 17.2 Opening the door to the voltage transformer compartment



### WARNING

#### Electric shock



Do not operate the panel with the door to the voltage transformer compartment open.



Open the door to the voltage transformer compartment only to remove or insert the removable voltage transformers.



### HINT

The door to the voltage transformer compartment is not linked with the high-voltage door.



The door to the voltage transformer compartment can be operated independently of the high-voltage door.

## Operating the removable voltage transformers

### Preconditions

- High-voltage door closed
- Door to voltage transformer compartment closed
- If inserted: removable voltage transformers in test position
- Hexagon socket head key size 6 available
- Key for padlock available

### Procedure

- ⇒ Remove the padlock from the operating slide (3).
- ⇒ Undo 3 nos. hexagon socket head bolts (1). The bolts remain permanently in the door to the voltage transformer compartment.
- ⇒ Open the door to the voltage transformer compartment at the handle (2).

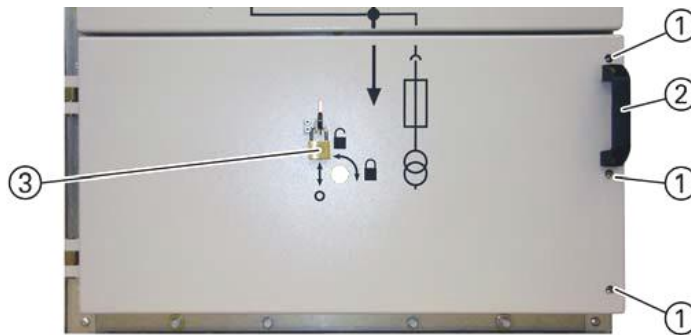


Fig. 268: Opening the door to the voltage transformer compartment

- ✓ The door to the voltage transformer compartment is open.

### 17.3 Closing the door to the voltage transformer compartment

#### **WARNING**

##### **Electric shock**

- ⇒ Do not operate the panel with the door to the voltage transformer compartment open.
- ⇒ Always secure the closed door to the voltage transformer compartment with the bolts.

#### **HINT**

The door to the voltage transformer compartment is not linked with the high-voltage door.

- ⇒ The door to the voltage transformer compartment can be operated independently of the high-voltage door.

### Preconditions

- High-voltage door closed
- Door to voltage transformer compartment open
- If removable voltage transformers inserted: low-voltage connector plugged on
- Hexagon socket head key size 6 available
- Padlock available

### Procedure

- ⇒ Close the door to the voltage transformer compartment at the handle (2).
- ⇒ Screw in 3 nos. hexagon socket head bolts (1) hand-tight using the hexagon socket head key. This corresponds to a tightening torque of approx. 20 Nm.
- ⇒ Fit the padlock (3) to the operating slide and close it.

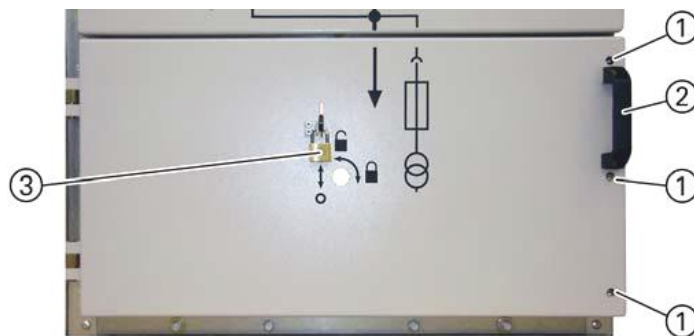


Fig. 269: Closing the door to the voltage transformer compartment

- ✓ The door to the voltage transformer compartment is closed.

### 17.4 Racking the removable voltage transformers to service position

#### NOTICE

##### Maloperation

If the removable voltage transformers are not correctly positioned in the panel, damages may occur when the removable voltage transformers are racked.

- ⇒ If you hear a noise or if you notice a resistance, stop racking immediately.
- ⇒ Inform the regional Siemens representative.

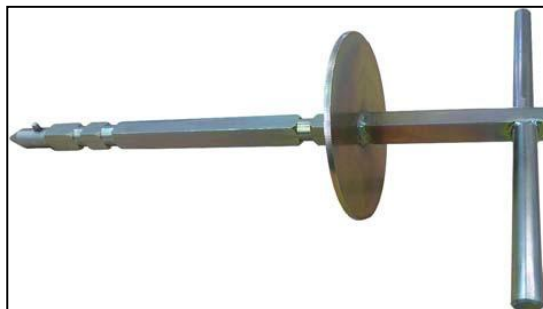


Fig. 270: Racking tool for the removable voltage transformers

## Operating the removable voltage transformers

### Preconditions

- High-voltage door closed
- Removable voltage transformers inserted in the panel
- Low-voltage connector plugged on
- Door to voltage transformer compartment closed and screwed tight
- Racking tool available
- Key for padlock available

The actuating opening for racking the removable voltage transformers is located on the control board of the door to the voltage transformer compartment.

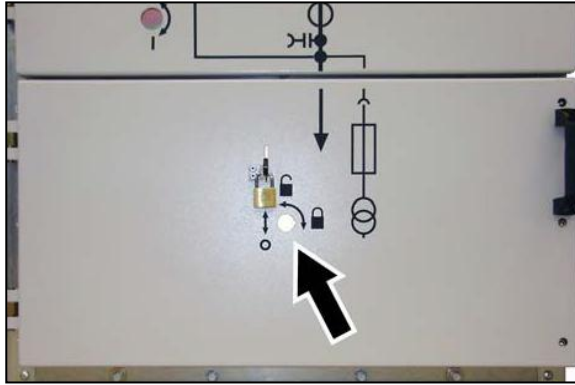


Fig. 271: Actuating opening for racking the removable voltage transformers

### Procedure

- ⇒ Remove the padlock from the operating slide.
- ⇒ Lift the operating slide and hold it.

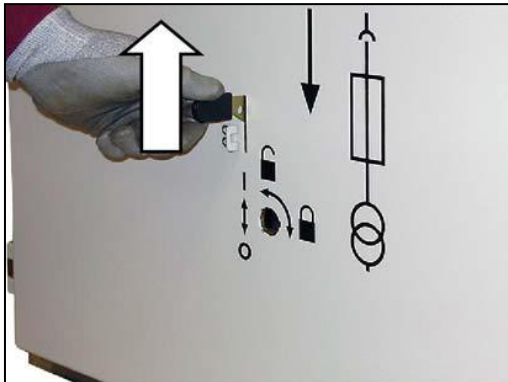


Fig. 272: Lifting the operating slide

- ⇒ Insert the racking tool into the actuating opening with the guide pin pointing to the right.

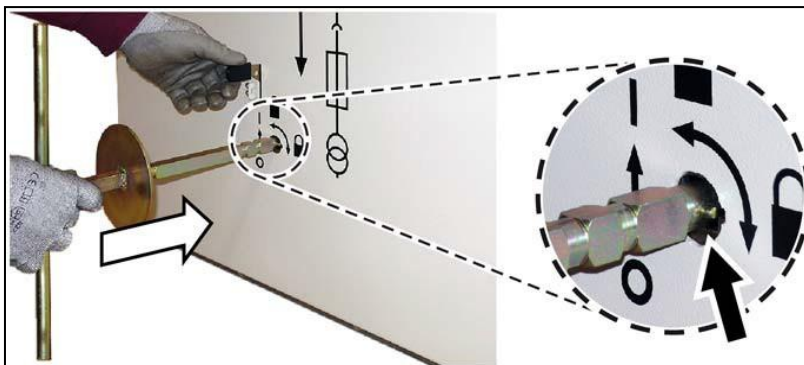


Fig. 273: Inserting the racking tool

- ⇒ Push the racking tool into the door as far as it will go.
- ⇒ Turn the racking tool 90° counter-clockwise to unlock the racking mechanism.

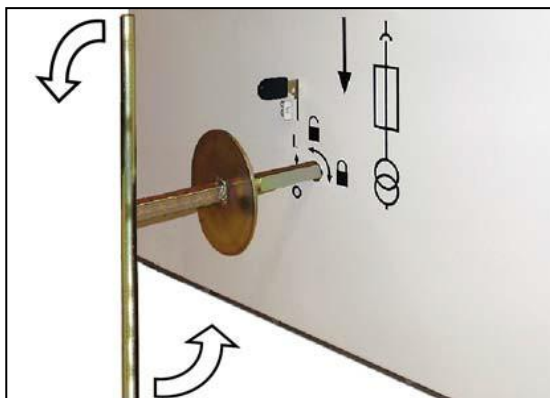


Fig. 274: Turning 90° counter-clockwise to unlock

### NOTICE

#### Maloperation

Turning the racking tool while racking the removable voltage transformers in the voltage transformer compartment can cause damages.

- ⇒ Rack the removable voltage transformers always up to the end position.
- ⇒ Turn the racking tool only in stable end positions of the removable voltage transformers.

- ⇒ To rack the removable voltage transformers, push the racking tool into the voltage transformer compartment as far as it will go (end position).

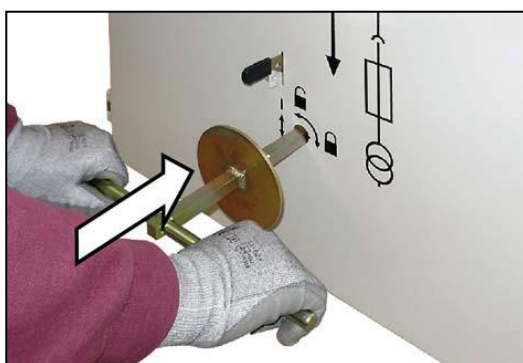


Fig. 275: Pushing the racking tool to rack

## Operating the removable voltage transformers

- ⇒ Turn the racking tool 90° clockwise to lock the racking mechanism.

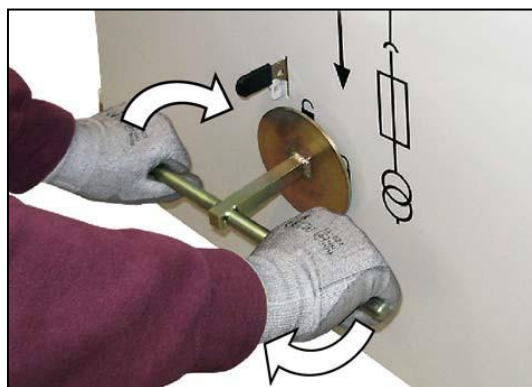


Fig. 276: Turning 90° clockwise to lock

- ⇒ Remove the racking tool.

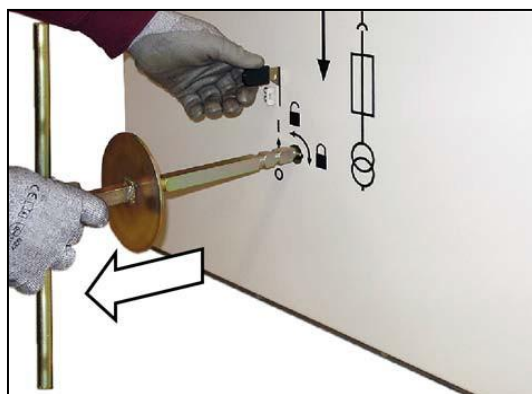


Fig. 277: Removing the racking tool

- ⇒ To close the actuating opening, push the operating slide down as far as it will go.

- ⇒ Fit the padlock to the operating slide and close it.

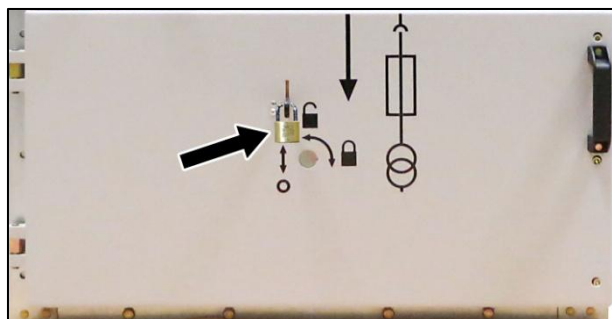


Fig. 278: Fitting a padlock

- ✓ The removable voltage transformers are in service position.

## 17.5 Racking the removable voltage transformers to test position

### NOTICE

#### Maloperation

If the removable voltage transformers are not correctly positioned in the panel, damages may occur when the removable voltage transformers are racked.

- ⇒ If you hear a noise or if you notice a resistance, stop racking immediately.
- ⇒ Inform the regional Siemens representative.

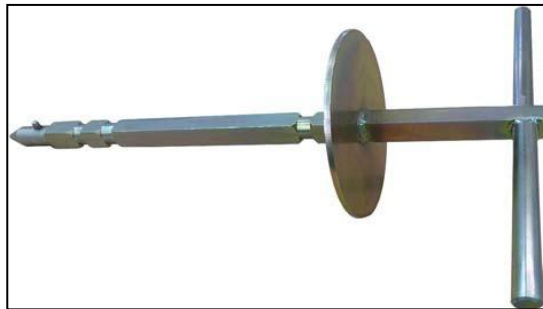


Fig. 279: Racking tool for the removable voltage transformers

#### Preconditions

- High-voltage door closed
- Removable voltage transformers in service position
- Door to voltage transformer compartment closed and screwed tight
- Racking tool available
- Key for padlock available

The actuating opening for racking the removable voltage transformers is located on the control board of the door to the voltage transformer compartment.

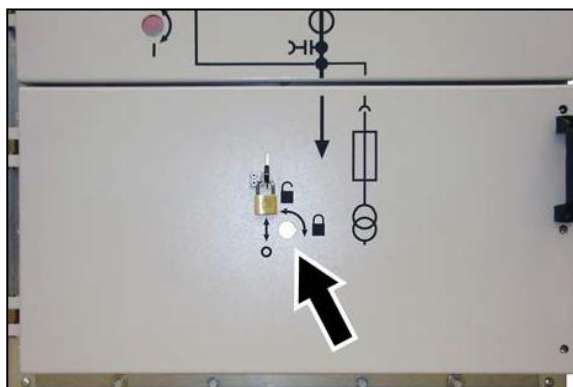


Fig. 280: Actuating opening for racking the removable voltage transformers

## Operating the removable voltage transformers

### Procedure

- ⇒ Remove the padlock from the operating slide.
- ⇒ Lift the operating slide and hold it.

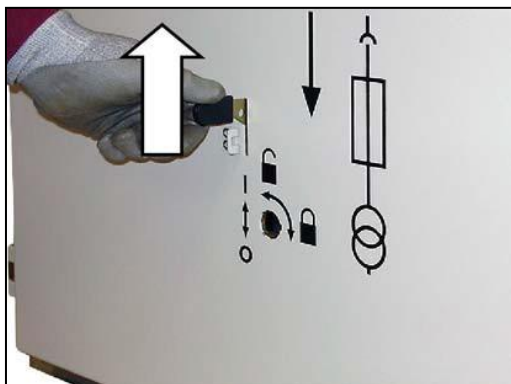


Fig. 281: Lifting the operating slide

- ⇒ Insert the racking tool into the actuating opening with the guide pin pointing to the right.

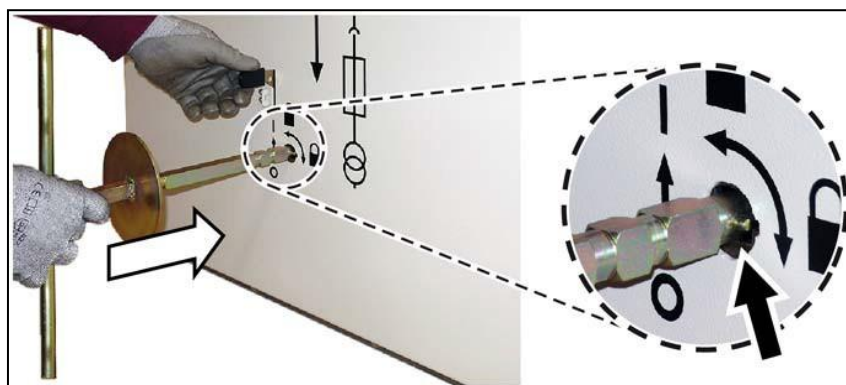


Fig. 282: Inserting the racking tool

- ⇒ Push the racking tool into the door as far as it will go.
- ⇒ Turn the racking tool 90° counter-clockwise to unlock the racking mechanism.

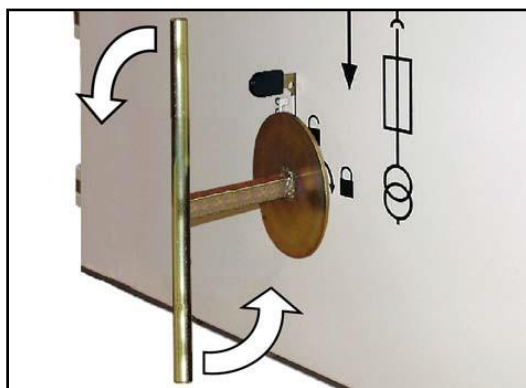


Fig. 283: Turning 90° counter-clockwise to unlock

## NOTICE

### Maloperation

Turning the racking tool while racking the removable voltage transformers in the voltage transformer compartment can cause damages.

- ⇒ Rack the removable voltage transformers always up to the end position.
- ⇒ Turn the racking tool only in stable end positions of the removable voltage transformers.

- ⇒ To rack the removable voltage transformers, pull the racking tool as far as it will go (end position).

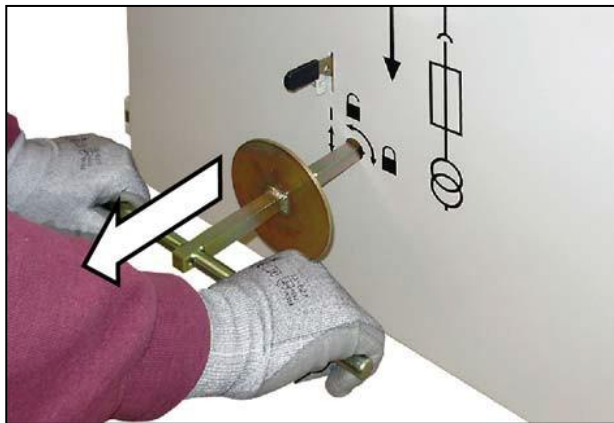


Fig. 284: Pulling the racking tool to rack

- ⇒ Turn the racking tool 90° clockwise to lock the racking mechanism.

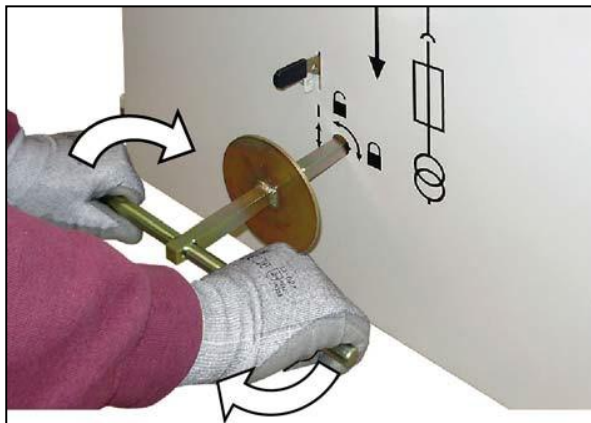


Fig. 285: Turning 90° clockwise to lock

## Operating the removable voltage transformers

- ⇒ Remove the racking tool.

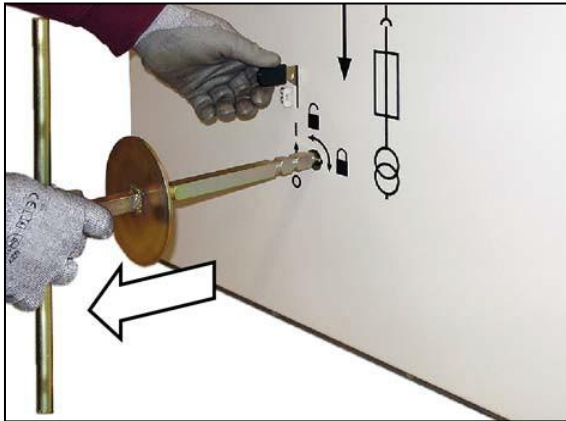


Fig. 286: Removing the racking tool

- ⇒ To close the actuating opening, push the operating slide down as far as it will go.

- ⇒ Fit the padlock to the operating slide and close it.

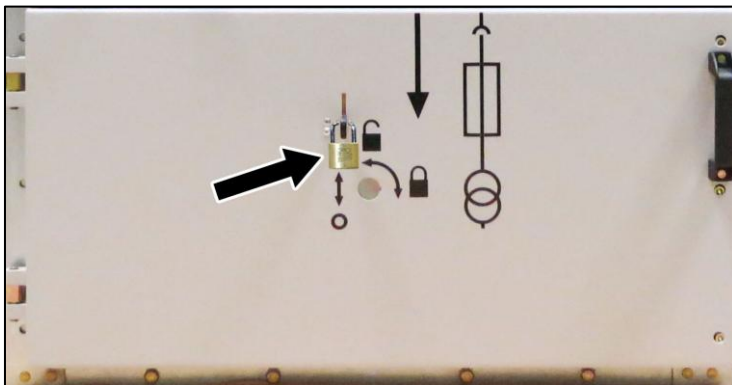


Fig. 287: Fitting a padlock

- ✓ The removable voltage transformers are in test position.

### 17.6 Taking the removable voltage transformers out of the panel

#### Preconditions

- High-voltage door closed
- Removable voltage transformers in test position
- Door to voltage transformer compartment open
- Service truck available

### Removing the low-voltage connector

- ⇒ To detach the low-voltage connector, push the longitudinal fastener (1) of the coupling downwards.
- ⇒ Remove the low-voltage connector (2) carefully upwards.

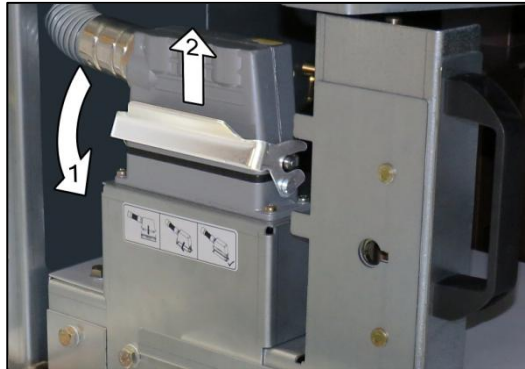


Fig. 288: Detaching and removing the low-voltage connector

- ⇒ Stow the low-voltage connector away in the shelf on the left inside the panel.

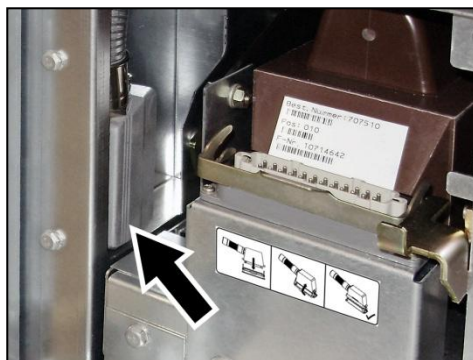


Fig. 289: Stowing the low-voltage connector

- ✓ The low-voltage connector is removed and stowed away.

### Positioning the service truck in front of the panel

#### NOTICE

##### Maloperation

If the service truck is not correctly interlocked with the panel while moving the removable voltage transformers onto the service truck, the switchgear and the removable voltage transformers can be seriously damaged.

- ⇒ The service truck must be interlocked with the panel before moving the removable voltage transformers onto the service truck.

## Operating the removable voltage transformers

- ⇒ Move the service truck centrally in front of the panel. The guide lugs bring the service truck to the correct position at the panel frame.

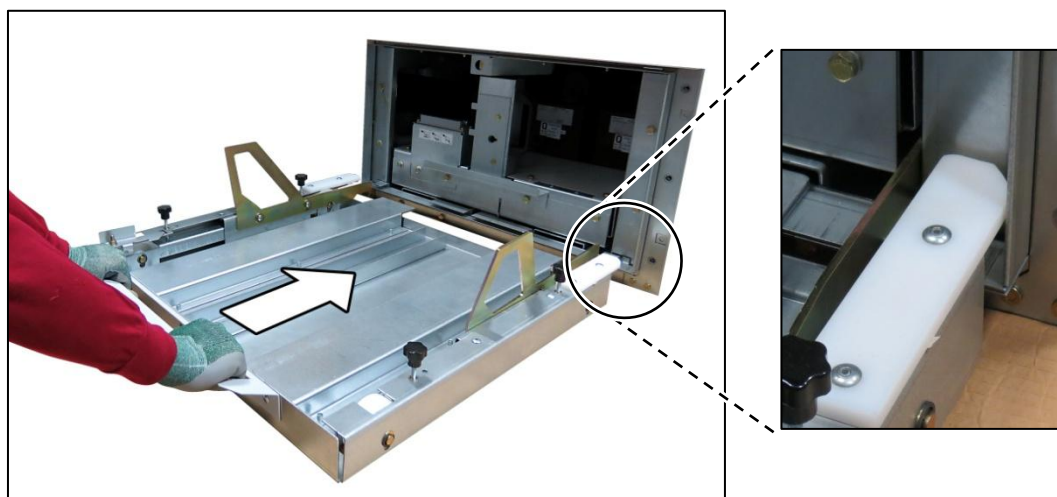


Fig. 290: Moving the service truck centrally in front of the panel

- ⇒ If necessary, adjust the height of the service truck with the 4 bolts to compensate unevenness in the floor.

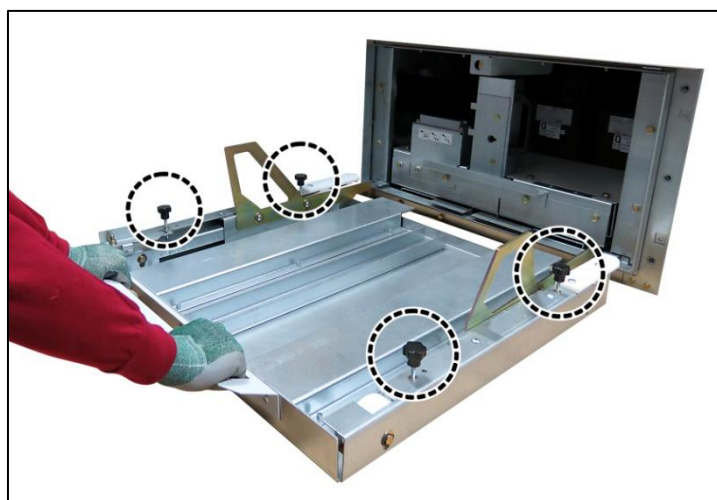


Fig. 291: Adjusting the height with the bolts

- ⇒ To hook the locking levers in at the panel frame, push the locking levers on the left and right side of the service truck downwards.

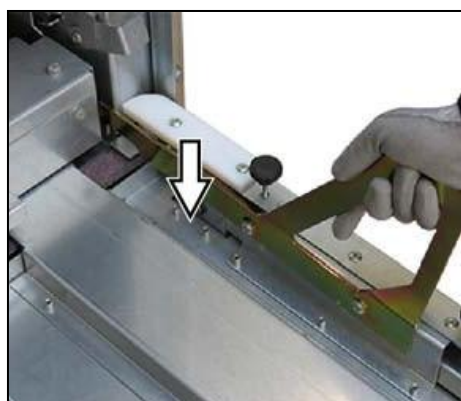


Fig. 292: Hooking the locking levers



To check whether the service truck is correctly interlocked with the panel, pull the service truck backwards using the handle.

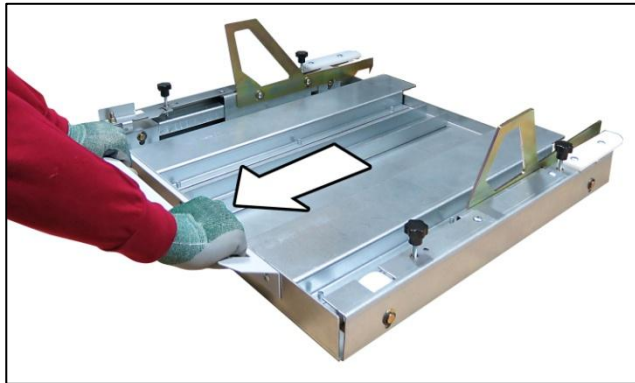


Fig. 293: Pulling the service truck back to check interlocking



The service truck is interlocked with the panel.

### Moving the removable voltage transformers onto the service truck

#### NOTICE

##### Maloperation

If the removable voltage transformers are not correctly interlocked with the service truck when moving the service truck away from the panel, the removable voltage transformers can be seriously damaged.



Move the service truck only if the removable voltage transformers are interlocked in their end position on the service truck.



Lift the handle of the removable voltage transformers. Keep it lifted and pull the removable voltage transformers onto the service truck as far as it will go. In the end position, the removable voltage transformers are automatically interlocked with the service truck.



Fig. 294: Pulling the voltage transformers onto the service truck

## Operating the removable voltage transformers

### Removing the service truck with the removable voltage transformers on top from the panel

- ⇒ To detach the locking levers from the panel frame, pull the locking levers on the left and right side of the service truck.

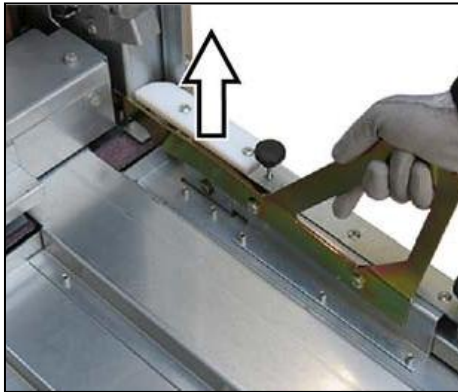


Fig. 295: Detaching the locking levers

- ⇒ To move the service truck with the removable voltage transformers on top away from the panel, pull the service truck using the handle of the removable voltage transformers.



Fig. 296: Moving the service truck using the handle

- ⇒ Close the door to the voltage transformer compartment and screw it tight.
- ⇒ Fit a padlock to the operating slide and close it.
- ✓ The removable voltage transformers are taken out of the panel.

### 17.7 Inserting the removable voltage transformers in a panel

#### Preconditions

- High-voltage door closed
- Door to voltage transformer compartment open
- Low-voltage connector stowed away
- Removable voltage transformers ready on service truck

### Positioning the service truck with the removable voltage transformers in front of the panel

#### NOTICE

##### Maloperation

If the service truck is not correctly interlocked with the panel while moving the removable voltage transformers into the panel, the switchgear and the removable voltage transformers can be seriously damaged.

⇒ The service truck must be interlocked with the panel before moving the removable voltage transformers into the panel.

⇒ Move the service truck with the removable voltage transformers on top centrally in front of the panel. The guide lugs bring the service truck directly to the correct position at the panel frame.

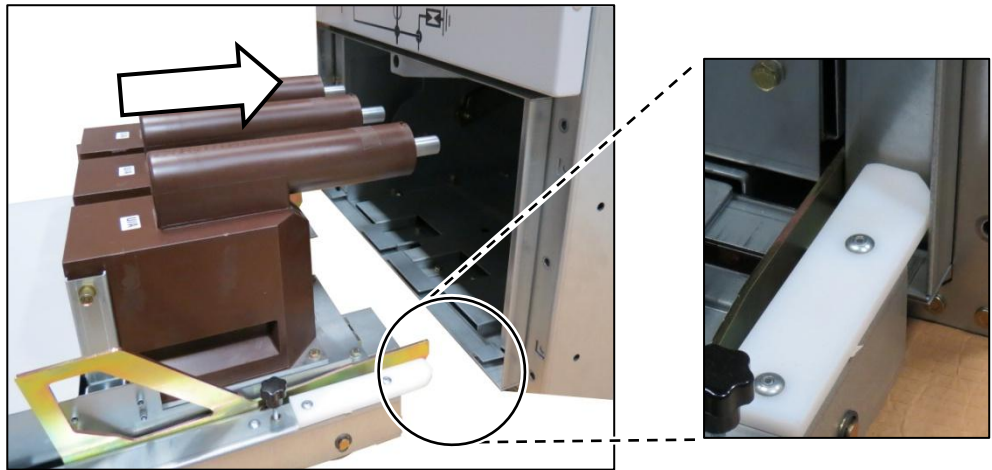


Fig. 297: Moving the truck centrally in front of the panel

⇒ If necessary, adjust the height of the service truck with the 4 bolts to compensate unevenness in the floor.

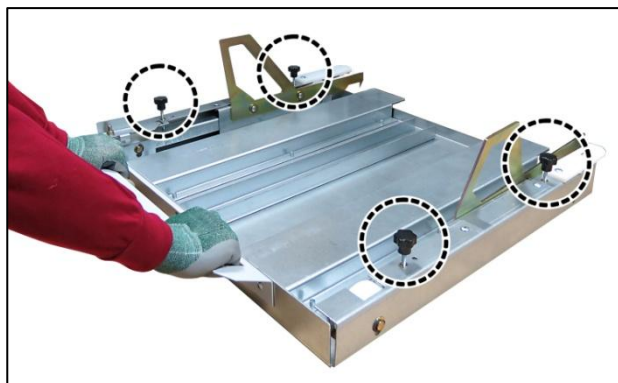


Fig. 298: Adjusting the height with the bolts

## Operating the removable voltage transformers

- ⇒ To hook the locking levers in at the panel frame, push the hooking levers on the left and right side of the service truck downwards.

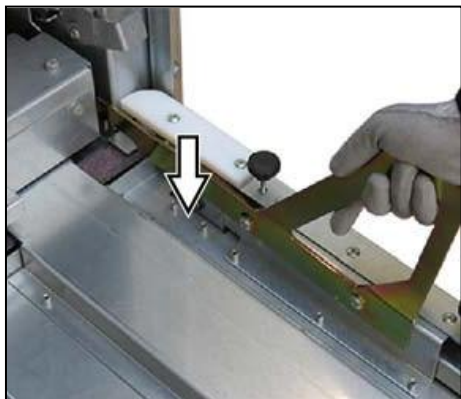


Fig. 299: Hooking the locking levers

- ⇒ To check whether the service truck is correctly interlocked with the panel, pull the service truck backwards using the handle.

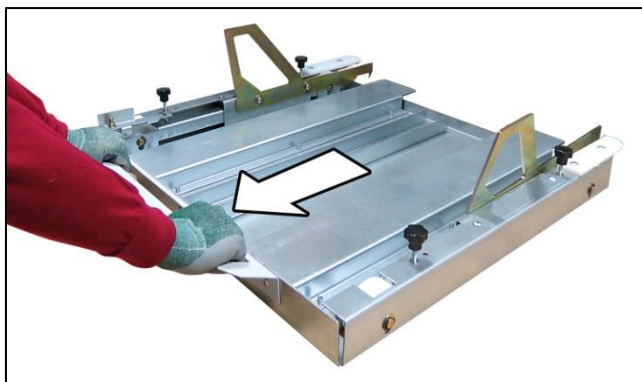


Fig. 300: Pulling the service truck to check interlocking

- ✓ The service truck is interlocked with the panel.

### Moving the removable voltage transformers into the panel

- ⇒ To undo the interlocking between the removable voltage transformers and the service truck, push the lever to the left and hold it.

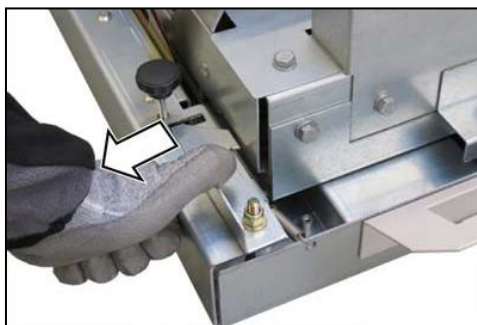


Fig. 301: Pulling the lever to unlock

- ⇒ Lift the handle of the removable voltage transformers. Keep it lifted and push the removable voltage transformers into the panel as far as it will go.



Fig. 302: Pushing the removable voltage transformers into the panel

- ⇒ Push the handle down to interlock the removable voltage transformers with the panel.
- ✓ The removable voltage transformers are inserted in the panel.

### Removing the service truck from the panel

- ⇒ To detach the locking levers from the panel frame, pull the locking levers on the left and right side of the service truck.

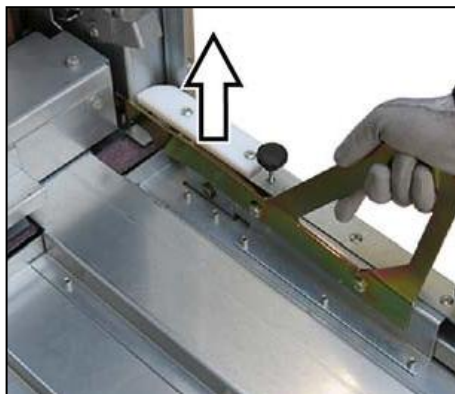


Fig. 303: Detaching the locking levers

## Operating the removable voltage transformers

- ⇒ Pull the service truck away from the panel.

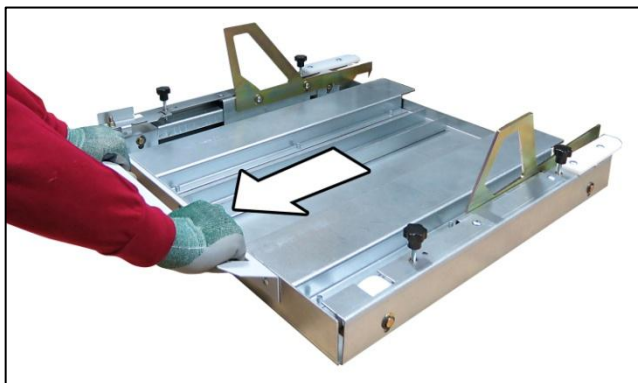


Fig. 304: Pulling the service truck away

- ✓ The service truck is removed from the panel.

### Plugging on the low-voltage connector



In addition to these instructions, an instruction label on the removable voltage transformers informs about plugging on the low-voltage connector.

Follow the advice on the label (3) to push the longitudinal fastener.

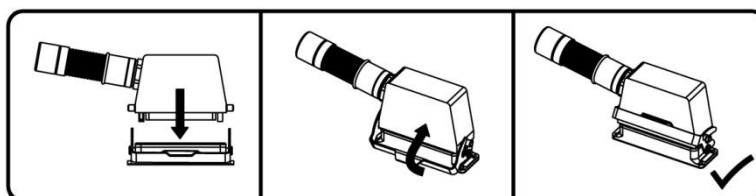


Fig. 305: Instruction label on the removable voltage transformers

- ⇒ Take the low-voltage connector out of the shelf on the left inside the panel.

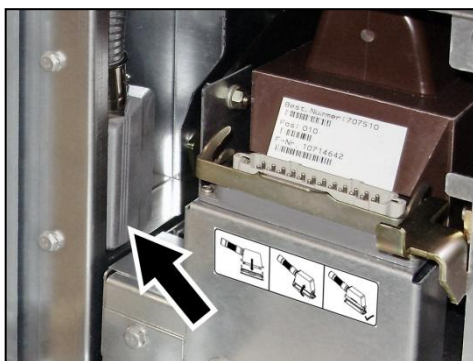


Fig. 306: Low-voltage connector stowed away

- ⇒ Carefully plug on the low-voltage connector (1) from above.
- ⇒ To secure the low-voltage connector, push the longitudinal fastener (2) of the coupling upwards.

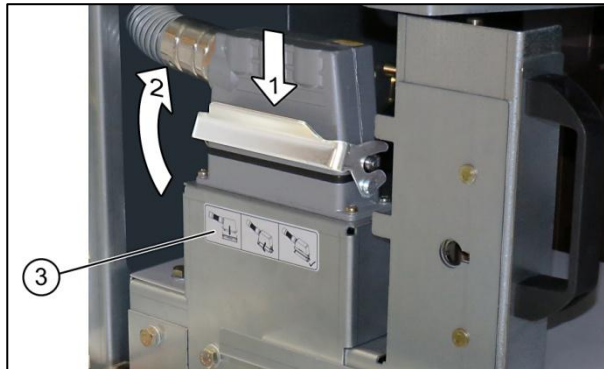


Fig. 307: Plugging on and securing the low-voltage connector

- ⇒ Close the door to the voltage transformer compartment and screw it tight.
- ⇒ Fit a padlock to the operating slide and close it.
- ✓ The removable voltage transformers are inserted in the panel.

### 17.8 Replacing protection fuse-links

#### NOTICE

##### Maloperation

Removable voltage transformers are exclusively designed for operation with specific protection fuse-links.

- ⇒ Use only the fuse-link types listed in the following table.
- ⇒ Do not mount bridging links instead of protection fuse-links.

#### HINT

A tripped protection fuse-link can cause hidden damages on the other protection fuse-links.

- ⇒ Always replace all protection fuse-links, even if only one protection fuse-link has tripped.

## Operating the removable voltage transformers

Selection table for protection fuse-links:

Rated voltage $U_r$ [kV]	Supplier:	Order details:
7.2	SIBA	3000211.2 / 2 A / 192 mm
12	SIBA	3011911.2 / 2 A / 192 mm
17.5	SIBA	3017911.2 / 2 A / 192 mm
Supplier information: <a href="http://www.siba-fuses.com">www.siba-fuses.com</a>		

Alternative supplier for fuse-links:

Rated voltage $U_r$ [kV]	Supplier:	Order details:
7.2	Inter-Teknik	S1Z1002 / 2 A / 192 mm
12	Inter-Teknik	+S1Z.12KV.192.002 / 2 A / 192 mm
17.5	Inter-Teknik	+S1Z.17.5KV.192.002 / 2 A / 192 mm
Supplier information: <a href="http://www.inter-teknik.com">www.inter-teknik.com</a>		

### Removable voltage transformer rating plate

Further technical data is shown on the rating plate of each removable voltage transformer.



Fig. 308: Rating plate on removable voltage transformer

### Design types of removable voltage transformers

Replacing the protection fuse-links is carried out differently depending on the design of a removable voltage transformer. There are four possible design types. Type 1 is substantially different from the others in that no tool is required for (un-)locking the contact caps of the voltage transformer housing. The other types require a tool. This tool is part of the delivery and is the same for all types.

#### Preconditions

- Removable voltage transformers taken out of the panel
- Set of proper protection fuse-links available
- Except for design type 1: tool available

### Procedure for design type 1: no tool required

- ⇒ Move the service truck with the removable voltage transformers away from the panel. The protection fuse-links are accessible.

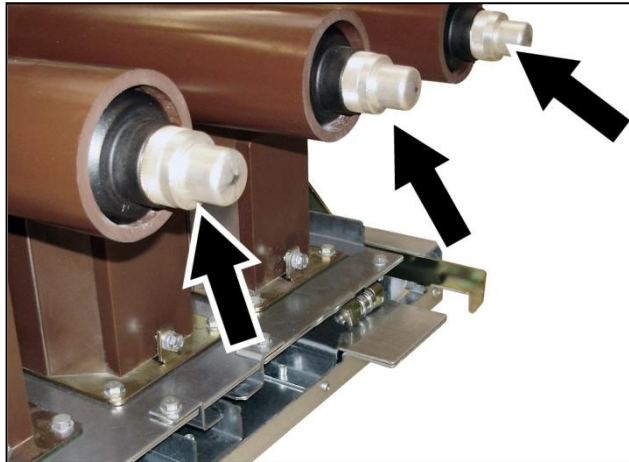


Fig. 309: Protection fuse-links accessible

- ⇒ Loosen the protection fuse-link by turning, and pull it out of the voltage transformer housing with mounted contact cap.

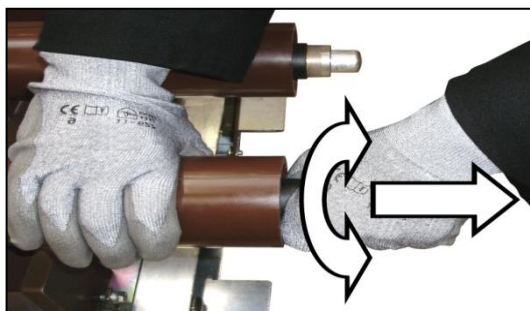


Fig. 310: Loosening fuse-link



Fig. 311: Pulling fuse-link out of the housing

- ⇒ Detach the contact cap from the protection fuse-link.

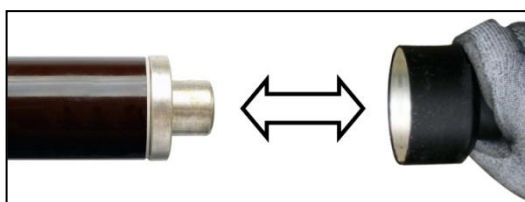


Fig. 312: Detaching contact cap from fuse-link

- ⇒ Mount the contact cap on the new protection fuse-link.

- ⇒ Insert the new protection fuse-link.

- ⇒ Perform replacement with all other fuse-links.

- ✓ The protection fuse-links have been replaced.

### HINT

#### Final procedure steps



Next, insert the removable voltage transformers into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

#### Procedure for design types 2, 3 and 4: tool required

Hereafter, the procedure is shown using the example of a removable voltage transformer type 2. For design types 3 and 4, the procedure is basically the same. Those types differ from type 2 only in that the contact caps are interlocked with the housing by a screw thread. The contact caps are unscrewed by turning counter-clockwise using the accessory tool:



Fig. 313: Tool for (un-)locking

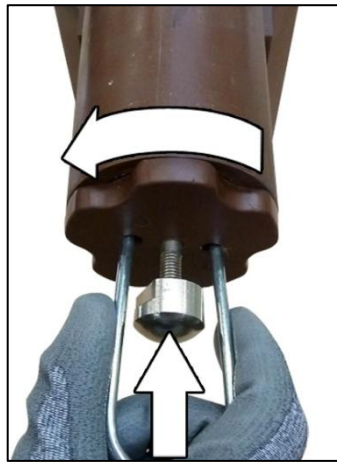


Fig. 314: Type 3: Unscrewing the contact cap

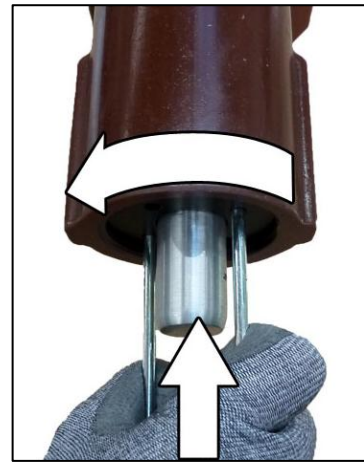


Fig. 315: Type 4: Unscrewing the contact cap



Move the service truck with the removable voltage transformers away from the panel. The protection fuse-links are covered by contact caps which are interlocked by a guide pin with the housing of the voltage transformer.

