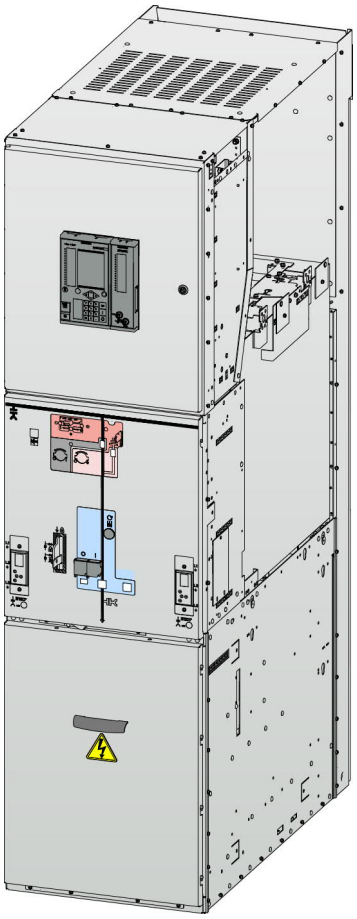
SIEMENS

Medium-Voltage Switchgear

Fixed-mounted circuit-breaker switchgear type NXPLUS C up to 38 kV, Extendable

Single busbar, metal-enclosed, gas-insulated



INSTALLATION AND OPERATING INSTRUCTIONS

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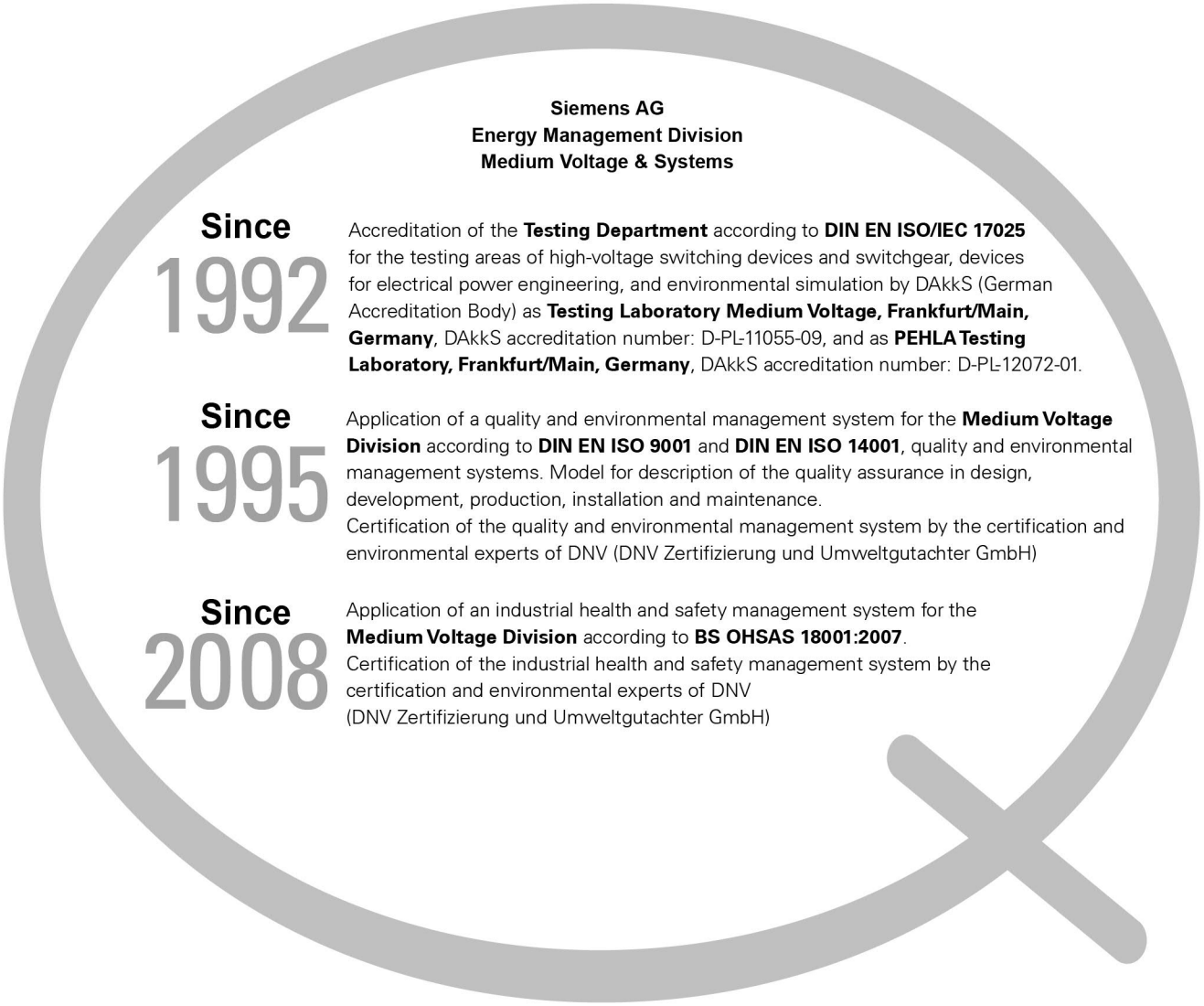


About these Instructions

In order to provide a clear overview, these instructions do not contain all detailed information on every product type. 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 such as technical data, secondary equipment and 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, including about additional equipment, please refer to catalog HA 35.41.

If more information is desired or particular problems arise which are not covered in sufficient detail by these instructions, please contact the applicable Siemens department to request the necessary information.

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 entirety of obligations of Siemens. The warranty contained in that contract between the parties is the full and only warranty provided. Any statements contained herein do not create new warranties or modify the existing warranty.

Contents

Safety instructions

1 Signal terms and definitions

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

⚠DANGER

Danger - Indicates an imminently hazardous situation.
If this hazardous situation is not avoided, death or serious injury will be the consequence.

⇨ Observe the safety instructions.

⚠WARNING

Warning - Indicates a potentially hazardous situation.
If this hazardous situation is not avoided, death or serious injury can be the consequence.

⇨ Observe the safety instructions.

⚠CAUTION

Caution - Indicates a potentially hazardous situation.
If this hazardous situation is not avoided, minor or moderate injury can be the consequence.

⇨ Observe the safety instructions.

NOTICE

Notice - Indicates a potentially hazardous situation.
If this hazardous situation is not avoided, damage to property or environment can be the consequence.

⇨ Observe the notes.

☞INFORMATION

Information - Indicates an important information or facilitation of work.

⇨ Observe the information.

Symbols used

⇨ Operation symbol: Identifies an operation. Asks the operator to perform an operation.

✔ Result symbol: Identifies the result of an operation.

2 General instructions

Important

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

NOTE

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

☞INFORMATION

Preconditions for perfect and safe operation of the switchgear:

- ⇨ Observance of operating and installation instructions.
- ⇨ Qualified personnel.
- ⇨ Proper transportation and correct storage of the switchgear.
- ⇨ Correct installation and commissioning.
- ⇨ Diligent operation and maintenance.
- ⇨ Observance of the installation, operation and safety regulations applicable at the place of installation.

⚠WARNING

Any kind of modification on the product or alteration of the product must be coordinated with the manufacturer in advance.
Uncoordinated modifications or alterations can cause the expiration of warranty claims, cause danger to life, limb and other legally protected interests.

The fulfillment of the type tests (according to IEC 62271-200) may not be guaranteed anymore. This applies especially though not exclusively to the following actions, e.g. in the course of maintenance or repairs.