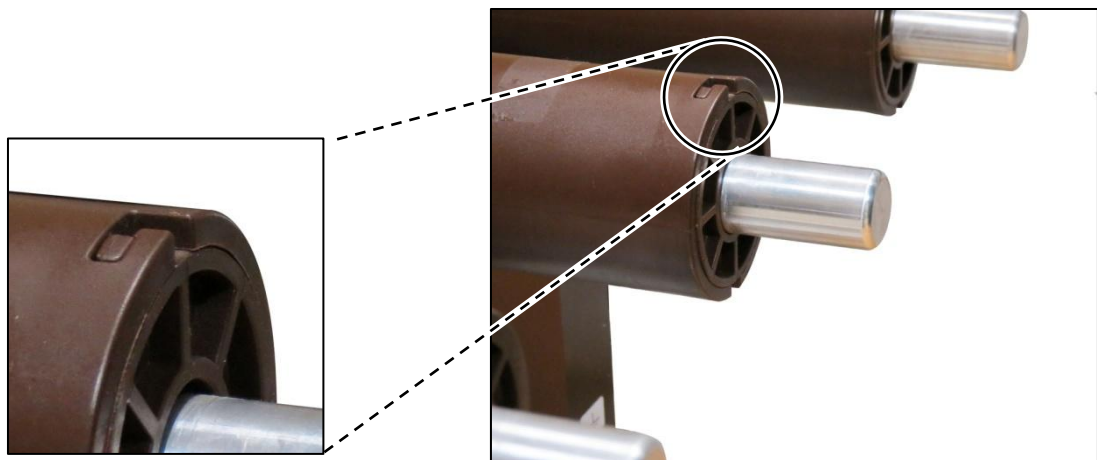


Fig. 316: Contact caps covering the protection fuse-link

- ⇒ To unlock the contact cap, insert both ends of the tool in the openings of the contact cap and turn clockwise as far as it will go.



Fig. 317: Unlocking the contact cap

- ⇒ Holding it by the contact, pull the contact cap off the housing, and store it.

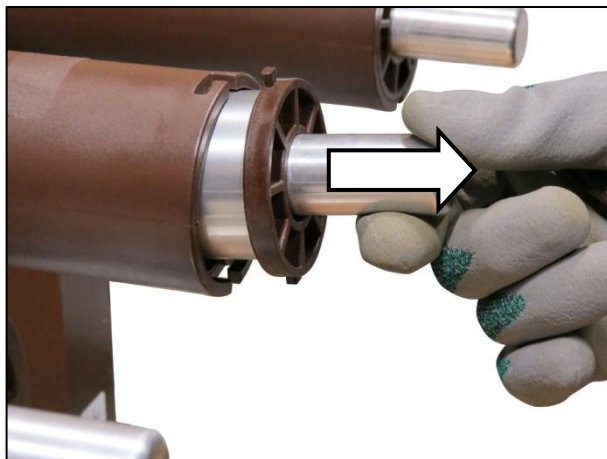


Fig. 318: Pulling the contact cap off the housing

- ⇒ Pull the spring off the protection fuse-link, and store it.

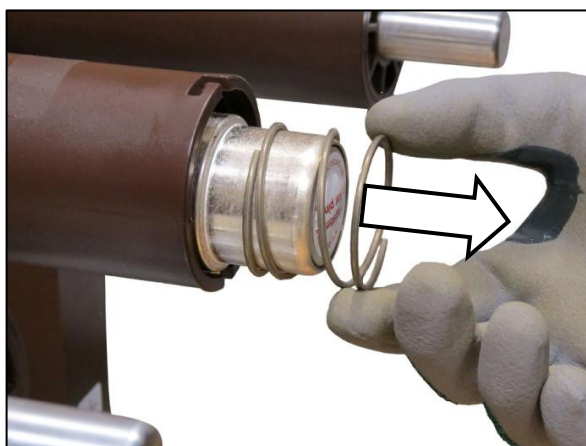


Fig. 319: Pulling the spring off the fuse-link

## Operating the removable voltage transformers

- ⇒ Pull the protection fuse-link out of the housing and dispose of it.



Fig. 320: Pulling the fuse-link out

- ⇒ Push the new protection fuse-link into the housing.

- ⇒ Push the spring on the protection fuse-link.

- ⇒ To insert the contact cap, align its guide pin with the angular slot in the housing. Then push the contact cap into the housing as far as it will go.

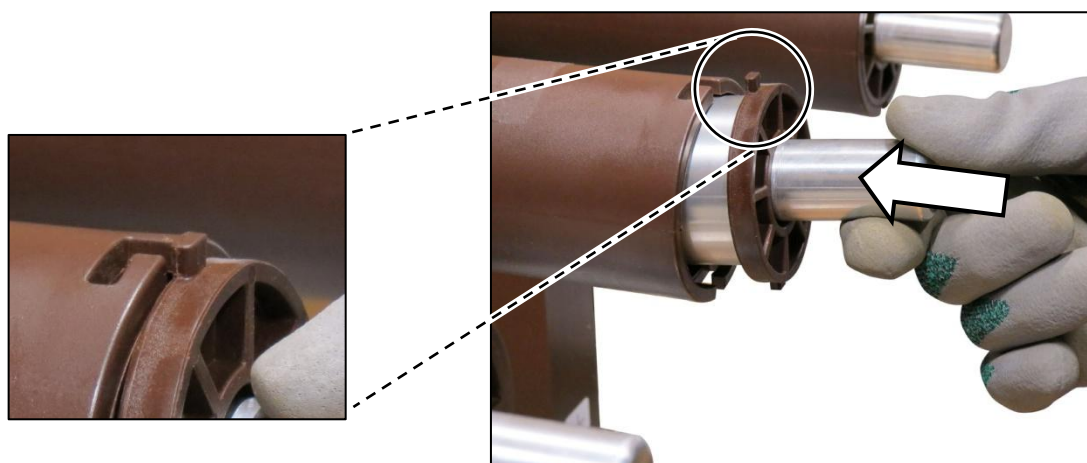


Fig. 321: Pushing the contact cap into the housing

- ⇒ To lock the contact cap, insert both ends of the tool in the openings of the contact cap and turn counter-clockwise as far as it will go.



Fig. 322: Locking the contact cap

- ⇒ Perform replacement with all other fuse-links.
- ✓ The protection fuse-links have been replaced.



### HINT

#### Final procedure steps



Next, insert the removable voltage transformers into the panel. After closing the high-voltage door, the panel can be integrated into the course of operation again.

# Verifying safe isolation from supply

## 18 Verifying safe isolation from supply

### HINT

Read and understand these instructions before attempting operating works.

Before performing any kind of check or work in the busbar compartment or the connection compartment of each panel, it has to be ensured that these compartments are safely isolated from supply.

To ensure the safe isolation from supply, use the integrated three-phase capacitive voltage detecting system according to IEC 61243-5.

### 18.1 Application of voltage indicators

#### DANGER

##### Electric shock

##### Always verify safe isolation from supply without any doubt

If safe isolation from supply is verified erroneously although operational voltage is still applied, there is danger to life.

- ⇒ Before performing any kind of checks or work in the busbar compartment or the connection compartment of each panel, verify safe isolation from supply in these compartments without any doubt.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ To verify safe isolation from supply, do exclusively use intact LRM voltage indicators that have been tested immediately before.
- ⇒ Please do absolutely observe the enclosed operating instructions for the function test unit and the voltage indicator.

### 18.2 Overview of voltage indicating systems

As voltage indicators, two device systems are used:

- **CAPDIS** and **VOIS** device systems installed in the door to the low-voltage compartment
- **LRM** device system as an indicator with the associated measuring system installed below the door to the low-voltage compartment

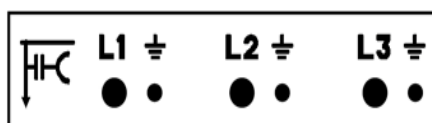


Fig. 323: Test sockets for feeder

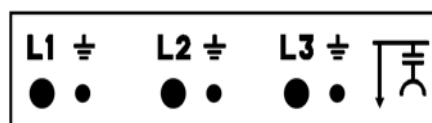
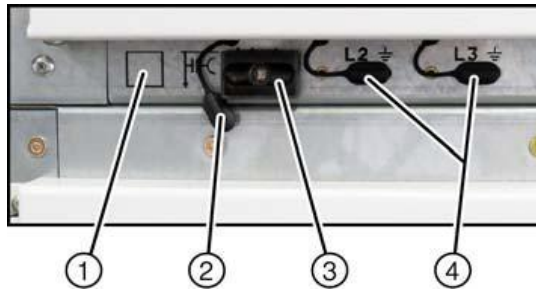


Fig. 324: Test sockets for busbar

### 18.3 LRM system overview



- (1) Documentation to repeat test of interface condition
- (2) Cover of test socket for L1, removed
- (3) LRM-ST, plugged on for L1
- (4) Covers of tests sockets for L2 and L3, fitted

Fig. 325: LRM system at the panel

#### Indication on LRM-ST

LRM-ST indication		Meaning
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	Indication does not light up or does not flash	Phase isolated from supply

#### NOTICE

##### Device system LRM

Before verifying safe isolation from supply with the LRM device system, do absolutely check proper functioning of the LRM-ST voltage indicator.



Fig. 326: LRM-ST voltage indicator

### 18.4 Verifying proper functioning of LRM-ST voltage indicator

To verify proper functioning of the LRM-ST voltage indicator, use the battery-operated function test unit (optional).



Fig. 327: Function test unit for LRM-ST voltage indicator

#### Preconditions

- Function test unit available ready for operation on LRM-ST voltage indicators
- LRM voltage indicator available to be tested

#### Procedure

- ⇒ Plug the contact pins of the LRM-ST voltage indicator on the test sockets at the function test unit.
- ⇒ Perform the test.

#### Alternative test method

If no function test unit is available to check the LRM-ST voltage indicator, the check must be executed on a live panel.

#### Procedure

- ⇒ Remove one cover from the test sockets. The cover remains permanently at the panel.
- ⇒ Plug the contact pins of the LRM-ST voltage indicator on the test sockets at the panel.
- ⇒ Perform the test.
- ✓ The test of the LRM-ST voltage indicator is completed. If the voltage indicator does not pass the function test, do not use this voltage indicator to verify safe isolation from supply.

## 18.5 Verifying safe isolation from supply with the LRM device system

### **DANGER**

#### **Electric shock**

#### **Always verify safe isolation from supply without any doubt**

If safe isolation from supply is verified erroneously although operational voltage is still applied, there is danger to life.

- ⇒ Before performing any kind of checks or work in the busbar compartment or the connection compartment of each panel, verify safe isolation from supply in these compartments without any doubt.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ To verify safe isolation from supply, do exclusively use intact LRM voltage indicators that have been tested immediately before.
- ⇒ Please do absolutely observe the enclosed operating instructions for the function test unit and the voltage indicator.

#### **Preconditions**

- High-voltage door closed
- Door to the low-voltage compartment closed
- Tested LRM voltage indicator available

#### **Procedure**

- ⇒ Remove the cover from the test socket. The cover remains permanently at the panel.
- ⇒ Plug the LRM-ST voltage indicator on the test socket.

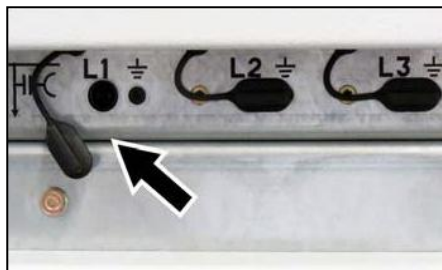


Fig. 328: Cover removed from test socket L1

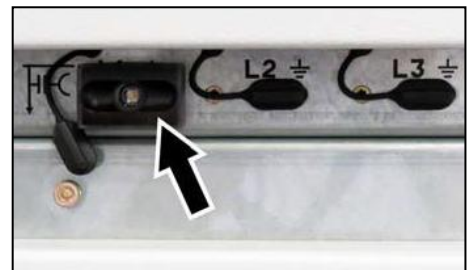


Fig. 329: LRM-ST voltage indicator at L1

- ⇒ Read the voltage indication at the LRM-ST.

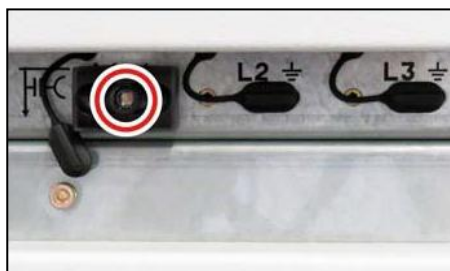





Fig. 330: LRM-ST indication

## Verifying safe isolation from supply

LRM-ST indication		Meaning
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	Indication does not light up or does not flash	Phase isolated from supply

- ⇒ Indication does not light up or does not flash.
- ⇒ Refit the cover on the test socket.
- ⇒ Proceed in the same way with the test sockets for L2, and then for L3.
- ✓ Safe isolation from supply is verified as soon as L1, L2 and L3 have been determined to be isolated from supply.

### 18.6 CAPDIS and VOIS systems overview

CAPDIS-S1+	Integrated capacitive voltage detecting system
CAPDIS-S2+	Integrated capacitive voltage monitoring system with relay output
VOIS+	Economic integrated capacitive voltage detecting system
VOIS-R+	Economic integrated capacitive voltage detecting system with relay output

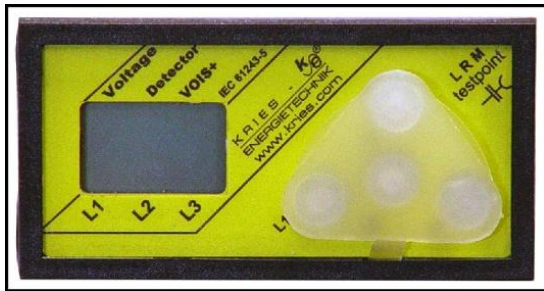


Fig. 331: VOIS+, cover closed

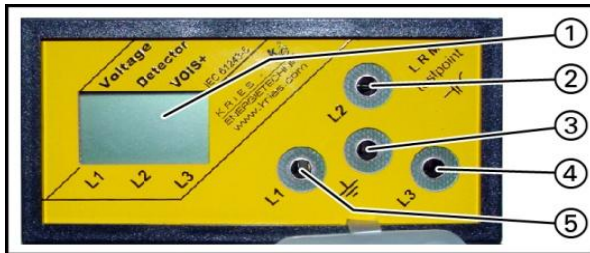


Fig. 332: VOIS+, cover open

- (1) LC display
- (2) Test socket L2
- (3) Earth socket
- (4) Test socket L3
- (5) Test socket L1

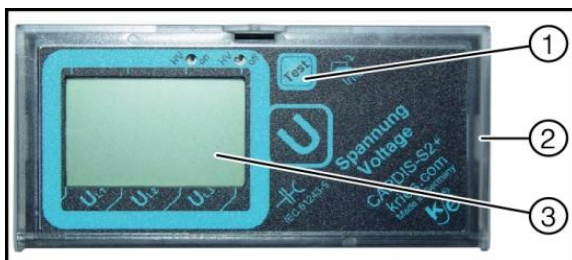


Fig. 333: CAPDIS-S2+, cover closed

- (1) "Test" button
- (2) Cover
- (3) LC display
- (4) Duct for signaling cables CAPDIS-M
- (5) Test socket L2
- (6) Earth socket
- (7) Test socket L3
- (8) Test socket L1
- (9) Short instructions



Fig. 334: CAPDIS-S2+, cover open

## Verifying safe isolation from supply

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

Indication:	VOIS+, VOIS-R+			CAPDIS-S1+			CAPDIS-S2+			
	L1	L2	L3	L1	L2	L3	L1	L2	L3	
A0										Operational high voltage not present
A1										Operational high voltage present
A2										<ul style="list-style-type: none"> <li>Operational high voltage not present</li> <li>Auxiliary voltage not available (only CAPDIS-S2+)</li> </ul>
A3										Failure in phase L1, Operational high voltage at L2 and L3
A4	—									Voltage (not operational high voltage) present
A5	—									Indication: "Test" passed (lights up shortly)
A6	—									Indication: "Test" not passed (lights up shortly)
A7	—									Overvoltage present (lights up permanently)
A8	—			—						Indication: "ERROR" for example in case of disconnected auxiliary voltage

Fig. 335: Indications VOIS+, VOIS-R+, CAPDIS-S1+/-S2+

### Features VOIS+, VOIS-R+, CAPDIS-S1+ / CAPDIS-S2+

VOIS+, VOIS-R+	CAPDIS-S1+ / CAPDIS-S2+
Integrated display, without auxiliary power	Integrated display, without auxiliary power
Maintenance-free, repeat test required	Maintenance-free
Degree of protection IP54	Degree of protection IP54
With integrated 3-phase test socket for phase comparison	With integrated 3-phase test socket for phase comparison
—	With signal-lead test
—	Integrated repeat test of the interfaces

## 18.7 Verifying safe isolation from supply with the CAPDIS or VOIS device system

**⚠ DANGER**

**Electric shock**

**Always verify safe isolation from supply without any doubt**

If safe isolation from supply is verified erroneously although operational voltage is still applied, there is danger to life.

⇒ Before performing any kind of checks or work in the busbar compartment or the connection compartment of each panel, verify safe isolation from supply in these compartments without any doubt.

⇒ Observe the **Five Safety Rules**.

### Preconditions

- High-voltage door closed
- Door to the low-voltage compartment closed
- Indication "Operational high voltage not present" visible

✓ Safe isolation from supply is verified as soon as L1, L2 and L3 have been determined to be isolated from supply.

## 18.8 Supplier information

Further information for the devices to get from:

Device	Supplier
VOIS+ / VOIS-R+ / CAPDIS-S1+ / CAPDIS-S2+	<a href="http://www.kries.com">www.kries.com</a>
LRM system	<a href="http://www.horstmannngmbh.com">www.horstmannngmbh.com</a>
LRM-ST voltage indicator	Siemens AG / Order No.: 8DX1620

# Earthing and de-earthing the busbar system

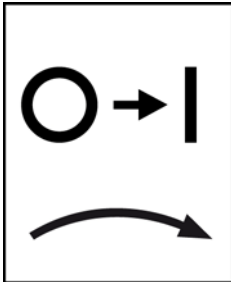
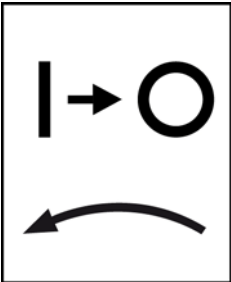
## 19 Earthing and de-earthing the busbar system

### HINT

Read and understand these instructions before attempting operating works.

### 19.1 Operating lever for earthing switch

- With the operating lever, the switching process at the busbar earthing switch can only be executed in turning direction.
- The turning movement into the opposite direction has a freewheel and does not move the busbar earthing switch; the operating lever works like a ratchet spanner.
- The busbar earthing switch is operated either clockwise or counter-clockwise according to the switching function.
- To use the operating lever, two instruction labels show the turning direction for the corresponding switching function.

Switching function	From OPEN position to CLOSED position	From CLOSED position to OPEN position
Turning direction of the operating lever:	Clockwise	Counter-clockwise
Instruction label on the operating lever:		

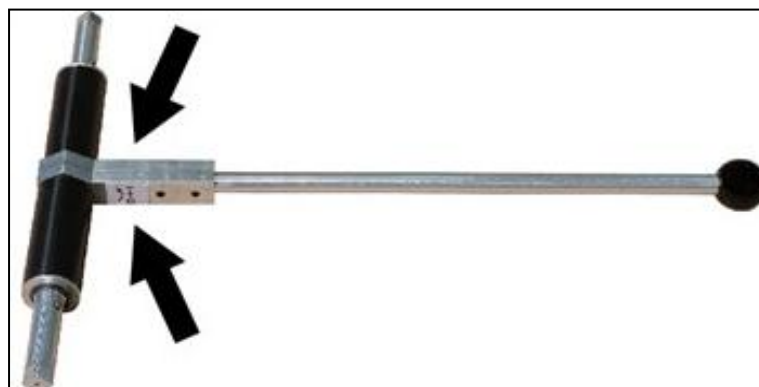


Fig. 336: Instruction labels on the operating lever

## 19.2 Earthing the busbar system manually

### Arrangement of control elements

The operating mechanism of the earthing switch provided for earthing the busbar system is located in the front upper area of the low-voltage compartment.



Fig. 337: Control elements of earthing switch for busbar system

### **WARNING**

#### **Risk of falling**

Falling from a ladder can lead to injuries and bone fractures.

- ⇒ Observe the guidelines for the use of working materials.
- ⇒ Use approved electrician's ladders only.
- ⇒ Observe the manual and the instructions on the ladder.

### **NOTICE**

#### **Maloperation**

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.

- ⇒ Do not try to remove the operating lever at intermediate positions.

### **NOTICE**

#### **Maloperation**

If the operating lever is not inserted correctly, the busbar earthing switch may be damaged.

- ⇒ Insert the operating lever in the actuating opening as far as it will go.

## Earthing and de-earthing the busbar system

### Instruction label on the door to the low-voltage compartment:

In addition to these instructions, an instruction label on the door to the low-voltage compartment informs about proper operation of the operating lever for the busbar earthing switch.

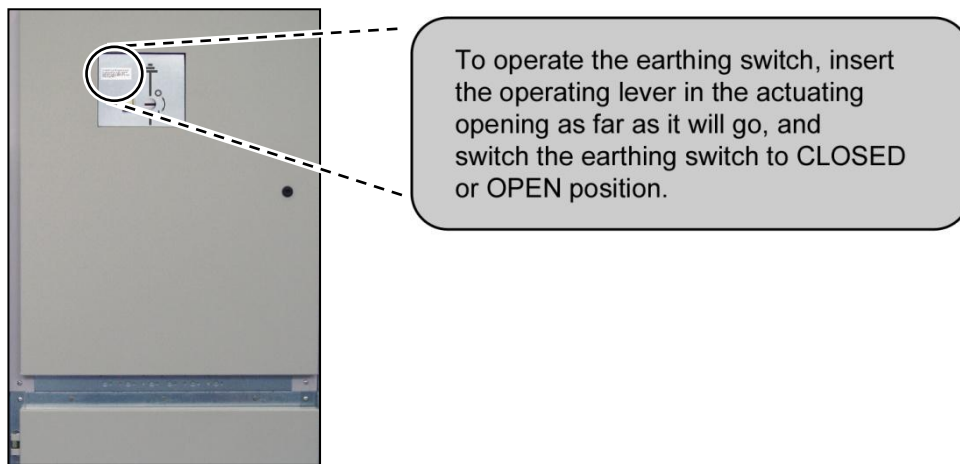


Fig. 338: Instruction label on door to the low-voltage compartment

### Preconditions

- Busbar earthing switch in OPEN position
- Intended opening of the padlock released externally
- Operating lever available
- Electrician's ladder available as double-step ladder
- Electromagnetic interlock (optional) deactivated
- If a withdrawable part / switching-device truck is inserted in the panel:
  - Withdrawable part / switching-device truck in test position
  - Low-voltage connector plugged on

### Procedure

- ⇒ Ensure that the intended manual switching operation has been released externally.
- ⇒ Make sure according to the panel number at the panel that the release for manual earthing of exactly this panel is available.
- ⇒ Position the electrician's ladder correctly in front of the panel.
- ⇒ Open the padlock.



Fig. 339: Operating slide on busbar earthing switch padlocked

⇒ Lift the operating slide and hold it.

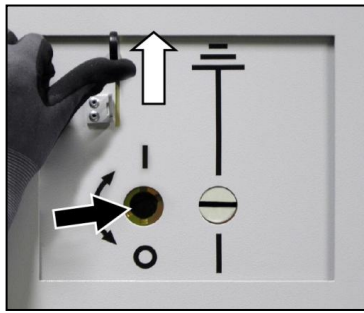


Fig. 340: Lifting the operating slide

## Actuating opening for busbar earthing switch

The actuating opening for the busbar earthing switch has different receptacles for inserting the operating lever for closing and opening the busbar earthing switch.

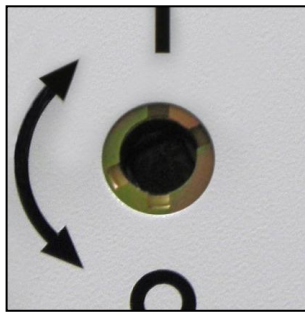


Fig. 341: Actuating opening for busbar earthing switch

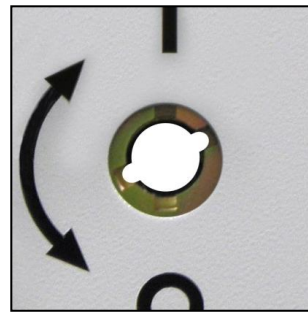


Fig. 342: Inserting the operating lever for closing

⇒ Insert the operating lever for the busbar earthing switch in the actuating opening in such a way that the instruction label for clockwise turning direction is visible.

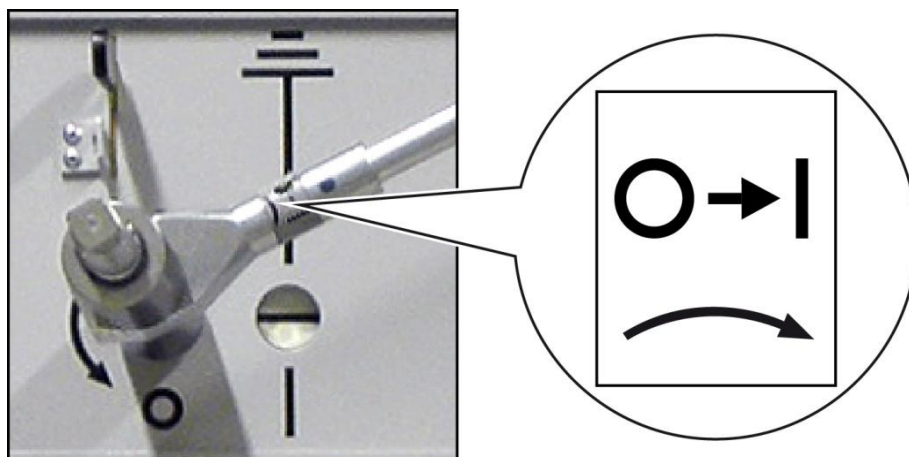


Fig. 343: Inserting the operating lever for closing

## Earthing and de-earthing the busbar system

- ⇒ Insert the busbar earthing switch operating lever in the actuating opening of the busbar earthing switch in such a way that the pins of the operating lever coincide with the actuating opening in "10 past 8" position.

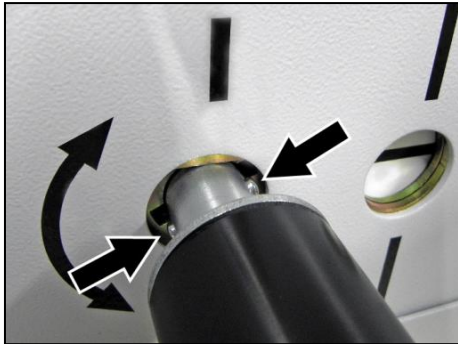


Fig. 344: Inserting the operating lever for closing

- ⇒ Insert the operating lever in the actuating opening as far as it will go.
- ⇒ Turn the operating lever clockwise as far as it will go (that is approx. 115°).



Fig. 345: Closing the busbar earthing switch



Fig. 346: Closing the busbar earthing switch using an electrician's ladder

- ⇒ While turning the operating lever, the position indicator of the busbar earthing switch changes from the OPEN position to the intermediate position.

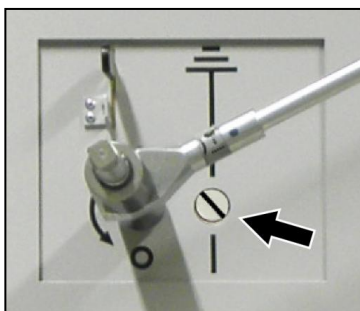


Fig. 347: Position indicator in intermediate position

- ⇒ After turning the operating lever to the end position, the position indicator of the busbar earthing switch changes from the intermediate position to the CLOSED position.



Fig. 348: Operating lever in end position

- ⇒ Remove the operating lever.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Fit a padlock to the operating slide and close it.

The busbar earthing switch has been switched from the OPEN position to the CLOSED position, thus earthing the busbar. The position indicator of the busbar earthing switch changes from the OPEN position via the intermediate position to the CLOSED position.



Fig. 349: Operating slide on busbar earthing switch padlocked

- ✓ The busbar system is earthed.

### 19.3 De-earthing the busbar system manually

#### Arrangement of control elements

The operating mechanism of the earthing switch provided for earthing the busbar system is located in the front upper area of the low-voltage compartment.



Fig. 350: Control elements of earthing switch for busbar system

#### **WARNING**

##### **Risk of falling**

Falling from a ladder can lead to injuries and bone fractures.

- ⇒ Observe the guidelines for the use of working materials.
- ⇒ Use approved electrician's ladders only.
- ⇒ Observe the manual and the instructions on the ladder.

#### **NOTICE**

##### **Maloperation**

A switching operation once started must be completed totally! A switching operation that was not completed cannot be turned back.

- ⇒ Do not try to remove the operating lever at intermediate positions.

#### **NOTICE**

##### **Maloperation**

If the operating lever is not inserted correctly, the busbar earthing switch may be damaged.

- ⇒ Insert the operating lever in the actuating opening as far as it will go.

### Instruction label on the door to the low-voltage compartment:

In addition to these instructions, an instruction label on the door to the low-voltage compartment informs about proper operation of the operating lever for the busbar earthing switch system.

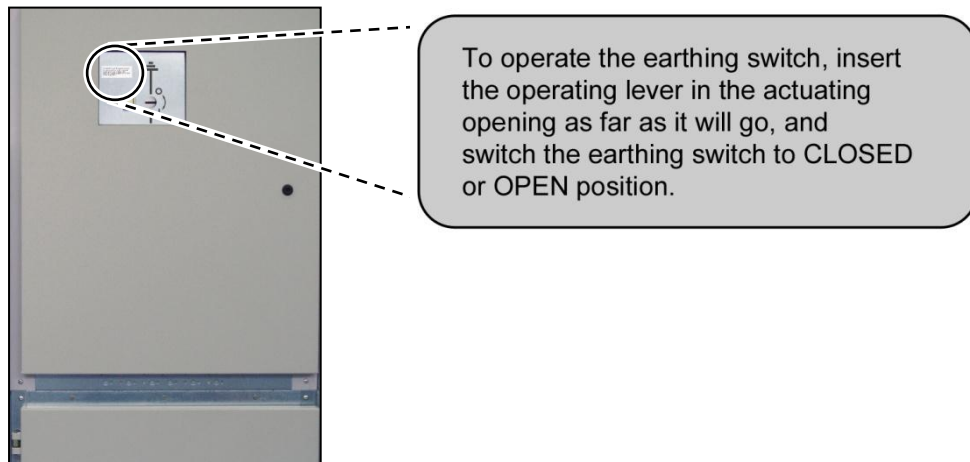


Fig. 351: Instruction label on door to the low-voltage compartment

### Preconditions

- Busbar earthing switch in CLOSED position
- Intended opening of the padlock released externally
- Operating lever available
- Electrician's ladder available as double-step ladder
- Electromagnetic interlock (optional) deactivated

### Procedure

- ⇒ Ensure that the intended manual switching operation has been released externally.
- ⇒ Make sure according to the panel number at the panel that the release for manual de-earthing of exactly this panel is available.
- ⇒ Position the electrician's ladder correctly in front of the panel.
- ⇒ Open the padlock.



Fig. 352: Operating slide on busbar earthing switch padlocked

⇒ Lift the operating slide and hold it.

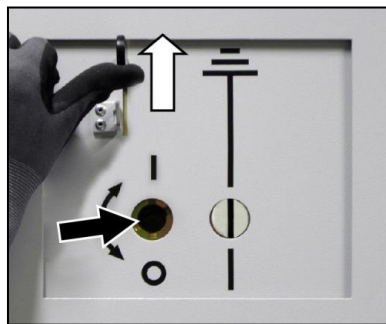


Fig. 353: Lifting operating slide, actuating opening open

### Actuating opening for busbar earthing switch

The actuating opening for the busbar earthing switch has different receptacles for inserting the operating lever for closing and opening the busbar earthing switch.

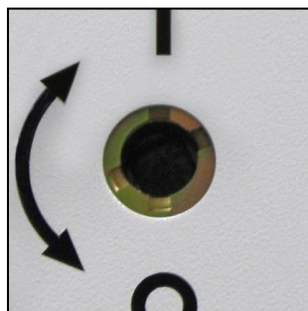


Fig. 354: Actuating opening for busbar earthing switch

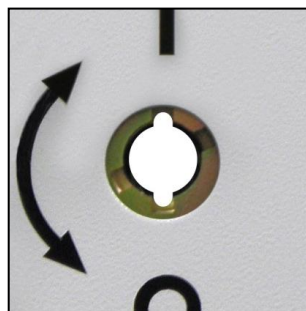


Fig. 355: Inserting the operating lever for opening

⇒ Insert the operating lever for the busbar earthing switch in the actuating opening in such a way that the instruction label for counter-clockwise turning direction is visible.

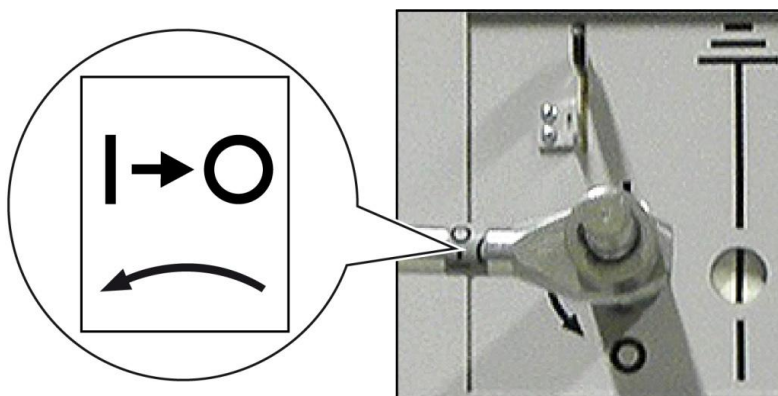


Fig. 356: Inserting the operating lever for opening

- ⇒ Insert the busbar earthing switch operating lever in the actuating opening of the busbar earthing switch in such a way that the pins of the operating lever coincide with the actuating opening in vertical position.

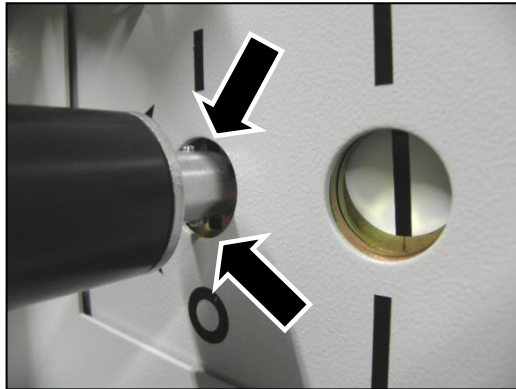


Fig. 357: Inserting the operating lever for opening

- ⇒ Insert the operating lever in the actuating opening as far as it will go.
- ⇒ Turn the operating lever counter-clockwise as far as it will go (that is approx. 115°).

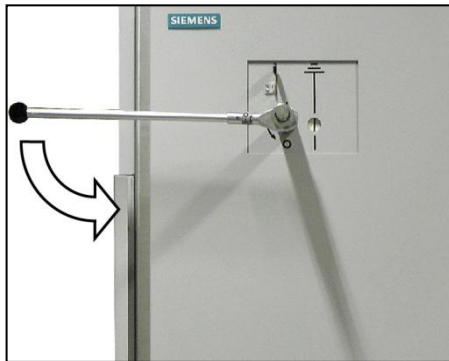


Fig. 358: Opening the busbar earthing switch



Fig. 359: Opening the busbar earthing switch using an electrician's ladder

## Earthing and de-earthing the busbar system

- ⇒ While turning the operating lever, the position indicator of the busbar earthing switch changes from the CLOSED position to the intermediate position.

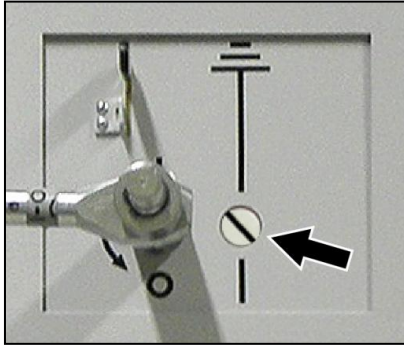


Fig. 360: Position indicator in intermediate position

- ⇒ After turning the operating lever to the end position, the position indicator of the busbar earthing switch changes from the intermediate position to the OPEN position.

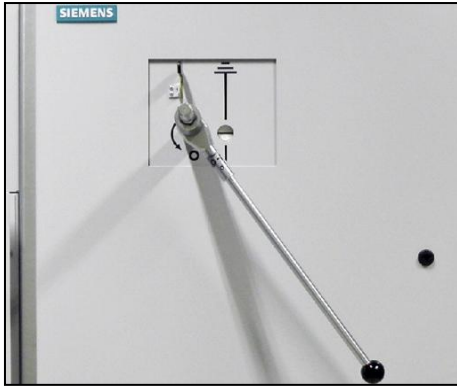


Fig. 361: Operating lever in end position

- ⇒ Remove the operating lever.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.

⇒ Fit a padlock to the operating slide and close it.

The busbar earthing switch has been switched from the CLOSED position to the OPEN position, thus de-earthing the busbar. The position indicator of the busbar earthing switch changes from the CLOSED position via the intermediate position to the OPEN position.



Fig. 362: Operating slide on busbar earthing switch padlocked

✓ The busbar system is de-earthed.

# Operating the shutters

## 20 Operating the shutters

### HINT

Read and understand these instructions before attempting operating works.

The shutter to the busbar compartment and the shutter to the connection compartment can be opened individually. When one shutter is opened, the mechanism of the other one must be padlocked. If both shutters have to be opened at the same time, locking the other shutter mechanism is omitted.

### 20.1 Operating the shutter to the busbar compartment in the switching-device compartment

#### DANGER

##### Electric shock

If the busbars in the busbar compartment have not been isolated, the contacts will be live at operational high voltage.

⇒ Always observe the **Five Safety Rules**.

**Before** opening the shutter to the busbar compartment:

⇒ Put on personal protective equipment.

⇒ Isolate and earth the busbars in the busbar compartment.

⇒ Verify safe isolation from supply.

⇒ Padlock the shutter mechanism on the right side in the switching-device compartment unless you intend to open the shutter to the connection compartment, too.

Open the shutter to the busbar compartment **safely**:

⇒ Only use the slip-on lever. Never try to open the shutter mechanism touching it directly.

⇒ Always operate the slip-on lever **outside** the panel using the handle.

**Always** close the shutter to the busbar compartment:

⇒ Before interrupting operations inside the switching-device compartment.

⇒ Immediately after completing operations inside the switching-device compartment.

#### CAUTION

##### Injury

The shutter mechanism on the left and right side in the switching-device compartment can cause injuries by getting squeezed, caught or cut.

⇒ Do not remove any parts of the covering.

⇒ Do not reach into the shutter mechanism with hands or tools.

## Opening the shutter to the busbar compartment (upper shutter)

### Preconditions

- Withdrawable part / switching-device truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- Low-voltage connector stowed away
- Withdrawable part / switching-device truck taken out of the panel

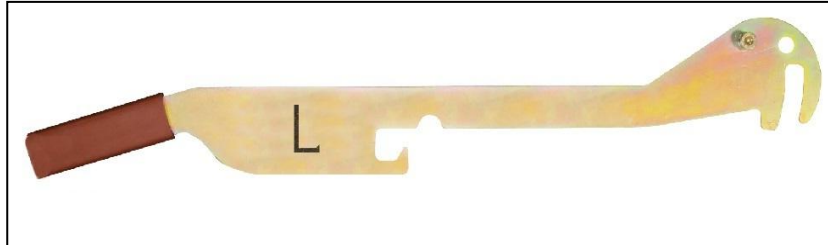


Fig. 363: Slip-on lever for opening the shutter (marked with L)

⇒ Padlock the shutter mechanism on the right side in the switching-device compartment.

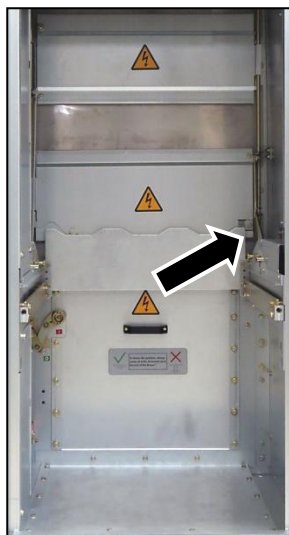


Fig. 364: Padlocking the shutter mechanism on the right side in the switching-device compartment

⇒ Push the slip-on lever (marked with L) on the shutter mechanism on the left side in the switching-device compartment.

## Operating the shutters

- ⇒ Operate the slip-on lever outside the panel using the handle: Push the handle downwards as far as it will go. The slip-on lever latches tight and the shutter opens.

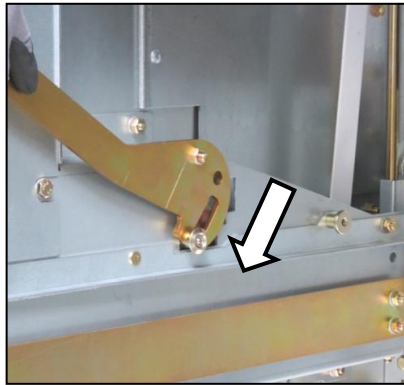


Fig. 365: Pushing on the slip-on lever



Fig. 366: Pushing the handle downwards to end position

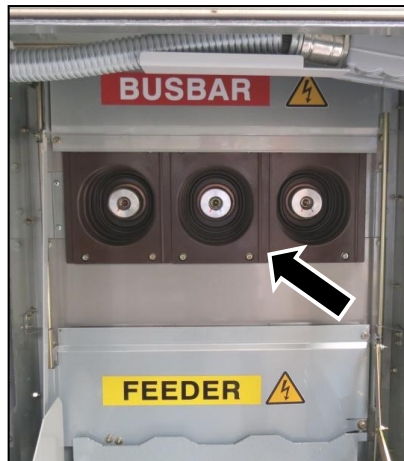


Fig. 367: Shutter to the busbar compartment open

- ✓ The shutter to the busbar compartment is open.

### HINT

#### Final procedure steps

- ⇒ Immediately proceed to perform a voltage test with recommended suitable equipment or other intended operations.

## Closing the shutter to the busbar compartment (upper shutter)

### NOTICE

#### Maloperation

Risk of damaging safety-relevant parts.

- ⇒ Remove the padlock **before** inserting the withdrawable part / switching-device truck in the switching-device compartment.

- ⇒ Push the handle of the slip-on lever slightly to the right (to release the latch) and let it slip upwards. The shutter closes.
- ⇒ Remove the slip-on lever.
- ⇒ Remove the padlock from the right side in the switching-device compartment.
- ✓ The shutter to the busbar compartment is closed.

## 20.2 Operating the shutter to the connection compartment in the switching-device compartment

### **DANGER**

#### **Electric shock**

If the cable / bar connections in the connection compartment have not been isolated, the contacts will be live at operational high voltage.

- ⇒ Always observe the **Five Safety Rules**.

**Before** opening the shutter to the connection compartment:

- ⇒ Put on personal protective equipment.
- ⇒ Isolate and earth the cable / bar connections in the connection compartment.
- ⇒ Verify safe isolation from supply.
- ⇒ Padlock the shutter mechanism on the left side in the switching-device compartment unless you intend to open the shutter to the busbar compartment, too.

Open the shutter to the connection compartment **safely**:

- ⇒ Only use the slip-on lever. Never try to open the shutter mechanism touching it directly.
- ⇒ Always operate the slip-on lever **outside** the panel using the handle.

**Always** close the shutter to the connection compartment:

- ⇒ Before interrupting operations inside the switching-device compartment.
- ⇒ Immediately after completing operations inside the switching-device compartment.

### **CAUTION**

#### **Injury**

The shutter mechanism on the left and right side in the switching-device compartment can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.
- ⇒ Do not reach into the shutter mechanism with hands or tools.

## Operating the shutters

### Opening the shutter to the connection compartment (lower shutter)

#### Preconditions

- Withdrawable part / switching-device truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- Low-voltage connector stowed away
- Withdrawable part / switching-device truck taken out of the panel



Fig. 368: Slip-on lever for opening the shutter (marked with R)

⇒ Padlock the shutter mechanism on the left side in the switching-device compartment.

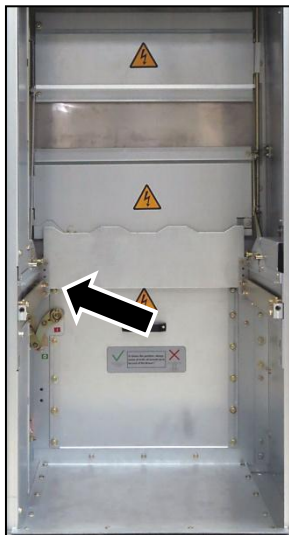


Fig. 369: Padlocking the shutter mechanism on the left side in the switching-device compartment

⇒ Push the slip-on lever (marked with R) on the shutter mechanism on the right side in the switching-device compartment.