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

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

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

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

Five Safety Rules of Electrical Engineering

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

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

Hazardous substances

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

Personal protective equipment (PPE)

For switchgear **with proof** of internal arc classification according to IEC 62271 Part 200, **no personal protective equipment must be worn for operating the switchgear**.

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

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

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

The personal protective equipment consists of:

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

Removing the front cover from the operating mechanism compartment

⚠WARNING

Risk of injury due to high-speed moving parts

Parts behind the front cover can automatically move quickly and cause serious injury. Do not remove the front cover of the operating mechanism until the following actions have been performed:

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

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

⇨ Check if the "spring charged" indicator shows "spring not charged".

Fig. 1: "Spring not charged" indication

Fig. 2: "Spring charged" indication

3 IT security

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

The Newsletter can be subscribed to at the following website:

www.siemens.com/gridsecurity

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

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

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

4 Due application

Extendable fixed-mounted circuit-breaker switchgear NXPLUS C with single busbar is used in transformer and distribution substations as well as for switching duties in industrial plants.

The application area extends to rated voltages up to 38 kV and rated operating currents up to 2500 A. In distribution networks up to 38 kV, a maximum short-circuit current of 31.5 kA is permissible (type-dependent).

5 Qualified personnel

Qualified personnel in accordance with these instructions are persons who have been instructed by the Switchgear Factory Frankfurt (participation in an assembly and installation training with certificate), who are familiar with transport, installation, commissioning, maintenance and operation of the product, and who have appropriate qualifications for their work.

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

Description

6 Features

Technology

- Factory-assembled, type-tested and metal-enclosed switchgear for indoor installation
- Stainless-steel vessel welded gas-tight
- Gas-insulated switching-device compartment
- Cable connection and busbar, single-pole insulated
- Installation and extension of the switchgear can be performed without gas work
- Screened busbar, silicone-rubber insulated
- Cable connection with cable plugs from the front
- Maintenance-free under normal operating conditions

Insulating gas

Insulating gas insulates live parts from each other and from the vessel wall. In panels with switch-disconnectors, the insulating gas is also used to extinguish the arc.

The switchgear is delivered ex works with gas filling ready for service. The gas filling is provided to last the total service life of the switchgear.

Personal safety

- Safe-to-touch due to metal enclosure of live parts
- Clear mimic diagram with mechanical switch position indicators
- HV HRC fuses are accessible only when outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detecting system to verify safe isolation from supply
- Earthing of feeders by means of make-proof earthing switch (this does not apply to disconnector panels)
- Resistance to arcing
  - Pressure-resistant design of connection compartments
  - Rear pressure relief duct

Security of operation and availability

- Hermetically sealed primary enclosure independent of environmental effects, such as dirt, humidity and small animals
- Welded switchgear vessel, sealed for life
- Circuit-breaker operating mechanism accessible outside the switchgear vessel
- Incorrect operation is virtually eliminated due to interlocks and logical arrangement of elements of the operating mechanism
- Self-monitoring ready-for-service indicator, easy to read, independent of temperature and environmental pressure variations, with contactless measured-value acquisition and with signaling switch (option) 1 changeover contact for telecommunication
- Minimum fire load
- Switchgear vessel designed as a "sealed pressure system" according to IEC 62271-200, i.e. the insulating gas filling requires no maintenance

Cost-efficiency

Extremely low lifecycle costs and maximum availability thanks to:

- Maintenance-free design under normal operating conditions (for the service life)
- Minimum space requirement
- Long service life

Seismic withstand capability (option)

NXPLUS C switchgear can be upgraded for regions at risk from earthquakes. For this upgrade, earthquake qualification testing has been carried out in accordance with the following standards:

- IEC 60068-3-3 "Guidance – Seismic test methods for equipment"
- IEC 60068-2-57 "Test Ff: Vibration – Time-history method"
- IEC 60068-2-59 "Test Fe: Vibration – Sine-beat method"

- IEEE 693-2005 "Recommended Practice for Seismic Design of Substations".

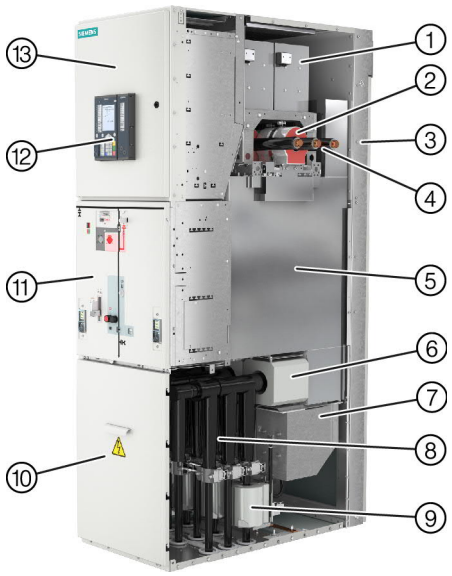
For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:

- Uniform Building Code 1997 (UBC) – Zone 4
- California Building Code 1998 (CBC) – Zone 4
- IEEE 693-2005 – High required response spectrum.

7 Panel versions

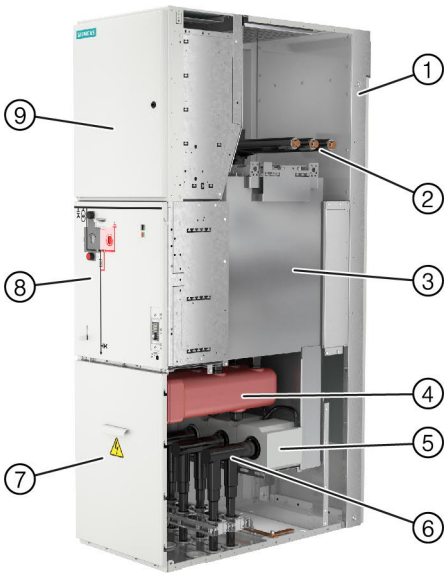
Panel type		Panel width [mm]
LS	Circuit-breaker panel	450/600
TR	Switch-disconnector panel with HV HRC fuses	600
ME	Metering panel	600
VS	Vacuum contactor panel with HV HRC fuses	600
RK	Ring-main panel	450
LK	Bus sectionalizer panel (single bay)	1 x 600 1x 900
	Bus sectionalizer panel (double bay)	2 x 600
TS	Disconnector panel	600
aME	Air-insulated metering panel	900
EB	Auxiliary transformer panel with switch-fuse combination	900

8 Examples for panel versions



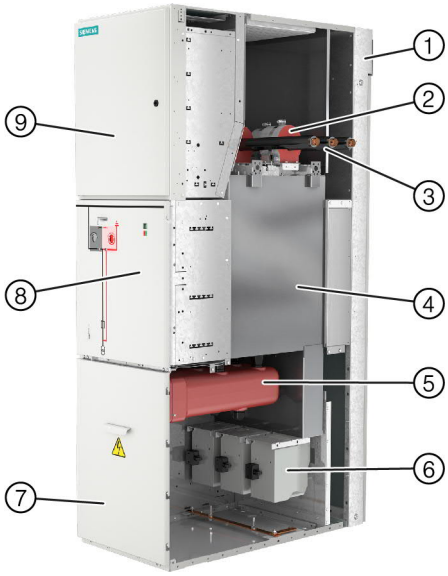
① Voltage transformer at the busbar (option)
② Current transformer at the busbar (option)
③ Pressure relief duct
④ Busbar
⑤ Switching-device vessel with circuit-breaker and three-position disconnector
⑥ Current transformer at the cable connection (option)
⑦ Voltage transformer (option)
⑧ Feeder cables with cable plugs
⑨ Current transformer (option)
⑩ Cable compartment cover
⑪ Front cover with control board
⑫ Bay controller (option)
⑬ Low-voltage compartment

Fig. 3: Circuit-breaker panel



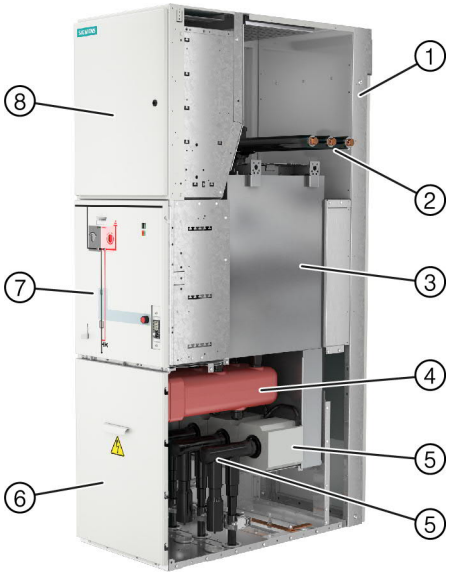
① Pressure relief duct
② Busbar
③ Switching-device vessel with three-position switch-disconnector
④ Fuse assembly with HV HRC fuses
⑤ Current transformer (option)
⑥ Feeder cables with cable plugs
⑦ Cable compartment cover
⑧ Front cover with control board
⑨ Low-voltage compartment

Fig. 4: Switch-disconnector panel



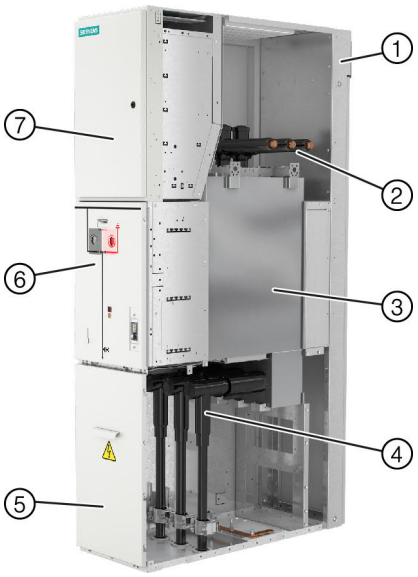
① Pressure relief duct
② Current transformer at the busbar (option)
③ Busbar
④ Switching-device vessel with three-position switch-disconnector
⑤ Fuse assembly with HV HRC fuses
⑥ Voltage transformer (option)
⑦ Instrument transformer compartment cover
⑧ Front cover with control board
⑨ Low-voltage compartment

Fig. 5: Metering panel



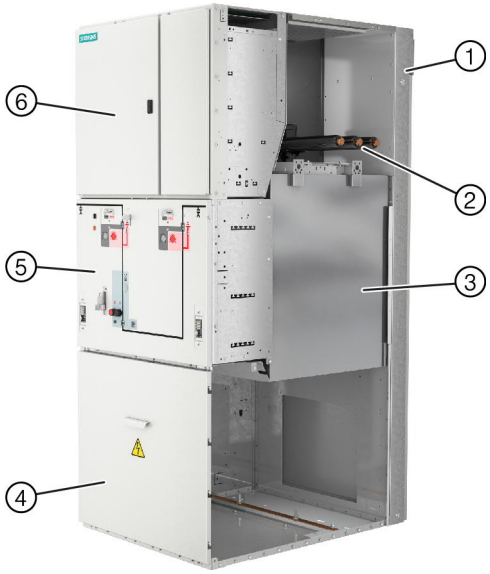
① Pressure relief duct
② Busbar
③ Switching-device vessel with vacuum contactor and three-position switch-disconnector
④ Fuse assembly with HV HRC fuses
⑤ Current transformer (option)
⑥ Cable compartment cover
⑦ Front cover with control board
⑧ Low-voltage compartment

Fig. 6: Vacuum contactor panel with HV HRC fuse assembly



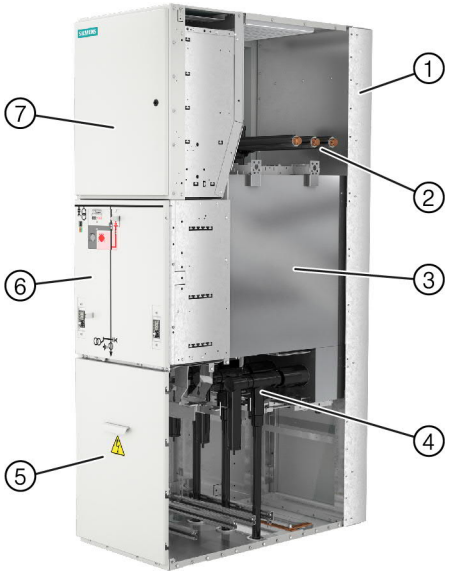
① Pressure relief duct
② Busbar
③ Switching-device vessel with three-position switch-disconnector
④ Feeder cables with cable plugs
⑤ Cable compartment cover
⑥ Front cover with control board
⑦ Low-voltage compartment

Fig. 7: Ring-main panel



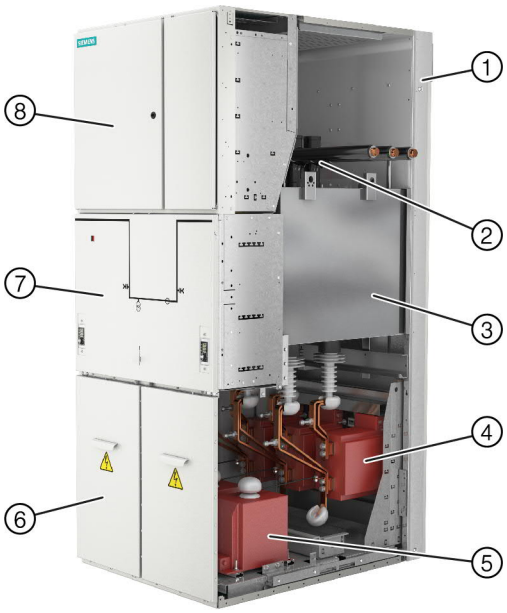
① Pressure relief duct
② Busbar
③ Switching-device vessel with three-position disconnector
④ Connection compartment cover
⑤ Front cover with control board
⑥ Low-voltage compartment

Fig. 8: Bus sectionalizer panel



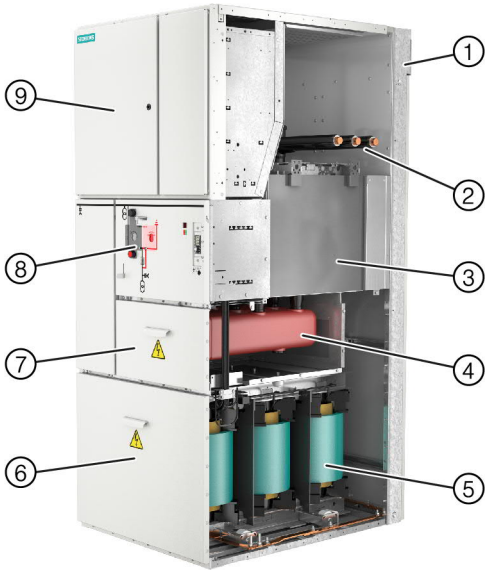
① Pressure relief duct
② Busbar
③ Switching-device vessel with three-position disconnector
④ Feeder cables with cable plugs
⑤ Cable compartment cover
⑥ Front cover with control board
⑦ Low-voltage compartment