⇒ Operate the slip-on lever outside the panel using the handle: Push the handle downwards as far as it will go. The slip-on lever latches tight and the shutter opens.



Fig. 370: Pushing on the slip-on lever

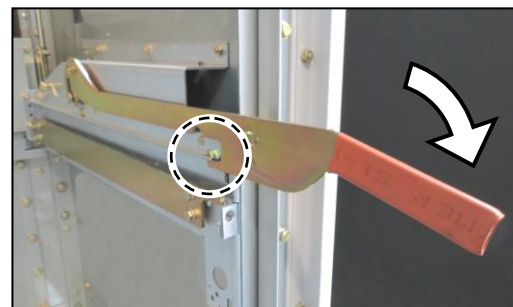


Fig. 371: Pushing the handle downwards to end position

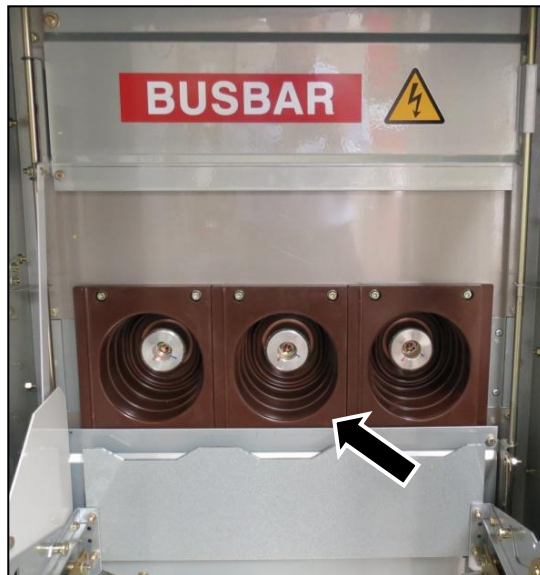


Fig. 372: Shutter to the connection compartment open

- ✓ The shutter to the connection compartment is open.

#### HINT

##### Final procedure steps

- ⇒ Immediately proceed to perform a voltage test with recommended suitable equipment or other intended operations.

#### Closing the shutter to the connection compartment (lower shutter)

#### NOTICE

##### Maloperation

Risk of damaging safety-relevant parts.

- ⇒ Remove the padlock **before** inserting the withdrawable part / switching-device truck in the switching-device compartment.

- ⇒ Push the handle of the slip-on lever slightly to the left (to release the latch) and let it slip upwards. The shutter closes.
- ⇒ Remove the slip-on lever.
- ⇒ Remove the padlock from the left side in the switching-device compartment.
- ✓ The shutter to the connection compartment is closed.

### 20.3 Operating the shutter to the busbar compartment in the contactor panel

#### **DANGER**

##### **Electric shock**

If the busbars in the busbar compartment have not been isolated, the contacts will be live at operational high voltage.

⇒ Always observe the **Five Safety Rules**.

**Before** opening the shutter to the busbar compartment:

⇒ Put on personal protective equipment.

⇒ Isolate and earth the busbars in the busbar compartment.

⇒ Verify safe isolation from supply.

⇒ Padlock the shutter mechanism on the right side in the switching-device compartment unless you intend to open the shutter to the connection compartment, too.

Open the shutter to the busbar compartment **safely**:

⇒ Only use the slip-on lever. Never try to open the shutter mechanism touching it directly.

⇒ Always operate the slip-on lever **outside** the panel using the handle.

**Always** close the shutter to the busbar compartment:

⇒ Before interrupting operations inside the switching-device compartment.

⇒ Immediately after completing operations inside the switching-device compartment.

#### **CAUTION**

##### **Injury**

The shutter mechanism on the left and right side in the switching-device compartment can cause injuries by getting squeezed, caught or cut.

⇒ Do not remove any parts of the covering.

⇒ Do not reach into the shutter mechanism with hands or tools.

### Opening the shutter to the busbar compartment (upper shutter)

#### **Preconditions**

- Contactor truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- Contactor truck taken out of the panel

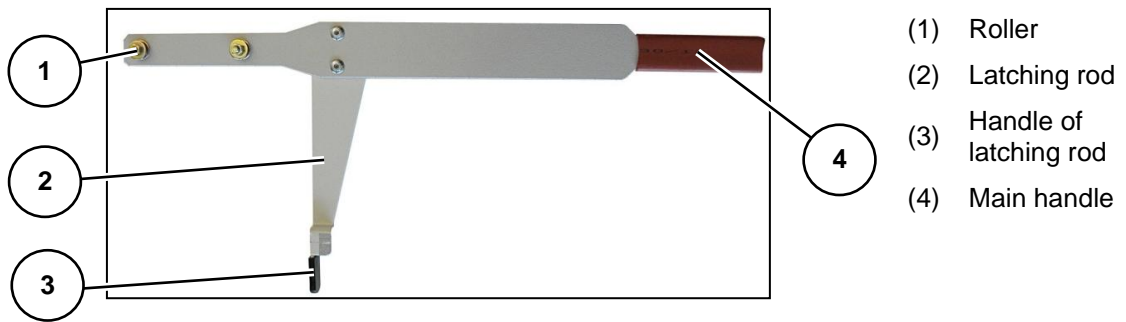


Fig. 373: Slip-on lever for opening the shutter;  
vertical latching rod (2) pointing downwards

⇒ On the right side in the switching-device compartment: Move the vertical interlocking lever (5) downwards and padlock (6) the shutter mechanism.

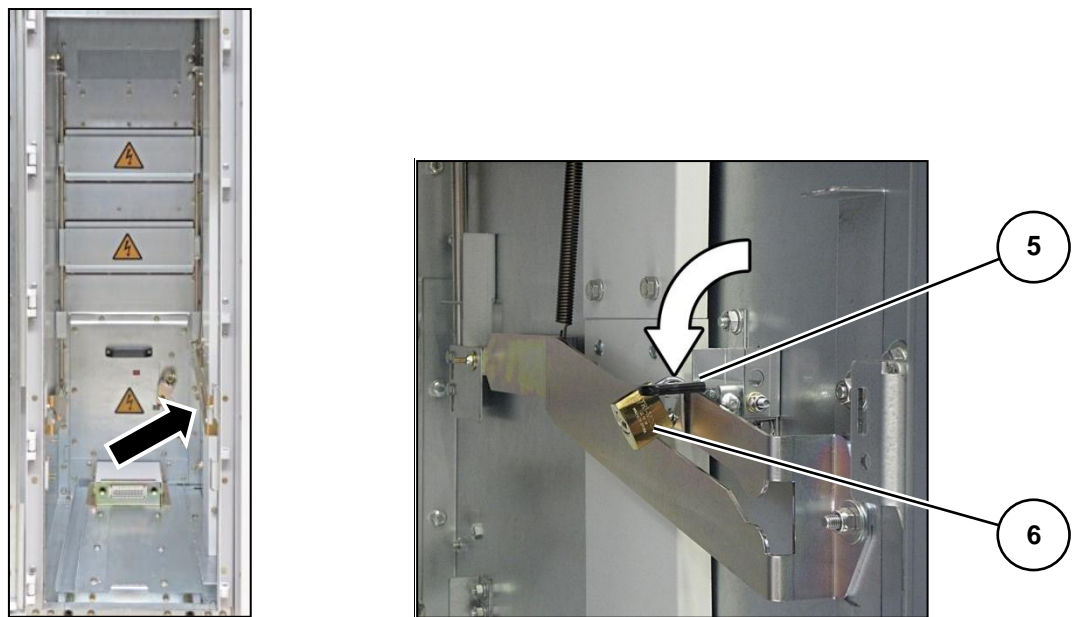


Fig. 374: Padlocking the shutter mechanism on the right side in  
the switching-device compartment

⇒ Take the slip-on lever by the main handle (4) with the vertical latching rod (2) pointing downwards.

⇒ Turn to the left side in the switching-device compartment. Insert the rollers (1) of the slip-on lever into the guide groove (7) of the shutter mechanism.

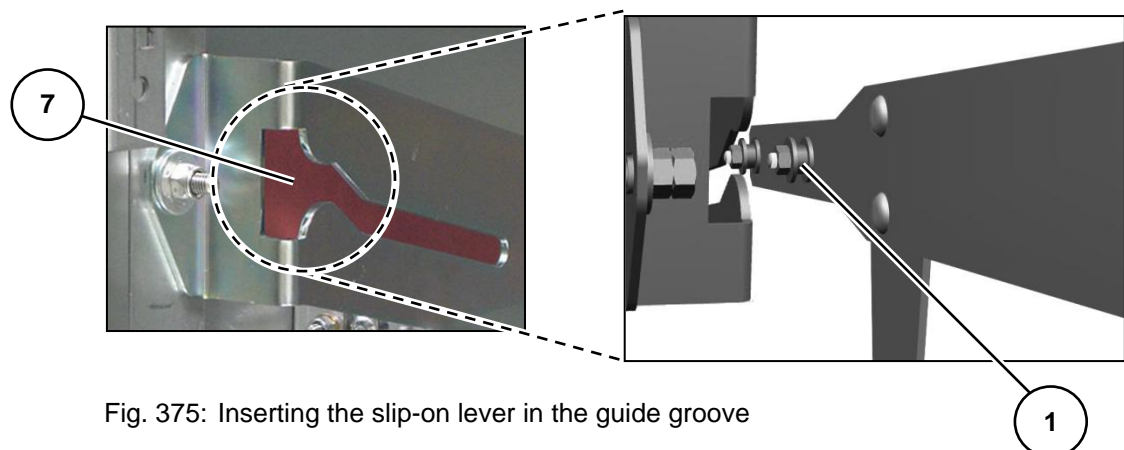


Fig. 375: Inserting the slip-on lever in the guide groove

## Operating the shutters

- ⇒ Push the slip-on lever into the guide groove as far as it will go.

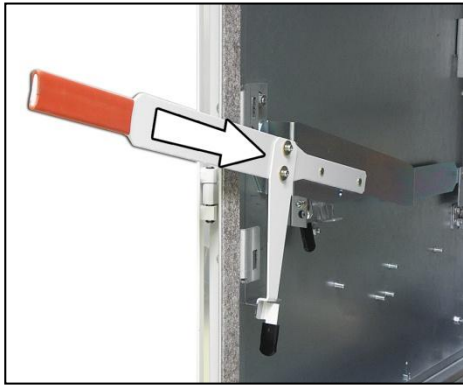


Fig. 376: Pushing the slip-on lever into the guide groove to end position

- ⇒ Push the main handle downwards as far as it will go. The shutter opens.

- ⇒ To hook in the slip-on lever to the shutter mechanism, engage the latching rod (2). To do so, hold the latching rod by the handle (3) and move it in a semi-circular way as shown. The slip-on lever is in stable position and the shutter stays open.

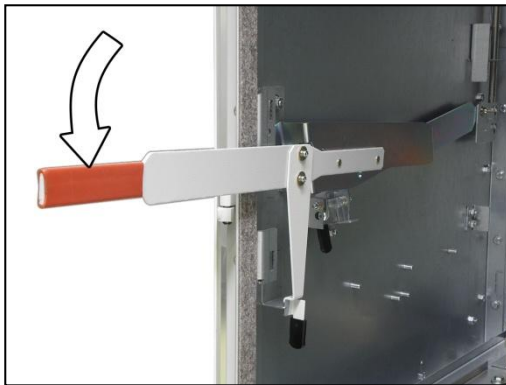


Fig. 377: Pushing the main handle downwards to end position

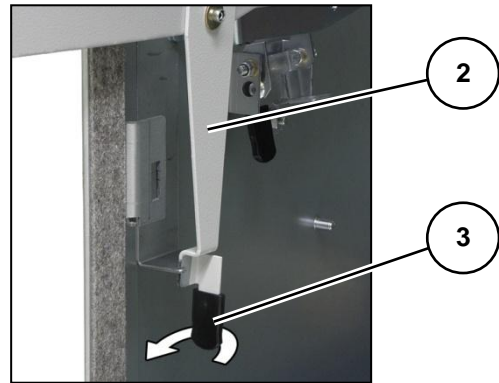


Fig. 378: Engaging the latching rod

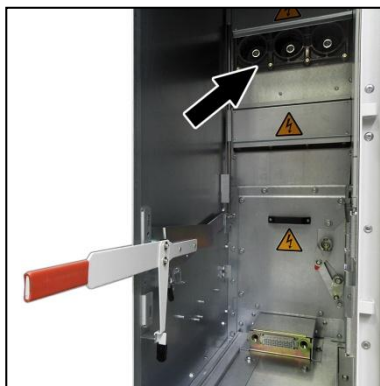


Fig. 379: Shutter to the busbar compartment open

- ✓ The shutter to the busbar compartment is open.

 **HINT**

**Final procedure steps**

- ⇒ Immediately proceed to perform a voltage test with recommended suitable equipment or other intended operations.

**Closing the shutter to the busbar compartment (upper shutter)**

**NOTICE**

**Maloperation**

Risk of damaging safety-relevant parts.

- ⇒ Remove the padlock **before** inserting the contactor truck in the switching-device compartment.

- ⇒ Release the latching rod (2). To do so, hold the latching rod by the handle (3) and move it in a semi-circular way as shown. Let the slip-on lever slip upwards. The shutter closes.

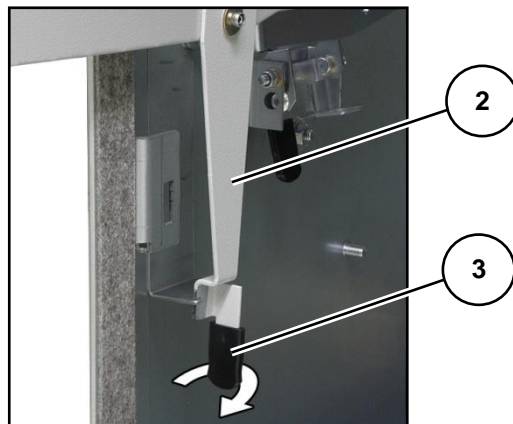


Fig. 380: Releasing the latching rod

- ⇒ Remove the slip-on lever.
- ⇒ Remove the padlock from the right side in the switching-device compartment and move the vertical interlocking lever upwards.
- ✓ The shutter to the busbar compartment is closed.

### 20.4 Operating the shutter to the connection compartment in the contactor panel

#### **DANGER**

##### **Electric shock**

If the cable / bar connections in the connection compartment have not been isolated, the contacts will be live at operational high voltage.

⇒ Always observe the **Five Safety Rules**.

**Before** opening the shutter to the connection compartment:

- ⇒ Put on personal protective equipment.
- ⇒ Isolate and earth the cable / bar connections in the connection compartment.
- ⇒ Verify safe isolation from supply.
- ⇒ Padlock the shutter mechanism on the left side in the switching-device compartment unless you intend to open the shutter to the busbar compartment, too.

Open the shutter to the connection compartment **safely**:

- ⇒ Only use the slip-on lever. Never try to open the shutter mechanism touching it directly.
- ⇒ Always operate the slip-on lever **outside** the panel using the handle.

**Always** close the shutter to the connection compartment:

- ⇒ Before interrupting operations inside the switching-device compartment.
- ⇒ Immediately after completing operations inside the switching-device compartment.

#### **CAUTION**

##### **Injury**

The shutter mechanism on the left and right side in the switching-device compartment can cause injuries by getting squeezed, caught or cut.

- ⇒ Do not remove any parts of the covering.
- ⇒ Do not reach into the shutter mechanism with hands or tools.

### Opening the shutter to the connection compartment (lower shutter)

#### **Preconditions**

- Contactor truck in test position
- Padlock (optional) removed from door handle
- High-voltage door open
- Contactor truck taken out of the panel

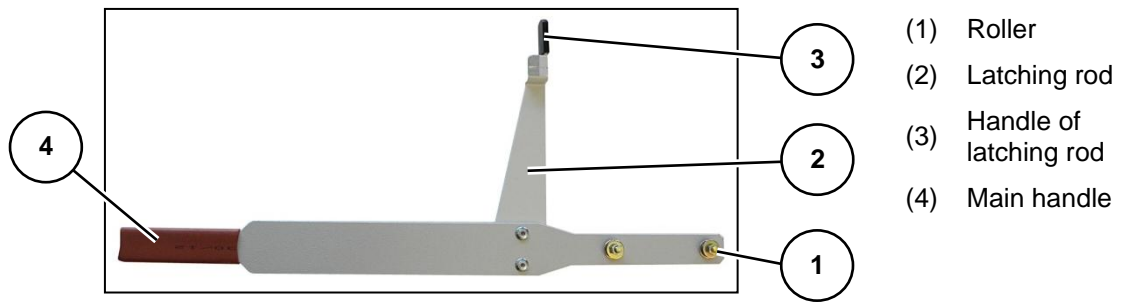


Fig. 381: Slip-on lever for opening the shutter;  
vertical latching rod (2) pointing upwards

⇒ On the left side in the switching-device compartment: Move the vertical interlocking lever (5) upwards and padlock (6) the shutter mechanism.

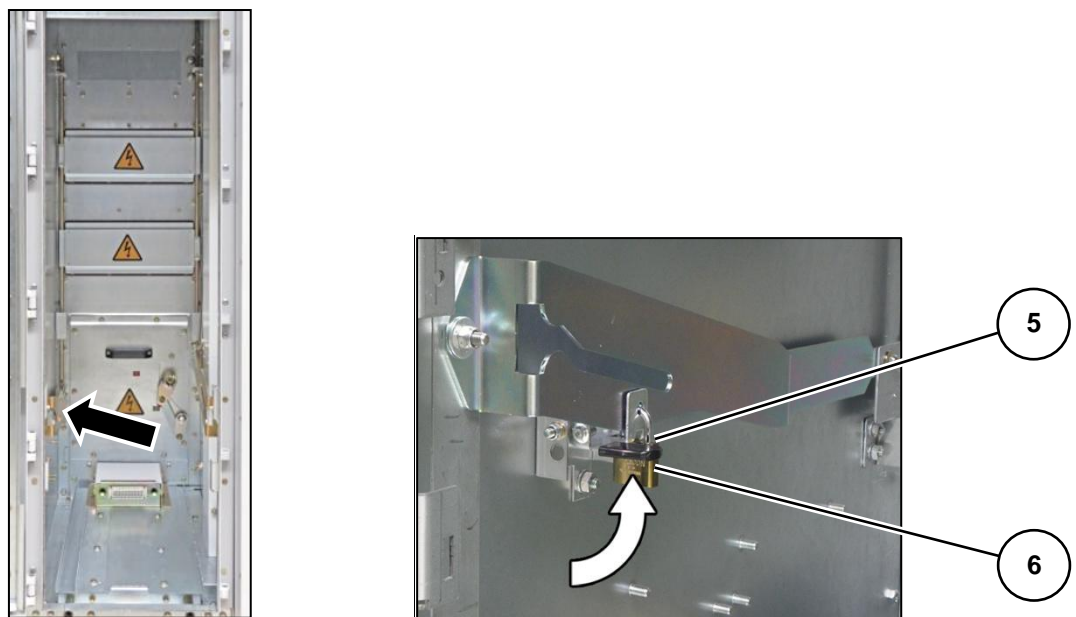


Fig. 382: Padlocking the shutter mechanism on the left side in  
the switching-device compartment

⇒ Take the slip-on lever by the main handle (4) with the vertical latching rod (2) pointing upwards.

⇒ Turn to the right side in the switching-device compartment. Insert the rollers (1) of the slip-on lever into the guide groove (7) of the shutter mechanism.

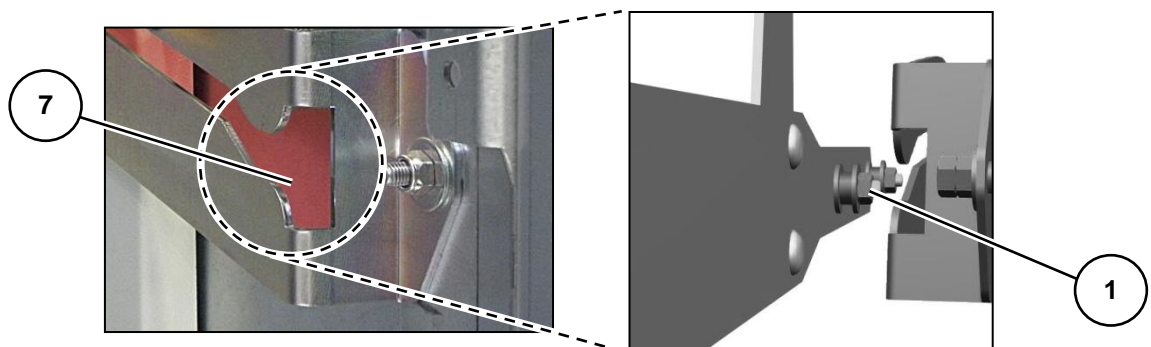


Fig. 383: Inserting the slip-on lever in the guide groove

## Operating the shutters

- ⇒ Push the slip-on lever into the guide groove as far as it will go.

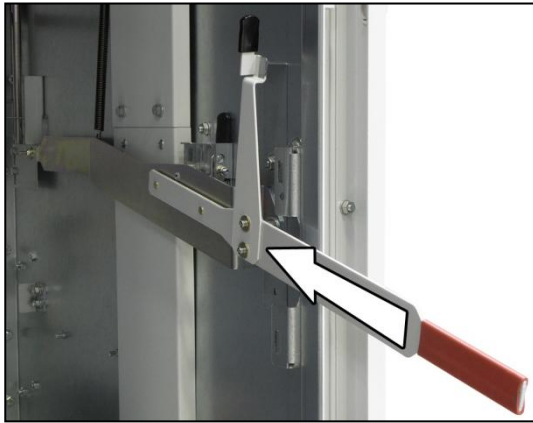


Fig. 384: Pushing the slip-on lever into the guide groove to end position

- ⇒ Push the main handle upwards as far as it will go. The shutter opens.

- ⇒ To hook in the slip-on lever to the shutter mechanism, engage the latching rod (2). To do so, hold the latching rod by the handle (3) and move it in a semi-circular way as shown. The slip-on lever is in stable position and the shutter stays open.

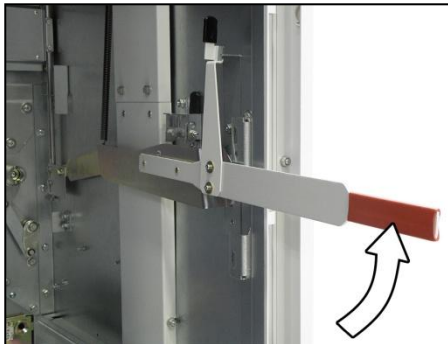


Fig. 385: Pushing the main handle upwards to end position

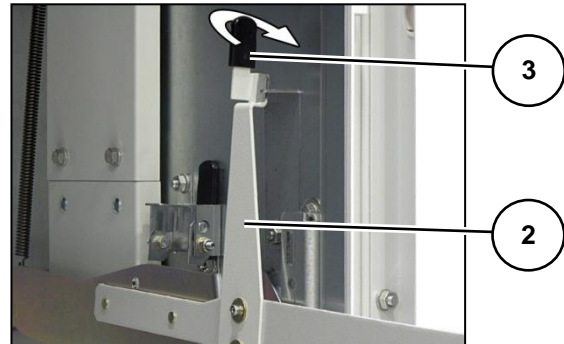


Fig. 386: Engaging the latching rod



Fig. 387: Shutter to the connection compartment open

- ✓ The shutter to the connection compartment is open.

 **HINT**

**Final procedure steps**

- ⇒ Immediately proceed to perform a voltage test with recommended suitable equipment or other intended operations.

**Closing the shutter to the connection compartment (lower shutter)**

**NOTICE**

**Maloperation**

Risk of damaging safety-relevant parts.

- ⇒ Remove the padlock **before** inserting the contactor truck in the switching-device compartment.

- ⇒ Release the latching rod (2). To do so, hold the latching rod by the handle (3) and move it in a semi-circular way as shown. Let the slip-on lever slip downwards. The shutter closes.

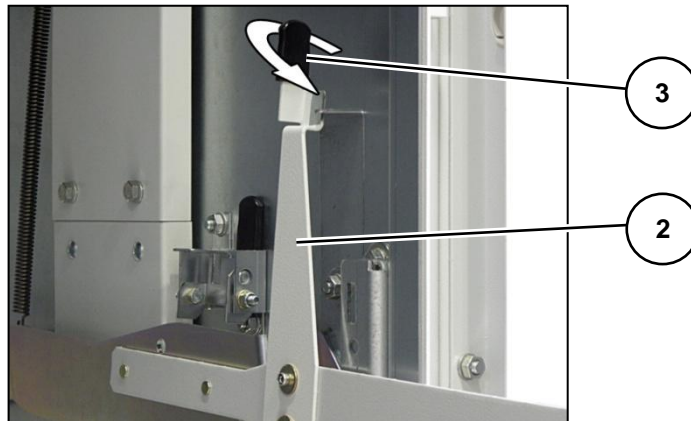


Fig. 388: Releasing the latching rod

- ⇒ Remove the slip-on lever.
- ⇒ Remove the padlock from the left side in the switching-device compartment and move the vertical interlocking lever downwards.
- ✓ The shutter to the connection compartment is closed.

# Accessing the connection compartment through the front

## 21 Accessing the connection compartment through the front

### HINT

Read and understand these instructions before attempting operating works.

### 21.1 Preparations before accessing the connection compartment

### DANGER

#### Electric shock

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Before removing the vertical partition inside the switching-device compartment of a panel, isolate and earth the cable / bar connections in the connection compartment.
- ⇒ Provide a warning on the high-voltage door to indicate activities in the connection compartment.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.

### HINT

**Hereafter, the disassembly of those parts is described, which are later assembled again at the same place.**

- ⇒ Store disassembled parts and bolting material carefully, and keep them ready for later reuse.

#### Preconditions

- Withdrawable part / switching-device truck is present in the switching-device compartment:
  - High-voltage door closed
  - Withdrawable part / switching-device truck in test position
  - Feeder earthing switch in CLOSED position

#### Procedure

- ⇒ Check if the position indicator of the feeder earthing switch on the high-voltage door is in vertical **I** position.

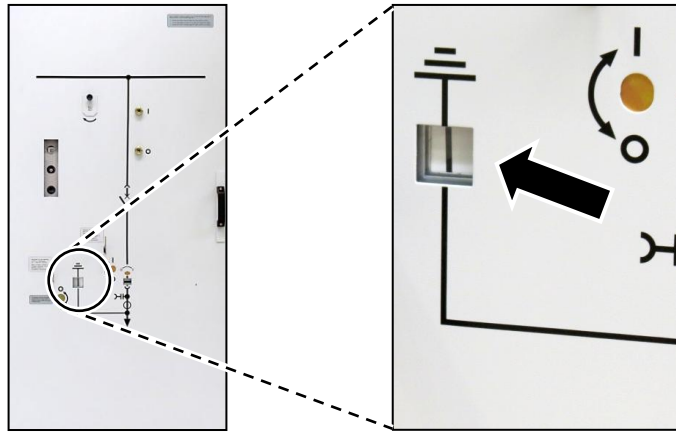


Fig. 389: All panel versions except for contactor panels:  
Position indicator of feeder earthing switch on high-voltage door

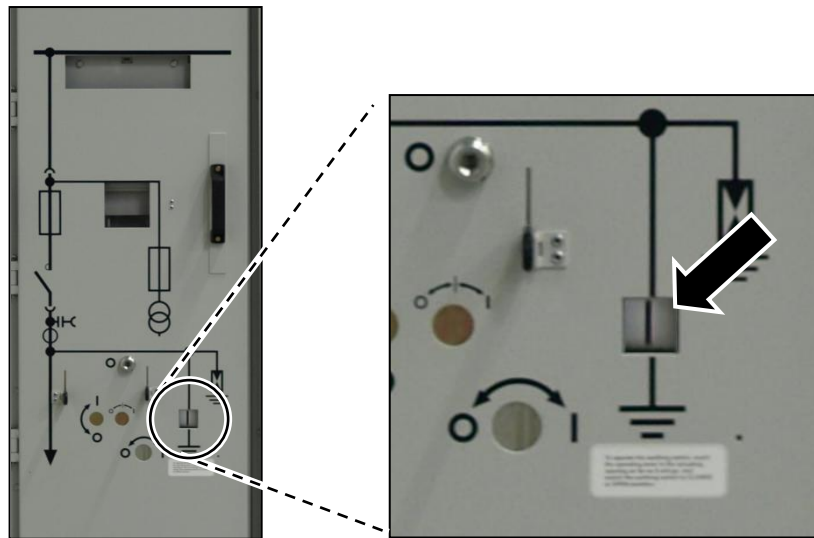


Fig. 390: Contactor panels only:  
Position indicator of feeder earthing switch on high-voltage door

⇒ Open the high-voltage door.

⇒ Take the withdrawable part / switching-device truck out of the panel.

### **HINT**

#### **Position indicator of the feeder earthing switch**

An additional position indicator of the feeder earthing switch is visible inside the switching-device compartment. The feeder earthing switch is earthed, if the additional position indicator points to the vertical I symbol.

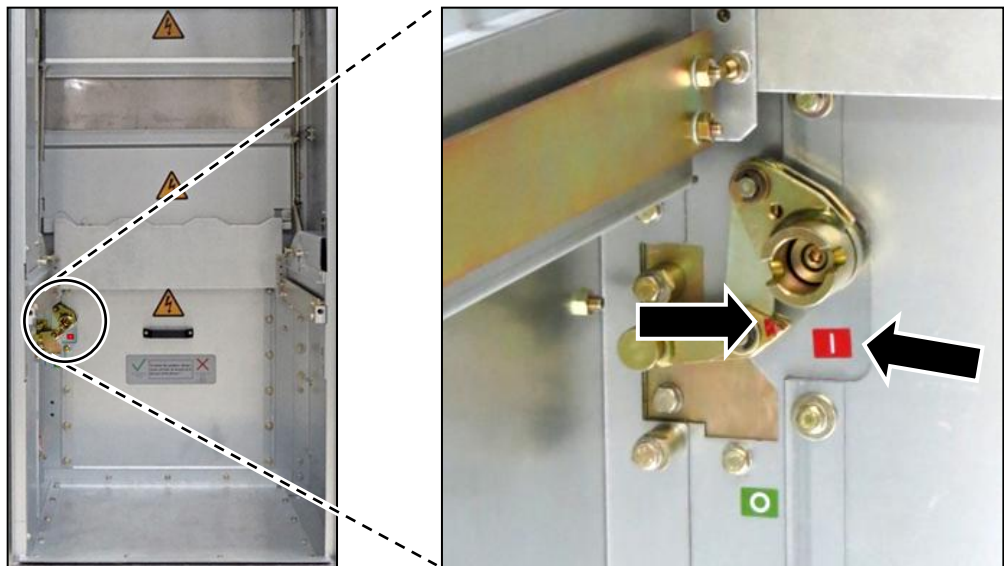


Fig. 391: All panel versions except for contactor panels:  
Additional position indicator of the feeder earthing switch inside the  
switching-device compartment

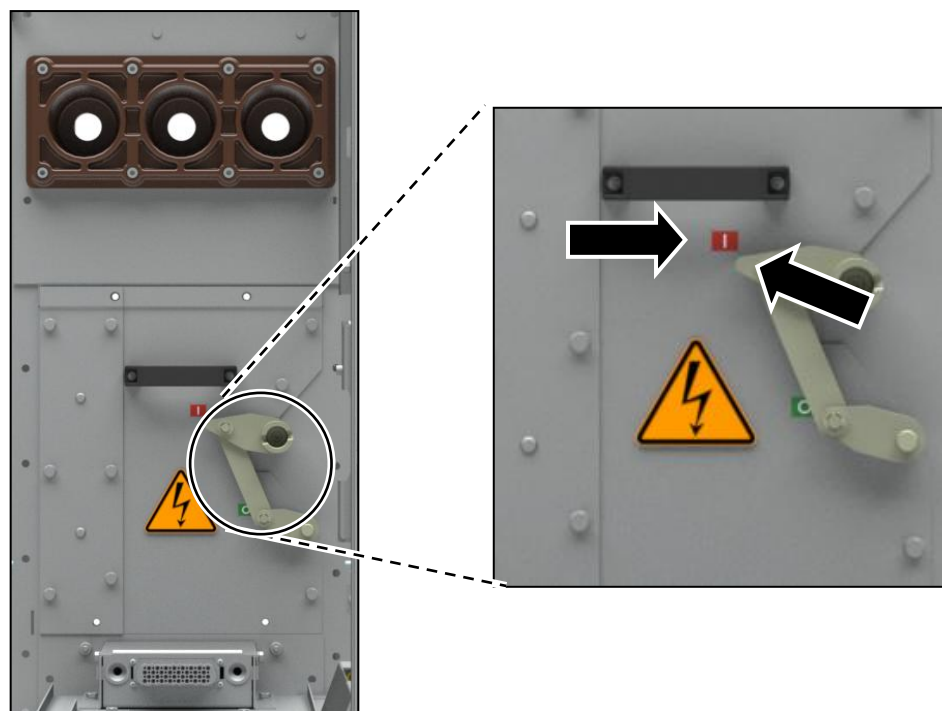


Fig. 392: Contactor panels only:  
Additional position indicator of the feeder earthing switch inside the  
switching-device compartment

## 21.2 Accessing the connection compartment through the switching-device compartment

### **WARNING**

#### **Reduced safety**

The closed connection compartment is an important safety element of the switchgear. The connection compartment is exclusively opened for performing operational activities inside the connection compartment.

Always install the partition between the connection compartment and the switching-device compartment:

- ⇒ If an activity inside the connection compartment is interrupted.
- ⇒ Immediately after an activity inside the connection compartment was completed.

### **CAUTION**

#### **Sharp edges**

The metal parts of the vertical partition may have sharp edges.

- ⇒ Put on personal protective equipment.

#### **Preconditions**

- Preparations as described in chapter 21.1 completed

#### **Procedure**

Panel versions with withdrawable circuit-breaker / circuit-breaker truck or withdrawable disconnector / disconnector truck only:

- ⇒ Unscrew and remove the bolting material (2) from the protection plate (1), and store it:
  - 4 nos. nut-and-washer assemblies size M8
- ⇒ Remove the protection plate (1), and store it.

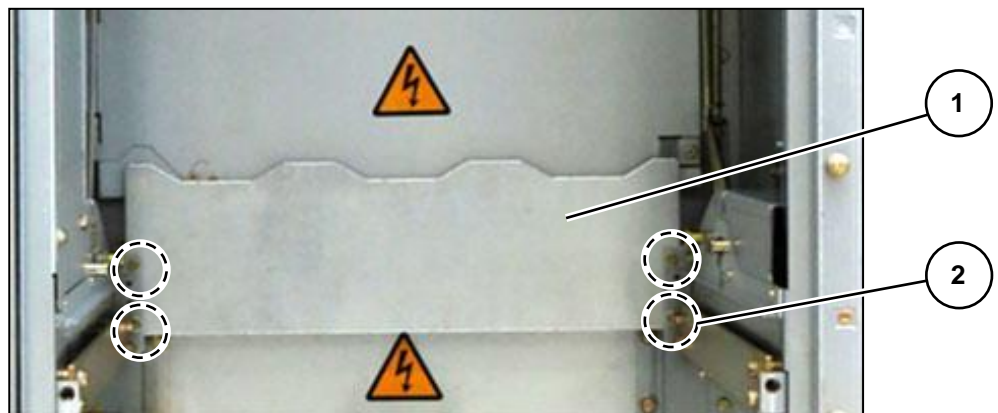


Fig. 393: 4 bolted joints on protection plate

## Accessing the connection compartment through the front

### Removing the partition, all panel versions except for contactor panels:

- ⇒ Remove the connecting elements from the partition to the connection compartment (1), and store them:

All panel versions except for contactor panels with panel width 435 mm:

- 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (2)
- 6 bolts M8x20 with contact washers (3)

- ⇒ Remove the partition (1), and store it.

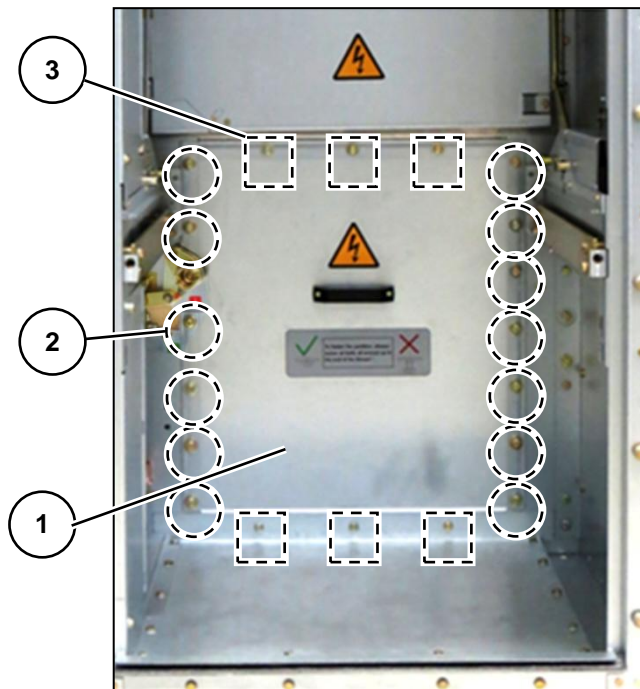


Fig. 394: All panel versions except for contactor panels:  
19 bolted joints on partition

### Removing the partition, for contactor panels without the heater

- ⇒ Remove the connecting elements (1) from the left part of partition (2) to the connection compartment and store them:

- 7 bolts M8x20 with contact washers (1)

- ⇒ Remove the left part of partition (2), and store it.

- ⇒ Remove the connecting elements (4) from the right part of partition (3) to the connection compartment and store them

- 4 bolts M8x16 with contact washers (4)

- ⇒ Remove the right part of partition (3), and store it.

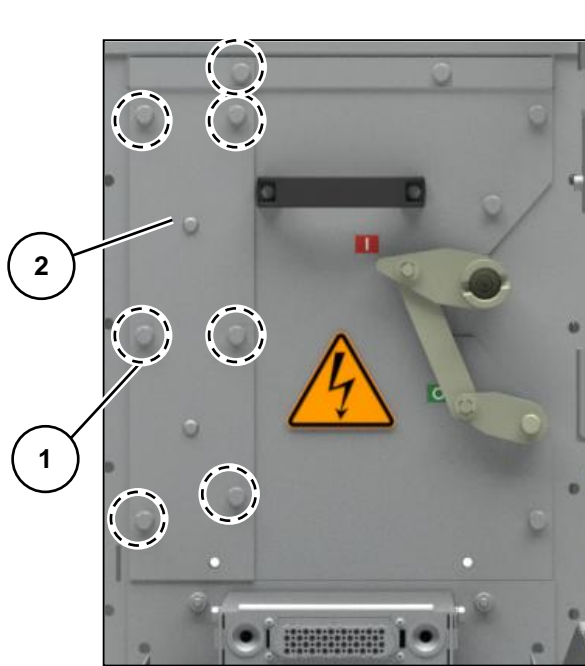


Fig. 395: The left part of partition (1)

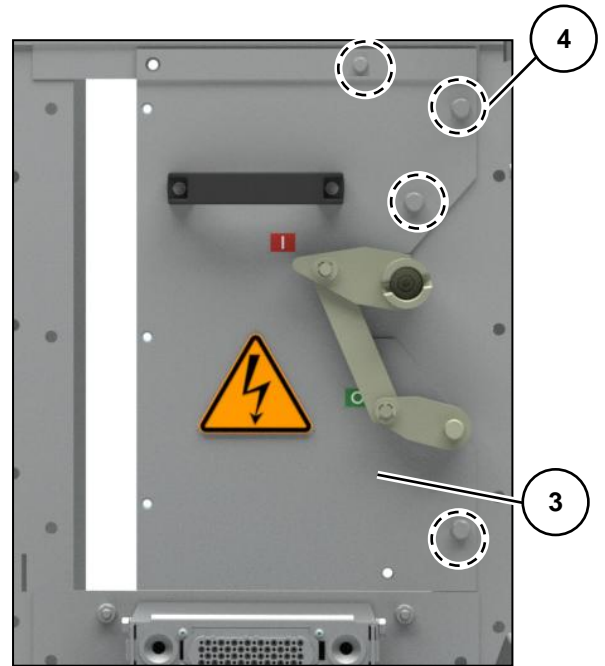


Fig. 396: The right part of partition (3)





Fig. 397: The partition is removed

### Removing the partition, for contactor panels with the heater (optional)

#### **CAUTION**

##### **Burns**

The heater and its protection cover can be hot. Touching hot heater may cause burns.

-  Put on personal protective equipment.
-  Switch off the heater before touching the protection cover and let the hot heater cool down.

## Accessing the connection compartment through the front

- ⇒ Remove the connecting elements (2) from the heater (1), and store them.
  - 2 nuts M8 with contact washers and plain washers (2)
- ⇒ Put the heater (1) into the available side of the switching-device compartment.
- ⇒ Remove the connecting elements (4) from the heater support (3), and store them
  - 2 bolts M8x20 with contact washers (4)
- ⇒ Put the heater support (3) into the available side of the switching- device compartment.

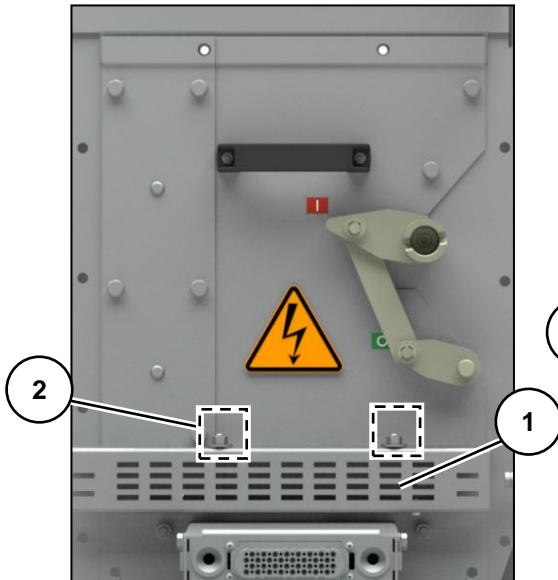


Fig. 398: Contactor panels with panel width 435 mm only: 2 bolted joints on the heater

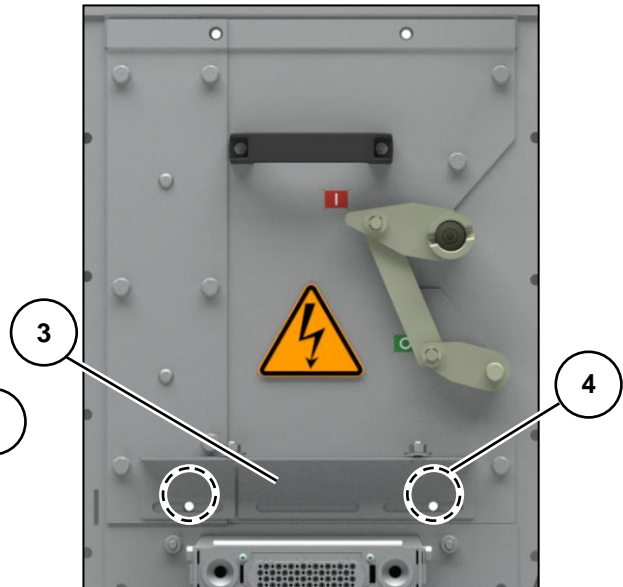


Fig. 399: Contactor panels with panel width 435mm only: 2 Bolted joints on the heater support

- ⇒ Remove the connecting elements (6) from the left part of partition (5) to the connection compartment and store them:
  - 7 bolts M8x20 with contact washers (6)
- ⇒ Remove the left part of partition (5), and store it
- ⇒ Remove the connecting elements (8) from the right part of partition (7) to the connection compartment and store them
  - 4 bolts M8x16 with contact washers (8)
- ⇒ Remove the right part of partition (7), and store it.

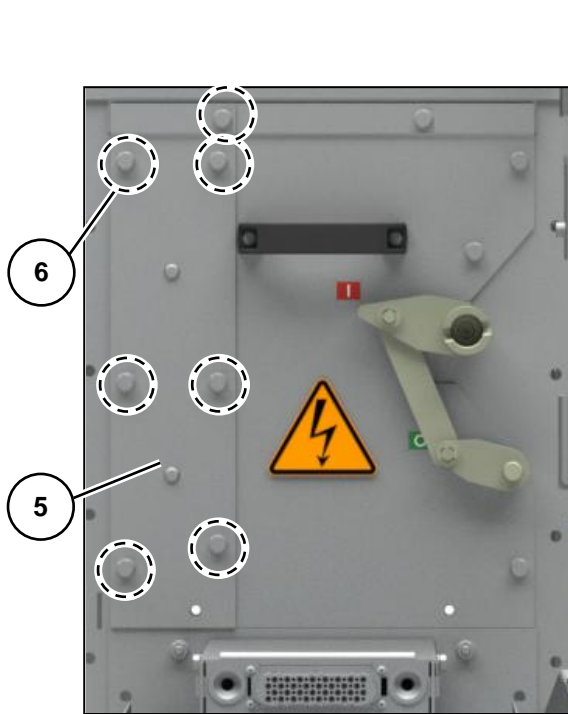


Fig. 400: The left part of the partition (5)

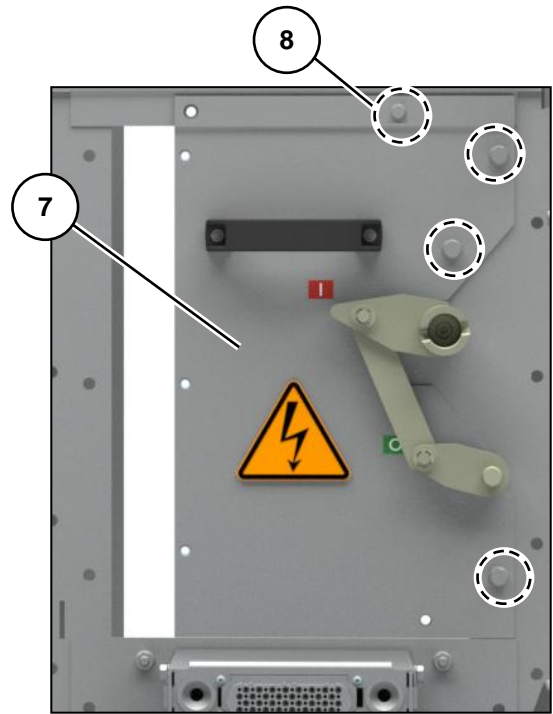


Fig. 401: The right part of partition(7)



Fig. 402: The partition is removed

✓ Access to the connection compartment through the panel front is given.