Fig. 9: Disconnector panel



① Pressure relief duct
② Busbar
③ Switchgear vessel
④ Current transformer
⑤ Voltage transformer
⑥ Instrument transformer compartment cover
⑦ Front cover
⑧ Low-voltage compartment

Fig. 10: Air-insulated metering panel



① Pressure relief duct
② Busbar
③ Switching-device vessel
④ Fuse assembly with HV HRC fuses
⑤ Auxiliary transformer
⑥ Transformer compartment cover
⑦ HV HRC fuse assembly cover
⑧ Control board
⑨ Low-voltage compartment

Fig. 11: Auxiliary transformer panel

9 Components

9.1 Circuit-breaker

Design

The Siemens vacuum circuit-breaker (VCB) is a three-pole indoor circuit-breaker for rated voltages from 7.2 kV to 38 kV.

The operating mechanism accommodates all electrical and mechanical components required for closing and opening the circuit-breaker. The removable front cover of the operating mechanism contains the openings for the control elements and indicators.

The circuit-breaker is closed by pressing the ON pushbutton. After closing, the motor recharges the closing spring. If the motor supply voltage fails, the closing spring can be charged manually.

Equipment

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

- Electrical operating mechanism (charging motor) with mechanical and electrical anti-pumping device (-M1)
- Closing solenoid (-Y9)
- Shunt release (-Y1)
- Low-voltage plug connector (-Q0)
- Auxiliary switch with 4NO + 4NC or 3NO + 4NC freely available (-S1)
- Position switch for "closing spring charged" signal (-S4)
- Circuit-breaker tripping signal, cutout switch (-S6)
- Operations counter
- Feeder locking device
- Interlocking between feeder locking device and three-position disconnector (circuit-breaker only lockable in earthed position)

Can be ordered optionally.

- Extended auxiliary switch with 10NO + 6NC or 9NO + 6NC freely available (-S1)
- Shunt release (-Y2)
- Undervoltage release (-Y7)
- Current-transformer release (-Y4)
- Low-energy current-transformer release (-Y6)
- Closing solenoid (-Y8)
- Circuit-breaker tripping signal (-S7/-S8)
- Interlocking of feeder locking device against three-position disconnector and cable compartment cover
  - Circuit-breaker only lockable in earthed position
  - Cable compartment cover only removable in earthed position

Possible release combinations

Release		Release combination				
		1	2	3	4	5
1st shunt release	Type 3AY1410	X	X	X	–	X
2nd shunt release	Type 3AX1101	–	X	–	–	–
C.t.-operated release	Type 3AX1102; 0.5 A or	–	–	X	X	–
	Type 3AX1104; 0.1 Ws					
Undervoltage release	Type 3AX1103	–	–	–	–	X
X: 1 no. of each release. A maximum of 2 releases can be combined only.						

9.2 Vacuum contactor

Design

The Siemens high-voltage vacuum contactor is a three-pole indoor contactor for the rated voltage range from 7.2 kV to 24 kV. The vacuum contactor can be controlled by remote and has an electromagnetic operating mechanism suitable for high switching rates and unlimited operating time. The electromagnetic operating mechanism is suitable for AC operation or DC operation.

The operating mechanism box accommodates all electrical and mechanical components required for closing and opening the vacuum contactor.

The vacuum contactor has opening springs to ensure that the vacuum contactor switches off if the supply voltage fails.

Equipment

The basic version of the vacuum contactor is equipped as follows:

- Electromagnetic operating mechanism for unlimited operating time
- Auxiliary switch with 3NO + 4NC freely available

Can be ordered optionally.

- Extended auxiliary switch with 5NO + 6NC freely available
- Mechanical closing latch

9.3 Three-position disconnector

The three-position disconnector combines the DISCONNECTING and READY-TO-EARTH functions with the switch positions CLOSED – OPEN – READY-TO-EARTH.

Application:

- Circuit-breaker panel of 630 A to 1250 A
- Disconnector panel of up to 1250 A
- Bus sectionalizer panel of 1000 A to 1250 A
- Air-insulated metering panel

In circuit-breaker panels, earthing and short-circuiting the feeder is done by closing the vacuum circuit-breaker.

In disconnector panels, earthing and short-circuiting the busbar is done by closing the vacuum circuit-breaker.

Equipment

The basic version of the three-position disconnector is equipped as follows:

- Auxiliary switch, freely available
  - In READY-TO-EARTH function with 6NO + 6NC
  - In DISCONNECTING function with 6NO + 6NC
- Manual operating mechanism
- Mechanical interlocking to the circuit-breaker

Can be ordered optionally.

- Motor operating mechanism
- Electromechanical interlock

9.4 Three-position switch-disconnector

The three-position switch-disconnector combines the LOAD BREAKING, DISCONNECTING and EARTHING functions with the switch positions CLOSED – OPEN – EARTHED.

Application:

- Switch-disconnector panel
- Ring-main panel
- Vacuum contactor panel
- Metering panel
- Auxiliary transformer panel

Equipment

The basic version of the three-position switch-disconnector is equipped as follows:

- Auxiliary switch, freely available
  - In EARTHING function with 6NO + 6NC
  - In DISCONNECTING function with 6NO + 6NC
- Manual operating mechanism
- Mechanical interlocking (connection compartment cover can be removed only in the earthed position)

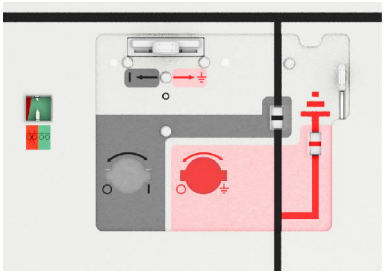
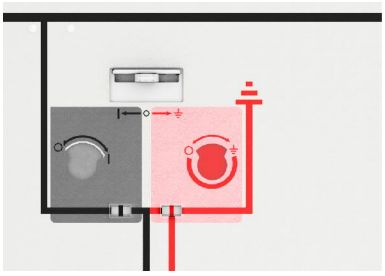
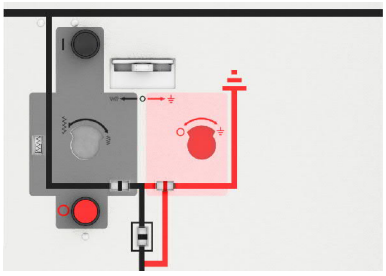
Can be ordered optionally.

- Motor operating mechanism
- Electromechanical interlock

9.5 Operating mechanisms for three-position switch

The three-position disconnector and the three-position switch-disconnector are operated from the switchgear front using the operating mechanisms.

Operating mechanisms

Slow motion mechanism	Spring-operated mechanism	Spring-operated/stored-energy mechanism
Application: • Circuit-breaker panel • Air-insulated metering panel • Disconnector panel • Bus sectionalizer panel **Feature** • Rotary lever mechanism 180°	**Application:** • Ring-main panel • Metering panel • Vacuum contactor panel with HV HRC fuses **Feature** • Rotary lever mechanism 90°	**Application:** • Auxiliary transformer panel • Switch-disconnector panel **Feature** • Rotary lever mechanism 90° • Additional energy store for the "stored-energy OPEN" function after tripping by HV HRC fuse or shunt release
		

Options for all operating mechanisms

- **Motor operating mechanism**
  - Remote operation (standard) applied to terminal
  - Local operation by momentary-contact rotary control switch (option)
  - Manual operation possible with operating lever
- **Shunt release** (f-release)
  - Spring-operated/stored-energy mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the magnetic coil of the shunt release, e.g. transformer overtemperature tripping.
- **Wiring**
  - Auxiliary switches, motor operating mechanisms or shunt releases are wired to terminal strips in the low-voltage compartment.