## HINT

### Final procedure steps

⇒ Immediately proceed to perform the intended checks and works in the connection compartment.

### 21.3 Installing the vertical partition in the switching-device compartment

#### **DANGER**

##### **Electric shock**

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.

#### **CAUTION**

##### **Sharp edges**

The metal parts of the vertical partition may have sharp edges.

- ⇒ Put on personal protective equipment.

#### **NOTICE**

##### **Danger due to damages**

Possible malfunctioning and switchgear damage caused by foreign objects:

- ⇒ Remove all foreign objects from the connection compartment, for example:
  - Tools
  - Unused installation material
  - Packing material
  - Cleaning material

#### **NOTICE**

##### **Cleaning**

Possible malfunctioning and damage to the panels caused by pollution.

Before closing the connection compartment:

- ⇒ Clean polluted areas in the connection compartment. To do this, use a vacuum cleaner and a lint-free cloth. If necessary, moisten the cloth, use a mild household cleaner, and dry properly at the end.
- ⇒ Some parts and surfaces of the switchgear are greased for functioning. Do not remove the grease there; do not clean the parts and surfaces.
- ⇒ If greased areas are dirty, clean the dirty area and grease again according to the maintenance instructions.

### NOTICE

#### **Damages inside the switching-device compartment**

Damages inside the switching-device compartment due to incorrect or incomplete installation of the partition.

⇒ To fasten the partition, always assemble all bolted joints of the partition all around, and screw them in up to the end of the thread.

All panel versions except for contactor panels:

In addition to these instructions, an instruction label on the vertical partition informs about safe fastening of the partition:

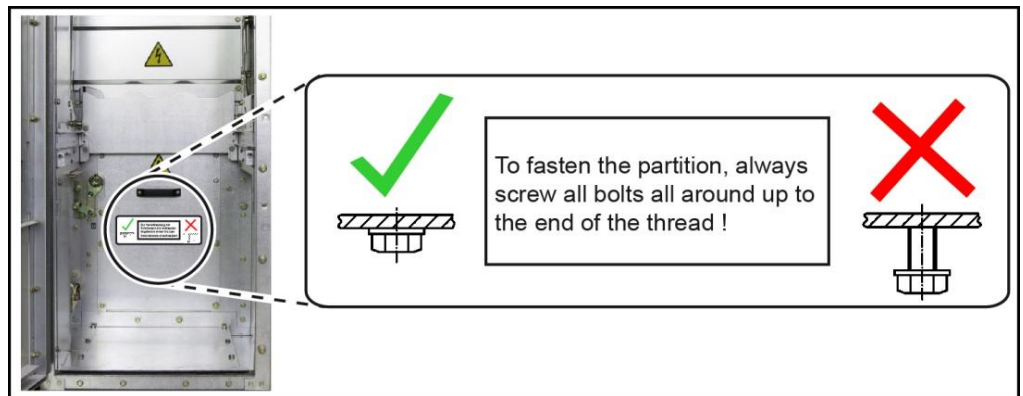


Fig. 403: All panel versions except for contactor panels:  
instruction label on the vertical partition

#### **Preconditions**

- Feeder earthing switch in CLOSED position
- High-voltage door open
- Low-voltage connector stowed away
  
- Panel versions with withdrawable circuit-breaker / circuit-breaker truck or withdrawable disconnector / disconnector truck only:
  - Protection plate available
  - Bolting material available: 4 nos. nut-and-washer assemblies size M8
  
- All panel versions except for contactor panels:
  - Partition available
  - Bolting material available:
    - 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
    - 6 bolts M8x20 with contact washers
  
- Contactor panels with panel width 435 mm only:
  - Partition available
  - Connecting elements available:
    - 7 bolts M8x20 with contact washers for the left part of partition
    - 4 bolts M8x16 with contact washers for the right part of partition

## Accessing the connection compartment through the front

### Procedure

#### All panel versions except for contactor panels:

- ⇒ Install the partition (1) between the connection compartment and the switching-device compartment.
- Fix the partition (1) by screwing the bolts hand-tight:
  - All panel versions except for contactor panels:
    - 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (2)
    - 6 bolts M8x20 with contact washers (3)
- ⇒ Tighten the fixing bolts all around with torque 25 Nm.

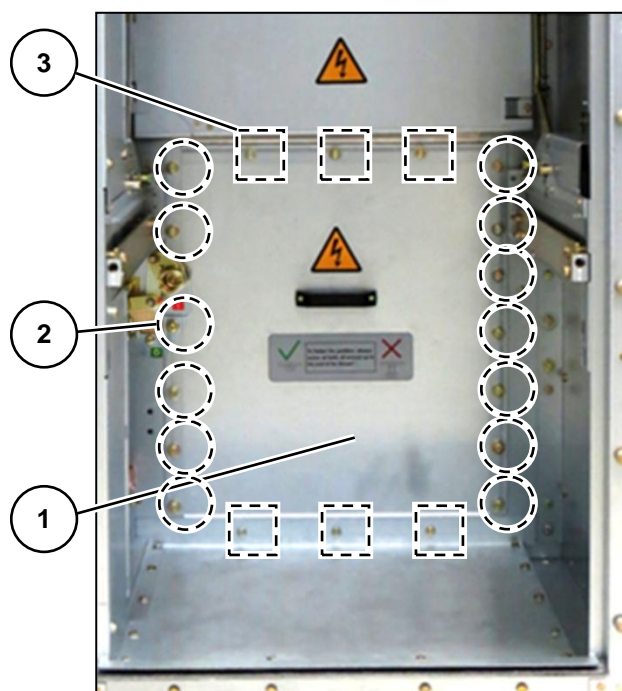


Fig. 404: All panel versions except for contactor panels:  
19 bolted joints on partition

### Contactor panels without the heater

- ⇒ Install the right part of partition (1) between the connection compartment and the switching device compartment.  
Fix the right part of partition (1), tighten the bolts all around hand-tight:
- 4 bolts M8x16 with contact washers (2)
- ⇒ Install the left part of partition (3) between the connection compartment and the switching device compartment.  
Fix the left part of partition (3), tighten the bolts all around hand-tight:
- 7 bolts M8x20 with contact washers (4)
- ⇒ Tighten the fixing bolts all around with a tightening torque of 25 Nm

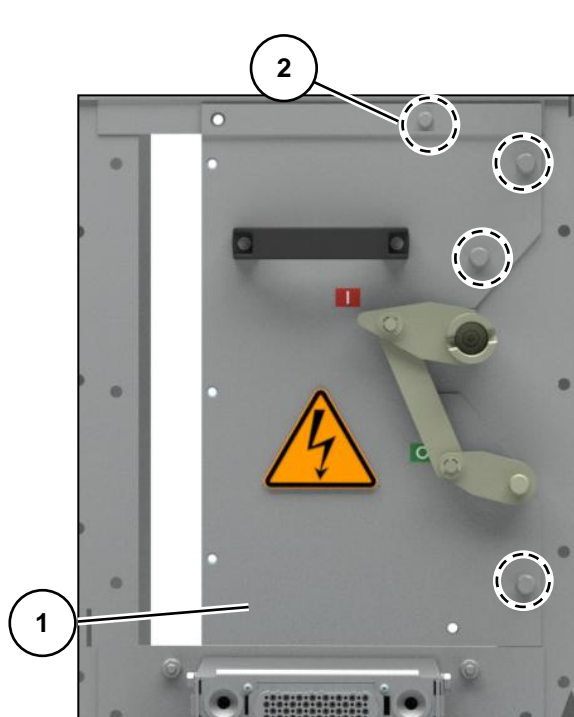


Fig. 405: The right part of partition (1)

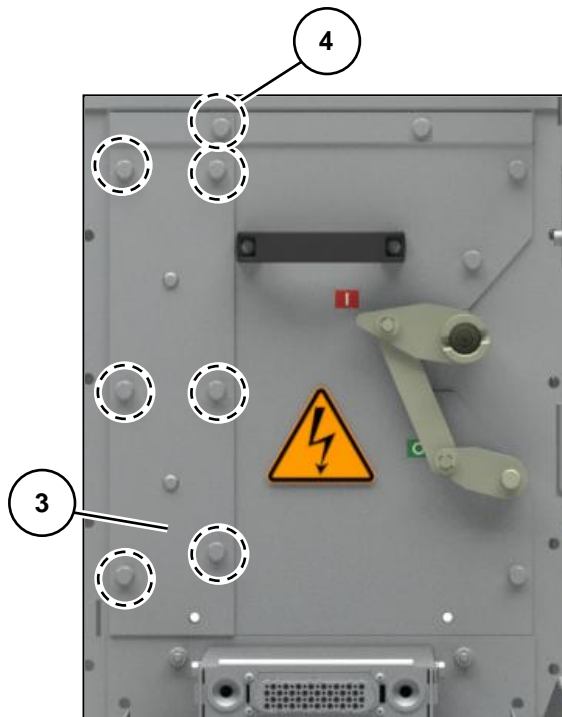


Fig. 406: The left part of partition (3)

### Contactor panels with the heater (optional)

- ⇒ Install the right part of partition (1) between the connection compartment and the switching device compartment.  
Fix the right part of partition (1), tighten the bolts all around hand-tight:
- 4 bolts M8x16 with contact washers (2)
- ⇒ Install the left part of partition (3) between the connection compartment and the switching device compartment.  
Fix the left part of partition (3), tighten the bolts all around hand-tight:
- 7 bolts M8x20 with contact washers (4)
- ⇒ Tighten the fixing bolts all around with a tightening torque of 25 Nm.

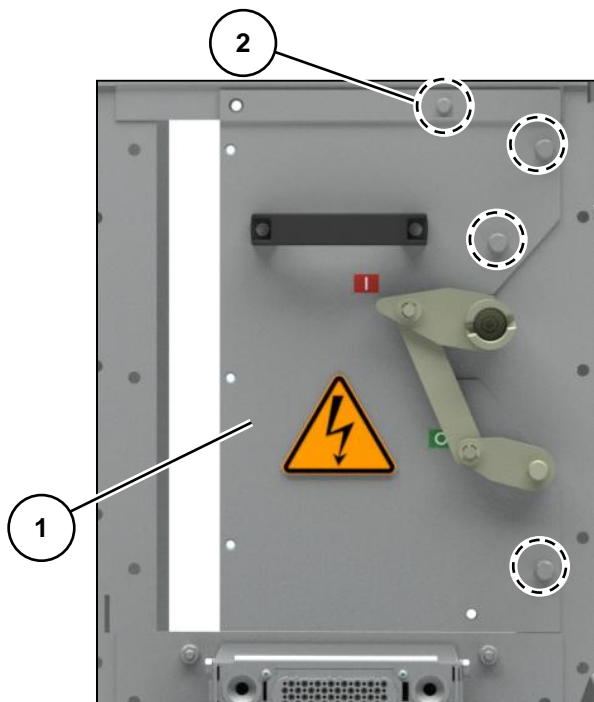


Fig. 407: The right part of partition (5)

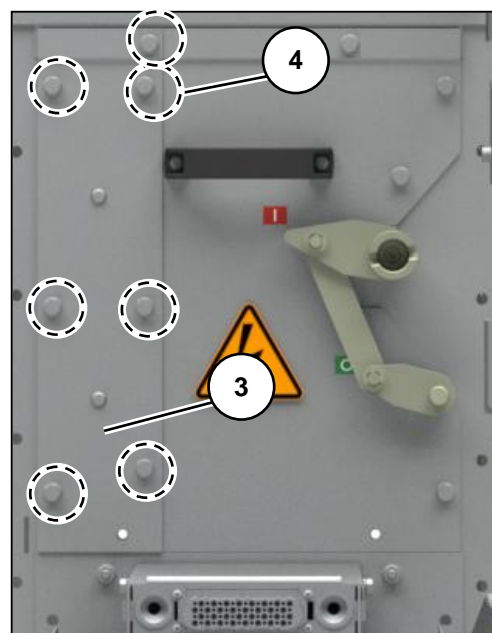


Fig. 408: The left part of partition(7)

- ⇒ Install the heater support (5).  
Fix the heater support (5) by screwing the nuts (6) hand-tight:
  - 2 boltsM8x20 (6)
 Tighten the fixing bolts all around with a tightening torque of 25 Nm
- ⇒ Install the heater (7).  
Fix the heater (7) by screwing the nuts (8) hand-tight:
  - 2 nos. nut-and-washer assemblies size M8 (8)
- ⇒ Tighten the fixing nuts (4) with torque 25 N

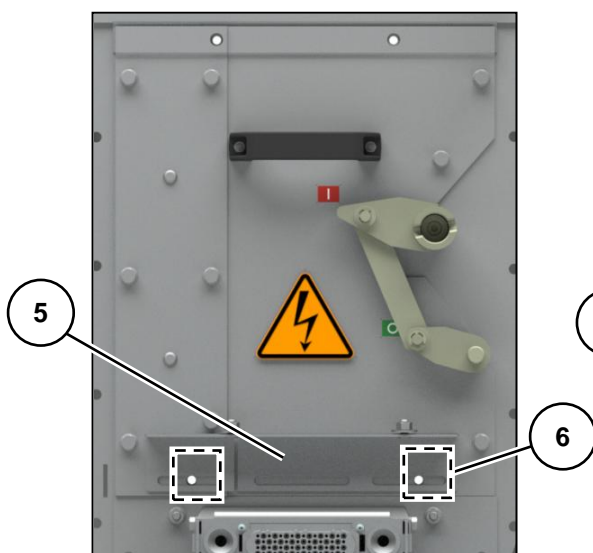


Fig. 409: 2 bolted joints on the heater support

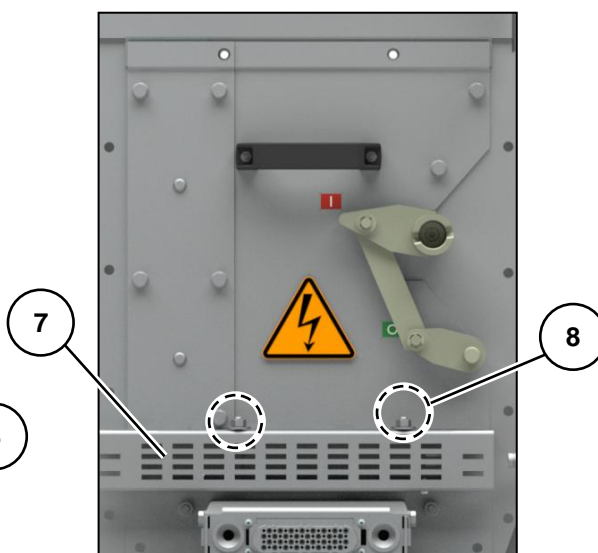


Fig. 410: 2 bolted joints on the heater

### HINT

#### Final procedure step

- ⇒ Do not forget to switch on the heater after the installation.

Panel versions with withdrawable circuit-breaker / circuit-breaker truck or withdrawable disconnector / disconnector truck only:

- ⇒ Install the protection plate (9).
- ⇒ Fix the protection plate (9) by screwing the nuts (10) hand-tight:
- 4 nuts M8 with contact washers
- ⇒ Tighten the fixing nuts (10) with torque 25 Nm.

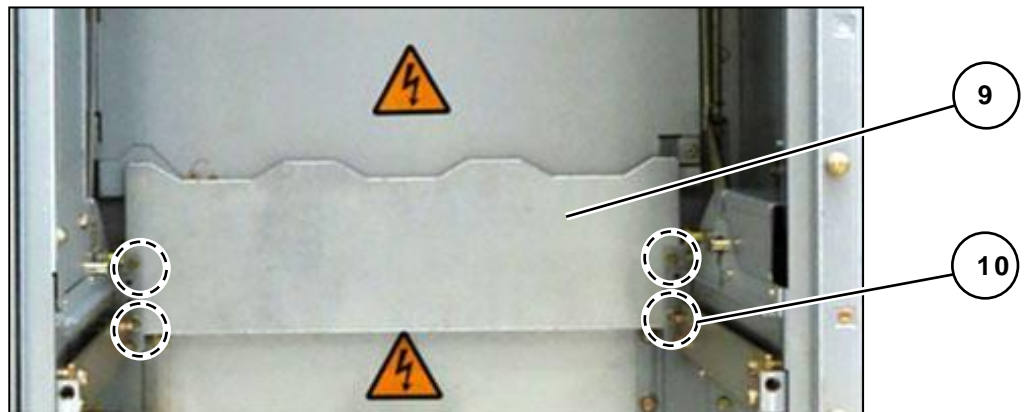


Fig. 411: 4 bolted joints of protection plate

- ✓ The partition between the connection compartment and the switching-device compartment is installed.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ Inserting a withdrawable part / switching-device truck in the panel.
- ⇒ Closing the high-voltage door.
- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part / switching-device truck to service position.



### 21.4 Accessing the connection compartment through the switching-device compartment at panel versions with ventilation system

#### **WARNING**

##### **Reduced safety**

The closed connection compartment is an important safety element of the switchgear. The connection compartment is exclusively opened for performing operational activities inside the connection compartment.


Close the high-voltage door:

-  If an activity inside the connection compartment is interrupted.
-  Immediately after an activity inside the connection compartment was completed.

#### **CAUTION**

##### **Sharp edges**



The metal parts of the ventilation duct and the vertical partition may have sharp edges.

-  Put on personal protective equipment.

#### **CAUTION**

##### **High weight**


The ventilation duct is heavy.

-  Remove the ventilation duct absolutely with 2 persons.
-  Put on personal protective equipment.

#### **NOTICE**

##### **Damages to the ventilation duct**

Loosening certain bolted joints could damage the ventilation duct.

-  When disassembling the ventilation duct, proceed exactly as described hereafter. Do **not** loosen any bolted joints other than those described.

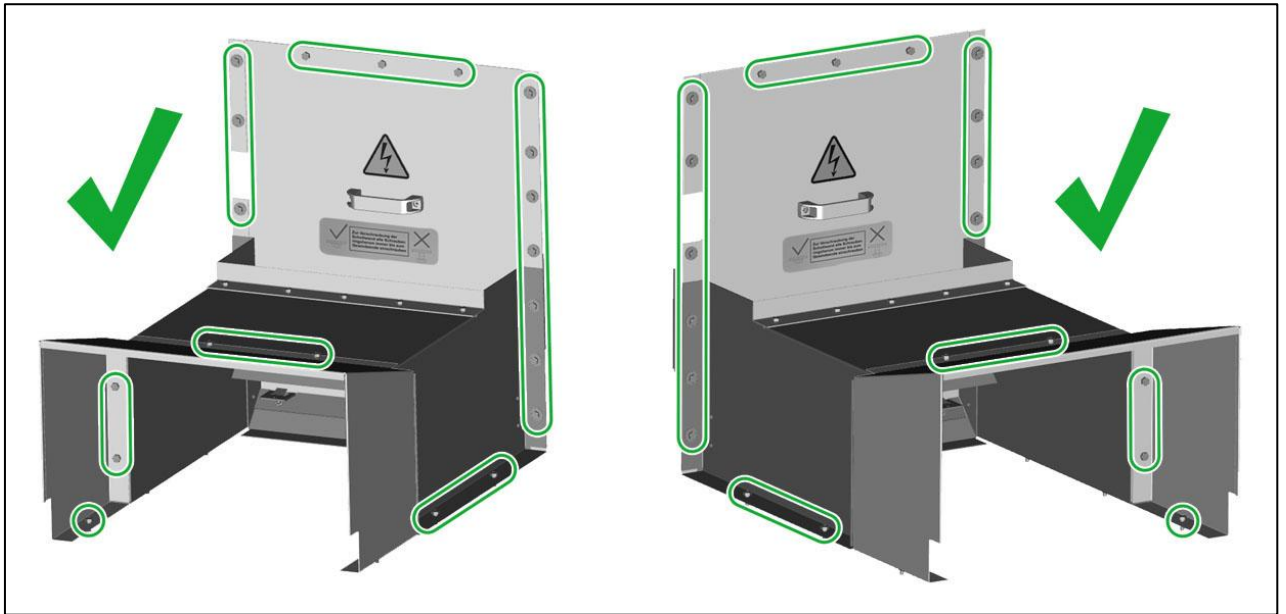


Fig. 412: Bolted joints to be loosened

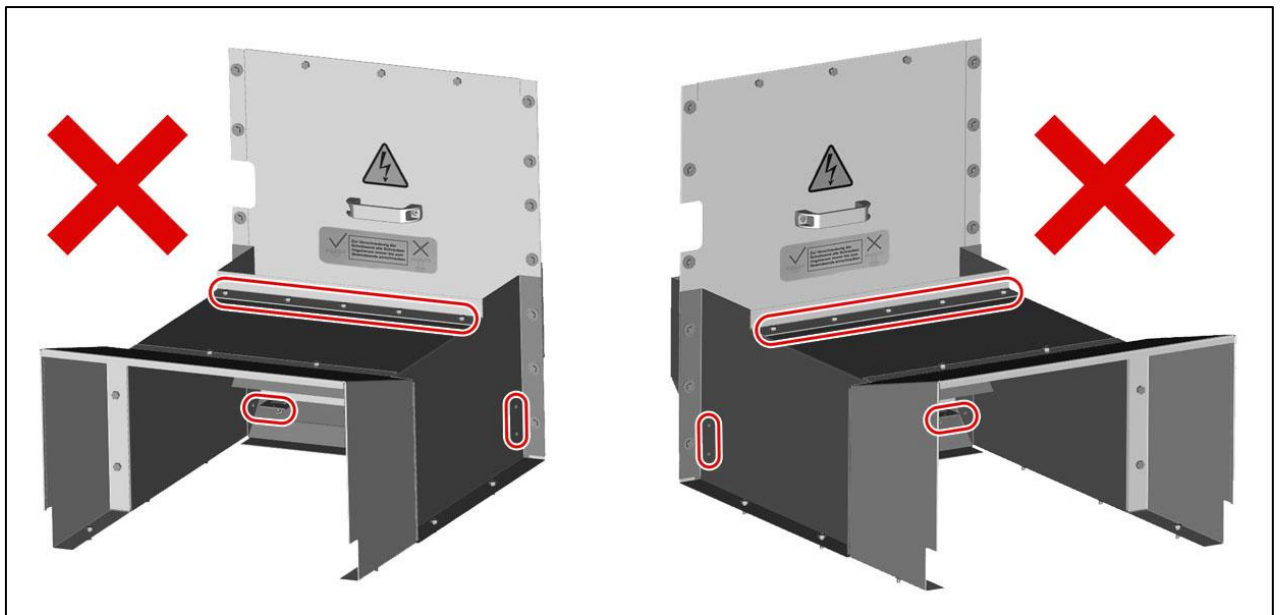


Fig. 413: Bolted joints not to be loosened

## Accessing the connection compartment through the front

### Preconditions

- Preparations as described in chapter 21.1 completed



Fig. 414: Panel prepared

### Procedure

- ⇒ Unscrew and remove the bolting material (2) from the protection plate (1), and store it:
- 4 nuts M8 with contact washers
- ⇒ Remove the protection plate (1), and store it.

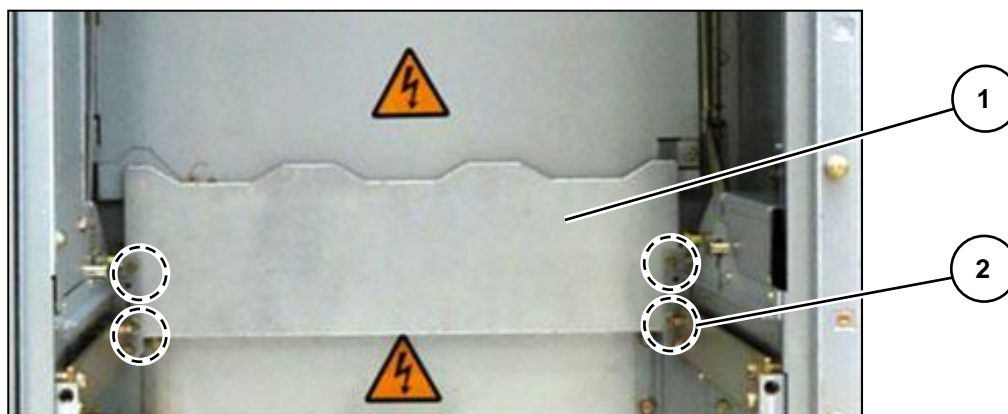


Fig. 415: 4 bolted joints on protection plate

- ⇒ Unscrew and remove the bolting material from the front part (3) of the ventilation duct, and store it:
- 8 bolts with contact washers M8x20

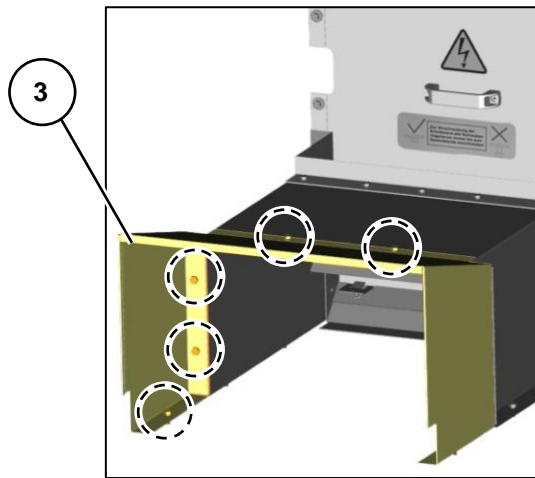


Fig. 416: Front part of ventilation duct, seen from center-right

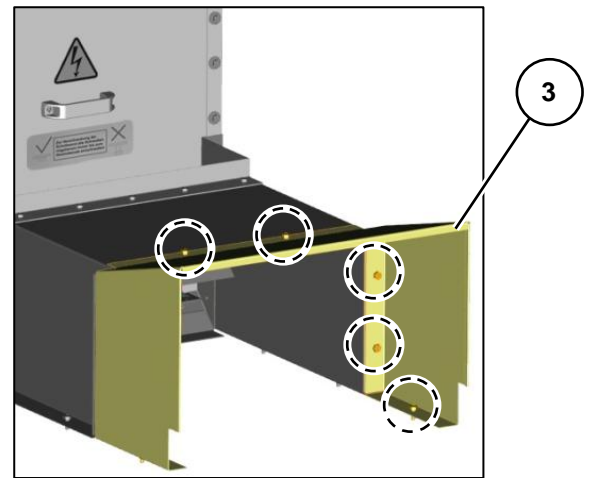


Fig. 417: Front part of ventilation duct, seen from center-left

- ⇒ To get the front part of the ventilation duct over the door threshold, lift it approx. 2 cm. Pull it out of the panel, and store it.

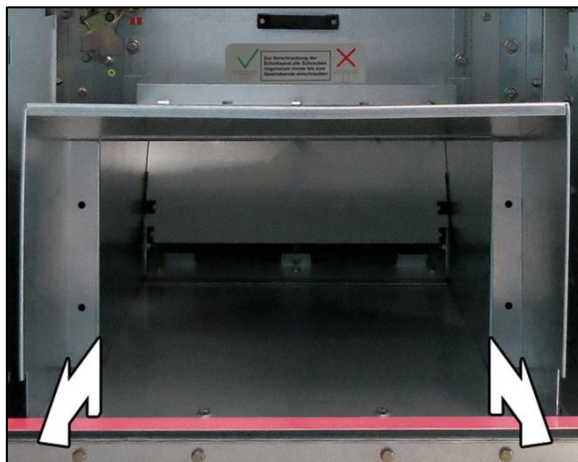


Fig. 418: Lifting and pulling the front part

## Accessing the connection compartment through the front

- ⇒ Unscrew and remove the bolting material from the remaining part of the ventilation duct (4) and the vertical partition to the connection compartment (5), and store it:
- 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (6)
  - 7 bolt M8x20 with contact washers (7)

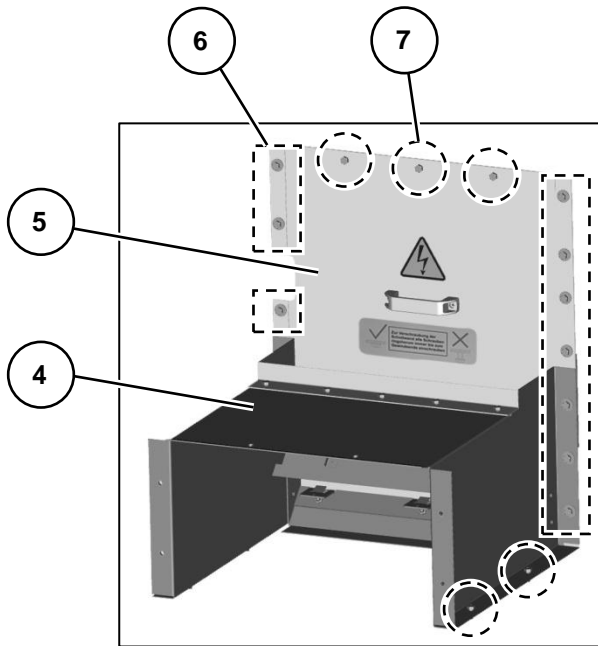


Fig. 419: Ventilation duct and partition, seen from center-right

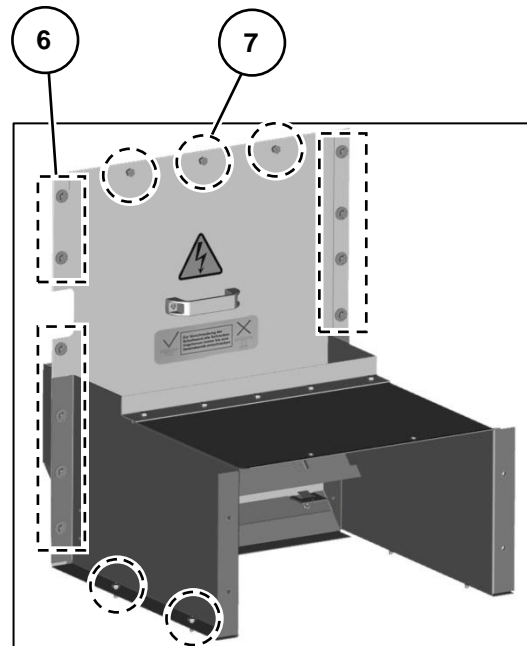


Fig. 420: Ventilation duct and partition, seen from center-left

- ⇒ Pull the unit consisting of ventilation duct and vertical partition towards the door threshold as far as it will go.
- ⇒ To get the unit over the door threshold, lift it approx. 2 cm. Pull it out of the panel. Store the unit, but do **not** disassemble the unit any further.
- ✓ Access to the connection compartment through the panel front is given.

### 21.5 Installing the vertical partition and the ventilation duct in the switching-device compartment

#### **DANGER**

##### **Electric shock**

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.

#### **CAUTION**

##### **Sharp edges**

The metal parts of the ventilation duct and the vertical partition may have sharp edges.

- ⇒ Put on personal protective equipment.

#### **NOTICE**

##### **Danger due to damages**

Possible malfunctioning and switchgear damage caused by foreign objects:

- ⇒ Remove all foreign objects from the connection compartment, for example:
  - Tools
  - Unused installation material
  - Packing material
  - Cleaning material

#### **NOTICE**

##### **Cleaning**

Possible malfunctioning and damage to the panels caused by pollution.

Before closing the connection compartment:

- ⇒ Clean polluted areas in the connection compartment. To do this, use a vacuum cleaner and a lint-free cloth. If necessary, moisten the cloth, use a mild household cleaner, and dry properly at the end.
- ⇒ Some parts and surfaces of the switchgear are greased for functioning. Do not remove the grease there; do not clean the parts and surfaces.
- ⇒ If greased areas are dirty, clean the dirty area and grease again according to the maintenance instructions.

### NOTICE

#### Damages inside the switching-device compartment

Damages inside the switching-device compartment due to incorrect or incomplete installation of the partition.



To fasten the partition, always assemble all bolted joints of the partition all around, and screw them in up to the end of the thread.

In addition to these instructions, an instruction label on the vertical partition informs about safe fastening of the partition:

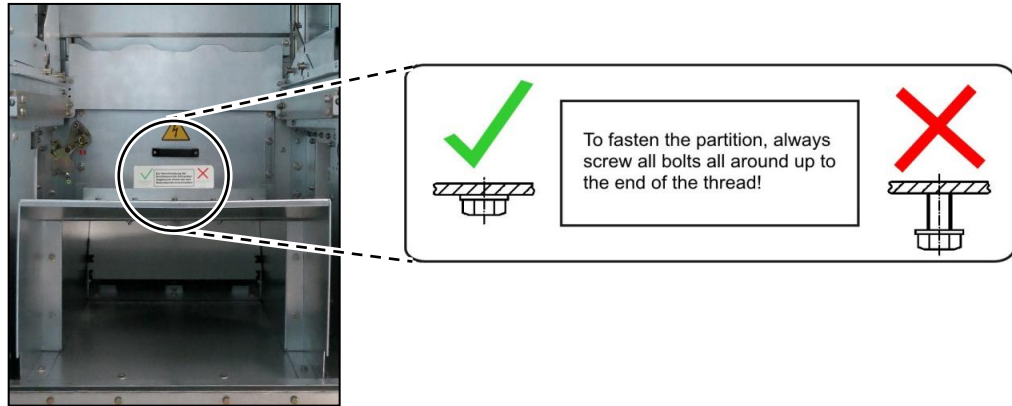


Fig. 421: Instruction label on the vertical partition

#### Preconditions

- Feeder earthing switch in CLOSED position
- High-voltage door open
- Low-voltage connector stowed away
- Unit consisting of ventilation duct and vertical partition available. Associated bolting material available:
  - 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
  - 7 bolts M8x20 with contact washers
- Protection plate and associated bolting material available:
  - 4 nuts M8 M8x20
- Front part of ventilation duct and associated bolting material available:
  - 8 bolts M8x20 with contact washers

#### Procedure



Place the unit consisting of ventilation duct (1) and vertical partition (2) centrally on the panel base frame. The vertical partition must point towards the connection compartment.



Push the unit towards the connection compartment as far as it will go.

- ⇒ Fix the unit by screwing the bolts hand-tight:
- 13 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (3)
  - 7 bolts M8x20 with contact washers (4)

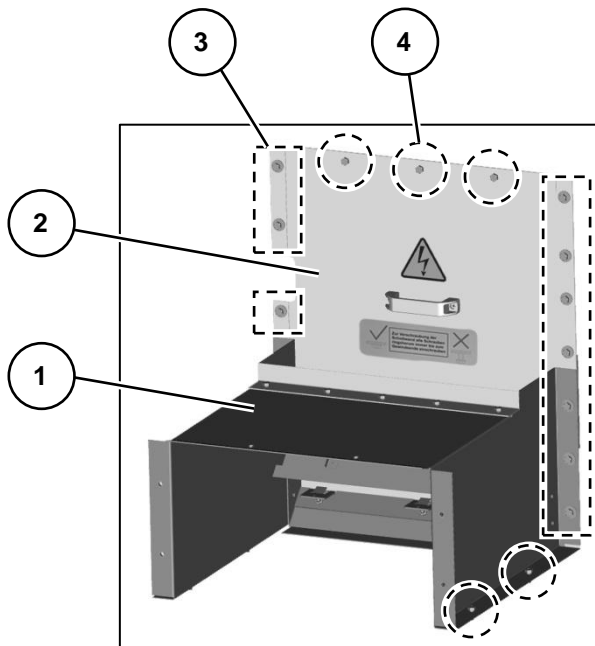


Fig. 422: Ventilation duct and partition, seen from center-right

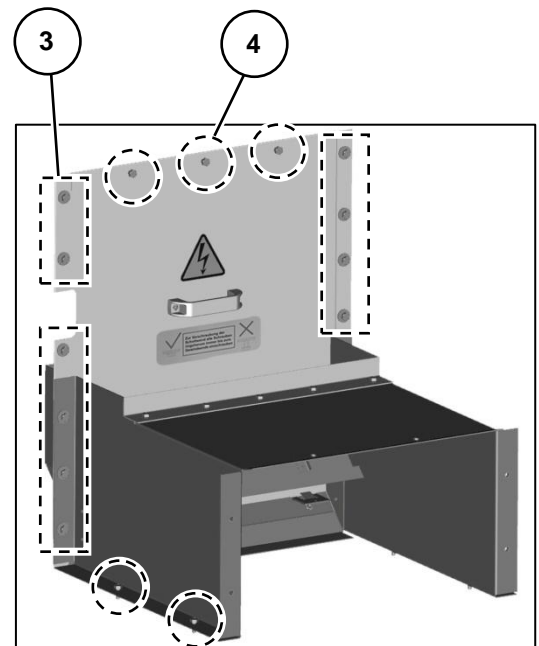


Fig. 423: Ventilation duct and partition, seen from center-left

- ⇒ Tighten the fixing bolts all around with torque 25 Nm.
- ⇒ Install the protection plate (5).
- ⇒ Fix the protection plate (5) by screwing the nuts (6) hand-tight:
- 4 nuts M8 with contact washers
- ⇒ Tighten the fixing nuts with torque 25 Nm.

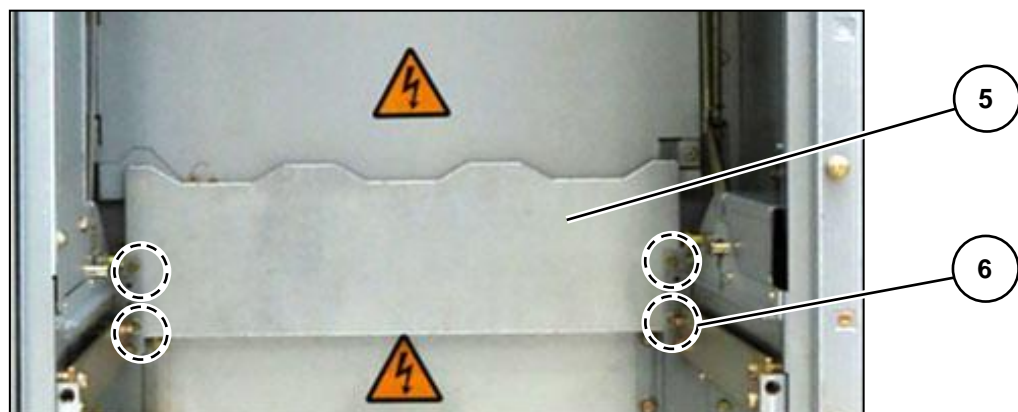


Fig. 424: 4 bolted joints of protection plate

- ⇒ Place the front part of the ventilation duct (7) centrally on the panel base frame.

## Accessing the connection compartment through the front

- ⇒ Fix the front part by screwing the bolts hand-tight:
- 8 bolts M8x20 with contact washers

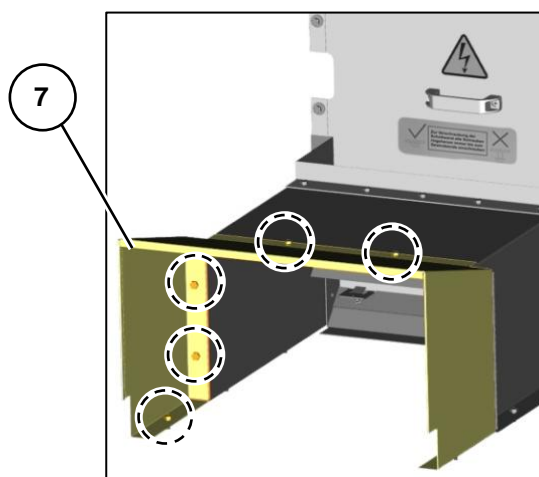


Fig. 425: Front part of ventilation duct, seen from center-right

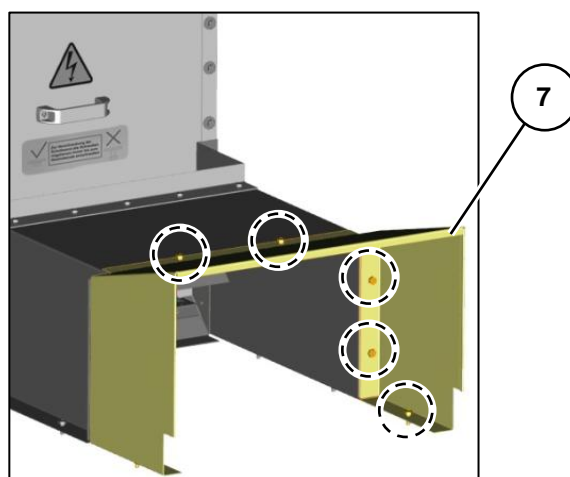


Fig. 426: Front part of ventilation duct, seen from center-left

- ✓ The vertical partition and the ventilation duct are installed.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ Inserting a withdrawable part in the panel.
- ⇒ Closing the high-voltage door.
- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part to service position.

### 21.6 Accessing the connection compartment through the switching-device compartment at panel versions with voltage transformer compartment

#### **⚠ WARNING**

##### **Reduced safety**

The closed connection compartment is an important safety element of the switchgear. The connection compartment is exclusively opened for performing operational activities inside the connection compartment.

Always install the bushing plate and the vertical partition:

- ⇒ If an activity inside the connection compartment is interrupted.
- ⇒ Immediately after an activity inside the connection compartment was completed.

#### **⚠ CAUTION**

##### **Sharp edges**

The metal parts of the voltage transformer compartment and the vertical partition may have sharp edges.

- ⇒ Put on personal protective equipment.

#### **⚠ CAUTION**

##### **High weight**

The voltage transformer compartment is heavy.

- ⇒ Remove the voltage transformer compartment absolutely with 2 persons.
- ⇒ Put on personal protective equipment.

#### **Preconditions**

- Preparations as described in chapter 21.1 completed
- Door to voltage transformer compartment open
- Removable voltage transformers removed from panel as described in chapter 17.6

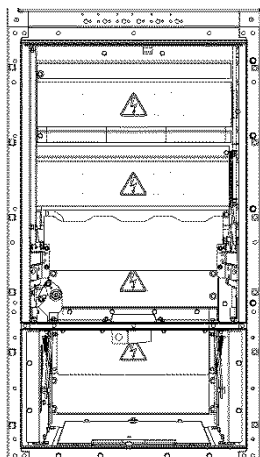


Fig. 427: Panel prepared

## Accessing the connection compartment through the front

### Procedure



Unscrew and remove the fixing bolting material from the front of the labyrinth, and store it:

- 2 nuts M8 with contact washers

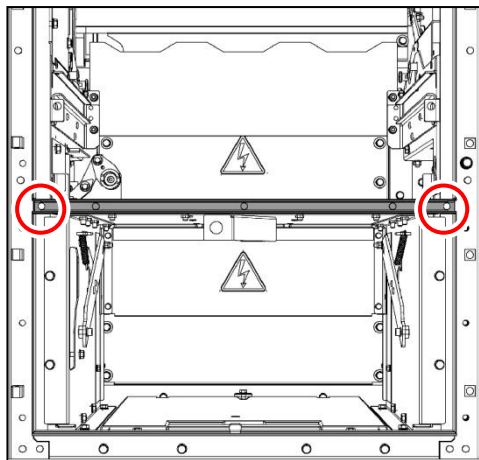


Fig. 428: 2 bolted joints at front of labyrinth



Unscrew and remove the bolting material from the top side of the labyrinth, and store it:

- 4 bolts M8x16 with contact washers

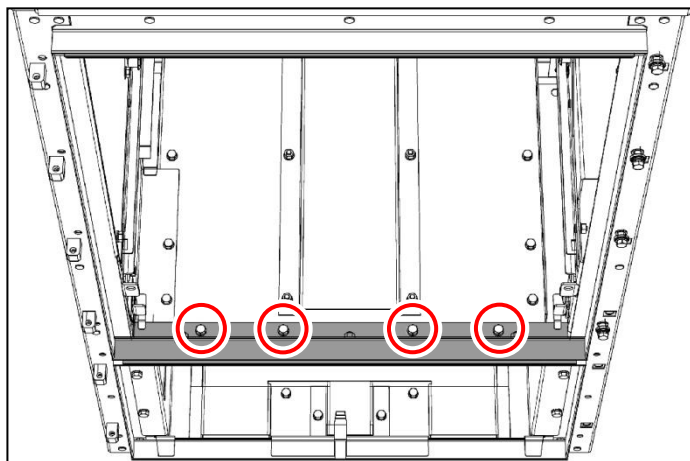


Fig. 429: 4 bolted joints at top side of labyrinth



Remove the labyrinth, and store it.