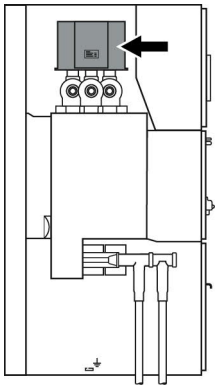
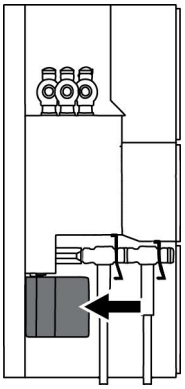
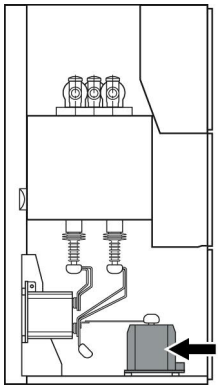
9.6 Voltage transformers

Voltage transformers of the 4MT2, 4MT3, 4MT26, 4MU1 or 4MR type in the NXPLUS C switchgear can be installed as an option.

Common features

- According to VDE 0414-9-3 and IEC 61869-3
- Cast-resin insulated
- Inductive type
- Arranged outside the primary enclosure (switching-device vessel)

Mounting locations

Busbar		**Panel connection**		**Instrument transformer compartment**
				
Instrument transformer types				
• 4MT2 (up to 24 kV)	• 4MT26 (up to 38 kV)	• 4MT3 (up to 24 kV)	• 4MU1 (up to 38 kV)	• 4MR (up to 24 kV)
Panel types				
• Circuit-breaker panel • Switch-disconnector panel with fuses • Vacuum contactor panel with fuses • Ring-main panel • Auxiliary transformer panel • Bus sectionalizer panel (LK-LS) • Disconnector panel	• Circuit-breaker panel • Disconnector panel	• Circuit-breaker panel (600 mm) • Disconnector panel • Metering panel	• Circuit-breaker panel • Disconnector panel	• Air-insulated metering panel

Features of the instrument transformer types

4MT2, 4MT26	**4MT3, 4MU1**	**4MR**
• Pluggable in the cross adapters of the busbar • No separate metering panel required • Repeat test at 80 % of the rated short-duration power-frequency withstand voltage possible with mounted voltage transformer • Touchable due to metal enclosure • Safe-to-touch due to the metal enclosure of the switchgear • Pluggable	• Switchable through gas-insulated disconnecting facility in the switching-device vessel • Switch position: "CLOSED" and "EARTHED" • Operation of the disconnecting facility from outside through a metal bellows welded in the switching-device vessel. • Voltage testing on switchgear and cable possible with mounted and earthed voltage transformer • Not suitable for 80 % of the rated short-duration power-frequency withstand voltage (disconnect and earth the voltage transformer through the disconnecting facility)	• Block-type voltage transformer • Mounted on instrument transformer cassette • Connection via flexible wire • Air-insulated

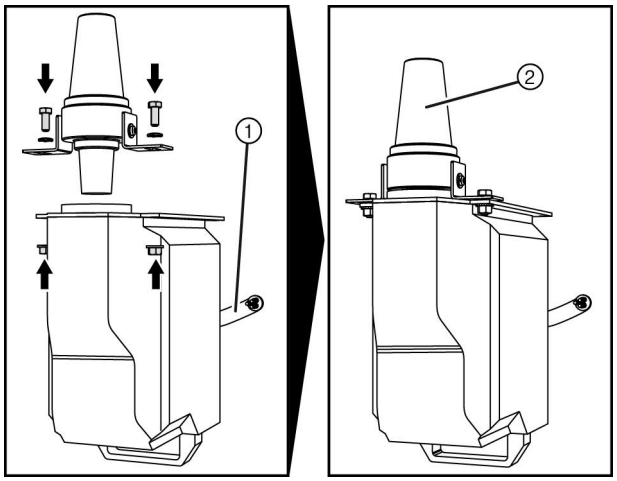
Conformity of voltage transformers

The voltage transformer can be used as measuring transformer.

The approval symbol for the voltage transformer is located on the type plate.
The approval symbol is valid throughout the entire service life of the voltage transformer.

Observe deviating country-specific statutory regulations, if applicable.

For an inspection by a calibration office or an officially recognized inspecting authority, the test adapter (802-8061.3) shown below can be installed on voltage transformer 4MT3.



① Secondary lead
② Connection of measuring equipment

Fig. 12: Installing the test adapter on voltage transformer 4MT3

The test adapter can be procured from the regional Siemens representative.

9.7 Current transformers

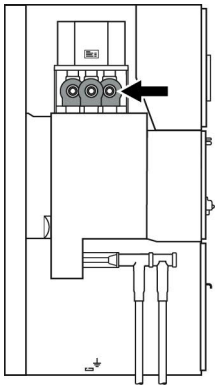
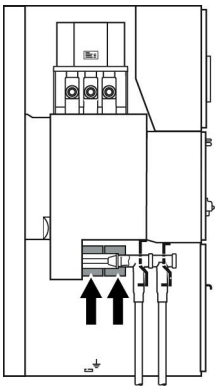
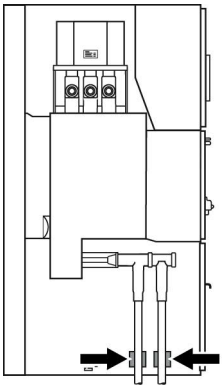
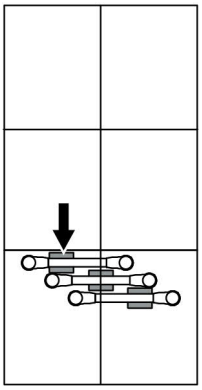
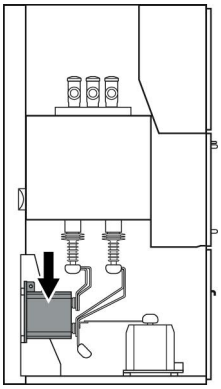
In NXPLUS C switchgear, the following current transformers can optionally be installed:

- Type 4MC4
- Type 4MA7
- Type 4MC7

Common features

- Safe-to-touch due to the metal enclosure of the switchgear
- Insulation class E

Mounting locations

Busbar	Panel connection	Cable	Longitudinal panel interconnection	Instrument transformer compartment
				