- ⇒ Unscrew and remove the bolting material from the wiring duct cover, and store it:
- 3 bolts M8x20 with contact washers

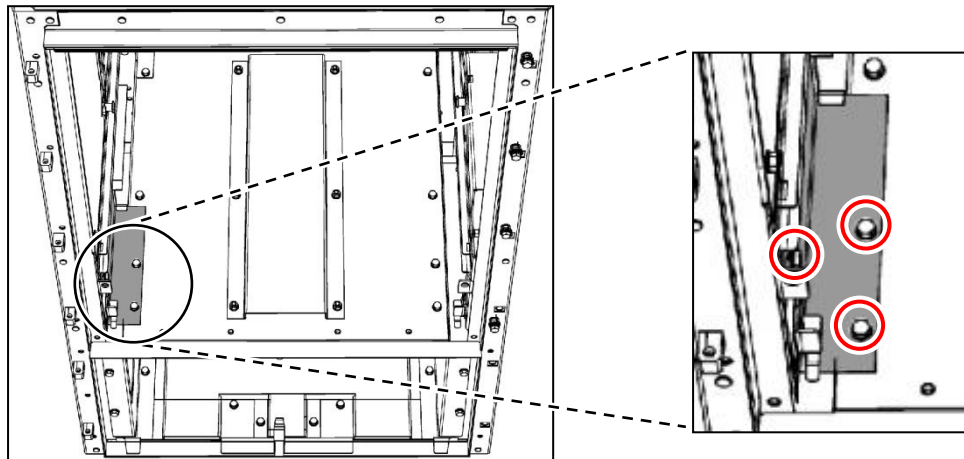


Fig. 430: 3 bolted joints on wiring duct cover

- ⇒ Remove the wiring duct cover, and store it.

- ⇒ Unscrew and remove the bolting material from the metal cover (1) for stowing the low-voltage connector, and store it:
- 6 bolts M8x20 with contact washers

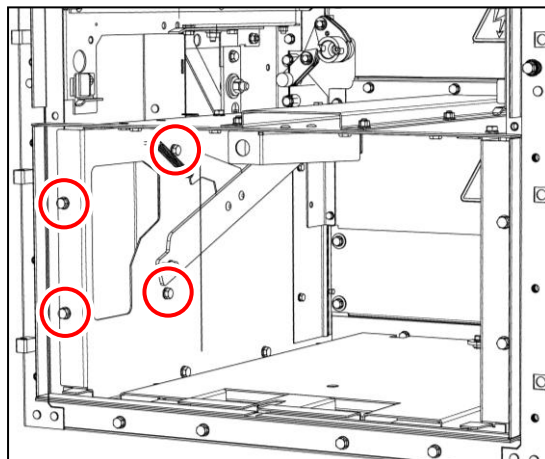


Fig. 431: 4 bolted joints on metal cover in voltage transformer compartment

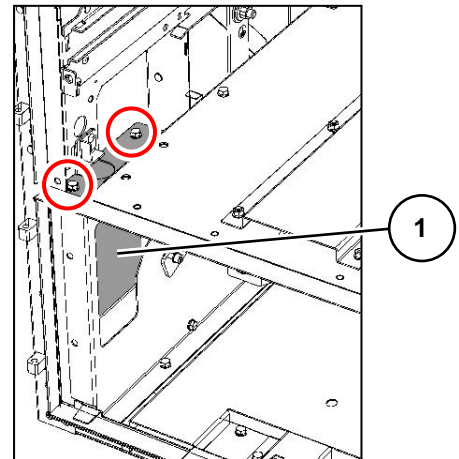


Fig. 432: 2 bolted joints on metal cover in switching-device compartment

## Accessing the connection compartment through the front

- ⇒ Remove the lid (2) of the metal cover, and store it.

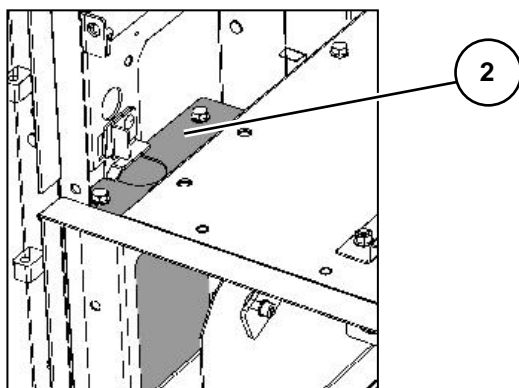


Fig. 433: Lid of metal cover

- ⇒ Unscrew and remove the bolting material from the voltage transformer compartment, and store it:
- 12 bolts M8x20 with contact washers

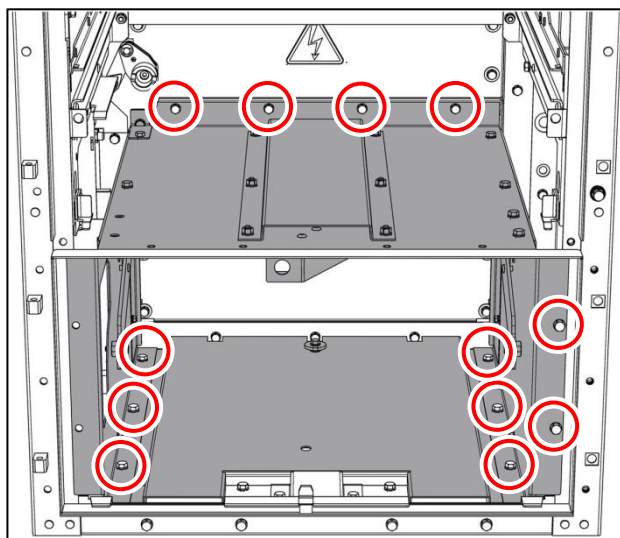


Fig. 434: 12 bolted joints at voltage transformer compartment

- ⇒ To get the voltage transformer compartment over the door threshold, lift it approx. 2 cm. Pull it out of the panel, and store it.

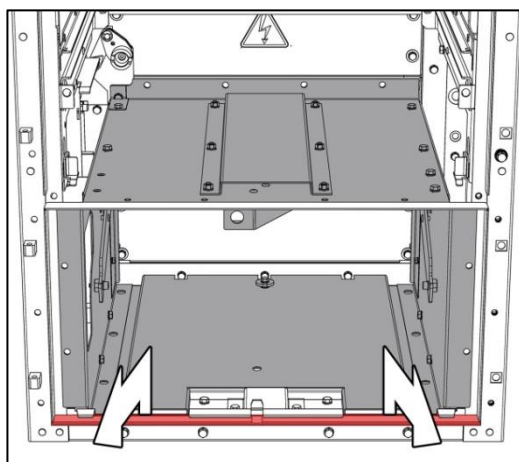


Fig. 435: Lifting and pulling the voltage transformer compartment

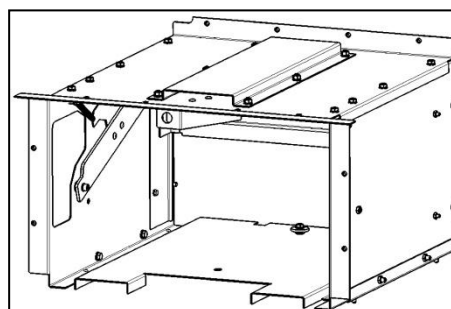


Fig. 436: Voltage transformer compartment, removed

## Accessing the connection compartment through the front

- ⇒ Unscrew and remove the bolting material from the protection plate of the switching-device compartment, and store it:
- 4 nuts M8 with contact washers
- ⇒ Remove the protection plate of the switching-device compartment, and store it.

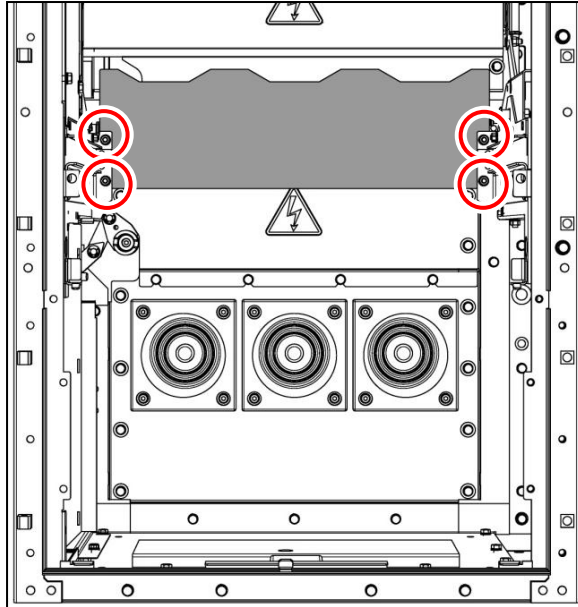


Fig. 437: 4 bolted joints on protection plate of switching-device compartment

- ⇒ Unscrew and remove the fixing bolting material from the vertical partition, and store it:
- 8 bolt M8x20 with contact washers and plain washers size 8 acc. to ISO 7093.

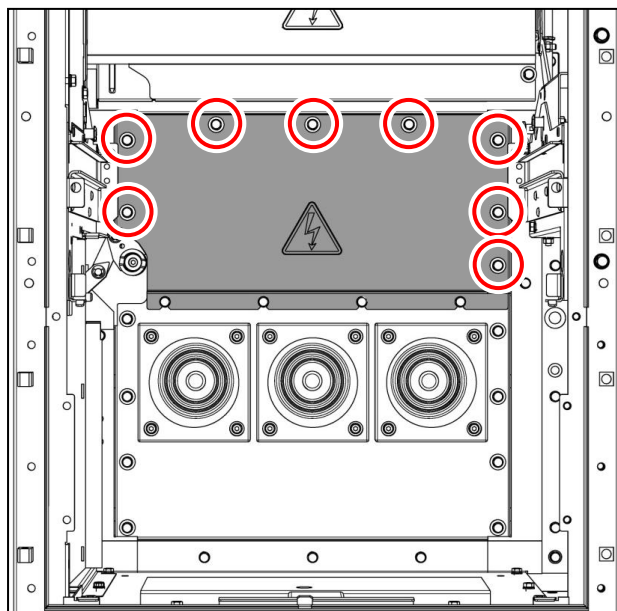


Fig. 438: 8 bolted joints on vertical partition

- ⇒ Remove the partition, and store it.

## Accessing the connection compartment through the front

- ⇒ Unscrew and remove the bolting material (3) at the 3 connecting leads from the cable / bar connections to the insulating bushings for the removable voltage transformers, and store it:
- 3 nuts M8 with contact washers and plain washers (3)

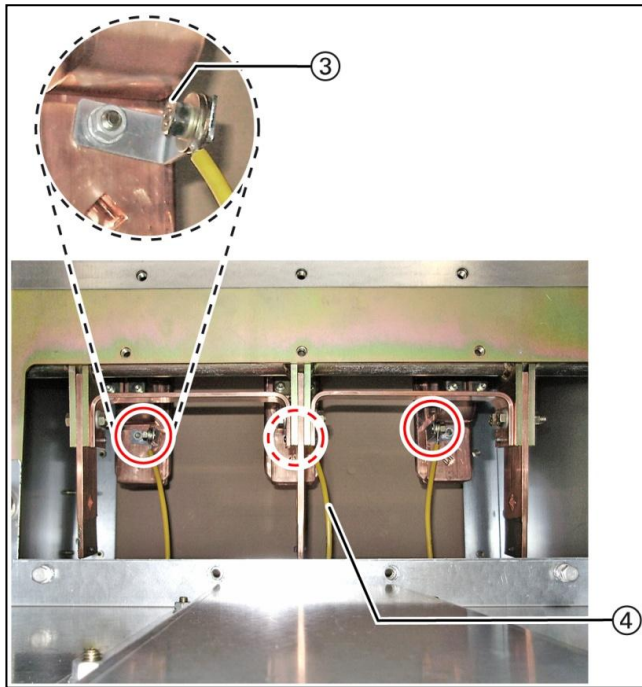


Fig. 439: Bolted joints at the cable connections (central joint covered)

- ⇒ Loosen the 3 connecting leads (4) for the removable voltage transformers from the cable / bar connections.

Unscrew and remove the bolting material from the left and right side of the bushing plate, and store it:

- ⇒
- 8 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (5)
- Loosen the fixing bolts at the lower side of the bushing plate:
- 3 bolts M8x20 with contact washers (6)

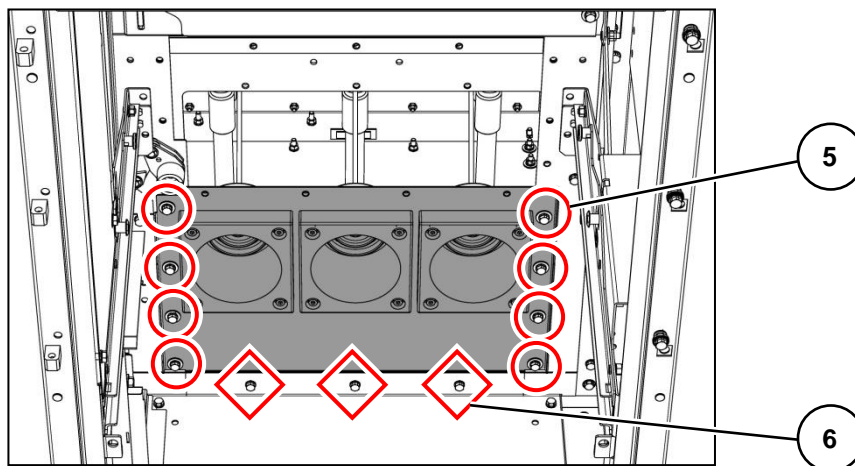


Fig. 440: 11 bolted joints on bushing plate

- ⇒ Remove the bushing plate with bushings, and store it.
- ✓ Access to the connection compartment through the panel front is given.

### 21.7 Installing the bushing plate, the vertical partition and the voltage transformer compartment in the switching-device compartment

#### **DANGER**

##### **Electric shock**

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.

#### **CAUTION**

##### **Sharp edges**

The metal parts of the voltage transformer compartment and the vertical partition may have sharp edges.

- ⇒ Put on personal protective equipment.

#### **NOTICE**

##### **Danger due to damages**

Possible malfunctioning and switchgear damage caused by foreign objects:

- ⇒ Remove all foreign objects from the connection compartment, for example:
  - Tools
  - Unused installation material
  - Packing material
  - Cleaning material

#### **NOTICE**

##### **Cleaning**

Possible malfunctioning and damage to the panels caused by pollution.

Before closing the connection compartment:

- ⇒ Clean polluted areas in the connection compartment. To do this, use a vacuum cleaner and a lint-free cloth. If necessary, moisten the cloth, use a mild household cleaner, and dry properly at the end.
- ⇒ Some parts and surfaces of the switchgear are greased for functioning. Do not remove the grease there; do not clean the parts and surfaces.
- ⇒ If greased areas are dirty, clean the dirty area and grease again according to the maintenance instructions.

### NOTICE

#### Damages inside the switching-device compartment

Damages inside the switching-device compartment / voltage transformer compartment due to incorrect or incomplete installation of the partition / bushing plate.



To fasten the partition / bushing plate, always assemble all bolted joints all around, and screw them in up to the end of the thread.

#### Preconditions

- Feeder earthing switch in CLOSED position
- High-voltage door open
- Door to voltage transformer compartment open
- In the switching-device compartment and in the voltage transformer compartment:
  - Low-voltage connectors stowed away
- Bushing plate and associated bolting material available:
  - 8 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
  - 3 bolts M8x20 with contact washers
- Cable connection and associated bolting material available:
  - 3 nuts M8 with contact washers and plain washers
- Vertical partition and associated bolting material available:
  - 8 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
- Protection plate and associated bolting material available:
  - 4 nuts M8 with contact washers
- Voltage transformer compartment and associated bolting material available:
  - 16 bolts M8x20 with contact washers
- Lid of metal cover and associated bolting material available:
  - 2 bolts M8x20 with contact washers
- Wiring duct cover and associated bolting material available:
  - 3 bolts M8x20 with contact washers
- Labyrinth and associated bolting material available:
  - 4 bolts M8x16 with contact washers
  - 2 nuts M8 with contact washers

#### Procedure



Install the bushing plate with bushings.

Fix the bushing plate by screwing the bolts hand-tight:



- 8 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093 (1)
- 3 bolts M8x20 with contact washers (2)

Tighten the bolts with torque 25 Nm.

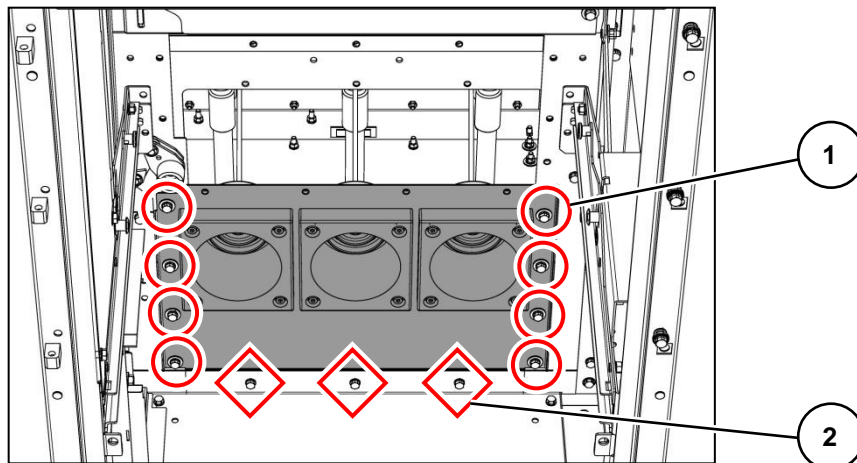


Fig. 441: 11 bolted joints on bushing plate

## Accessing the connection compartment through the front

⇒ Connect the 3 connecting leads (4) for the removable voltage transformers with the cable / bar connections.

⇒ Fix the leads by attaching and screwing the bolting material (3) hand-tight:

- 3 nuts M8 with contact washers and plain washers

Tighten the nuts with torque 25 Nm.

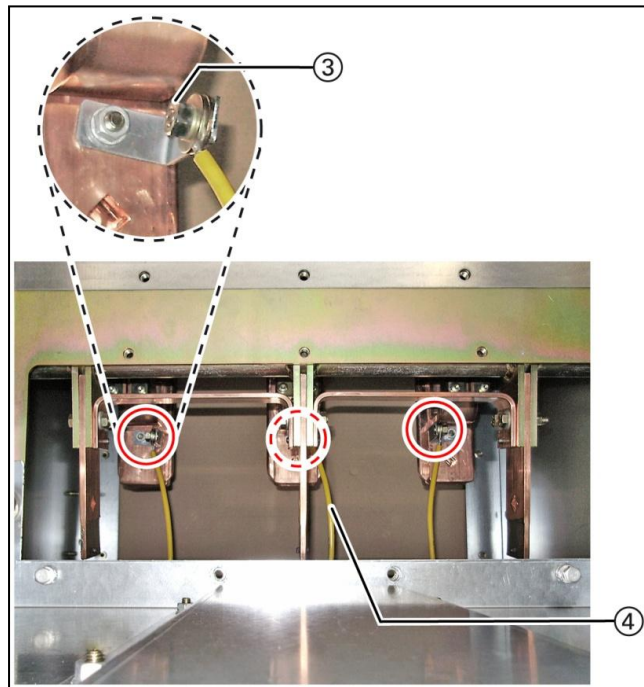


Fig. 442: 3 bolted joints at the cable connections (central joint covered)

⇒ Install the vertical partition on the connection compartment.

⇒ Fix the partition by screwing the bolts hand-tight:

- 8 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093

Tighten the bolts with torque 25 Nm.

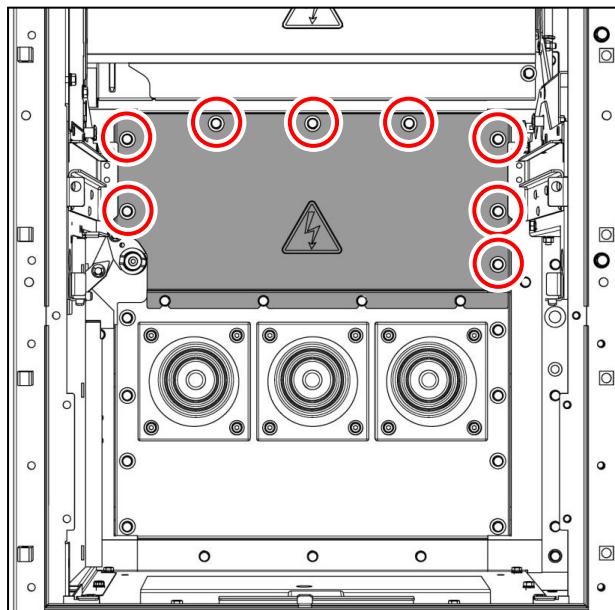


Fig. 443: 8 bolted joints on vertical partition

## Accessing the connection compartment through the front

⇒ Install the protection plate in the switching-device compartment.

⇒ Fix the protection plate by screwing the nuts hand-tight:

- 4 nuts M8 with contact washers

Tighten the nuts with torque 25 Nm.

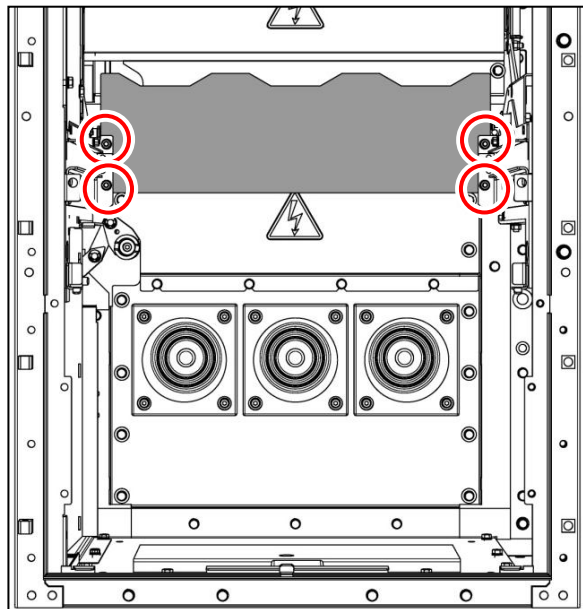


Fig. 444: 4 bolted joints on protection plate of switching-device compartment

⇒ Prepare the voltage transformer compartment for installation by laying it down centrally in front of the panel. The shutter (5) must point to the bushing plate.

⇒ To install the voltage transformer compartment, lift it approx. 2 cm. Push it into the panel and put it down on the panel base frame.

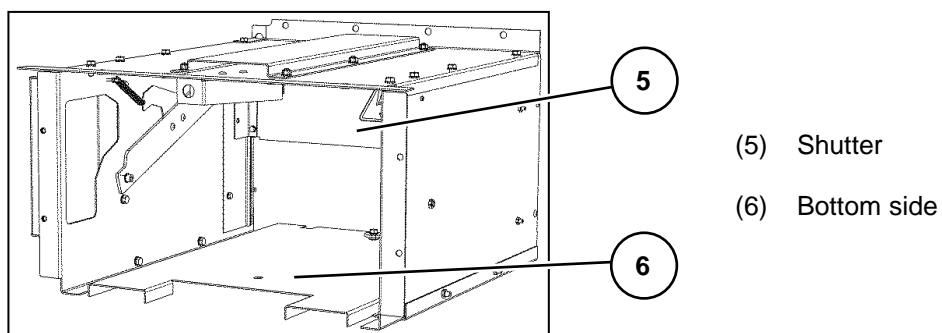


Fig. 445: Voltage transformer compartment



Fix the voltage transformer compartment by screwing the bolts hand-tight:

- 12 bolts M8x20 with contact washers

Tighten the bolts with torque 25 Nm.

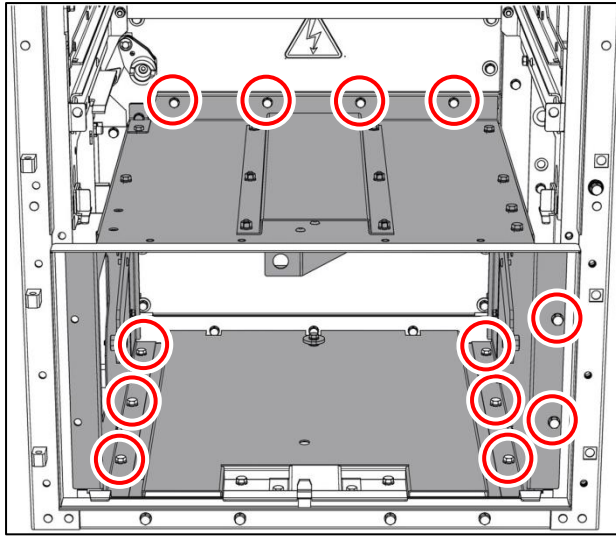


Fig. 446: 12 bolted joints at voltage transformer compartment



Set the metal cover up. Link the voltage transformer compartment and the metal cover together by screwing the bolts hand-tight:

- 4 bolts M8x20 with contact washers

Tighten the bolts with torque 25 Nm.

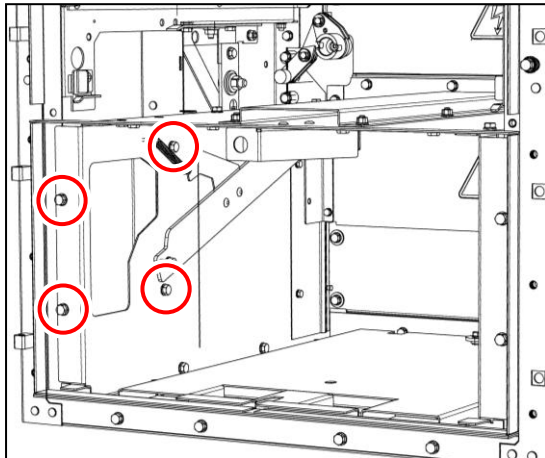


Fig. 447: 4 bolted joints on metal cover in voltage transformer compartment

## Accessing the connection compartment through the front

- ⇒ Install the lid (7) of the metal cover. Fix it by screwing the bolts hand-tight:
- 2 bolts M8x20 with contact washers
- Tighten the bolts with torque 25 Nm.

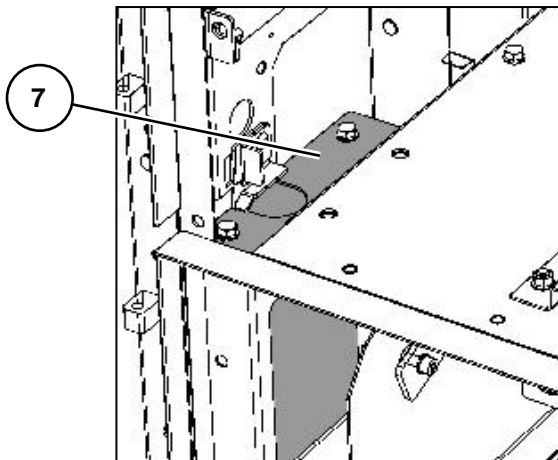


Fig. 448: Lid of metal cover

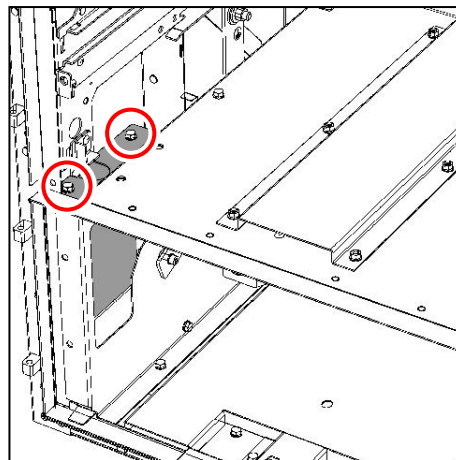


Fig. 449: 2 bolted joints on metal cover in switching-device compartment

- ⇒ Install the wiring duct cover.

- ⇒ Fix the wiring duct cover by screwing the bolts hand-tight:
- 3 bolts M8x20 with contact washers
- Tighten the bolts with torque 25 Nm.

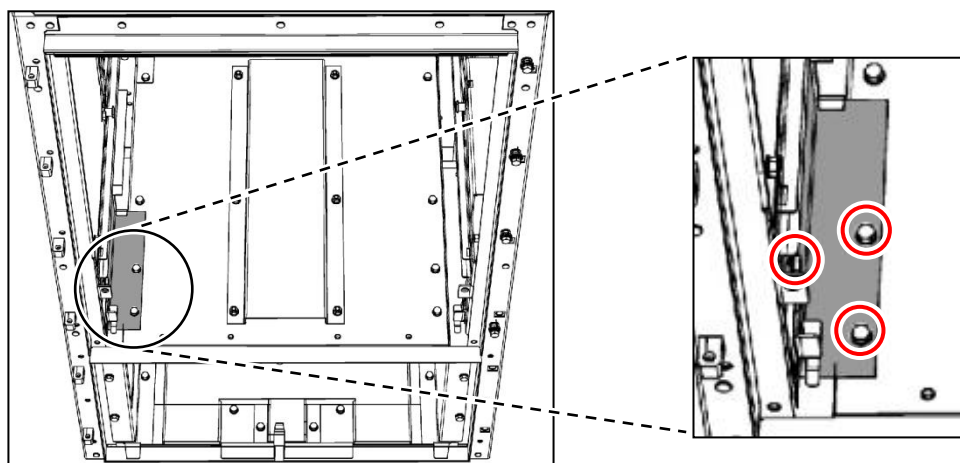


Fig. 450: 3 bolted joints on wiring duct cover

⇒ Install the labyrinth.

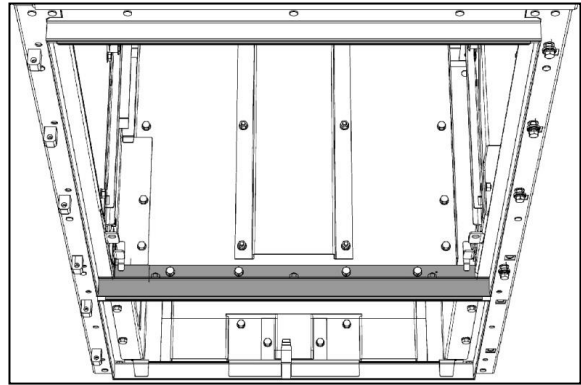
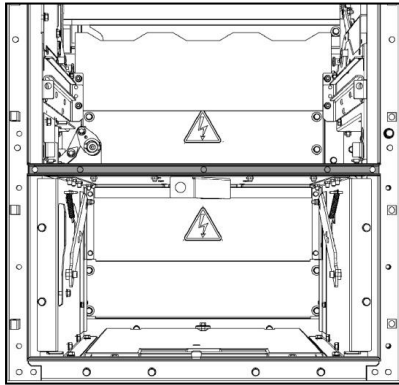


Fig. 451: Labyrinth installed, front

Fig. 452: Labyrinth installed, top side

⇒ Fix the labyrinth by screwing the outermost nuts hand-tight:

- 2 nuts M8 with contact washers

Tighten the nuts with torque 25 Nm.

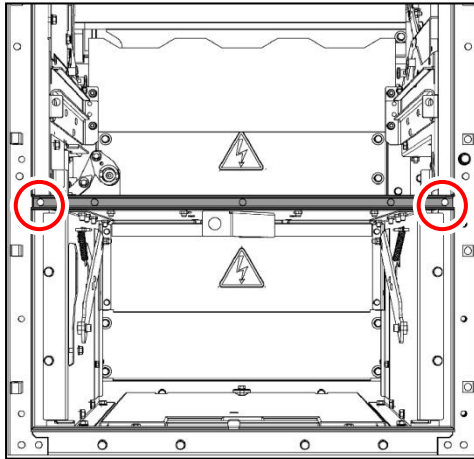


Fig. 453: 2 bolted joints at front of labyrinth

⇒ Screw the fixing bolts in at the top side of the labyrinth:

- 4 bolts M8x16 with contact washers

Tighten the bolts with torque 25 Nm.

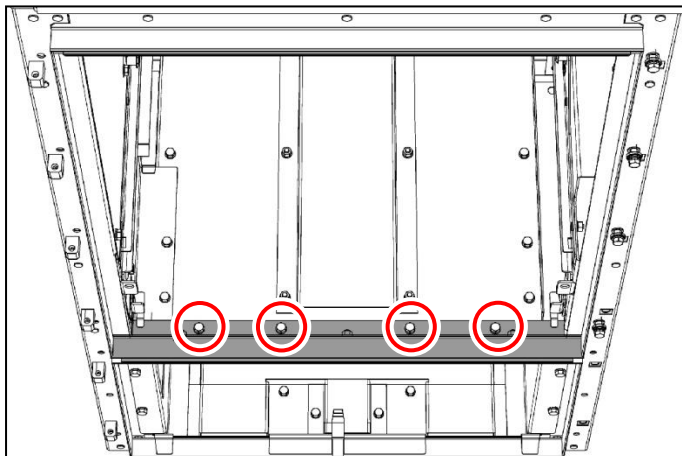


Fig. 454: 4 bolted joints at top side of labyrinth

## Accessing the connection compartment through the front

Perform final checks regarding the correct state and position of the shutter (1) and the levers (2) for moving the shutter. If any of these checks fails, do **not** insert any removable voltage transformers in the voltage transformer compartment, but inform the regional Siemens representative.

- ⇒ Check against the labyrinth (3) if the shutter (1) is horizontally arranged.
- ⇒ Check if the top edge of the shutter is flush with the shutter frame (4).
- ⇒ Check if the levers (2) are in perfectly straight condition.

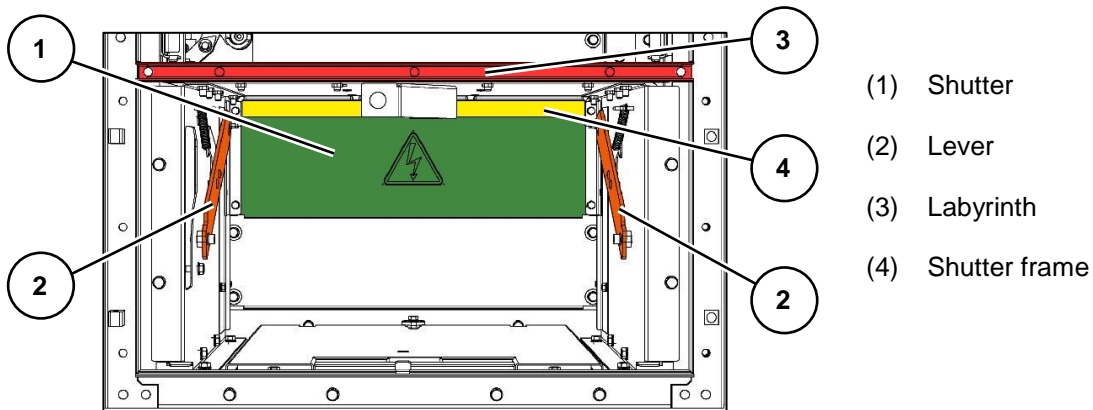


Fig. 455: Checking state and position of shutter and levers

- ✓ The bushing plate, the vertical partition and the voltage transformer compartment are installed.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ Inserting a withdrawable part / removable voltage transformers in the panel.
- ⇒ Closing the high-voltage door / door to the voltage transformer compartment.
- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part / removable voltage transformers to service position.

# Accessing the connection compartment through the rear

## 22 Accessing the connection compartment through the rear



### HINT

Read and understand these instructions before attempting operating works.

### 22.1 Accessing the connection compartment through the rear side of the panel



### DANGER

#### Electric shock

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Before removing the rear wall on the rear side of a panel, isolate and earth the cable / bar connections in the connection compartment.
- ⇒ Provide a warning on the high-voltage door to indicate activities in the connection compartment on the rear side of the panel.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.
- ⇒ Do **not** remove any ledges on the rear side of the busbar compartment.



### WARNING

#### Reduced safety

The closed connection compartment is an important safety element of the switchgear. The connection compartment is exclusively opened for performing operational activities inside the connection compartment.

Close the connection compartment with the rear wall, ledges and tightened bolts:

- ⇒ If an activity inside the connection compartment is interrupted.
- ⇒ Immediately after an activity inside the connection compartment was completed.



### CAUTION

#### Sharp edges

The metal parts of the rear wall may have sharp edges.

- ⇒ Put on personal protective equipment.

### HINT

Hereafter, the disassembly of those parts is described, which are later assembled again at the same place.



Store disassembled parts and bolting material carefully, and keep them ready for later reuse.

### Preconditions

- Withdrawable part / switching-device truck is present in the switching-device compartment:
  - High-voltage door closed
  - Withdrawable part / switching-device truck in test position
  - Feeder earthing switch in CLOSED position

### Procedure



Check if the position indicator of the feeder earthing switch on the high-voltage door is in vertical I position.

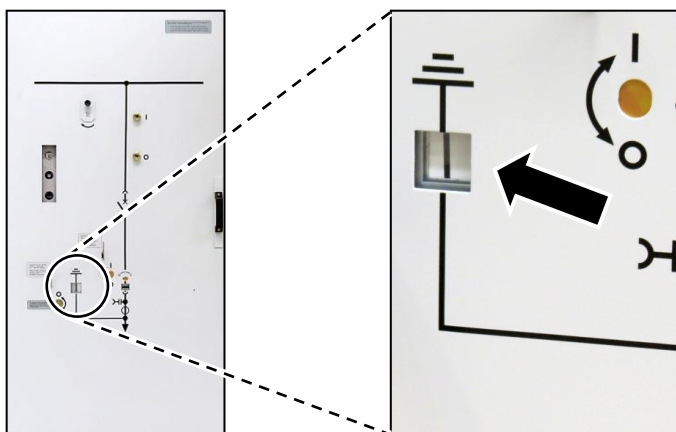


Fig. 456: All panel versions except for contactor panels:  
position indicator of feeder earthing switch on high-voltage door

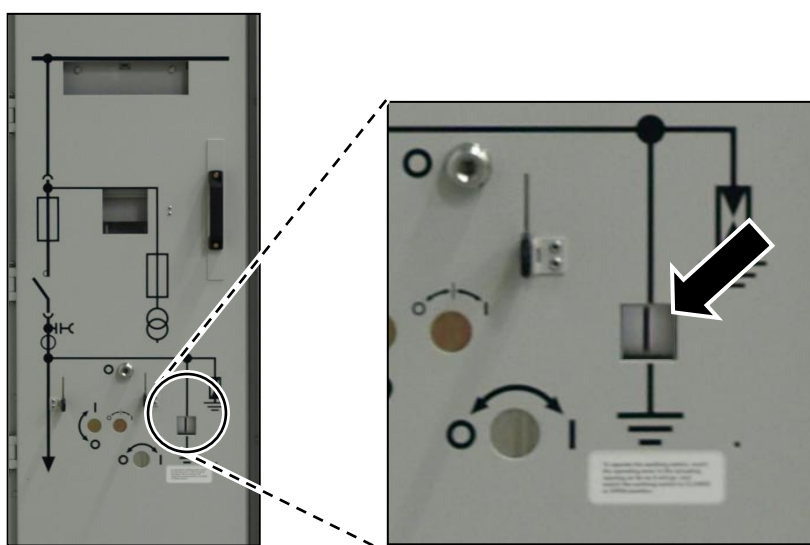


Fig. 457: Contactor panels only:  
position indicator of the feeder earthing switch on high-voltage door

Hereafter, gaining access through the rear wall is shown using the example of a 3-panel arrangement.

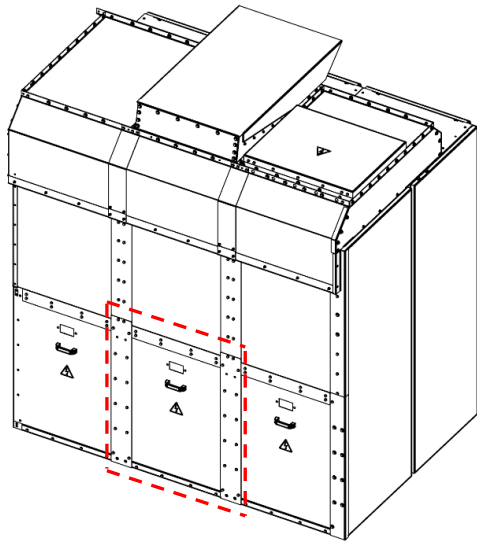


Fig. 458: All panel versions except for contactor panels:  
rear wall, 3-panel arrangement

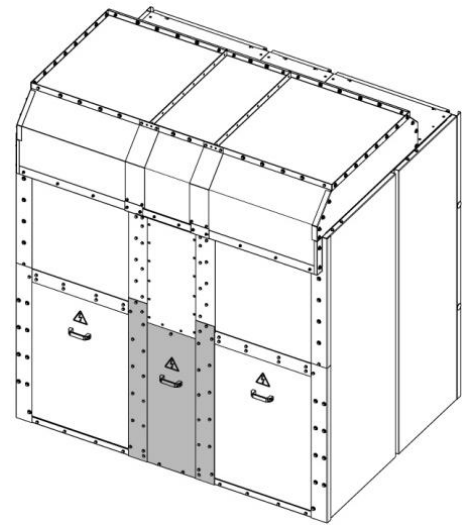


Fig. 459: Contactor panels only:  
rear wall, 3-panel arrangement

### All panel versions except for contactor panels:

- ⇒ Unscrew and remove the bolting material from the horizontal ledge (1):
  - 8 bolts M8x25 with contact washers and plain washers size 8 acc. to ISO 7093
- ⇒ Remove the horizontal ledge, and store it together with the associated bolting material.
- ⇒ Unscrew and remove the bolting material from one of the vertical ledges (2):
  - 14 bolts M8x20 with contact washers
- ⇒ Remove the vertical ledge, and store it together with the associated bolting material.
- ⇒ Proceed in the same way with the other vertical ledge.

## Accessing the connection compartment through the rear

⇒ Remove the sealing brackets (3), and store them.

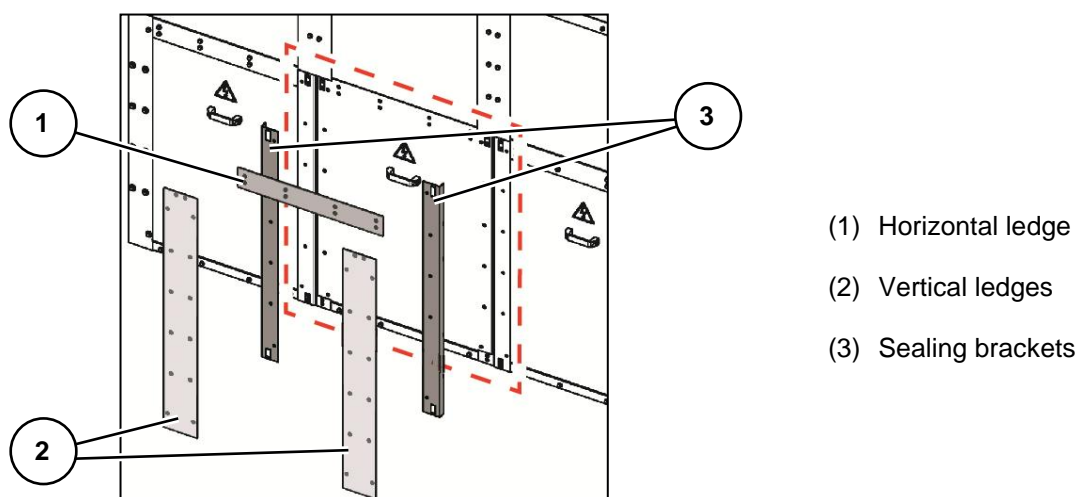


Fig. 460: All panel versions except for contactor panels:  
removing ledges and brackets

⇒ Unscrew and remove the bolting material at the panel bottom:

- 4 bolts M8x20 with contact washers (5)

⇒ To remove the rear wall, lift and pull it using the handle (4). Store the rear wall.

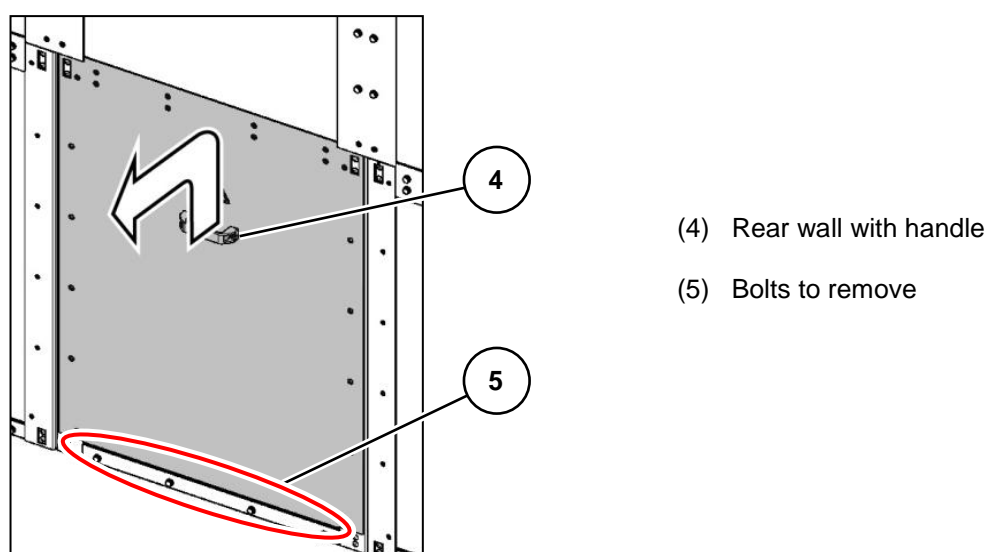


Fig. 461: All panel versions except for contactor panels: removing the rear wall

✓ Access to the connection compartment through the rear side is given.

### HINT

#### Final procedure steps

⇒ Immediately proceed to perform the intended checks and works in the connection compartment.

### Contactor panels only:

- ⇒ Unscrew and remove the bolting material from one of the vertical ledges (1):
  - 15 bolts M8x20
- ⇒ Remove the vertical ledge, and store it together with the associated bolting material.
- ⇒ Proceed in the same way with the other vertical ledge.