Instrument transformer type				
4MC4	4MC4	4MC4	4MC7	4MA7
Panel types				
• Circuit-breaker panel • Auxiliary transformer panel • Air-insulated metering panel (at busbar - busbar) • Disconnector panel • Switch-disconnector panel with fuses • Vacuum contactor panel with fuses • Ring-main panel • Bus sectionalizer panel (LK-TS)	• Circuit-breaker panel • Disconnector panel • Switch-disconnector panel • Ring-main panel • Vacuum contactor panel with fuses	• Circuit-breaker panel	• 2-panel bus sectionalizer	• Air-insulated metering panel
Features				
• Diameter: 55/150 mm ≤ 1250 A • Oval design >1250 A • Max. height 170 mm	• Diameter: 106/190 mm at ≤ 1250 A • Oval design >1250 A • Max. height 122 mm at LS (450 mm) • Max. height 214 mm	**for shielded cables** • Diameter: 55/150 mm ≤ 1250 A • Oval design >1250 A • Max. height 170 mm	• Diameter: 55/125 mm • Max. height 150 mm	• Designed as indoor block-type current transformer, 1-pole • Dimensions according to DIN 42600 Part 8 • Secondary connection by means of screw-type terminals • Cast-resin insulated
• Arranged outside the primary enclosure (switching-device vessel) due to single-pole design of cable connection and busbar • Free of dielectrically stressed cast-resin parts (due to design) **Designed as ring-core current transformer:** • Ring core as carrier of secondary winding • Main circuit corresponds to primary winding				

9.8 HV HRC fuse assembly

Features

- With fuse slide for fuse replacement without tools
- HV HRC fuse-links according to DIN 43625 (main dimensions) with striker in "medium" version according to IEC/EN 60282-1
  - As short-circuit protection before transformers
  - With selectivity to upstream and downstream connected equipment
  - 1-pole insulated
- Reference dimension e of the fuse-links
  - U_r = 12 kV: e = 292 mm (option: e = 442 mm)
  - U_r = 24 kV: e = 442 mm
- Requirements according to IEC 62271-105 / VDE 0671-105 met for HV HRC fuse-links in combination with the three-position switch-disconnector
- Thermal striker tripping when the corresponding HV HRC fuse-link is used
- Climate-independent and maintenance-free, with fuse boxes made of cast resin
- Arrangement of HV HRC fuse assembly below the switching-device vessel
- HV HRC fuse assembly connected to the three-position switch-disconnector via welded-in bushings and connecting bars
- Fuse replacement is only possible when the feeder is earthed
- Option for HV HRC fuse-links: "Tripped" indication for remote electrical indication with a NO contact

Mode of operation

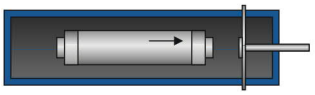
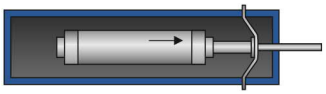
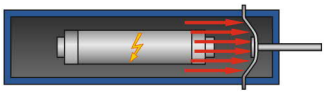
If a HV HRC fuse-link operates, the switch is tripped via an articulation which is integrated into the cover of the fuse box.

Thermal protection

If the fuse tripping fails, the sudden overpressure trips the switch via a diaphragm and the articulation situated in the cover of the fuse box.

The thermal protection works independently of the type and design of the HV HRC fuse-link used. The thermal protection is maintenance-free and independent of any outside climatic effects.

Basic scheme of fuse tripping

	HV HRC fuse-link in service condition
	Fuse tripping through striker of HV HRC fuse-link
	Fuse tripping due to sudden overpressure in the fuse box

The HV HRC fuse-links make SIBA (see page 47, "Selection of HV HRC fuse-links") release the striker depending on the temperature and trip the switch-disconnector as early as in the overload range of the fuses. Impermissible heating of the fuse box can be avoided in this way.

9.9 Busbar system

The busbar is single-pole insulated with silicone rubber. Each phase has a earthed layer on the outside (screened busbar system). This design makes the busbar independent of climatic effects.

As the busbar system is arranged outside the gas compartment, a panel extension, replacement or doubling to increase current-carrying ability are possible within a very short period of time without requiring any gas work.

Double-length busbars are available for bypassing a removed panel. Double-length busbars make it possible to bypass a defective panel within a few hours, and switchgear operation can continue. In order to keep the busbar stable, a busbar support must be installed starting from a specific busbar length (see page 99, "Installing the busbar support").

9.10 Cable connection

Possible combinations of cable connection types (T-plugs, coupling inserts) and surge arresters up to 38 kV

NOTICE

Flashovers due to incompatible plug combinations
Can damage the switchgear.

⇨ Use the same makes for combining plug types, surge arresters and limiters.

For gas-insulated switchgear NXPLUS C, only cable plugs shielded by means of an external conductive layer (also called screened cable T-plugs) can be used. This external semi-conductive layer must be earthed. Earthing is normally done through a cable connection.

Insulated cable T-plugs (without external conductive layer) are **not** permissible, as partial discharges can arise very quickly due to the proximity to earthed parts. Partial discharges destroy the cable T-plug, causing an arc between phase and earth.

The connection of conventional cable sealing ends with elbow adapters (e.g. type AKE) is not permissible, as this connection system is insulated and not screened (no external conductive layer).

Installation possibilities for cable connections and surge arresters, single-core PE-insulated and XLPE-insulated

Circuit-breaker panel 630 A, 800 A (up to 24 kV)									
Panel spacing 450 mm									
Product	Rated voltage	Conductor cross-section[1]	Insulation	Cable T-plug	Coupling plug	Surge arrester with coupling inserts		According to standard	Cable spacing of one phase
	[kV]	[mm²]		bolted	bolted	Surge arrester	Coupling inserts (additional)		
1 cable per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	-	300SA-5(10)SA	-	IEC	-
	24			1x K430TB/G	-		-		-
	36			1x M430TB/G	-		-		-
	12	35...300	EPDM	1x 480TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K480TB/G	-		-		-
	36			1x M480TB/G	-		-		-
	38			1x P480TB/G	-		-		-
	12	50...630	EPDM	1x 484TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K484TB/G	-		-		-
	36			1x M484TB/G	-		-		-
	38			1x P484TB/G	-		-		-
NKT	12	25...300	Silicone	1x CB 24-630	-	CSA 24-x	-	IEC	-
	24				-		-		-
	36	35...300		1x CB 36-630	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...500	Silicone	1x CB 24-1250/2	-	CSA 24-x	-	IEC	-
	24	35...500			-		-		-
	36	150...630		1x CB 36-630(1250)	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-

Circuit-breaker panel 630 A, 800 A (up to 24 kV)									
Panel spacing 450 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	-	RSTI-CC-58SAxxxx	-	IEC	-
	24				-		-		-
	36	35...300		1x RSTI-68xx	-	RSTI-CC-68SAxxxx	-		-
	38				-		-		-
	12	400...800	Silicone	1x RSTI-395x	-	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	-
	24			1x RSTI-595x	-				-
	36			1x RSTI-695x	-	RSTI-CC-68SAxxxx			-
	38				-				-
	12	25...500	EPDM	1x ELBC-810	-	ELBC-CC-810-Saxxxx	-	IEC	-
	24	35...400		1x ELBC-824	-	ELBC-CC-824-Saxxxx	-		-
2 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	1x 300PB/G	-	-	IEC	105
	24			1x K430TB/G	1x K300PB/G	-	-		
	36			1x M430TB/G	1x M300PB/G	-	-		
	12	35...300	EPDM	1x 480TB/G	1x 800PB/G	-	-	IEC	105
	24			1x K480TB/G	1x K800PB/G	-	-		
	36			1x M480TB/G	1x M800PB/G	-	-		
	38			1x P480TB/G	1x P800PB/G	-	-		
	12	50...630	EPDM	1x 484TB/G	1x 804PB/G	-	-	IEC	110
	24			1x K484TB/G	1x K804PB/G	-	-		
	36			1x M484TB/G	1x M804PB/G	-	-		
	38			1x P484TB/G	1x P804PB/G	-	-		
NKT	12	25...300	Silicone	1x CB 24-630	1x CC 24-630 M12	-	-	IEC	100
	24					-	-		
	36	35...300		1x CB 36-630	1x CC 36-630 M12	-	-		110
	38					-	-		
	12	95...500	Silicone	1x CB 24-1250/2	1x CC 24-1250/2 M12	-	-	IEC	110
	24	35...500				-	-		
	36	150...630		1x CB 36-630(1250)	1x CC 36-630(1250)	-	-		
	38					-	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	1x RSTI-CC-58xx	-	-	IEC	100
	24					-	-		
	36	35...300		1x RSTI-68xx	1x RSTI-CC-68xx	-	-		101
	38					-	-		
	12	400...800	Silicone	1x RSTI-395x	1x RSTI-CC-395x	-	-	IEC	100
	24			1x RSTI-595x	1x RSTI-CC-595x	-	-		
	36			1x RSTI-695	1x RSTI-CC-695x	-	-		120
	38					-	-		
	12	25...500	EPDM	1x ELBC-810	1x ELBC-CC-810	-	-	IEC	105
	24	35...400		1x ELBC-824	1x ELBC-CC-824	-	-		