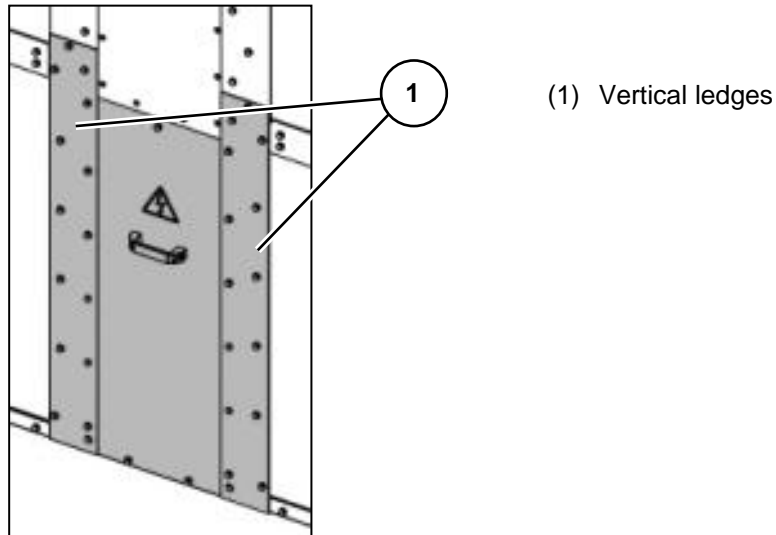


Fig. 462: Contactor panels only: 30 bolts on ledges

- ⇒ Remove the sealing brackets (2), and store them.

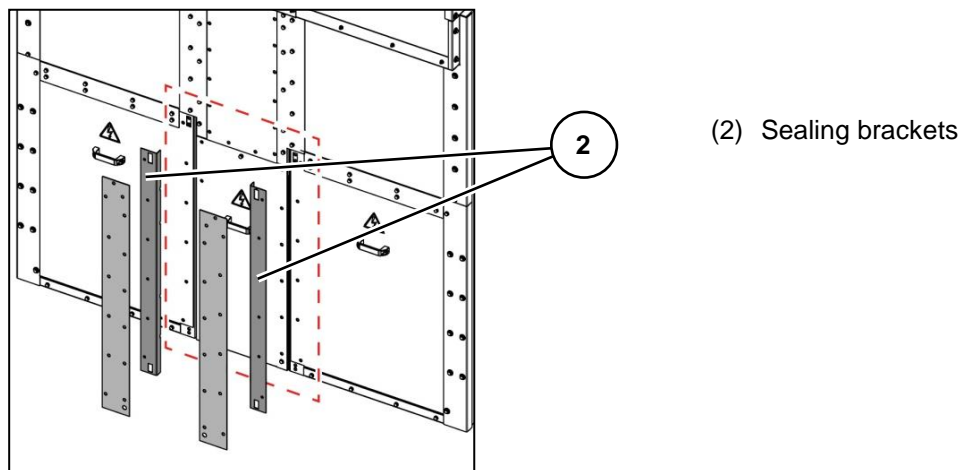


Fig. 463: Contactor panels only: removing the sealing brackets

- ⇒ Unscrew and remove the bolting material on the rear wall:
  - 3 bolts M8x20 (3).

## Accessing the connection compartment through the rear

- ⇒ To remove the rear wall, pull it using the handle (4). Store the rear wall together with the associated bolting material.

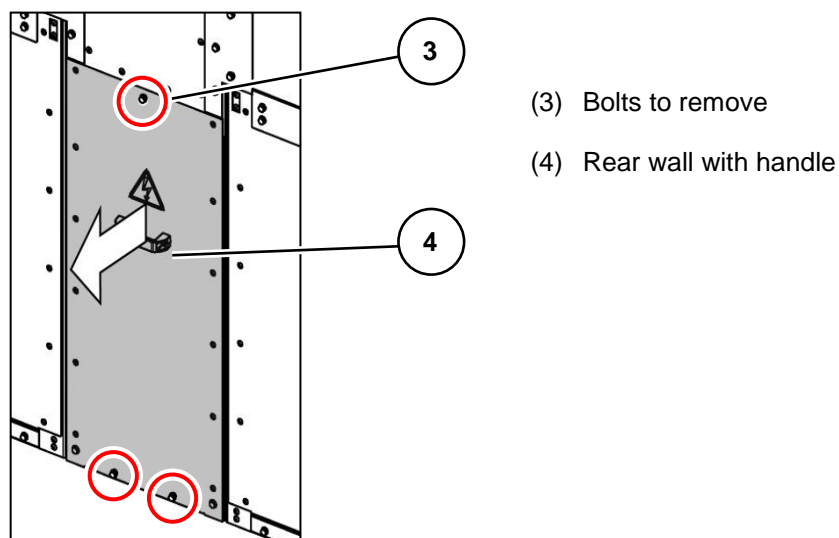


Fig. 464: Contactor panels only: removing the rear wall

- ✓ Access to the connection compartment through the rear side is given.

### HINT

#### Final procedure steps

- ⇒ Immediately proceed to perform the intended checks and works in the connection compartment.

## 22.2 Installing the rear wall on the connection compartment

### **DANGER**

#### **Electric shock**

To perform any kind of activities inside or near the connection compartment of a panel, you must ensure that this compartment is safely isolated from supply. Without isolation from supply, the cables / bars in the connection compartment will be live at operational high voltage.

- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Make sure all openings on the rear side are closed by fixing bolts before the panel is put into operation again.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection compartment.
- ⇒ Do **not** remove any ledges on the rear side of the busbar compartment.

### **CAUTION**

#### **Sharp edges**

The metal parts of the rear wall may have sharp edges.

- ⇒ Put on personal protective equipment.

### **NOTICE**

#### **Danger due to damages**

Possible malfunctioning and switchgear damage caused by foreign objects:

- ⇒ Remove all foreign objects from the connection compartment, for example:
  - Tools
  - Unused installation material
  - Packing material
  - Cleaning material

### NOTICE

#### Cleaning

Possible malfunctioning and damage to the panels caused by pollution.

Before closing the connection compartment:

- ⇒ Clean polluted areas in the connection compartment. To do this, use a vacuum cleaner and a lint-free cloth. If necessary, moisten the cloth, use a mild household cleaner, and dry properly at the end.
- ⇒ Some parts and surfaces of the switchgear are greased for functioning. Do not remove the grease there; do not clean the parts and surfaces.
- ⇒ If greased areas are dirty, clean the dirty area and grease again according to the maintenance instructions.

#### Preconditions

- Rear wall available
- Corresponding number of sealing brackets, ledges and associated bolting material available:
  - All panel versions except for contactor panels 435 mm width:
    - 2 nos. sealing brackets
    - 1 no. horizontal ledge and associated 8 nos. bolt-and-washer assemblies size M8x25 plus plain washers size 8 acc. to ISO 7093
  - 2 nos. vertical ledges and a total of associated 28 nos. bolt-and-washer assemblies size M8x20
  - 4 nos. bolt-and-washer assemblies size M8x20 to fix the rear wall at the panel bottom
- Contactor panels 435 mm width only:
  - 2 nos. sealing brackets
  - 2 nos. vertical ledges and a total of associated 28 nos. bolts size M8x20
  - 3 nos. bolts size M8x20 to fix the rear wall

#### Procedure

Hereafter, installing the rear wall is shown using the example of a 3-panel arrangement.

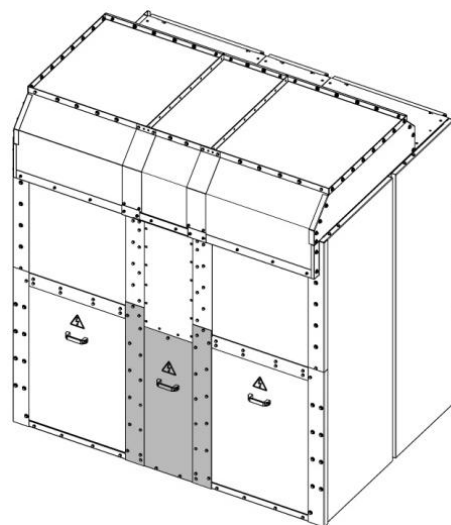
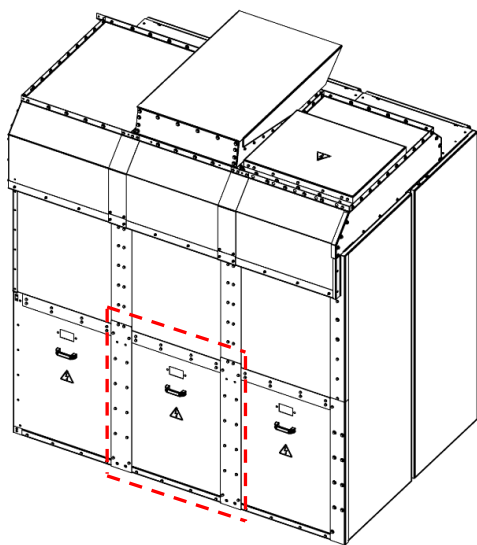


Fig. 465: All panel versions except for contactor panels:  
rear wall, 3-panel arrangement

Fig. 466: Contactor panels only:  
rear wall,  
3-panel arrangement

### All panel versions except for contactor panels:

- ⇒ Insert the rear wall (1) on the rear side of the panel and push it down using the handle.
- ⇒ Fix the rear wall by screwing the bolts at the bottom hand-tight:
  - 4 bolts M8x20 with contact washers (2)
- ⇒ Tighten the bolts with torque 25 Nm.

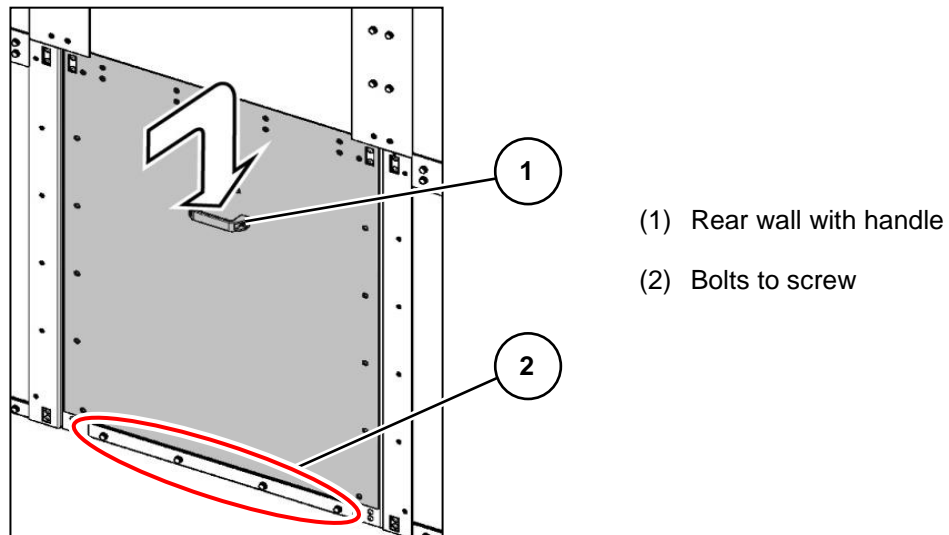


Fig. 467: All panel versions except for contactor panels:  
inserting and fixing the rear wall

- ⇒ Insert the 2 sealing brackets (3) into the vertical gaps between the panels.
- ⇒ Install the horizontal ledge (4). Fix it by screwing the bolts hand-tight:
  - 8 bolts M8x25 with contact washers and plain washers size 8 acc. to ISO 7093
- ⇒ Tighten the bolts with torque 25 Nm.
- ⇒ Install one of the vertical ledges (5). Fix it by screwing the bolts hand-tight:
  - 14 bolts M8x20 with contact washers

## Accessing the connection compartment through the rear

- ⇒ Tighten the bolts with torque 25 Nm.
- ⇒ Proceed in the same way with the other vertical ledge.

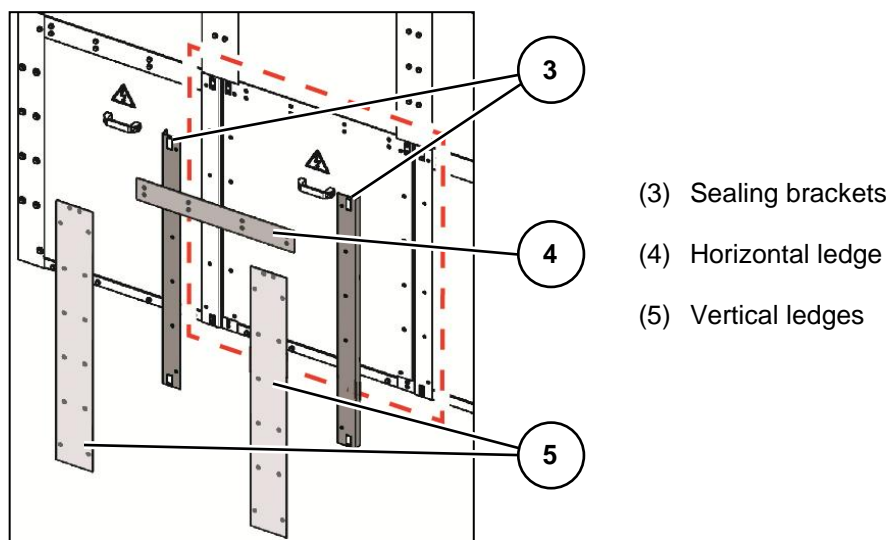


Fig. 468: All panel versions except for contactor panels:  
installing ledges and brackets

- ✓ The rear wall is installed on the connection compartment.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part / switching-device truck to service position.

### Contactor panels only:

- ⇒ Insert the rear wall (2) on the rear side of the panel using the handle.
- ⇒ Fix the rear wall by screwing the bolts hand-tight:
  - 3 bolts M8x20 (1)
- ⇒ Tighten the bolts with torque 25 Nm.

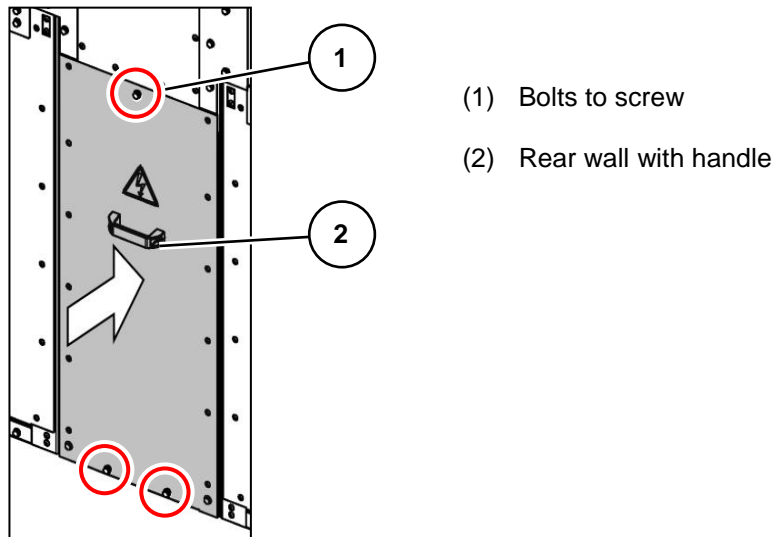


Fig. 469: Contactor panels only: inserting and fixing the rear wall

- ⇒ Insert the 2 sealing brackets (3) into the vertical gaps between the panels.
- ⇒ Install one of the vertical ledges (4). Fix it by screwing the bolts hand-tight:
  - 15 bolts M8x20

## Accessing the connection compartment through the rear

- ⇒ Tighten the bolts with torque 25 Nm.
- ⇒ Proceed in the same way with the other vertical ledge.

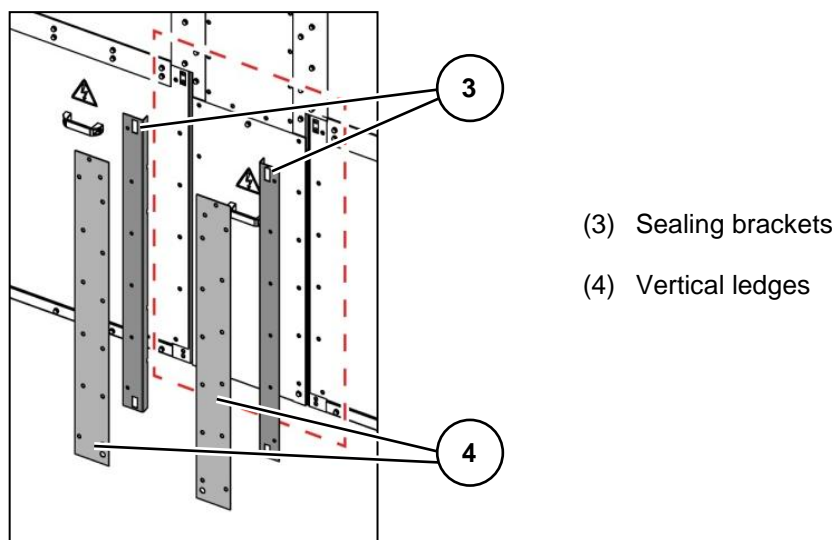


Fig. 470: Contactor panels only: installing ledges and brackets

- ✓ The rear wall is installed on the connection compartment.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part / switching-device truck to service position.

## 22.3 Accessing the connection duct through the rear side of the panel

### **DANGER**

#### **Electric shock**

To perform any kind of activities inside or near the connection duct of a panel, you must ensure that the connection duct is safely isolated from supply. Without isolation from supply, the cables in the connection duct will be live at operational high voltage.

- ⇒ Before removing a rear wall on the connection duct of a panel, isolate and earth the cable connection in the connection duct.
- ⇒ Provide a warning on the high-voltage door to indicate activities in the connection duct on the rear side of the panel.
- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection duct.

### **WARNING**

#### **Reduced safety**

The closed connection duct is an important safety element of the switchgear. The connection duct is exclusively opened for performing operational activities inside the connection duct.

Close the connection duct with rear walls, ledges and tightened bolts:

- ⇒ If an activity inside the connection duct is interrupted.
- ⇒ Immediately after an activity inside the connection duct was completed.

### **CAUTION**

#### **Sharp edges**

The metal parts of the rear walls may have sharp edges.

- ⇒ Put on personal protective equipment.

### **HINT**

**Hereafter, the disassembly of those parts is described, which are later assembled again at the same place.**

- ⇒ Store disassembled parts and bolting material carefully, and keep them ready for later reuse.

## Accessing the connection compartment through the rear

### Preconditions

- Withdrawable part / switching-device truck is present in the switching-device compartment:
  - High-voltage door closed
  - Withdrawable part / switching-device truck in test position
  - Feeder earthing switch in CLOSED position

### Procedure

- ⇒ Check if the position indicator of the feeder earthing switch on the high-voltage door is in vertical I position.

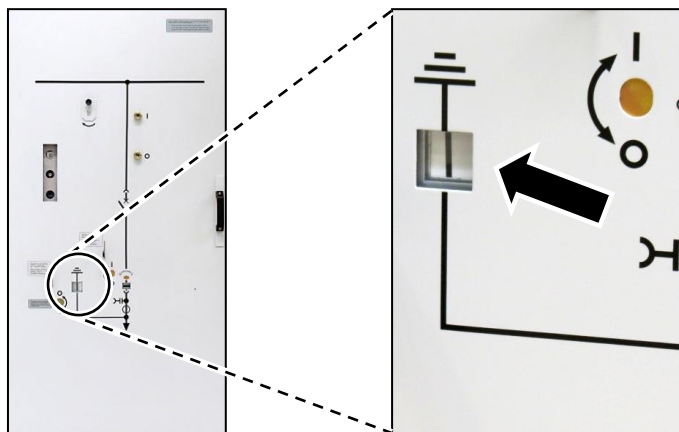


Fig. 471: Position indicator of feeder earthing switch on high-voltage door

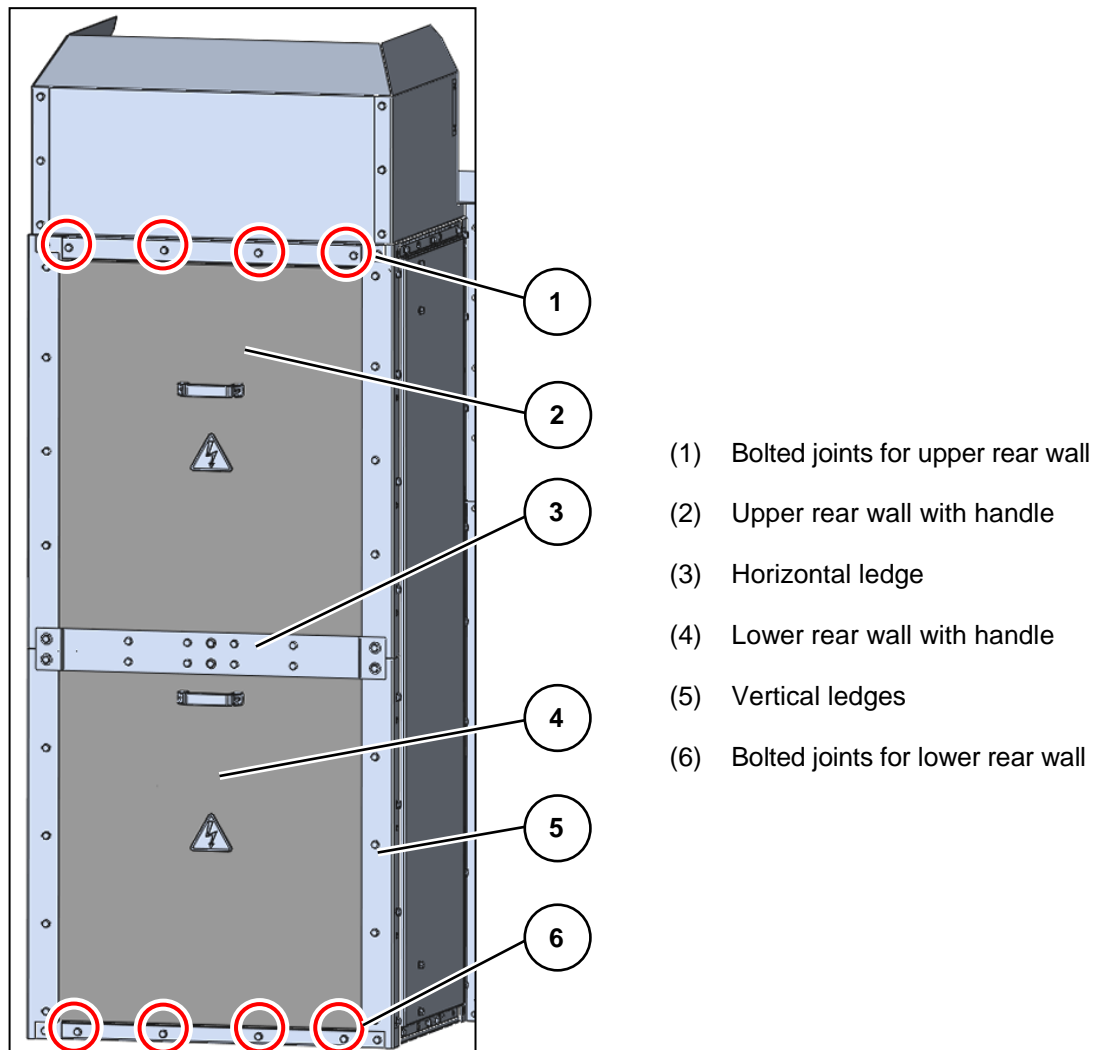


Fig. 472: Rear ledges and rear walls on connection duct

- ⇒ Unscrew and remove the bolting material from the horizontal ledge (3):
  - 12 / 14 bolts M8x20 with contact washers
- ⇒ Remove the horizontal ledge, and store it together with the associated bolting material.
- ⇒ Unscrew and remove the bolting material from one of the vertical ledges (5):
  - 9 / 19 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
- ⇒ Remove the vertical ledges, and store them together with the associated bolting material.
- ⇒ Proceed in the same way with the other vertical ledges.
- ⇒ Loosen the bolting material for the lower rear wall at the panel bottom (6):
  - 4 / 6 bolts M8x20 with contact washers
- ⇒ To remove the lower rear wall, lift and pull the wall using the handle (4). Store the rear wall.

## Accessing the connection compartment through the rear

- ⇒ Loosen the bolting material for the upper rear wall in the upper area (1):
  - 4 / 5 bolts M8x20 with contact washers
- ⇒ To remove the upper rear wall, lower the wall using the handle (2). Store the rear wall.
- ✓ Access to the connection duct through the rear side is given.

### **HINT**

#### **Final procedure steps**

- ⇒ Immediately proceed to perform the intended checks and works in the connection duct.

## 22.4 Installing the rear walls on the connection duct

### **DANGER**

#### **Electric shock**

To perform any kind of activities inside or near the connection duct of a panel, you must ensure that the connection duct is safely isolated from supply. Without isolation from supply, the cables in the connection duct will be live at operational high voltage.

- ⇒ Observe the **Five Safety Rules**.
- ⇒ Verify safe isolation from supply.
- ⇒ Make sure all openings on the rear side are closed by fixing bolts before the panel is put into operation again.
- ⇒ Do **not** operate the feeder earthing switch during any activities inside or near the connection duct.

### **CAUTION**

#### **Sharp edges**

The metal parts of the rear walls may have sharp edges.

- ⇒ Put on personal protective equipment.

### NOTICE

#### Danger due to damages

Possible malfunctioning and switchgear damage caused by foreign objects:

- ⇒ Remove all foreign objects from the connection duct, for example:
  - Tools
  - Unused installation material
  - Packing material
  - Cleaning material

### NOTICE

#### Cleaning

Possible malfunctioning and damage to the panels caused by pollution.

Before closing the connection duct:

- ⇒ Clean polluted areas in the connection duct. To do this, use a vacuum cleaner and a lint-free cloth. If necessary, moisten the cloth, use a mild household cleaner, and dry properly at the end.
- ⇒ Some parts and surfaces of the switchgear are greased for functioning. Do not remove the grease there; do not clean the parts and surfaces.
- ⇒ If greased areas are dirty, clean the dirty area and grease again according to the maintenance instructions.

#### Preconditions

- Upper and lower rear wall available
- Corresponding number of ledges and associated bolting material available:
  - 1 no. horizontal ledge
  - 4 nos. vertical ledges
  - Bolt-and-washer assemblies size M8x20 plus plain washers size 8 acc. to ISO 7093

- ⇒ Insert the lower rear wall (4) on the rear side of the panel and push it down using the handle.
- ⇒ Fix the rear wall by screwing the bolts at the bottom hand-tight:
  - 4 / 6 bolts M8x20 with contact washers (6)
- ⇒ Insert the upper rear wall (2) on the rear side of the panel and push it up using the handle.
- ⇒ Fix the rear wall by screwing the bolts in the upper area hand-tight:
  - 4 / 5 bolts M8x20 with contact washers (1)
- ⇒ Install one of the 4 vertical ledges (5). Fix it by screwing the bolts hand-tight:
  - 9 / 19 bolts M8x20 with contact washers and plain washers size 8 acc. to ISO 7093
- ⇒ Proceed in the same way with the other vertical ledges.

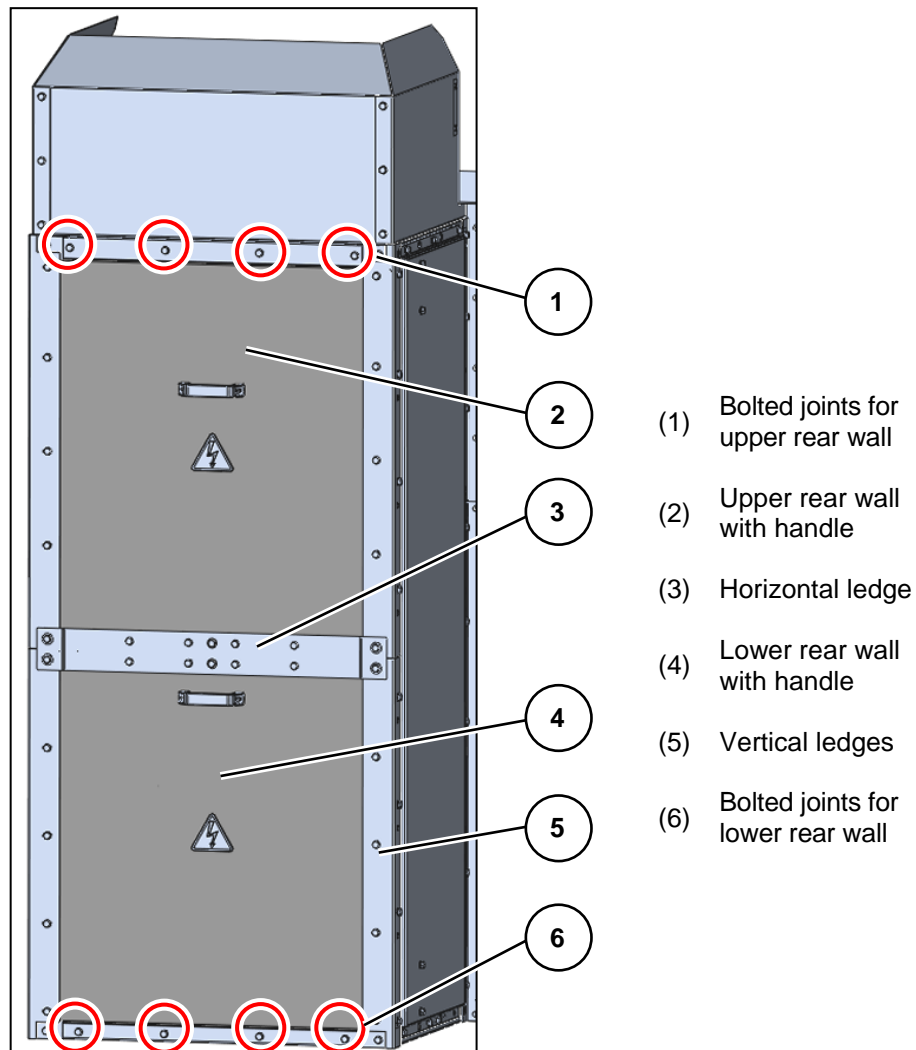


Fig. 473: Rear ledges and rear walls on connection duct

- ⇒ Install the horizontal ledge (3). Fix it by screwing the bolts hand-tight:
  - 12 / 14 bolts M8x20 with contact washers; use washers size 8 acc. to ISO 7093 with the bolt fixing in the area of the vertical ledges
- ⇒ Tighten the bolts with torque 25 Nm.
- ✓ The rear walls are installed on the connection duct.

### HINT

#### Final procedure steps

Now the panel can be integrated into the course of operation again, for example:

- ⇒ De-earthing the feeder.
- ⇒ Racking the withdrawable part / switching-device truck to service position.

# Key-operated interlocks

## 23 Key-operated interlocks



### HINT

Read and understand these instructions before attempting operating works.

### 23.1 Key-operated interlocks for the withdrawable part / switching-device truck

#### Function and design

Key-operated interlocks are available for circuit-breaker, disconnecting and contactor panels. Access to the key of any interlock is given with closed high-voltage door.

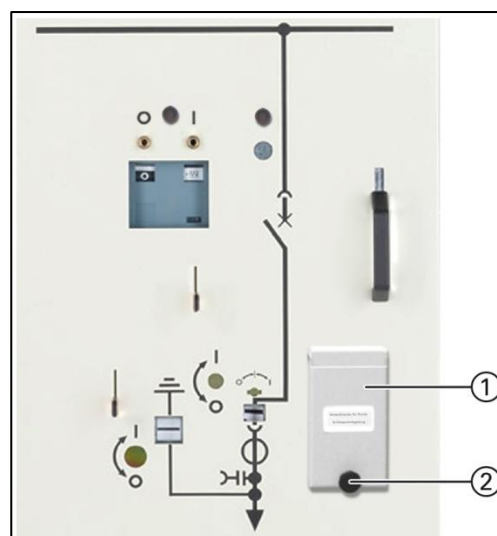
Key-operated interlocks allow interlocking or releasing associated operating functions depending on the state of the operated device. Key-operated interlocking is available for the following functions:

- If the withdrawable part / switching-device truck is racked to test position, racking it to service position can be interlocked by turning and removing the associated key.
- If the feeder earthing switch is in OPEN position, switching it to CLOSED position can be interlocked by turning and removing the associated key.
- If the feeder earthing switch is in CLOSED position, switching it to OPEN position can be interlocked by turning and removing the associated key.

The interlocked functions can be released again by reinserting the associated key, and subsequently turning it in opposite direction.

For customization, the interlocking options are available individually and can be combined at will. When operating the panel, it is possible to interlock two operating functions in combination: racking the withdrawable part / switching-device truck and changing the position of the feeder earthing switch. As the feeder earthing switch must always be either in CLOSED position or OPEN position, removing both associated keys simultaneously is not possible.

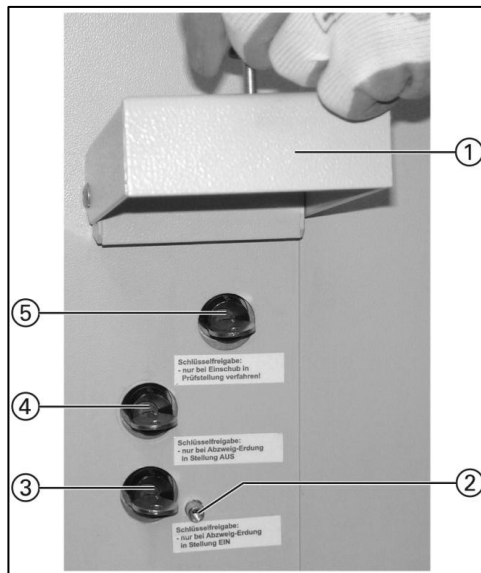
A cover protects the locks against accidental access. The cover is secured on the high-voltage door with a rotary button.



(1) Cover

(2) Rotary button to secure the cover

Fig. 474: Example: high-voltage door with key-operated interlocks protected by cover



(1) Cover, lifted

(2) Screw thread for rotary button

Key release:

(3) only when feeder earthing switch is in CLOSED position

Key release:

(4) only when feeder earthing switch is in OPEN position

Key release:

(5) only when withdrawable part / switching-device truck is racked to test position

Fig. 475: Example: cover lifted

### Operating the interlocks

#### Precondition

- High-voltage door closed

#### Procedure

⇒ Turn the rotary button counter-clockwise until it is possible to lift the cover.

⇒ To interlock an operating function, turn the associated key counter-clockwise as far as it will go (that is 180°), and remove it.

Example: The feeder earthing switch is in CLOSED position (2). To interlock switching to OPEN, turn the associated key (1) counter-clockwise as far as it will go, and remove it.

⇒ To release an interlocked function, insert the associated key, and turn it clockwise as far as it will go (that is 180°).

Example: The feeder earthing switch is in CLOSED position (2). To release switching to OPEN, insert the associated key (1) as far as it will go, and turn clockwise.

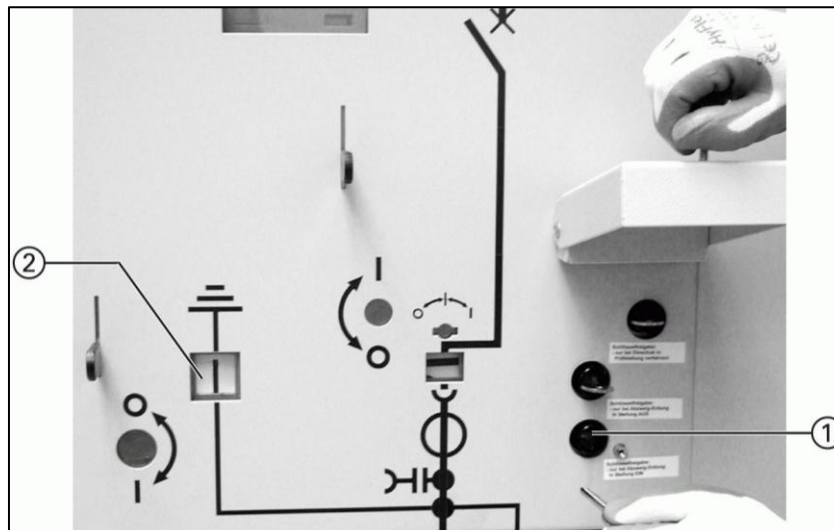


Fig. 476: Example: interlocking / releasing switching to OPEN

⇒ Lower the cover and secure it by turning the rotary button clockwise.

✓ The selected operating function is interlocked / released.

## 23.2 Key-operated interlocks for the busbar earthing switch

### Function and design

Key-operated interlocks are available for circuit-breaker and disconnecting panels. Access to the key of any interlock is given with closed door to the low-voltage compartment.

Key-operated interlocks allow interlocking or releasing the following operating functions:

- If the busbar earthing switch is in OPEN position, switching it to CLOSED position can be interlocked by turning and removing the associated key.
- If the busbar earthing switch is in CLOSED position, switching it to OPEN position can be interlocked by turning and removing the associated key.

An interlocked function can be released again by reinserting the associated key, and subsequently turning it in opposite direction.

For customization, the interlocking options are available individually. In case of two interlocks, removing both keys simultaneously is not possible because the busbar earthing switch must always be either in CLOSED position or OPEN position.

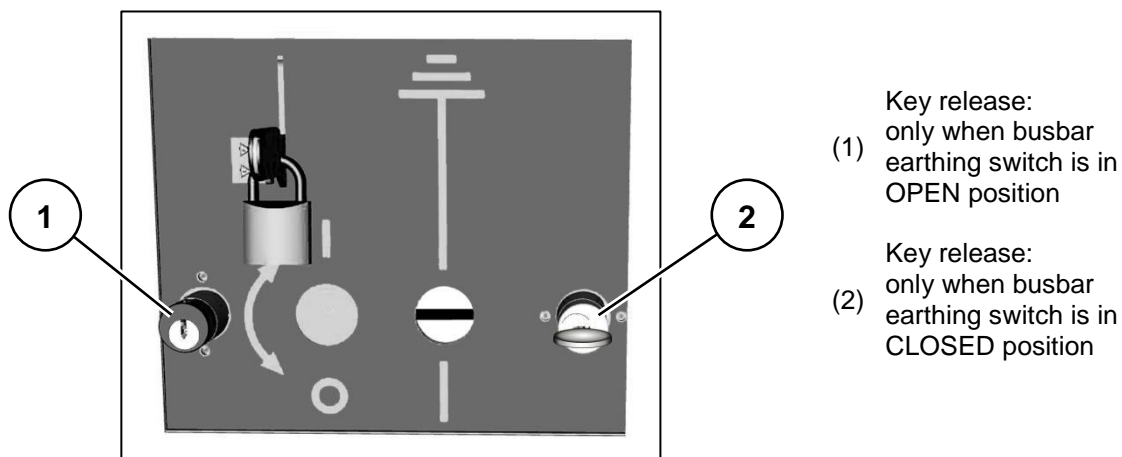


Fig. 477: Door to the low-voltage compartment with key-operated interlocks

## Key-operated interlocks

### Operating the interlocks

#### Precondition

- Door to the low-voltage compartment closed

#### Procedure

- ⇒ To interlock an operating function, turn the associated key counter-clockwise as far as it will go (that is 180°), and remove it.  
Example: The busbar earthing switch is in CLOSED position. To interlock switching to OPEN, turn the associated key counter-clockwise as far as it will go (1), and remove it (2).

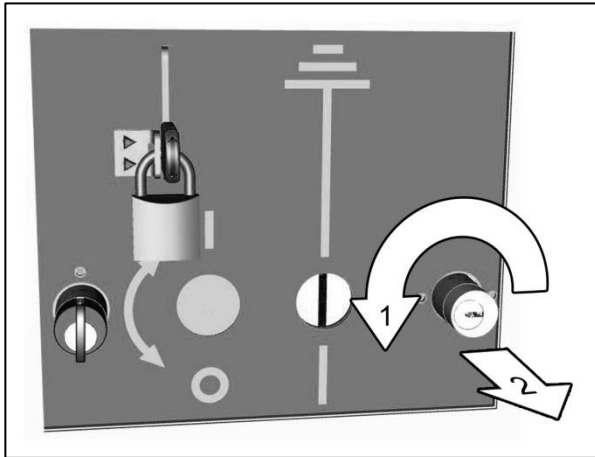


Fig. 478: Interlocking switching to OPEN

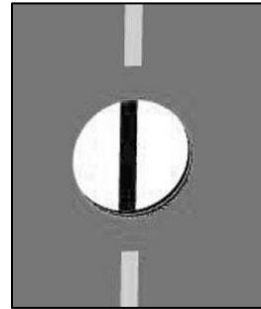


Fig. 479: Position indicator for busbar earthing switch: CLOSED

- ⇒ To release an interlocked function, insert the associated key, and turn it clockwise as far as it will go (that is 180°).  
Example: The busbar earthing switch is in CLOSED position. To release switching to OPEN, insert the associated key (1), and turn clockwise as far as it will go (2).

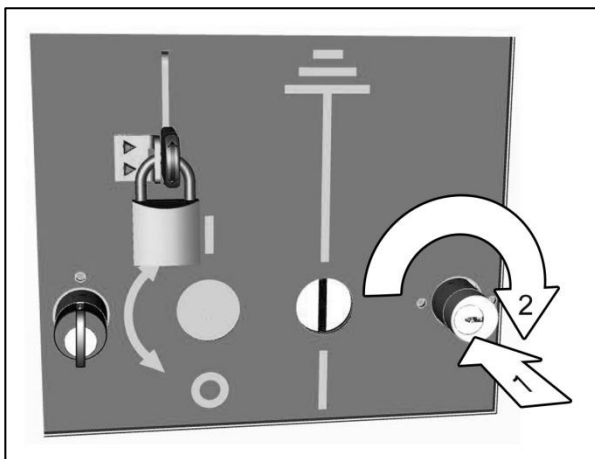


Fig. 480: Releasing switching to OPEN

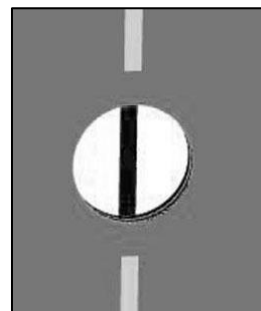


Fig. 481: Position indicator for busbar earthing switch: CLOSED

- ✓ The selected operating function is interlocked / released.

# Panels with motor operating mechanism control

## 24 Panels with motor operating mechanism control



### HINT

Read and understand these instructions before attempting operating works.

### 24.1 Overview of functionality

Circuit-breaker panels can optionally be equipped with motor operating mechanism control as an electrical operating mode (as opposed to manual operating mode) for the following functions:

- Racking the withdrawable circuit-breaker / circuit-breaker truck from test position to service position, and from service position to test position
- Switching the feeder earthing switch to CLOSED position or OPEN position
- Switching the busbar earthing switch to CLOSED position or OPEN position

#### Manual operation versus electrical operation

For the mentioned functions, manual operation and electrical operation can be operated independently from one another. Hence, any combination is possible:

Withdrawable circuit-breaker / circuit-breaker truck: Racking	Feeder earthing switch: Switching	Busbar earthing switch: Switching
Electrical or manual operation	Manual operation only	Manual operation only
Electrical or manual operation	Electrical or manual operation	
Manual operation only	Manual operation only	Electrical or manual operation
Manual operation only	Electrical or manual operation	

#### Central versus local control

All functions possible from the central control can also be operated locally at the panel, either manually or electrically. For safe and consistent operation, it is not possible to operate from the central control and locally at the same time. Depending on the design of the panel version, switching between local and central control is carried out in different ways, for example via a local-remote switch located on the door to the low-voltage compartment.



Fig. 482: Example of a local-remote switch

### Operating modes for racking the withdrawable circuit-breaker / circuit-breaker truck

For safe and consistent operation, it is not possible to rack the withdrawable circuit-breaker / circuit-breaker truck manually and electrically at the same time. This is ensured via two mechanisms.

First, the panel automatically blocks access for electrical operation when the control door (1) on the high-voltage door (2) is opened. To prevent accidentally blocking access for electrical operation, the control door has to be padlocked (3) when the panel is set to the electrical racking for normal operation. This measure also prevents accidentally stopping the motor, for example during an ongoing electrical racking procedure by opening the control door.

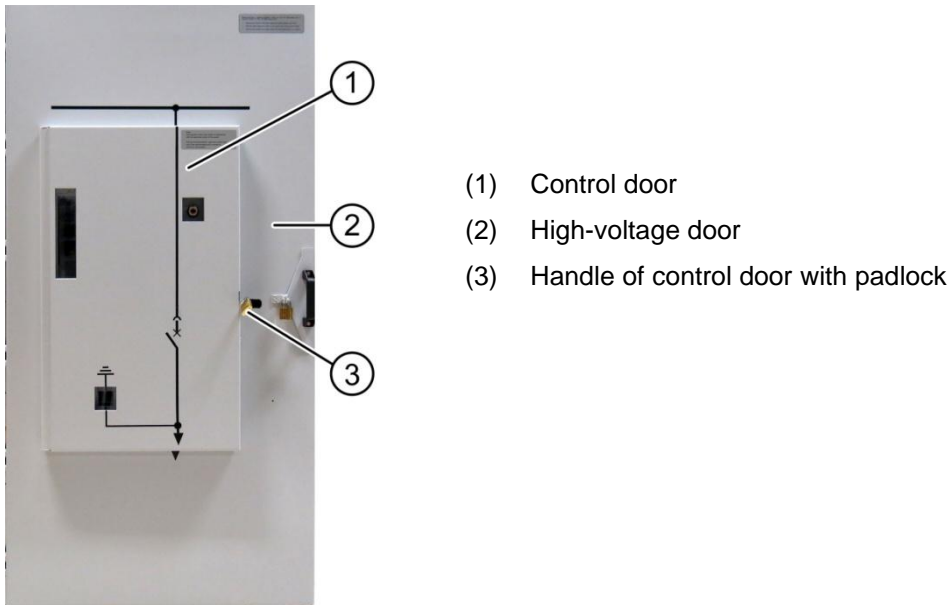


Fig. 483: Control door padlocked

Second, the user is required to select the appropriate access mode before racking manually or electrically. Once an access mode is selected, the mechanism blocks access for manual racking and releases access for electrical racking, and vice versa. However, it is important to stress: When access is released for electrical racking, it is not until the control door is closed that this operating mode becomes active. A third mode blocks any racking altogether as a precondition for opening the high-voltage door.