[1] Observe the actual current and short-circuit carrying capacity of the cables and sealing ends.

Installation possibilities for cable connections and surge arresters, single-core PE-insulated and XLPE-insulated

Vacuum contactor panel (up to 24 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
1 cable per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	-	300SA-5(10)SA	-	IEC	-
	24			1x K430TB/G	-		-		-
	36			1x M430TB/G	-		-		-
	12	35...300	EPDM	1x 480TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K480TB/G	-		-		-
	36			1x M480TB/G	-		-		-
	38			1x P480TB/G	-		-		-
	12	50...630	EPDM	1x 484TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K484TB/G	-		-		-
	36			1x M484TB/G	-		-		-
	38			1x P484TB/G	-		-		-
NKT	12	25...300	Silicone	1x CB 24-630	-	CSA 24-x	-	IEC	-
	24				-		-		-
	36	35...300		1x CB 36-630	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...500	Silicone	1x CB 24-1250/2	-	CSA 24-x	-	IEC	-
	24	35...500			-		-		-
	36	150...630		1x CB 36-630(1250)	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	-	RSTI-CC-58SAxxxx	-	IEC	-
	24				-		-		-
	36	35...300		1x RSTI-68xx	-	RSTI-CC-68SAxxxx	-		-
	38				-		-		-
	12	400...800	Silicone	1x RSTI-395x	-	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	-
	24			1x RSTI-595x	-				-
	36			1x RSTI-695x	-	RSTI-CC-68SAxxxx			-
	38				-				-
	12	25...500	EPDM	1x ELBC-810	-	ELBC-CC-810-Saxxxx	-	IEC	-
	24	35...400		1x ELBC-824	-	ELBC-CC-824-Saxxxx	-		-
2 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	1x 300PB/G	-	-	IEC	105
	24			1x K430TB/G	1x K300PB/G	-	-		
	36			1x M430TB/G	1x M300PB/G	-	-		
	12	35...300	EPDM	1x 480TB/G	1x 800PB/G	-	-	IEC	105
	24			1x K480TB/G	1x K800PB/G	-	-		
	36			1x M480TB/G	1x M800PB/G	-	-		
	38			1x P480TB/G	1x P800PB/G	-	-		
	12	50...630	EPDM	1x 484TB/G	1x 804PB/G	-	-	IEC	110
	24			1x K484TB/G	1x K804PB/G	-	-		
	36			1x M484TB/G	1x M804PB/G	-	-		
	38			1x P484TB/G	1x P804PB/G	-	-		

Vacuum contactor panel (up to 24 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
NKT	12	25...300	Silicone	1x CB 24-630	1x CC 24-630 M12	-	-	IEC	100
	24					-	-		
	36	35...300		1x CB 36-630	1x CC 36-630 M12	-	-		110
	38					-	-		
	12	95...500	Silicone	1x CB 24-1250/2	1x CC 24-1250/2 M12	-	-	IEC	110
	24	35...500				-	-		
	36	150...630		1x CB 36-630(1250)	1x CC 36-630(1250)	-	-		
	38					-	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	1x RSTI-CC-58xx	-	-	IEC	100
	24					-	-		
	36	35...300		1x RSTI-68xx	1x RSTI-CC-68xx	-	-		101
	38					-	-		
	12	400...800	Silicone	1x RSTI-395x	1x RSTI-CC-395x	-	-	IEC	100
	24			1x RSTI-595x	1x RSTI-CC-595x	-	-		
	36			1x RSTI-695	1x RSTI-CC-695x	-	-		120
	38					-	-		
	12	25...500	EPDM	1x ELBC-810	1x ELBC-CC-810	-	-	IEC	105
	24	35...400		1x ELBC-824	1x ELBC-CC-824	-	-		

[1] Observe the actual current and short-circuit carrying capacity of the cables and sealing ends.

Installation possibilities for cable connections and surge arresters, single-core PE-insulated and XLPE-insulated

Circuit-breaker panel 630 A, 800 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**according to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
1 cable per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	-	300SA-5(10)SA	-	IEC	-
	24			1x K430TB/G	-		-		-
	36			1x M430TB/G	-		-		-
	12	35...300	EPDM	1x 480TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K480TB/G	-		-		-
	36			1x M480TB/G	-		-		-
	38			1x P480TB/G	-		-		-
	12	50...630	EPDM	1x 484TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K484TB/G	-		-		-
	36			1x M484TB/G	-		-		-
	38			1x P484TB/G	-		-		-
	12	800...1200	EPDM	1x 489TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K489TB/G	-		-		-
	36			1x M489TB/G	-		-		-
	38			1x P489TB/G	-		-		-

Circuit-breaker panel 630 A, 800 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**according to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
NKT	12	25...300	Silicone	1x CB 24-630	-	CSA 24-x	-	IEC	-
	24				-		-		-
	36	35...300		1x CB 36-630	-	CAS 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...500	Silicone	1x CB 24-1250/2	-	CSA 24-x	-	IEC	-
	24	35...500			-		-		-
	36	240...630		1x CB 36-630(1250)	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...1000	Silicone	1x CB 42-1250/3	-	CSA 12-x	-	IEC	-
	24				-	CSA 24-x	-		-
	36				-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	-	RSTI-CC-58SAxxxx	-	IEC	-
	24				-		-		-
	36	35...300		1x RSTI-68xx	-	RSTI-CC-68SAxxxx	-		-
	38				-		-		-
	12	400...800	Silicone	1x RSTI-395x	-	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	-
	24			1x RSTI-595x	-				-
	36			1x RSTI-695x	-	RSTI-CC-68SAxxxx			-
	38				-				-
	12	25...500	EPDM	1x ELBC-810	-	ELBC-CC-810-Saxxxx	-	IEC	-
	24	35...400		1x ELBC-824	-	ELBC-CC-824-Saxxxx	-		-