An indicator on the high-voltage door informs about the selected access mode:

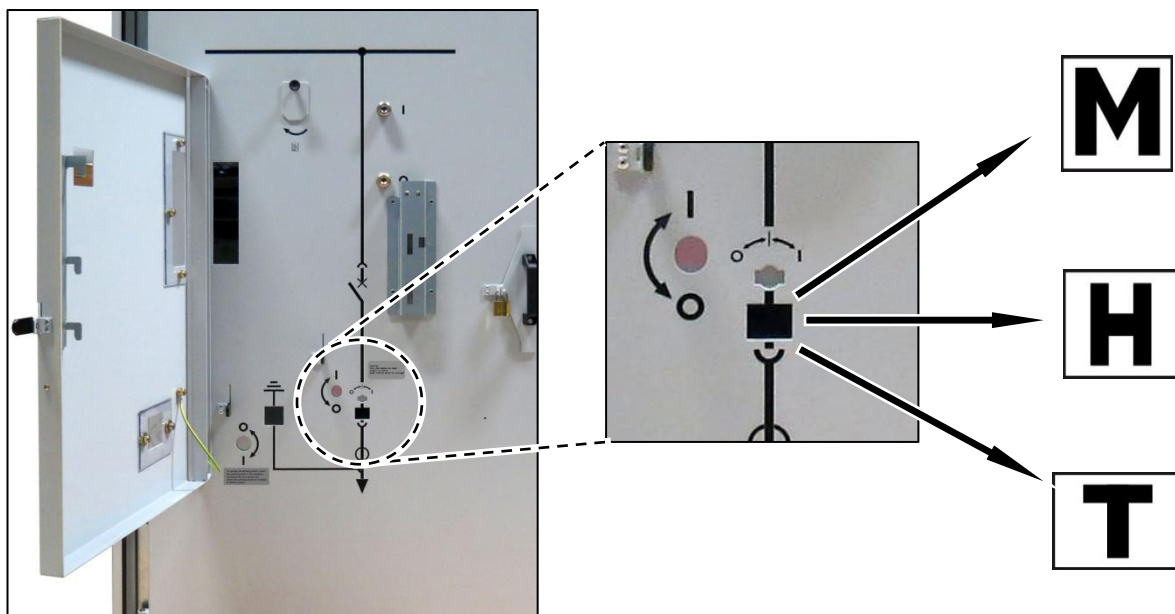





Fig. 484: Control door open, access mode indicator visible

Fig. 485: Access mode indicator for racking: possible indications

The following table gives an overview of the possible access mode indications, the corresponding operating options and their preconditions.

Indication	Access mode	Operating options
	Access is released for motor-operated racking	Racking the withdrawable circuit-breaker / circuit-breaker truck <b>electrically</b> from test position to service position, or from service position to test position
	<b>Preconditions for operating options:</b> <ul style="list-style-type: none"> <li>• Low-voltage connector plugged on</li> <li>• High-voltage door closed</li> <li>• Feeder earthing switch in OPEN position</li> <li>• Circuit-breaker in OPEN position</li> <li>• Control door closed and padlocked</li> <li>• Local or remote control</li> </ul>	
	Access is released for manual racking	Racking the withdrawable circuit-breaker / circuit-breaker truck <b>manually</b> from test position to service position, or from service position to test position
	<b>Preconditions for operating options:</b> <ul style="list-style-type: none"> <li>• High-voltage door closed</li> <li>• Feeder earthing switch in OPEN position</li> <li>• Circuit-breaker in OPEN position</li> <li>• Panel set to local control</li> <li>• Control door open</li> </ul>	
	Racking interlocked	<ul style="list-style-type: none"> <li>• Closing the control door</li> <li>• Opening the high-voltage door</li> <li>• Taking the withdrawable circuit-breaker / circuit-breaker truck out of the panel</li> </ul>
	<b>Preconditions for operating options:</b> <ul style="list-style-type: none"> <li>• Circuit-breaker in OPEN position</li> <li>• Withdrawable circuit-breaker / circuit-breaker truck in test position</li> <li>• Panel set to local control</li> </ul>	

## HINT

Blocking any racking operation is the precondition for opening the high-voltage door.



Before opening the high-voltage door, set the access mode indicator to "T".

## Panels with motor operating mechanism control

Several electrical interlocks support safe electrical operation:

Operating option	Preconditions for operating option	Electrical interlock
Racking the withdrawable circuit-breaker / circuit-breaker truck electrically	<ul style="list-style-type: none"> <li>Low-voltage connector plugged on</li> <li>High-voltage door closed</li> <li>Feeder earthing switch in OPEN position</li> <li>Circuit-breaker in OPEN position</li> <li>Access released for motor-operated racking</li> <li>Control door closed</li> </ul>	During an ongoing racking procedure, racking in opposite direction <b>is interlocked</b> electrically.
		During an ongoing racking procedure, opening / closing the circuit-breaker <b>is interlocked</b> electrically.
		During an ongoing racking procedure, opening / closing the feeder earthing switch <b>is interlocked</b> electrically.
Opening / closing the circuit-breaker electrically for testing purposes	<ul style="list-style-type: none"> <li>Low-voltage connector plugged on</li> <li>High-voltage door closed</li> <li>Control door closed</li> <li>Withdrawable circuit-breaker / circuit-breaker truck <b>in test position</b></li> </ul>	Opening / closing the circuit-breaker electrically for testing purposes is <b>not interlocked</b> electrically.
Opening / closing the circuit-breaker electrically during service	<ul style="list-style-type: none"> <li>Low-voltage connector plugged on</li> <li>High-voltage door closed</li> <li>Control door closed</li> <li>Withdrawable circuit-breaker / circuit-breaker truck <b>in service position</b></li> </ul>	Opening / closing the circuit-breaker electrically during service is <b>not interlocked</b> electrically.
Opening / closing the feeder earthing switch electrically for testing purposes	<ul style="list-style-type: none"> <li>Low-voltage connector plugged on</li> <li>High-voltage door closed</li> <li>Control door closed</li> <li>Withdrawable circuit-breaker / circuit-breaker truck <b>in test position</b></li> </ul>	Opening / closing the feeder earthing switch electrically for testing purposes is <b>not interlocked</b> electrically.
Closing the feeder earthing switch electrically during service	<ul style="list-style-type: none"> <li>Low-voltage connector plugged on</li> <li>High-voltage door closed</li> <li>Control door closed</li> <li>Withdrawable circuit-breaker / circuit-breaker truck <b>in service position</b></li> </ul>	Closing the feeder earthing switch electrically during service <b>is interlocked</b> electrically.

## 24.2 Opening the control door

**NOTICE****Conflicting operation**

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

**NOTICE****Maloperation**

Electrically racking the withdrawable circuit-breaker / circuit-breaker truck is only possible when both the high-voltage door **and** the control door are closed. If the control door is opened during an electrical racking procedure, the motor stops immediately.

⇒ Do **not** open the control door during an electrical racking procedure.

**Instruction label on control door**

In addition to these instructions, an instruction label provided on the control door informs about opening the control door.

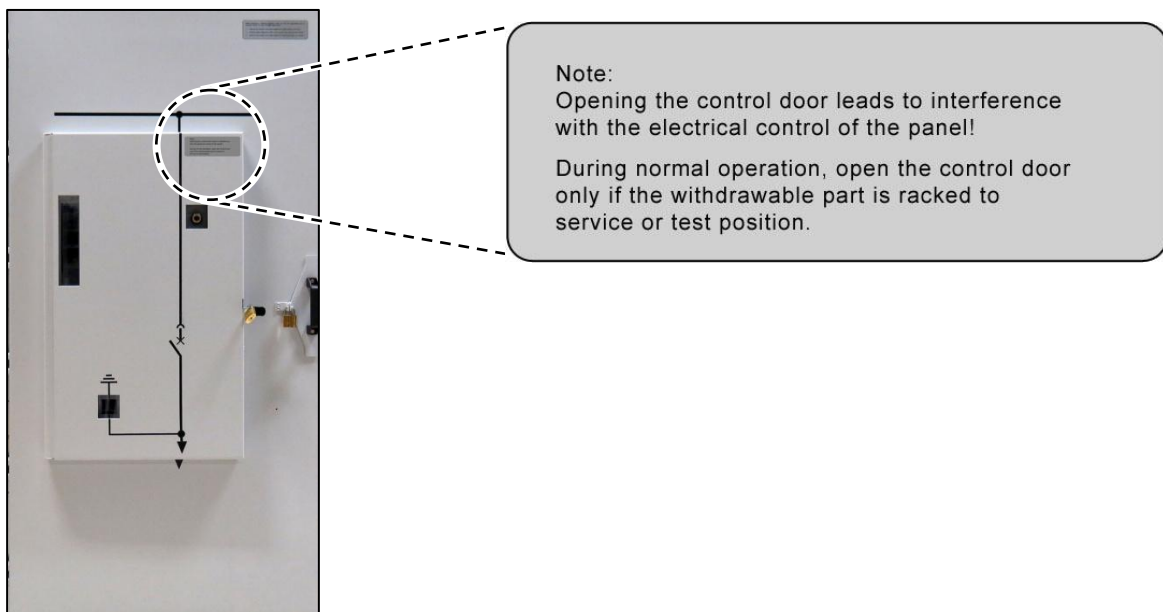


Fig. 486: High-voltage door: instruction label about opening the control door

## Panels with motor operating mechanism control

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Panel set to local control
- High-voltage door closed

### Procedure

- ⇒ Open the padlock at the control door and remove it.
- ⇒ Pull the handle of the control door upwards, and open the door to the left.

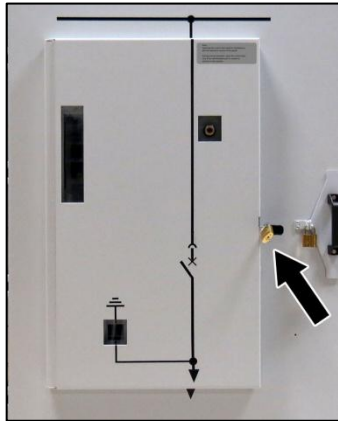


Fig. 487: Removing padlock from control door

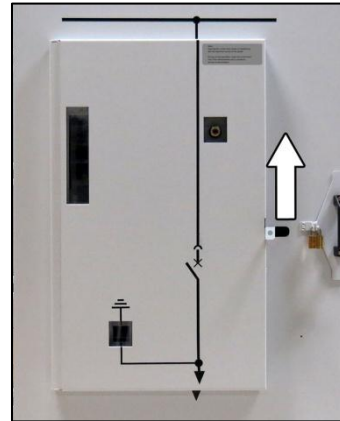


Fig. 488: Pulling handle upwards

✓ The control door is open.

### 24.3 Closing the control door

#### NOTICE

##### Maloperation

The panel automatically blocks electrical racking when the control door is opened.

- ⇒ To prevent accidentally blocking access for electrical racking by opening the control door, padlock the control door immediately after closing it.

### Preconditions

- High-voltage door open or closed
- Padlock for control door available

### Procedure

- ⇒ Pull the handle upwards and hold it.
- ⇒ Press the control door totally against the high-voltage door.
- ⇒ Push the handle downwards as far as it will go.

⇒ Fit a padlock to the control door and close it.

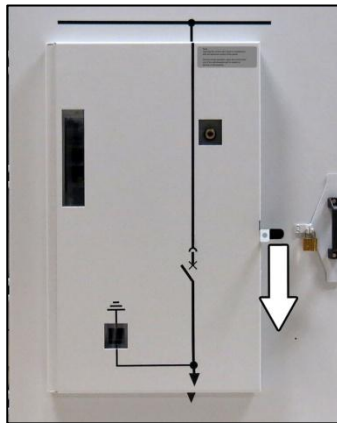


Fig. 489: Pushing handle downwards

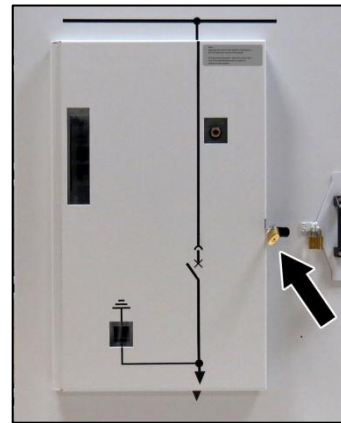


Fig. 490: Control door padlocked

✓ The control door is closed.

## 24.4 Selecting manual operation for racking

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

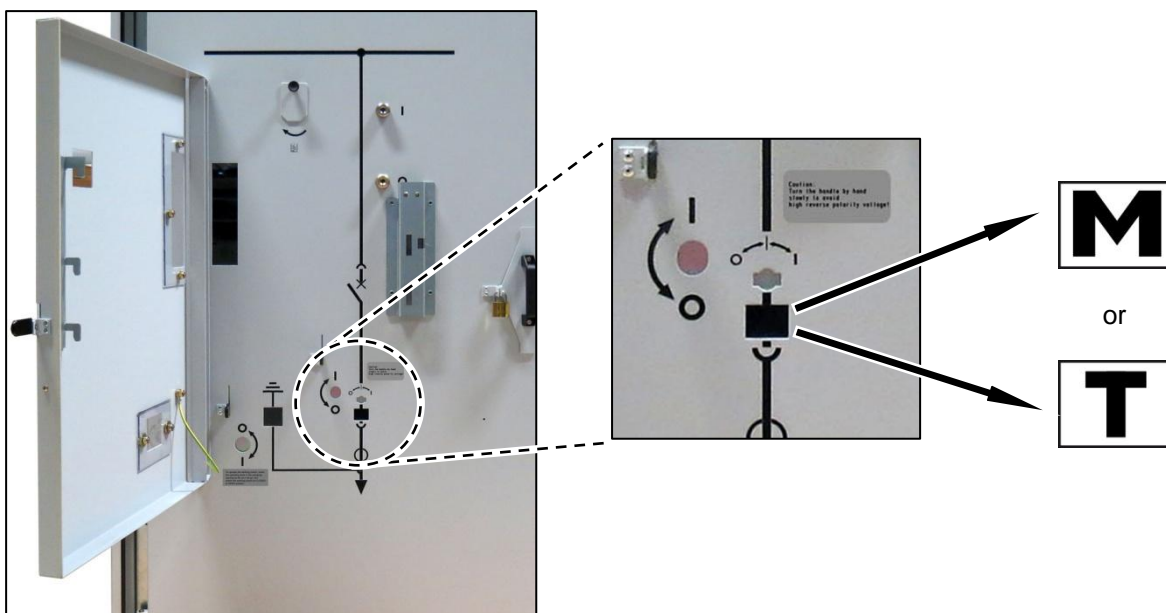


Fig. 491: Access mode indicator for racking: starting point "M" or "T"

## Panels with motor operating mechanism control

### Preconditions

- Feeder earthing switch in OPEN position
- Circuit-breaker in OPEN position
- Panel set to local control
- Control door open
- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated
- Access mode indicator shows "M" or "T"

### Procedure

⇒ To release the actuating opening for the double-bit key, lift the operating slide (1) and hold it.

⇒ Insert the double-bit key (2).

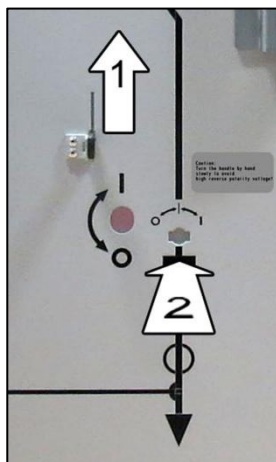
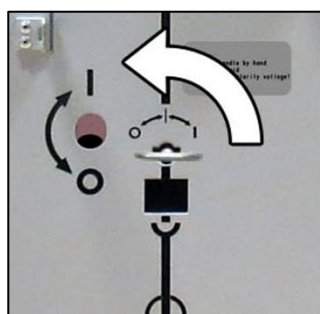


Fig. 492: Lifting the operating slide and inserting the key

⇒ To release manual access to the withdrawable circuit-breaker / circuit-breaker truck, turn the double-bit key until the operating mode indicator changes to "H":

- To change from "M" to "H" turn 90° counter-clockwise
- To change from "T" to "H" turn 90° clockwise



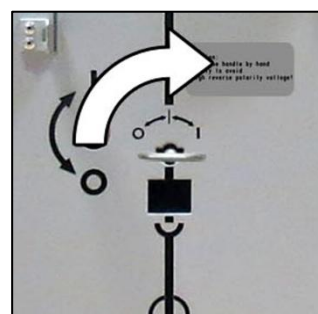
from

**M**

to

**H**

Fig. 493: Turning the key counter-clockwise



from

**T**

to

**H**

Fig. 494: Turning the key clockwise

## HINT

### Final procedure steps

- ⇒ Next, insert the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.

✓ Racking the withdrawable circuit-breaker / circuit-breaker truck is set to manual operation.

## 24.5 Selecting electrical operation for racking

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

## HINT

Electrical racking is only possible when both the high-voltage door **and** the control door are closed.

- ⇒ After releasing electrical access to the withdrawable circuit-breaker / circuit-breaker truck, close the control door and padlock it.

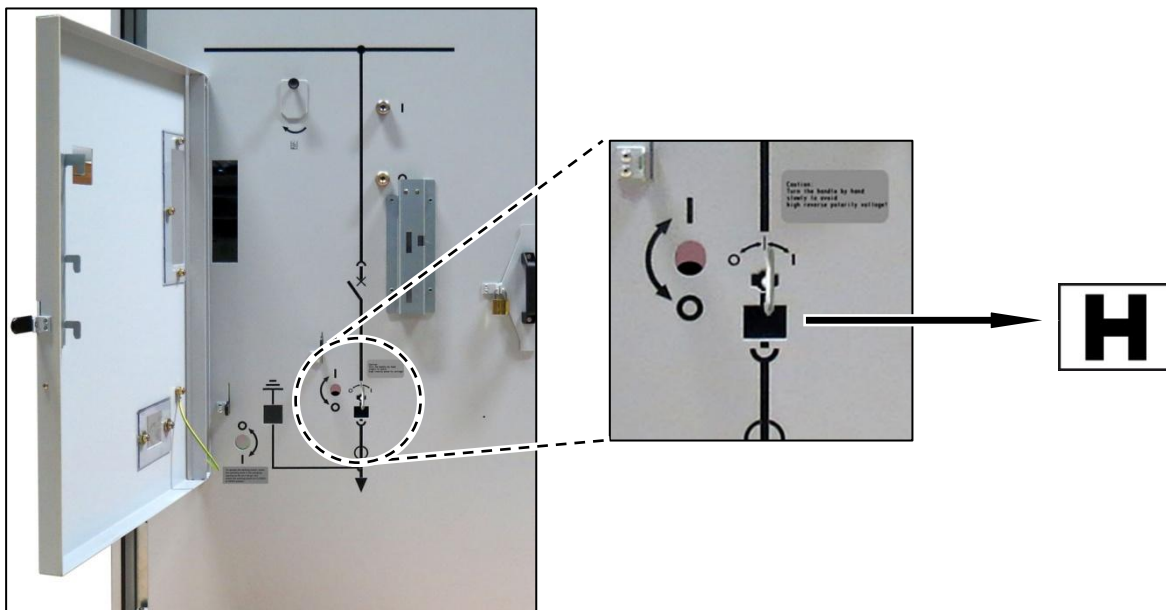


Fig. 495: Access mode indicator for racking: starting point "H"

## Panels with motor operating mechanism control

### Preconditions

- Feeder earthing switch in OPEN position
- Circuit-breaker in OPEN position
- Panel set to local control
- Control door open
- Withdrawable circuit-breaker / circuit-breaker truck in service position or in test position
- Double-bit key for selecting racking mode inserted and access mode indicator shows "H"

### Procedure

- ⇒ To release electrical access to the withdrawable circuit-breaker / circuit-breaker truck, turn the double-bit key 90° clockwise until the operating mode indicator changes to "M".

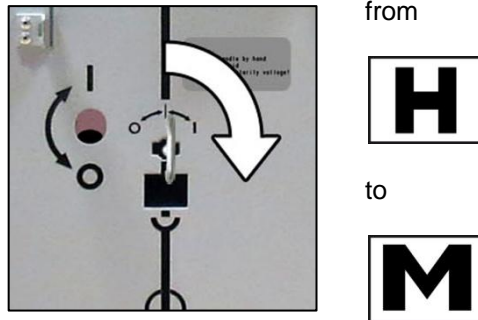


Fig. 496: Turning the key clockwise

- ⇒ Remove the double-bit key and push the operating slide downwards as far as it will go.
- ⇒ Close the control door.
- ⇒ Fit a padlock to the control door and close the padlock.
- ✓ Racking the withdrawable circuit-breaker / circuit-breaker truck is set to electrical operation.

## 24.6 Selecting interlocking

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

### HINT

Blocking any racking operation is the precondition for opening the high-voltage door.

- ⇒ Before opening the high-voltage door, set the access mode indicator to "T".

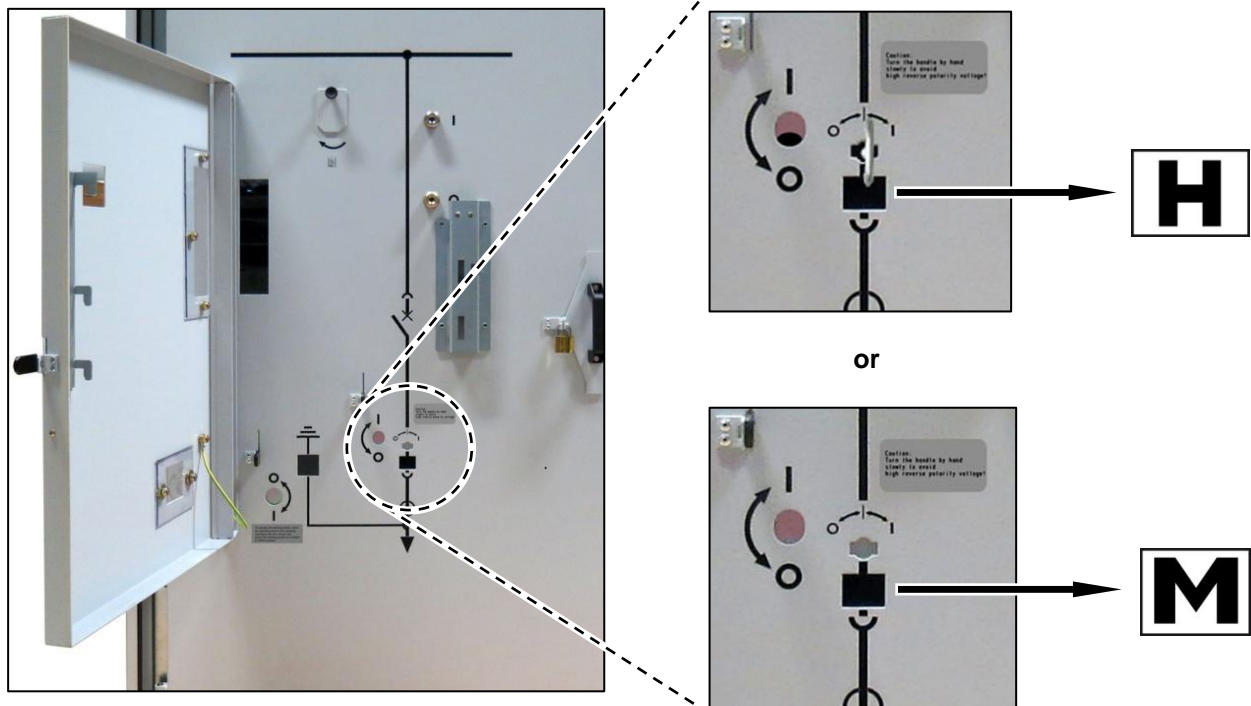


Fig. 497: Access mode indicator for racking: starting point "H" or "M"

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Panel set to local control
- Control door open
- Feeder earthing switch in OPEN position
- Access mode indicator shows "M", or double-bit key for selecting racking mode inserted and access mode indicator shows "H"
- For electromagnetic interlock (optional):
  - Electromagnetic interlock deactivated

#### Procedure

If the access mode indicator shows "M" and the double-bit key is not inserted, insert it:

- ⇒ To release the actuating opening for the double-bit key, lift the operating slide (1) and hold it.
- ⇒ Insert the double-bit key (2).

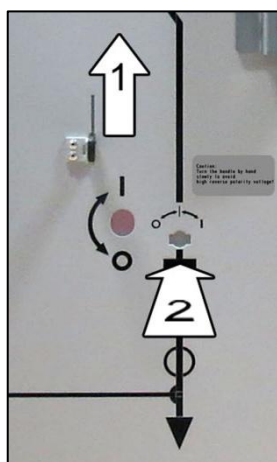
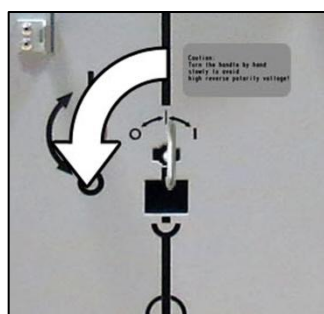


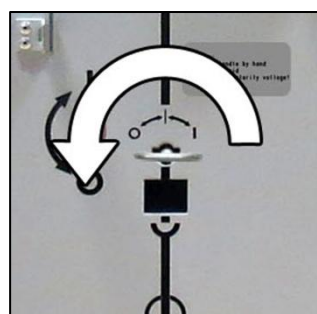
Fig. 498: Lifting the operating slide and inserting the key: starting point "M"

- ⇒ To block any access to the withdrawable circuit-breaker / circuit-breaker truck, turn the double-bit key until the operating mode indicator changes to "T":
- To change from "H" to "T" turn 90° counter-clockwise
  - To change from "M" to "T" turn 180° counter-clockwise



from  
**H**  
to  
**T**

Fig. 499: Turning the key 90° counter-clockwise



from  
**M**  
to  
**T**

Fig. 500: Turning the key 180° counter-clockwise

- ⇒ Remove the double-bit key and push the operating slide downwards as far as it will go.
- ⇒ Close the control door.
- ⇒ Fit a padlock to the control door and close the padlock.

### HINT

#### Final procedure steps

- ⇒ You may now open the high-voltage door and take the withdrawable circuit-breaker / circuit-breaker truck out of the panel.

### HINT

When the control door is closed, the access mode indicator for the withdrawable circuit-breaker / circuit-breaker truck is covered.

- ⇒ If required, open the control door to read the indicator.

- ✓ Racking the withdrawable circuit-breaker / circuit-breaker truck is blocked.

## 24.7 Racking the withdrawable circuit-breaker / circuit-breaker truck to service position manually

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

**NOTICE****Maloperation**

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check if the circuit-breaker is in OPEN position.
- ⇒ If required, switch the circuit-breaker to OPEN position before racking.

**NOTICE****Maloperation**

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the feeder earthing switch is in OPEN position.

- ⇒ Check if the feeder earthing switch is in OPEN position.
- ⇒ If required, switch the feeder earthing switch to OPEN position before racking.

**NOTICE****Incorrect stress of the motor operating mechanism**

When the withdrawable circuit-breaker / circuit-breaker truck is racked manually, the motor operating mechanism is also turned via the wheel chain mechanism.

- ⇒ Turn the racking crank slowly and uniformly to avoid high reverse polarity voltage.

**NOTICE****Maloperation**

All interlocks are only released when the withdrawable circuit-breaker / circuit-breaker truck is in a stable end position.

- ⇒ Rack the withdrawable circuit-breaker / circuit-breaker truck absolutely until end position.

**NOTICE****Maloperation**

The panel automatically blocks electrical racking when the control door is opened.

- ⇒ To prevent accidentally blocking access for electrical racking by opening the control door, padlock the control door immediately after closing it.

### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.

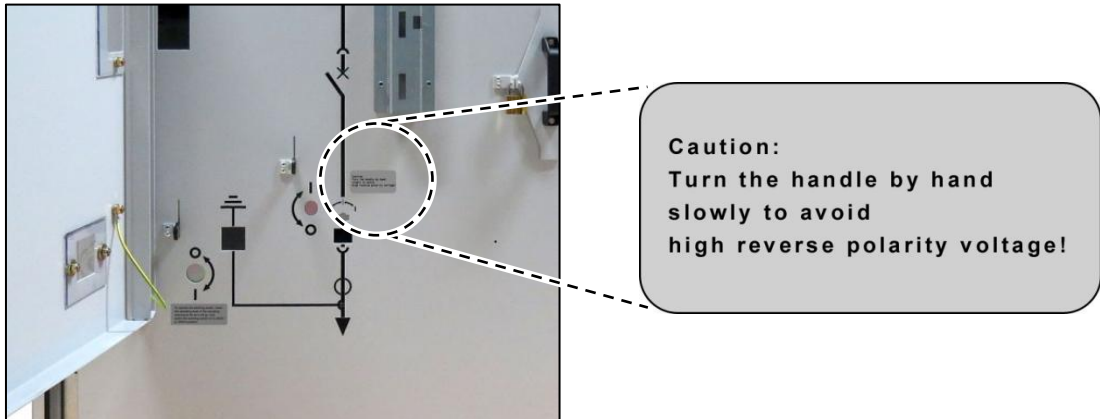


Fig. 501: High-voltage door: instruction label about operation of racking crank

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Low-voltage connector plugged on
- High-voltage door closed
- Feeder earthing switch in OPEN position
- Circuit-breaker in OPEN position
- Panel set to local control
- Control door open
- Double-bit key for selecting racking mode inserted and access mode indicator shows "H"

### Procedure

- ⇒ To open the actuating opening for racking, lift the operating slide as far as it will go and hold it.
- ⇒ Push the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck onto the operating shaft, and turn clockwise as far as it will go.

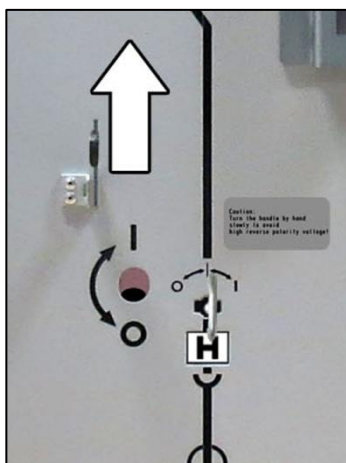


Fig. 502: Lifting the operating slide

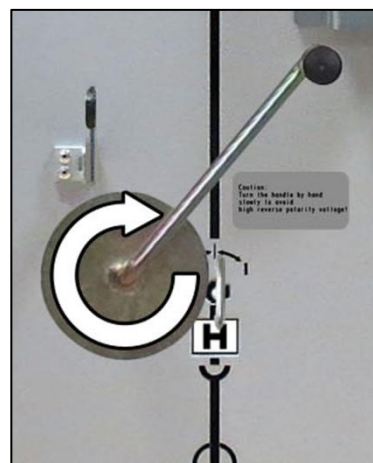


Fig. 503: Turning the racking crank clockwise

- ⇒ Remove the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.

- ⇒ Turn the double-bit key clockwise as far as it will go to block manual access and release electrical racking. The operating mode indicator changes to "M".

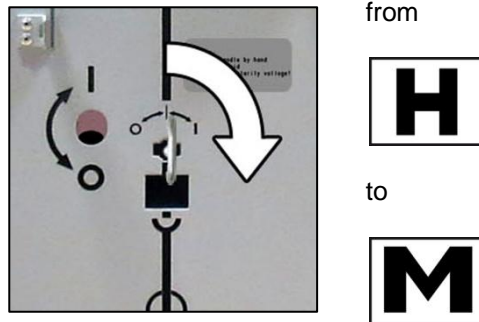


Fig. 504: Turning key clockwise

- ⇒ Remove the double-bit key.
- ⇒ To close the actuating opening, push the operating slide down as far as it will go.
- ⇒ Close the control door.
- ⇒ Fit a padlock to the control door and close the padlock.
- ✓ The withdrawable circuit-breaker / circuit-breaker truck has been manually racked from test position to service position.

### 24.8 Racking the withdrawable circuit-breaker / circuit-breaker truck to service position electrically

#### NOTICE

##### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check if the circuit-breaker is in OPEN position.
- ⇒ If required, switch the circuit-breaker to OPEN position before racking.

#### NOTICE

##### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the feeder earthing switch is in OPEN position.

- ⇒ Check if the feeder earthing switch is in OPEN position.
- ⇒ If required, switch the feeder earthing switch to OPEN position before racking.

### NOTICE

#### Maloperation

Electrically racking the withdrawable circuit-breaker / circuit-breaker truck is only possible when both the high-voltage door **and** the control door are closed. If the control door is opened during an electrical racking procedure, the motor stops immediately.

⇒ Do **not** open the control door during an electrical racking procedure.

### NOTICE

#### Conflicting operation

Racking the withdrawable circuit-breaker / circuit-breaker truck electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in test position
- Low-voltage connector plugged on
- High-voltage door closed
- Feeder earthing switch in OPEN position
- Circuit-breaker in OPEN position
- Remote or local control
- Control door closed and padlocked
- Access mode indicator for racking shows "M"

#### Procedure

- ⇒ Rack the withdrawable circuit-breaker / circuit-breaker truck electrically to service position either locally or from the central control.
- ✓ The withdrawable circuit-breaker / circuit-breaker truck has been electrically racked from test position to service position.

## 24.9 Racking the withdrawable circuit-breaker / circuit-breaker truck to test position manually

**NOTICE****Conflicting operation**

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

**NOTICE****Maloperation**

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check if the circuit-breaker is in OPEN position.
- ⇒ If required, switch the circuit-breaker to OPEN position before racking.

**NOTICE****Incorrect stress of the motor operating mechanism**

When the withdrawable circuit-breaker / circuit-breaker truck is racked manually, the motor operating mechanism is also turned via the wheel chain mechanism.

- ⇒ Turn the racking crank slowly and uniformly to avoid high reverse polarity voltage.

**NOTICE****Maloperation**

All interlocks are only released when the withdrawable circuit-breaker / circuit-breaker truck is in a stable end position.

- ⇒ Rack the withdrawable circuit-breaker / circuit-breaker truck absolutely until end position.

**NOTICE****Maloperation**

The panel automatically blocks electrical racking when the control door is opened.

- ⇒ To prevent accidentally blocking access for electrical racking by opening the control door, padlock the control door immediately after closing it.

### Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.

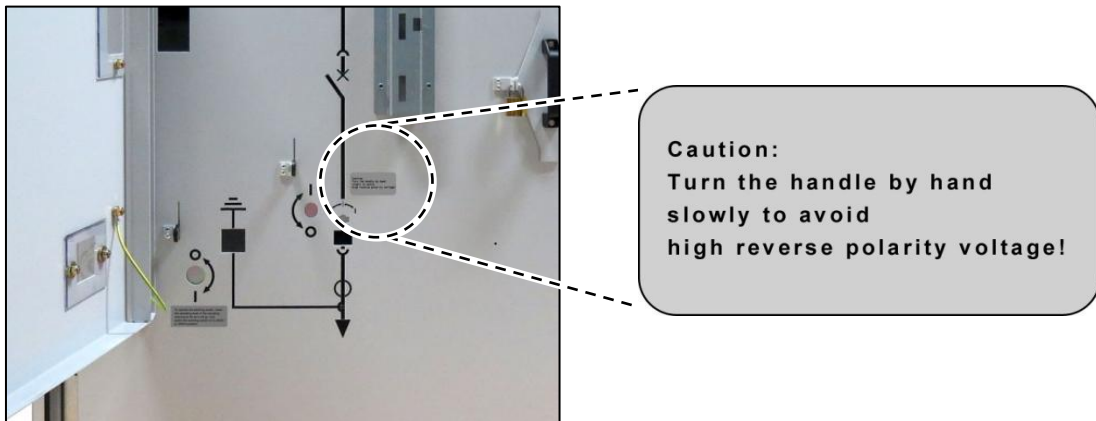


Fig. 505: High-voltage door: instruction label about operation of racking crank

### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position
- Circuit-breaker in OPEN position
- Panel set to local control
- Control door open
- Double-bit key for selecting racking mode inserted and access mode indicator shows "H"

### Procedure

- ⇒ To open the actuating opening for racking, lift the operating slide as far as it will go and hold it.
- ⇒ Push the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck onto the operating shaft, and turn counter-clockwise as far as it will go.

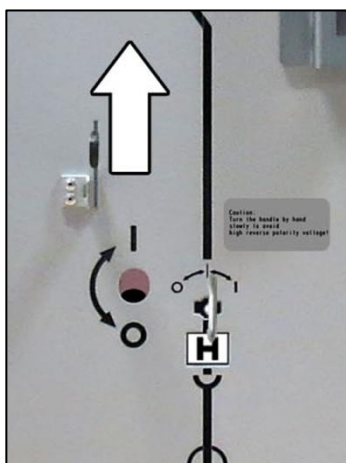


Fig. 506: Lifting the operating slide

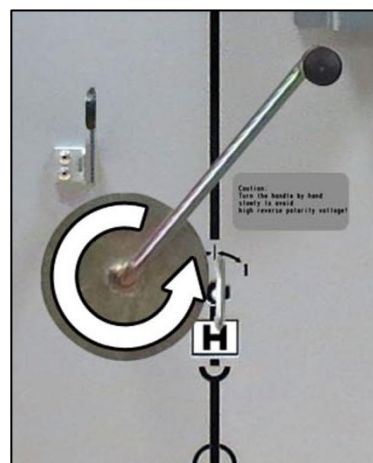


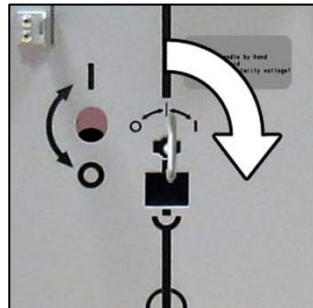
Fig. 507: Turning the racking crank counter-clockwise

- ⇒ Remove the racking crank for moving the withdrawable circuit-breaker / circuit-breaker truck.

Depending on the access mode intended, turn the double-bit key until the operating mode indicator changes to "M" or to "T":



- To release electrical access to the withdrawable circuit-breaker / circuit-breaker truck, change from "H" to "M" by turning 90° clockwise.
- To block any access to the withdrawable circuit-breaker / circuit-breaker truck, change from "H" to "T" by turning 90° counter-clockwise.



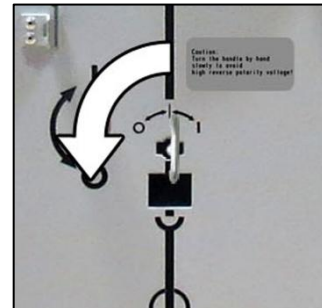
from



to



Fig. 508: Turning key clockwise



from



to



Fig. 509: Turning key counter-clockwise



Remove the double-bit key.



To close the actuating opening, push the operating slide down as far as it will go.



Close the control door.



Fit a padlock to the control door and close the padlock.



The withdrawable circuit-breaker / circuit-breaker truck has been manually racked from service position to test position.

### HINT

#### Final procedure steps



If "T" is selected, you may now open the high-voltage door and take the withdrawable circuit-breaker / circuit-breaker truck out of the panel.



Otherwise, you may now go on to close the circuit-breaker electrically for testing purpose.

### 24.10 Racking the withdrawable circuit-breaker / circuit-breaker truck to test position electrically

#### NOTICE

##### Maloperation

Racking the withdrawable circuit-breaker / circuit-breaker truck is only permissible if the circuit-breaker is in OPEN position.

- ⇒ Check if the circuit-breaker is in OPEN position.
- ⇒ If required, switch the circuit-breaker to OPEN position before racking.

#### NOTICE

##### Maloperation

Electrically racking the withdrawable circuit-breaker / circuit-breaker truck is only possible when both the high-voltage door **and** the control door are closed. If the control door is opened during an electrical racking procedure, the motor stops immediately.

- ⇒ Do **not** open the control door during an electrical racking procedure.

#### NOTICE

##### Conflicting operation

Racking the circuit-breaker / circuit-breaker truck electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

#### Preconditions

- Withdrawable circuit-breaker / circuit-breaker truck in service position
- Circuit-breaker in OPEN position
- Remote or local control
- Control door closed and padlocked
- Access mode indicator for racking shows "M"

#### Procedure

- ⇒ Rack the withdrawable circuit-breaker / circuit-breaker truck electrically to test position either locally or from the central control.
- ✓ The withdrawable circuit-breaker / circuit-breaker truck has been electrically racked from service position to test position.

## 24.11 Opening the circuit-breaker manually

Opening the circuit-breaker manually is carried out by pushing a rod through an actuating opening in the high-voltage door, thereby operating the OFF pushbutton underneath the high-voltage door. This can be done with the control door either open or closed. When the control door is closed, the push rod is inserted through an opening in the control door (2). The indicator for the circuit-breaker position can be seen through an inspection window (1).

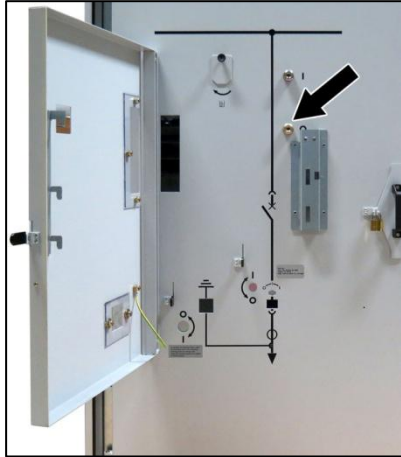


Fig. 510: High-voltage door:  
actuating opening for  
opening the circuit-breaker  
manually

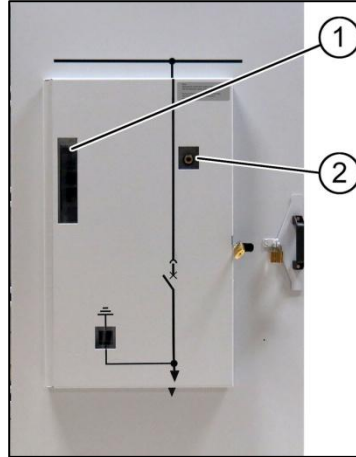


Fig. 511: Control door

- (1) Inspection window for  
CLOSED/OPEN  
indicator of the circuit-  
breaker
- (2) Actuating opening for  
opening the circuit-  
breaker

### NOTICE

#### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

The procedure for opening the circuit-breaker manually in panels with motor operating mechanism control is identical with the procedure in panels without motor operating mechanism control.

⇒ For opening the circuit-breaker manually, see chapter 10.13.

### 24.12 Closing the circuit-breaker manually

Closing the circuit-breaker manually is carried out by pushing a rod through an actuating opening in the high-voltage door, thereby operating the ON pushbutton underneath the high-voltage door. In contrast to manually opening the circuit-breaker, closing is only possible when the control door is open. However, the indicator for the circuit-breaker position can still be seen through an inspection window after closing the control door.

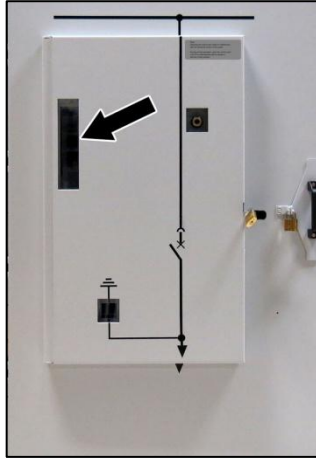


Fig. 512: Control door:  
inspection window for  
CLOSED/OPEN indicator of the  
circuit-breaker

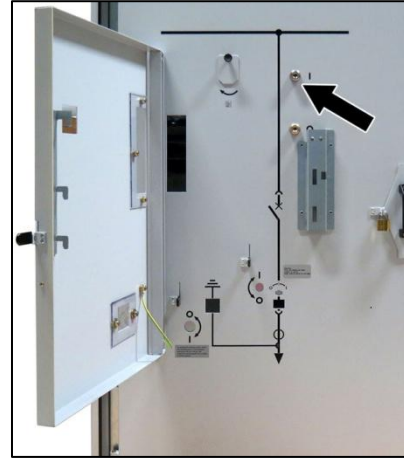


Fig. 513: High-voltage door:  
actuating opening for  
closing the circuit-breaker  
manually

#### NOTICE

##### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.



For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

#### NOTICE

##### Covered control elements

For safety reasons, the actuating opening for closing the circuit-breaker is covered by the control door.



Open the control door to uncover the actuating opening on the high-voltage door.

The procedure for closing the circuit-breaker manually in panels with motor operating mechanism control is identical with the procedure in panels without motor operating mechanism control.

⇒ For closing the circuit-breaker manually, see chapter 10.12.

### 24.13 Charging / discharging the spring energy store manually

Charging the spring energy store manually is carried out by inserting a hand crank through an actuating opening in the high-voltage door, and turning it subsequently. Discharging can only be done manually. It is carried out by pushing a rod alternately through the actuating openings for opening / closing the circuit-breaker.

Charging and discharging manually can only be carried out when the control door is open. However, the indicators for the circuit-breaker position and the closing spring state can still be seen through an inspection window after closing the control door.

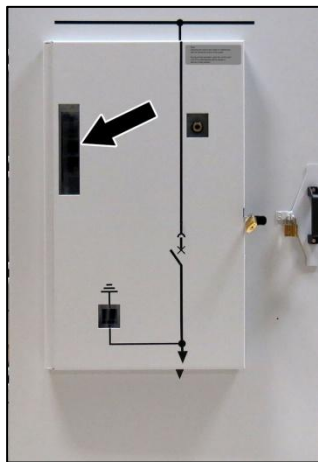


Fig. 514: Control door:  
inspection window for  
circuit-breaker position  
and closing spring  
state

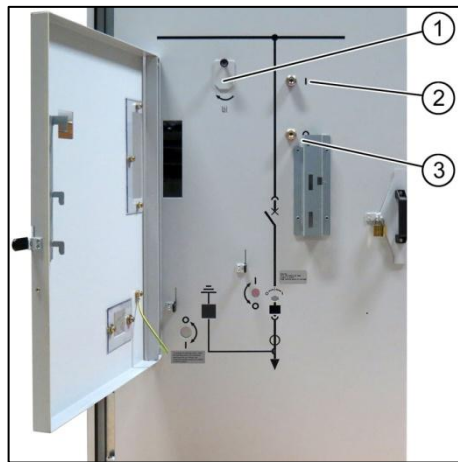


Fig. 515: High-voltage door:  
actuating openings for charging / discharging  
the spring energy store manually

- (1) Opening for charging the spring energy store in the circuit-breaker manually (covered)
- (2) Actuating opening for closing the circuit-breaker
- (3) Actuating opening for opening the circuit-breaker

## NOTICE

### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

## NOTICE

### Covered control elements

For safety reasons, some of the actuating openings involved in charging / discharging the spring energy store are covered by the control door.

⇒ Open the control door to uncover the actuating openings on the high-voltage door.

## Panels with motor operating mechanism control

The procedures for charging / discharging the spring energy store manually in panels with motor operating mechanism control are identical with the procedures in panels without motor operating mechanism control.

⇒ For charging / discharging the spring energy store manually, see chapters 10.15 and 10.16.

### 24.14 Earthing / de-earthing the feeder manually

Earthing / de-earthing the feeder manually is carried out by inserting a lever through an actuating opening in the high-voltage door, and turning it subsequently. Depending on the turning direction, the feeder earthing switch in the connection compartment is set to either CLOSED (= earthed) position or OPEN (= de-earthed) position.

Earthing / de-earthing the feeder manually can only be carried out when the control door is open. However, the indicator for the feeder earthing switch position can still be seen through an inspection window after closing the control door.

The moving space when turning is restricted by the opened control door. The turning movements must be kept well within the safe area.

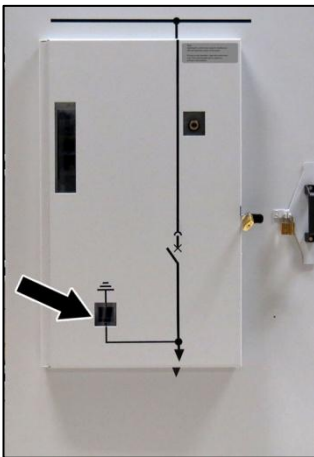


Fig. 516: Control door:  
inspection window for feeder earthing switch position

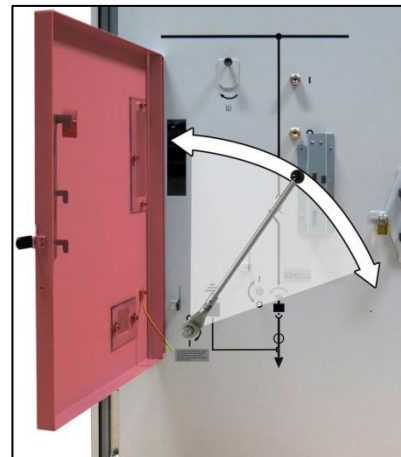


Fig. 517: Safe area for turning movements

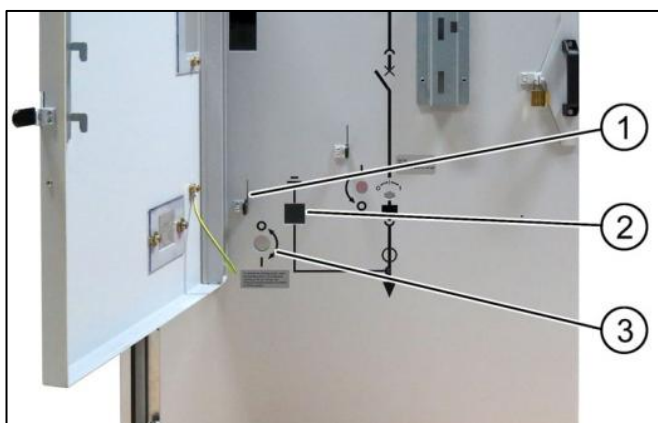


Fig. 518: High-voltage door:  
control elements for feeder earthing switch

- (1) Operating slide for opening and closing the actuating opening for operating the feeder earthing switch
- (2) Mechanical position indicator for feeder earthing switch
- (3) Actuating opening for operating the feeder earthing switch

## Instruction label on high-voltage door:

In addition to these instructions, an instruction label on the high-voltage door informs about proper operation of the operating lever for the feeder earthing switch.

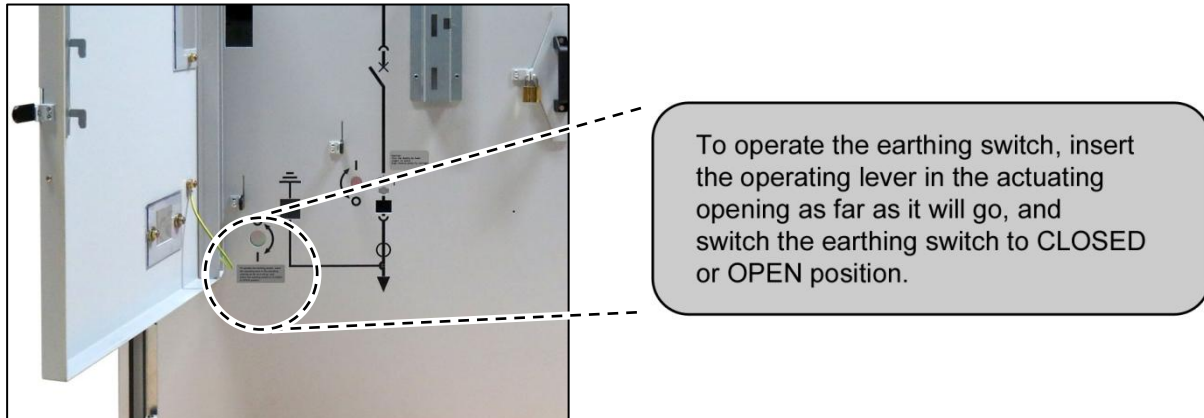


Fig. 519: High-voltage door: instruction label about operation of feeder earthing switch

## **⚠ CAUTION**

### **Restricted moving space**

The moving space when turning the lever is restricted by the opened control door.

⇒ For turning the operating lever, place yourself on the right side of the panel. Stop each turning movement well within the safe area.

## **NOTICE**

### **Conflicting operation**

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.

## **NOTICE**

### **Covered control elements**

For safety reasons, the actuating opening for earthing / de-earthing the feeder is covered by the control door.

⇒ Open the control door to uncover the actuating opening on the high-voltage door.

### HINT

Earthing the feeder is only permissible if the withdrawable circuit-breaker / circuit-breaker truck is in test position.

When earthing the feeder in this way, the position of the circuit-breaker is not significant: The feeder may be earthed while the circuit-breaker is in OPEN position or CLOSED position.

The procedures for earthing / de-earthing the feeder manually in panels with motor operating mechanism control are identical with the procedures in panels without motor operating mechanism control.

⇒ For earthing / de-earthing the feeder manually, see chapters 10.17, 10.18 and 10.19.

### 24.15 Earthing / de- earthing the feeder electrically

#### NOTICE

##### Maloperation

Earthing / de-earthing the feeder electrically is only possible when both the high-voltage door **and** the control door are closed.

⇒ Close the control door before earthing / de-earthing the feeder electrically.

#### NOTICE

##### Conflicting operation

Earthing / de-earthing the feeder electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

### HINT

Earthing the feeder is only permissible if the withdrawable circuit-breaker / circuit-breaker truck is in test position.

When earthing the feeder in this way, the position of the circuit-breaker is not significant: the feeder may be earthed while the circuit-breaker is in OPEN position or CLOSED position.

#### Preconditions

- Low-voltage connector plugged on
- High-voltage door closed
- Feeder to be earthed isolated
- Control door closed
- Remote or local control
- Withdrawable circuit-breaker / circuit-breaker truck in test position

**Procedure**

⇒ Set the feeder earthing switch to OPEN or CLOSED either locally or from the central control.

**24.16 Earthing / de-earthing the busbar system manually**

Earthing / de-earthing the busbar system manually is carried out by inserting a lever through an actuating opening in the door to the low-voltage compartment, and turning it subsequently. Depending on the turning direction, the busbar earthing switch in the busbar compartment is set to either CLOSED (= earthed) position or OPEN (= de-earthed) position.

**NOTICE****Conflicting operation**

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ For any local operations – manual or electrical – set the panel to local control, for example by switching the local-remote switch to LOCAL position.

The procedures for earthing / de-earthing the busbar system manually in panels with motor operating mechanism control are identical with the procedures in panels without motor operating mechanism control.

⇒ For earthing / de-earthing the busbar system manually, see chapter 19.

**24.17 Earthing / de- the busbar system electrically****NOTICE****Conflicting operation**

Earthing / de-earthing the busbar system electrically is possible locally or from a central control. The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

⇒ Depending on the intended operating mode, set the panel to either local or remote control (for example by switching the local-remote switch).

**Preconditions**

- Remote or local control
- If a withdrawable circuit-breaker / circuit-breaker truck is inserted in the panel:
  - Withdrawable circuit-breaker / circuit-breaker truck in test position
  - Low-voltage connector plugged on

**Procedure**

⇒ Set the feeder busbar earthing switch to OPEN or CLOSED either locally or from the central control.

### 24.18 Further operating options

#### NOTICE

##### Conflicting operation

The requirement of setting the panel to either local or remote control prevents operating the panel locally and centrally at the same time.

- ⇒ For any local operations — manual or electrical — set the panel to local control, for example by switching the local-remote switch to LOCAL position.
- ⇒ For any central operations set the panel to remote control.

#### NOTICE

##### Covered control elements

For safety reasons, some of the control elements on the high-voltage door are covered by the control door.

- ⇒ If required, open the control door to uncover the control elements on the high-voltage door.

#### HINT

Blocking any racking operation is the precondition for opening the high-voltage door.

- ⇒ Before opening the high-voltage door, set the access mode indicator to "T".

For any operating options concerning circuit-breaker panels with motor operating mechanism control that have not been described in the chapters 24.1 to 24.17, see the relevant chapters in these Operating Instructions, in particular:

- Opening the high-voltage door, chapter 10.4
- Closing the high-voltage door, chapter 10.5
- Closing the circuit-breaker, chapter 10.10
- Opening the circuit-breaker, chapter 10.11
- Removing the low-voltage connector, chapter 10.20
- Plugging on the low-voltage connector, chapter 10.21
- Taking the withdrawable circuit-breaker out of the panel, chapter 10.22
- Inserting the withdrawable circuit-breaker in a panel, chapter 10.23
- Taking the circuit-breaker truck out of the panel, chapter 10.24
- Inserting the circuit-breaker truck in a panel, chapter 10.25

## 24.19 Technical data / operating times

Item number	Functional unit	Technical data
1.	Voltage supply for control circuit and motor circuit	Wide-voltage range 24 V DC / 48 V DC / 60 V DC / 110 V DC / 220 V DC / 110 V AC / 230 V AC  Control and motor circuit are executed separately  Voltage fluctuations in the range from $0.85 \times U_n$ to $1.1 \times U_n$ are permissible
2.	Power consumption of control circuit	< 100 mA in operating mode
3.	Energizing when the command is given	Until the motor starts up > 180 ms
4.	Power consumption of geared motor for racking function	110 V DC: Motor starting current, approx. 6.5 A Continuous motor current while racking, approx. 1 A Motor power, approx. 1.2 W  Further values on request.
5.	Motor running time for racking function	< 65 s
6.	Feedback monitoring time for racking valid switching functions: racking to service or test position	After giving the command and when a motor has started, a fault signal is issued if the feedback contacts detect no end position within 65 s.  Fault indication and fault evaluation according to chapter 24.20.

### 24.20 Fault indication and fault evaluation

A fault will always shut down the associated motor operating mechanism, and can be issued as a fault indication when a SIPROTEC relay is installed. The fault is generally reset by switching the auxiliary voltage off and on again.

For several fault outputs, the fault signal is reset automatically or by certain actions.

Type of fault	Reverse interlocking to circuit-breaker	Cause / Remedy
Motor voltage is not switched on	On	Check MCB or wiring
Motor voltage is not switched off	On	Motor voltage relay in motor control unit defective
No feedback of auxiliary switch during command "rack withdrawable circuit-breaker / circuit-breaker truck to service position"	On	Check operating mechanism or motor with respect to blocking <sup>1)</sup>
No feedback of auxiliary switch during command "rack withdrawable circuit-breaker / circuit-breaker truck to test position"	On	Check operating mechanism or motor with respect to blocking <sup>1)</sup>
No automatic shutdown after end of command	On	Circuit for automatic shutdown in motor control unit defective
High-voltage door is opened while the withdrawable circuit-breaker / circuit-breaker truck is being racked	On	Operating mechanism stops
The withdrawable circuit-breaker / circuit-breaker truck is racked and stops in an intermediate position when the motor voltage fails	On	When the motor voltage is switched on again, the withdrawable circuit-breaker / circuit-breaker truck can be racked to a valid end position by hand. Then, the fault is reset.
The auxiliary voltage and the motor voltage fail while racking. The auxiliary switch does not report a valid end position	On	When the auxiliary voltage and the motor voltage are switched on again, the fault can be reset by manual operation to a valid end position.

<sup>1)</sup> This fault signal can be reset

# Panel heater

## 25 Panel heater

### HINT

Read and understand these instructions before attempting operating works.

### 25.1 Heater versions

Optionally, one heater is installed each in the switching-device compartment and/or the connection compartment. The panel heater is designed as high-load wire resistor in the following versions:

#### Types

Mounting location	High-load wire resistor [ $\Omega$ ]	Operational voltage [V AC]
Switching-device compartment and/or connection compartment	125 ( $\pm 10\%$ )	110
	500 ( $\pm 10\%$ )	230 to 240


Temperature control in the panel is done via a mechanical temperature controller or via an electronic temperature and humidity controller.

### 25.2 Mechanical temperature controller

#### NOTICE

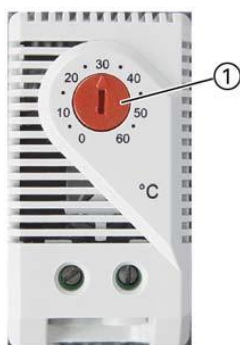
##### Damage due to incorrect application

The temperature controllers require direct connection to the ambient air.

 Do **not** cover the ventilation slots of the temperature controllers.

The mechanical temperature controller can either be designed as a normally closed contact or as a normally open contact:

Normally closed contact	Contact opens when temperature rises
Normally open contact	Contact closes when temperature rises



(1) Selector for temperature control


Fig. 520: Mechanical temperature controller

25.3 Electronic temperature and humidity controller

**NOTICE**

**Damage due to incorrect application**

The temperature and humidity controllers require direct connection to the ambient air.

 Do **not** cover the ventilation slots of the temperature and humidity controllers.

The electronic temperature and humidity controller can either be designed as a normally closed contact or as a normally open contact:

Temperature function	If the ambient temperature falls below the adjusted value, the circuit for heater operation is closed (LED lights up).
	If the ambient temperature rises above the adjusted value, the circuit for heater operation is opened (LED does not light up).
Humidity function	If the relative humidity rises above the adjusted value, the circuit for heater operation is closed (LED lights up).
	If the relative humidity falls below the adjusted value, the circuit for heater operation is opened (LED does not light up).

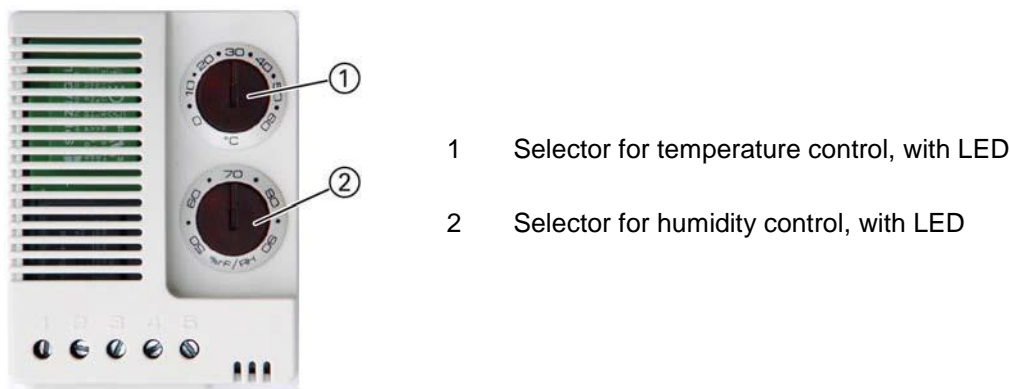



Fig. 521: Electronic temperature and humidity controller

25.4 Applications for temperature controller

**NOTICE**

**Maloperation**

Observe the manufacturer's information.

 Please do absolutely observe the enclosed operating instructions for the temperature and humidity controllers.

	Temperature for application [°C]	Humidity for application, not condensing [% r h]
Mechanical temperature controller	-20 to +80	≤ 90
Electronic temperature and humidity controller	0 to +60	≤ 90

**Factory default settings**

The temperature and humidity controllers are preset at the factory.

	Temperature [°C]	Humidity [% r h]
Mechanical temperature controller	approx. +30	—
Electronic temperature and humidity controller	approx. +30	approx. 70

**Adjustment during operation**

At the place of operation of the switchgear, the integrated temperature and humidity controllers must be adjusted to the local temperature and/or humidity conditions in the application area of the switchgear panels by the respective operator.

**Installation in the panel**

The temperature and humidity controllers are installed top-left inside the switching-device compartment, directly at the side of the vertical wiring duct.

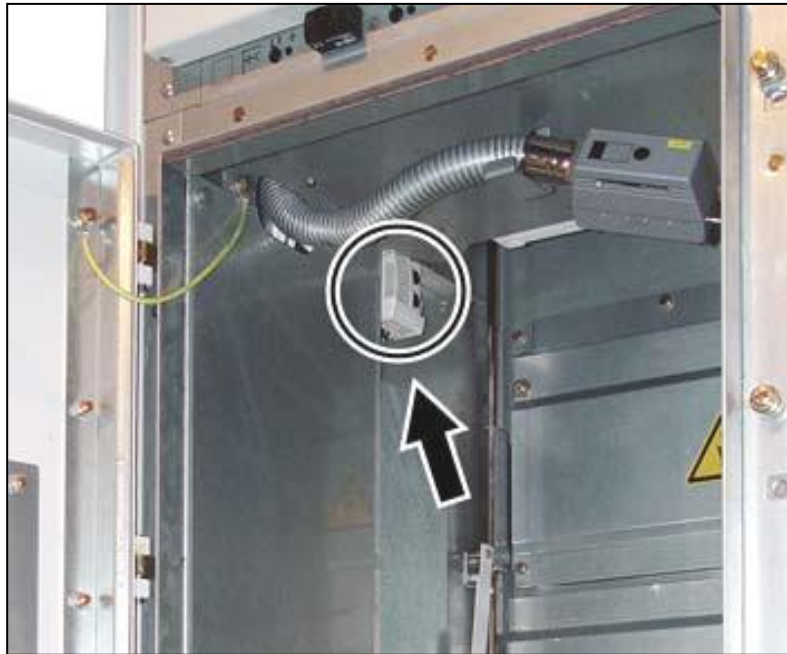


Fig. 522: Installation of the electronic temperature and humidity controller in the switching-device compartment

## 26 Service information

### HINT

Read and understand these instructions before attempting operating works.

### 26.1 Maintenance

Maintenance ensures undisturbed and uninterrupted operation of the switchgear. The frequency of inspection, periodic cleaning and preventive maintenance schedule will depend upon the operating conditions of the switchgear.

The maintenance measures are divided into the following fields:

- Visual inspection
- Maintenance

### NOTICE

#### Non-observance of instructions

Non-observance of the following instructions can damage the switchgear.

- All measures within the scope of maintenance may only be executed by qualified personnel.
- Furthermore, the relevant IEC standards and the local and site-related safety regulations must be observed.
- For questions about maintenance measures, please contact your regional Siemens representative.

### 26.2 Time schedule for maintenance measures

Besides the recommended maintenance intervals, additional maintenance measures may be required for operational reasons.

**Recommended time schedule for maintenance measures:**

Measure	Interval	Operational fact
Visual inspection	Every year or at the operator's discretion.	—
Maintenance	Every 10 years, or depending on operational facts, or at the operator's discretion.	For example, after a short circuit or breaking / making operation of a circuit-breaker and/or an earthing switch when the permissible number of operating cycles has been reached.
Cleaning	Depending on operational facts, or at the operator's discretion.	Visual inspection, maintenance.
Circuit-breaker	According to advice and requirements in Operating Instructions of circuit-breaker.	
Vacuum contactor	According to advice and requirements in Operating Instructions of vacuum contactor.	
Protection relays and instruments	According to advice and requirements in respective instruction manuals.	

### 26.3 Visual inspection

The visual inspection is performed every year or at the operator's discretion.

- ⇒ General check for paint damages on all panels of a switchgear assembly in the area of the front doors, the lateral and the rear termination. If required, repair damages.
- ⇒ General check of the switchgear for dust layers, especially of the ventilation units in the pressure relief duct, as well as the fan box.
- ⇒ Clean dust layers on the units by using a customary vacuum cleaner without damaging the metal grids (1) or ventilation slots (2).

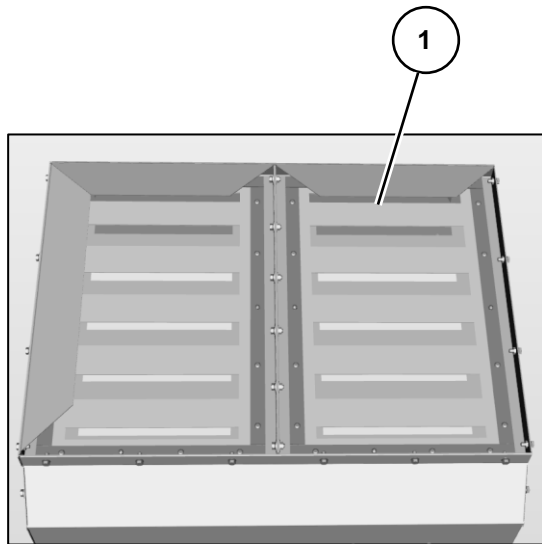


Fig. 523: View from above onto a ventilation unit in the pressure relief duct

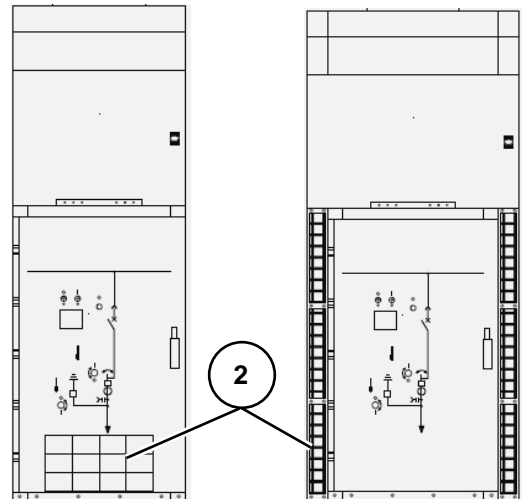


Fig. 524: Exemplary view of a ventilated panel with ventilation slots at the side and in the high-voltage door

- ⇒ Clean dust layers or foreign objects in the fan box by using a customary vacuum cleaner without damaging the metal grids (1).

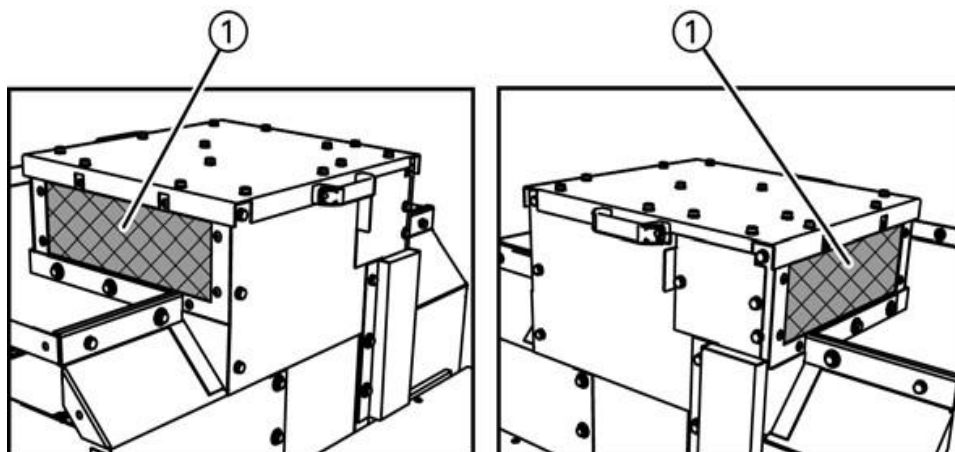


Fig. 525: Exemplary view of a fan box with metal grid on the right and left in the front area of the pressure relief duct

- ⇒ General check for humidity. To do this, open the high-voltage door of the switching-device compartment of every third panel and check the switching-device compartment for humidity or condensation.

- ⇒ If there is humidity or condensation inside a switching-device compartment, determine the cause thereof. To do this, do also observe the climatic conditions of the switchgear room, and arrange for suitable measures such as room ventilation or room heating.
- ⇒ General check for partial discharge noises. If there are any partial discharge noises, determine the cause thereof and take adequate countermeasures.
- ⇒ Check whether the accessories are complete.

### 26.4 Preventive maintenance

#### **DANGER**

##### **Electric shock**

Before any maintenance work is performed within primary compartments, it is to make certain that the respective panel or panels are completely de-energized, tagged or locked out and released for work in an authorized manner.

- ⇒ Disable remote control and automatic schemes.
- ⇒ De-energize all direct and back-feed power and control sources.
- ⇒ Disconnect all voltage and control power transformers.
- ⇒ Verify safe isolation from supply.
- ⇒ Earth the feeder in the respective panel or panels.

#### **DANGER**

##### **Danger due to foreign objects**

Serious switchgear damage and malfunctioning due to flashovers caused by foreign objects.

- ⇒ Remove all foreign objects from the switchgear, e.g. tools, cleaning cloths or lubricants.

#### **NOTICE**

##### **Damage due to removal of greasing**

Some parts and surfaces of the switchgear are greased for functioning.

- ⇒ Do not remove the grease from greased parts and surfaces.
- ⇒ Do not clean greased parts and surfaces.

If greased areas are dirty.

- ⇒ Clean the dirty area and grease again according these maintenance instructions.

**NOTICE****Damage due to incorrect cleaning**

Dust and loose pollutants can impair the functioning of the switchgear and lead to damages. For cleaning, remove dust and loose pollutants precisely from the switchgear.

- ⇒ Use vacuum cleaner and dry, lint-free cloths.
- ⇒ Do **not** clean with compressed air or similar means.

- ⇒ Perform visual inspection and carry out the necessary maintenance work according to the problems determined.
- ⇒ When an earthing switch has performed two short-circuit making operations, maintenance work has to be done by means of a visual inspection of the earthing switch blades and the fixed laminated contacts. If there is any visible erosion, the stressed components must be replaced. To do this, please contact the regional Siemens representative.
- ⇒ Built-in equipment such as circuit-breakers, voltage transformers, current transformers, relays, meters, protection equipment, etc. must be serviced and maintained as specified in the associated operating instructions.
- ⇒ Carry out maintenance and servicing at shorter intervals (at the operator's discretion) if there is a lot of dust, or if the air is extremely humid and/or polluted.
- ⇒ Following the results of the visual inspection, grease the following:
  - Guide rails and shutter guiding linkage
  - Fixed contacts of the earthing switch
  - Fixed contacts of the bushings
- ⇒ Apply WD-40 waterproof spray oil to a cleaning cloth, and clean the shutter guiding linkage therewith.
- ⇒ Independently of the regular visual inspection and preventive maintenance, immediately determine the cause of failures and short circuits, and document it completely.
- ⇒ Read the protection relays (optional) immediately after the fault, and evaluate the information.
- ⇒ Add fault records and pictures to the documentation.
- ⇒ At the panel concerned, check the switching device and the compartments for damages. If damage is determined, inform the Siemens representative and submit the documentation of the fault.
- ⇒ Remove foreign objects, for example cleaning material.
- ⇒ Check the area directly around the panel and clean, if required.

26.5 Lubricants to be used

⚠ CAUTION

**Injury due to incorrect application**

Incorrect application of the lubricants can cause injuries of the sense organs or the hands.

➡

Observe the safety instructions in the safety data sheets of the lubricant suppliers.

➡

Put on personal protective equipment.

Component	Lubricant	Supplier
Shutter guiding linkage (1)	WD-40 waterproof spray oil	Hardware store
Guide rails (2)	ISOFLEX TOPAS L 32 (Order no.: 3AX1133-3E 1 kg)	<a href="http://www.klueber.com">www.klueber.com</a>
Fixed contacts of feeder earthing switch (3)	MOLYKOTE® LONGTERM 2 PLUS EXTREME PRESSURE BEARING GREASE (Order no.: 8BX1022 1 kg)	<a href="http://www.dowcorning.com">www.dowcorning.com</a>
Main fixed contacts of bushings (4)		

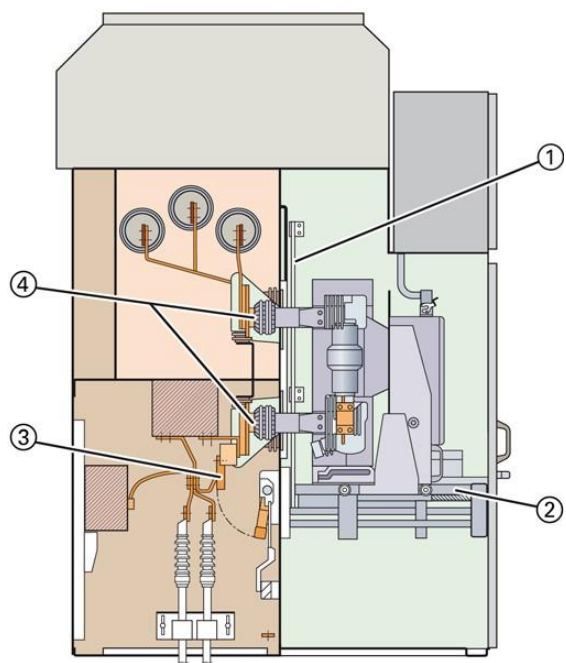


Fig. 526: Circuit-breaker, disconnecting and metering panels

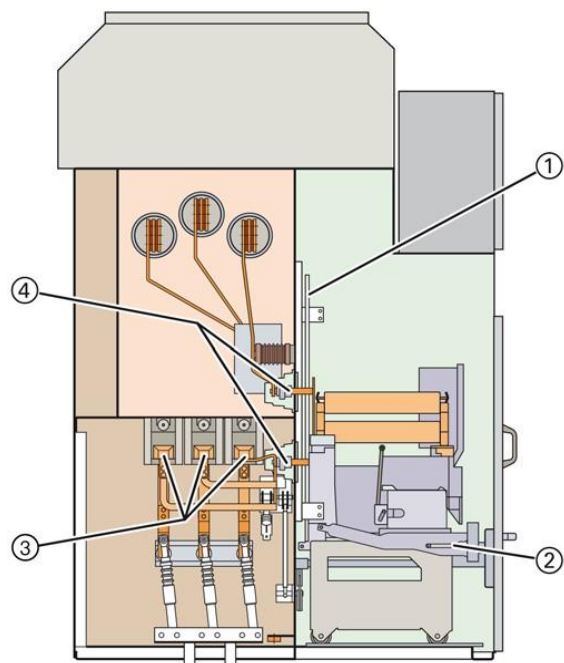


Fig. 527: Contactor panel

- (1)

Shutter guiding linkage
- (2)

Guide rails
- (3)

Fixed contacts of the feeder earthing switch
- (4)

Fixed contacts of the bushings

## 26.6 Overpressure sensors (optional), function test

Depending on the panel version, overpressure monitors for the individual compartments are located in the low-voltage compartment. To check proper functioning of the overpressure monitors, use the test unit from the accessories.

### DANGER

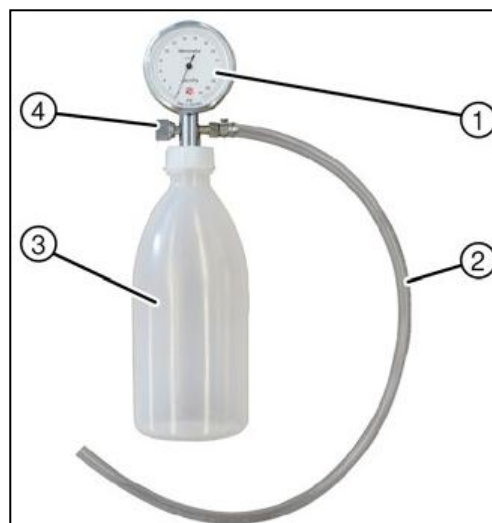
#### Maloperation

The function test at the overpressure monitors may be performed during running operation.

- ⇒ Obtain release for the planned test of the overpressure monitors.
- ⇒ Coordinate the procedure with operational activities.
- ⇒ Ensure uninterrupted communication with the operator at the central control.
- ⇒ Always perform the function test on one overpressure monitor only, and complete it. Test several overpressure monitors one after the other.

#### Test unit

To perform the function test of the overpressure monitors, a test unit is available as an accessory. The test unit enables the function test of every single overpressure monitor.

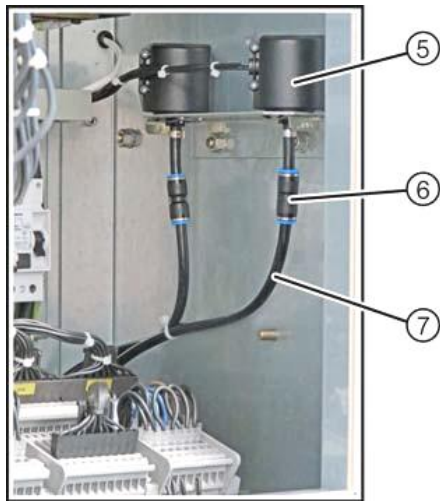


- (1) Manometer
- (2) Test tube
- (3) Lab bottle made of polyethylene
- (4) Locking cap

Fig. 528: Test unit

#### Preconditions

- High-voltage door closed
- Release for checking the overpressure monitors available
- Uninterrupted communication established with the operator at the central control
- Door to the low-voltage compartment open
- Test unit available, locking cap firmly screwed on



- (5) Overpressure monitor
- (6) Tube connector
- (7) Tube to compartment

Fig. 529: Low-voltage compartment,  
for example with 2 overpressure monitors

### Procedure



Detach the tube to the compartment (7) from the tube connector (6). To do this, push the detachment ring (8) at opposite points towards the tube connector, and — at the same time — pull the tube to the compartment out of the tube connector in opposite direction.



Fig. 530: Detail view of tube connector



Instead of the tube to the compartment, insert the tube of the test unit (2) into the tube connector as far as it will go.

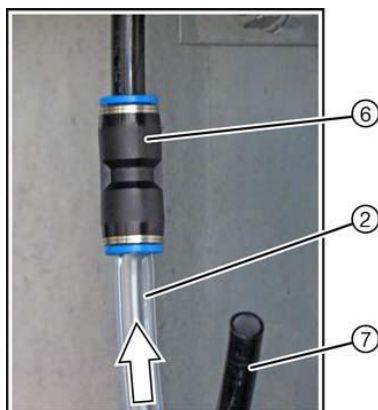


Fig. 531: Detail view of connection of test tube

- ⇒ Press the soft lab bottle of the test unit carefully and observe the manometer indication (1). In the indication range from 8 to 12, the overpressure monitor must trip.

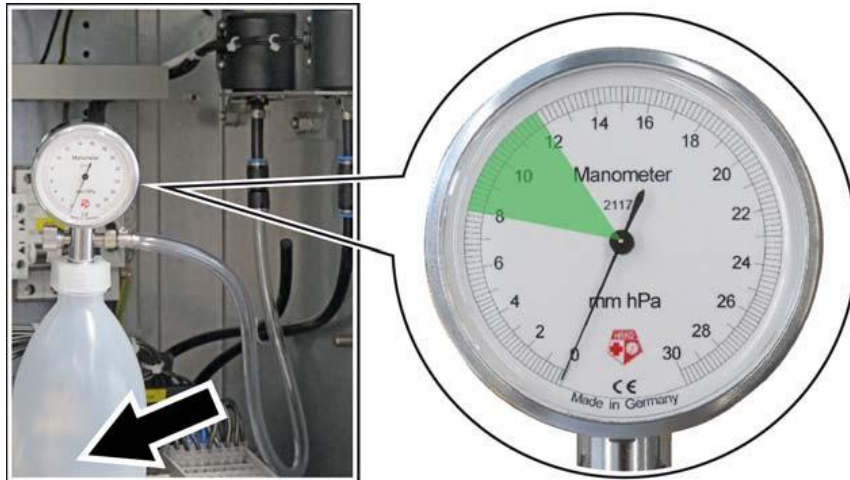


Fig. 532: Overpressure function test

#### Overpressure monitor trips in the indication range from 8 to 12:

- ⇒ Push the detachment ring again, and pull the test tube out of the tube connector.
- ⇒ Insert the tube to the compartment into the tube connector as far as it will go.
- ⇒ Perform the function test of the other overpressure monitors in the same way.
- ⇒ After the function test of all overpressure monitors, close the door to the low-voltage compartment.
- ✓ The function test of the overpressure monitor is completed.

#### Overpressure monitor does not trip in the indication range from 8 to 12:

- ⇒ Document the tripping value and repeat the test. If this overpressure monitor does not trip in the indication range from 8 to 12 again, mark the overpressure monitor.
- ⇒ Push the detachment ring again, and pull the test tube out of the tube connector.
- ⇒ Insert the tube to the compartment into the tube connector as far as it will go.
- ⇒ Inform the regional Siemens representative and ask for support and advice.

### 26.7 Maintenance of fan(s) for forced ventilation

The fans used for forced ventilation are designed for a maximum operating time of 40,000 hours.

- ⇒ Replace a fan in the fan box on the pressure relief duct before it reaches 40,000 operating hours.  
The procedure is described in the Installation Instructions, order number 172-2014.9 / 8BX3300-0LA00-0AH2.

Specification of fans to be used		
Manufacturer	ebm-papst company	
Type	R2E270-AA01-05	
Power consumption	280 W / 50 Hz	430 W / 60 Hz
Operating hours	40,000 h	
Operating manual	Item no. 11005-5-9970 EN	
Contact	www.ebmpapst.com / phone: +49793881-0	

### 26.8 Switchgear extension

The switchgear can be extended at both ends without modification of existing panels. For switchgear extension, please contact the regional Siemens representative.

### 26.9 Spare part orders

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

- Type and serial number of the switchgear and the withdrawable part as per 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.
- Spare parts have to be ordered at the regional Siemens representative.

### 26.10 Replacement of panels and components

Replacement of panels:

- For replacement of panels, please contact the regional Siemens representative.

Replacement of components:

- The individual components, such as measuring instruments, current transformers, etc., can be replaced. The contact pieces in the bushings are bolted and can be replaced. In case of wear or changed environmental conditions, the contact pieces can be replaced from the front without dismantling any conductor bars.
- For replacement of components, please contact the regional Siemens representative.

### 26.11 Disposal

NXAIR switchgear is an environmentally compatible product.

The panels are made of galvanized sheet metal. The doors and lateral switchgear end walls are powder-coated with resistant epoxy resin material.

The switchgear materials should be recycled as far as possible. The switchgear can be disposed of in an environmentally compatible manner in compliance with existing legislation.

The components of the switchgear can be recycled as mixed scrap; however, dismantling as far as possible into sorted scrap with a residual mixed-scrap portion is the more environmentally compatible way.

Electronic scrap must be disposed of in accordance with the existing regulations. The switchgear consists of the following materials:

- Sheet metal: galvanized / powder-coated / Cr-Ni steel
- Copper and aluminum
- Polycarbonate (PC)
- Epoxy resin
- Cast resin
- Fiber-reinforced plastics
- Rubber materials
- Ceramic materials
- Lubricants
- Bolts, washers, nuts, rivets made of steel
- Electrical wires and electronic equipment such as relays, control boards, voltmeters, ammeters

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

For further information, regarding declarable or restricted substances in this product, please contact:

- [materialcompliance.ms.ehs@siemens.com](mailto:materialcompliance.ms.ehs@siemens.com).

# Trouble shooting

## 27 Trouble shooting

### 27.1 Panels with withdrawable part

#### Interlocking of withdrawable part

Fault	Cause	Remedy
Withdrawable part cannot be pushed completely into the panel and interlocked.	Positions of feeder earthing switch operating mechanism (withdrawable part) and feeder earthing switch (panel) not in line.	Bring the positions of the feeder earthing switch operating mechanism (withdrawable part) and the feeder earthing switch (panel) into line.
Withdrawable part cannot be pulled out of panel.	Interlocking of withdrawable part closed.	Open interlocking of withdrawable part.
High-voltage door cannot be closed.	Low-voltage connector is not plugged on.	Plug on the low-voltage connector.
High-voltage door cannot be opened.	Withdrawable part is in service position.	Rack the withdrawable part to test position.

#### Withdrawable part

Fault	Cause	Remedy
Actuating opening cannot be opened (withdrawable part cannot be moved to service position).	Operating lever is inserted in the manual CLOSE/OPEN operating mechanism of the feeder earthing switch.	Remove the operating lever.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
	Operating slide for opening the actuating opening is interlocked by the electromagnetic interlock.	Request external release.
Double-bit key for releasing the withdrawable part can be inserted, but not turned to the right.	Circuit-breaker is in CLOSED position.	Switch the circuit-breaker to OPEN position.
	Feeder earthing switch is in CLOSED position.	Switch the feeder earthing switch to OPEN position.
	High-voltage door is not closed.	Close the high-voltage door.

### Earthing switch

Fault	Cause	Remedy
Actuating opening for feeder earthing switch cannot be opened.	Racking crank for moving the withdrawable part is inserted.	Remove the racking crank for moving the withdrawable part.
	General panel interlock active.	Observe general panel interlock.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
Actuating opening for busbar earthing switch cannot be opened.	General panel interlock active.	Observe general panel interlock.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
	Operating slide for opening the actuating opening is interlocked by the electromagnetic interlock.	Request external release.
Operating lever cannot be inserted.	Withdrawable part in service position.	Rack the withdrawable part to test position, switch the circuit-breaker to OPEN position, if required.

### Circuit-breaker

Fault	Cause	Remedy
Circuit-breaker cannot be closed.	Racking crank for moving the withdrawable part is inserted.	Remove the racking crank for moving the withdrawable part.
	Withdrawable part is in intermediate position.	Rack the withdrawable part to service position or test position.
	Spring energy store not charged.	Wait for 15 s (motor) or charge manually.
	Undervoltage release is not energized.	Activate the undervoltage release.
Spring energy store is not charged automatically.	No auxiliary voltage.	Apply auxiliary voltage or charge the spring manually.

If these Operating Instructions should not clarify all questions regarding operation and maintenance of the NXAIR switchgear, please contact the Siemens sales partner or the regional Siemens representative.

## 27.2 Panels with switching-device truck

### Interlocking of switching-device truck

Fault	Cause	Remedy
Switching-device truck cannot be pushed completely into the panel and interlocked.	Positions of feeder earthing switch operating mechanism (switching-device truck) and feeder earthing switch (panel) not in line.	Bring the positions of the feeder earthing switch operating mechanism (switching-device truck) and the feeder earthing switch (panel) into line.
Switching-device truck cannot be pulled out of panel.	Interlocking of switching-device truck closed.	Open interlocking of switching-device truck.
High-voltage door cannot be closed.	Low-voltage connector is not plugged on.	Plug on the low-voltage connector.
High-voltage door cannot be opened.	Switching-device truck is in service position.	Rack the switching-device truck to test position.

### Switching-device truck

Fault	Cause	Remedy
Actuating opening cannot be opened (switching-device truck cannot be moved to service position).	Operating lever is inserted in the manual CLOSE/OPEN operating mechanism of the feeder earthing switch.	Remove the operating lever.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
	Operating slide for opening the actuating opening is interlocked by the electromagnetic interlock.	Request external release.
Double-bit key for releasing the switching-device truck can be inserted, but not turned to the right.	Circuit-breaker is in CLOSED position.	Switch the circuit-breaker to OPEN position.
	Feeder earthing switch is in CLOSED position.	Switch the feeder earthing switch to OPEN position.
	High-voltage door is not closed.	Close the door.

### Earthing switch

Fault	Cause	Remedy
Actuating opening for feeder earthing switch cannot be opened.	Racking crank for moving the switching-device truck is inserted.	Remove the racking crank for moving the switching-device truck.
	General panel interlock active.	Observe general panel interlock.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
Actuating opening for busbar earthing switch cannot be opened.	General panel interlock active.	Observe general panel interlock.
	Operating slide for opening the actuating opening is locked.	Open the padlock.
	Operating slide for opening the actuating opening is interlocked by the electromagnetic interlock.	Request external release.
Operating lever cannot be inserted.	Switching-device truck in service position.	Rack the switching-device truck to test position, switch the circuit-breaker to OPEN position, if required.

### Circuit-breaker

Fault	Cause	Remedy
Circuit-breaker cannot be closed.	Racking crank for moving the switching-device truck is inserted.	Remove the racking crank for moving the switching-device truck.
	Switching-device truck is in intermediate position.	Rack the switching-device truck to service position or test position.
	Spring energy store not charged.	Wait for 15 s (motor) or charge manually.
	Undervoltage release is not energized.	Activate the undervoltage release.
Spring energy store is not charged automatically.	No auxiliary voltage.	Apply auxiliary voltage or charge the spring manually.

If these Operating Instructions should not clarify all questions regarding operation and maintenance of the NXAIR switchgear, please contact the Siemens sales partner or the regional Siemens representative.

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# **Imprint**

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