Circuit-breaker panel 630 A, 800 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**according to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
2 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	1x 300PB/G	300SA-5(10)SA	-	IEC	105
	24			1x K430TB/G	1x K300PB/G		-		
	36			1x M430TB/G	1x M300PB/G		-		
	12	35...300	EPDM	1x 480TB/G	1x 800PB/G	800SA-10-xxx	-	IEC	105
	24			1x K480TB/G	1x K800PB/G		-		
	36			1x M480TB/G	1x M800PB/G		-		
	38			1x P480TB/G	1x P800PB/G		-		
	12	50...630	EPDM	1x 484TB/G	1x 804PB/G	800SA-10-xxx	-	IEC	110
	24			1x K484TB/G	1x K804PB/G		-		
	36			1x M484TB/G	1x M804PB/G		-		
	38			1x P484TB/G	1x P804PB/G		-		
	12	800...1200	EPDM	1x 489TB/G	1x 809PB/G	800SA-10-xxx	-	IEC	120
	24			1x K489TB/G			-		
	36			1x M489TB/G			-		
	38			1x P489TB/G			-		
NKT	12	25...300	Silicone	1x CB 24-630	1x CC 24-630 M12	CSA 12-x	-	IEC	110
	24					CSA 24-x	-		
	36	35...300		1x CB 36-630	1x CC 36-630 M12	CSA 36-x	-		
	38					CSA 38-x	-		
	12	95...500	Silicone	1x CB 24-1250/2	1x CC 24-1250/2 M12	CSA 12-x	-	IEC	110
	24	35...500				CSA 24-x	-		
	36	240...630		1x CB 36-630(1250)	1x CC 36-630(1250)	CSA 36-x	-		
	38					CSA 38-x	-		
	12	95...1000	Silicone	1x CB 42-1250/3	1x CC 42-2500/3	CSA 12-x	-	IEC	127
	24					CSA 24-x	-		
	36					CSA 36-x	-		
	38					CSA 38-x	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	1x RSTI-CC-58xx	RSTI-CC58SAxxxx	-	IEC	100
	24						-		
	36	35...300		1x RSTI-68xx	1x RSTI-CC-68xx	RSTI-CC-68SAxxxx	-		101
	38						-		
	12	400...800	Silicone	1x RSTI-395x	1x RSTI-CC-395x	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	100
	24			1x RSTI-595x	1x RSTI-CC-595x				
	36			1x RSTI-695x	1x RSTI-CC-695x	RSTI-CC-68SAxxxx			120
	38								
	12	25...500	EBDM	1x ELBC-810	1x ELBC-CC-810	ELBC-CC-810-Saxxxx	-	IEC	105
	24	35...400		1x ELBC-824	1x ELBC-CC-824	ELBC-CC-824-Saxxxx	-		

Circuit-breaker panel 630 A, 800 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**according to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
3 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	2x 300PB/G	-	-	IEC	105
	24			1x K430TB/G	2x K300PB/G	-	-		
	36			1x M430TB/G	2x M300PB/G	-	-		
	12	35...300	EPDM	1x 480TB/G	2x 800PB/G	-	-	IEC	105
	24			1x K480TB/G	2x K800PB/G	-	-		
	36			1x M480TB/G	2x M800PB/G	-	-		
	38			1x P480TB/G	2x P800PB/G	-	-		
	12	50...630	EPDM	1x 484TB/G	2x 804PB/G	-	-	IEC	110
	24			1x K484TB/G	2x K804PB/G	-	-		
	36			1x M484TB/G	2x M804PB/G	-	-		
	38			1x P484TB/G	2x P804PB/G	-	-		
	12	800...1200	EPDM	1x 489TB/G	2x 809PB/G	-	-	IEC	120
	24			1x K489TB/G		-	-		
	36			1x M489TB/G		-	-		
	38			1x P489TB/G		-	-		
NKT	12	25...300	Silicone	1x CB 24-630	2x CC 24-630 M12	-	-	IEC	100
	24					-	-		
	36	35...300		1x CB 36-630	2x CC 36-630 M12	-	-		110
	38					-	-		
	12	95...500	Silicone	1x CB 24-1250/2	2x CC 24-1250/2 M12	-	-	IEC	110
	24	35...500				-	-		
	36	240...630		1x CB 36-630(1250)	2x CC 36-630(1250)	-	-		
	38					-	-		
	12	95...1000	Silicone	1x CB 42-1250/3	2x CC 42-2500/3	-	-	IEC	127
	24					-	-		
	36					-	-		
	38					-	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	2x RSTI-CC-58xx	-	-	IEC	100
	24					-	-		
	36	35...300		1x RSTI-68xx	2x RSTI-CC-68xx	-	-		101
	38					-	-		
	12	400...800	Silicone	1x RSTI-395x	2x RSTI-CC-395x	-	-	IEC	100
	24			1x RSTI-595x	2x RSTI-CC-595x	-	-		
	36			1x RSTI-695x	2x RSTI-CC-695x	-	-		120
	38					-	-		

[1] Observe the actual current and short-circuit carrying capacity of the cables and sealing ends.

Installation possibilities for cable connections and surge arresters, single-core PE-insulated and XLPE-insulated

Circuit-breaker panel 1000 A, 1250 A (up to 38 kV) ● Disconnector panel 630 A, 800 A, 1000 A, 1250 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
1 cable per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	-	300SA-5(10)SA	-	IEC	-
	24			1x K430TB/G	-		-		-
	36			1x M430TB/G	-		-		-
	12	35...300	EPDM	1x 480TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K480TB/G	-		-		-
	36			1x M480TB/G	-		-		-
	38			1x P480TB/G	-		-		-
	12	50...630	EPDM	1x 484TB/G	-	800SA-10-xxx	-	IEC	-
	24			1x K484TB/G	-		-		-
	36			1x M484TB/G	-		-		-
	38			1x P484TB/G	-		-		-
	12	800...1200	EPDM	1x 489TP/G	-	800SA-10-xxx	-	IEC	-
	24			1x M489TP/G	-		-		-
	36			1x K489TP/G	-		-		-
	38			1x P489TP/G	-		-		-
NKT	12	25...300	Silicone	1x CB 24-630	-	CSA 24-x	-	IEC	-
	24				-		-		-
	36	35...300		1x CB 36-630	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...500	Silicone	1x CB 24-1250/2	-	CSA 24-x	-	IEC	-
	24	35...500			-		-		-
	36	240...630		1x CB 36-630(1250)	-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
	12	95...1000	Silicone	1x CB 42-1250/3	-	CSA 12-x	-	IEC	-
	24				-	CSA 24-x	-		-
	36				-	CSA 36-x	-		-
	38				-	CSA 38-x	-		-
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	-	RSTI-CC-58SAxxxx	-	IEC	-
	24				-		-		-
	36	35...300		1x RSTI-68xx	-	RSTI-CC-68SAxxxx	-		-
	38				-		-		-
	12	400...800	Silicone	1x RSTI-395x	-	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	-
	24			1x RSTI-595x	-				-
	36			1x RSTI-695x	-	RSTI-CC-68SAxxxx			-
	38				-				-
	12	25...500	EPDM	1x ELBC-810	-	ELBC-CC-810-Saxxxx	-	IEC	-
	24	35...400		1x ELBC-824	-	ELBC-CC-824-Saxxxx	-		-

Circuit-breaker panel 1000 A, 1250 A (up to 38 kV) ● Disconnector panel 630 A, 800 A, 1000 A, 1250 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
2 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	1x 300PB/G	300SA-5(10)SA	-	IEC	105
	24			1x K430TB/G	1x K300PB/G		-		
	36			1x M430TB/G	1x M300PB/G		-		
	12	35...300	EPDM	1x 480TB/G	1x 800PB/G	800SA-10-xxx	-	IEC	105
	24			1x K480TB/G	1x K800PB/G		-		
	36			1x M480TB/G	1x M800PB/G		-		
	38			1x P480TB/G	1x P800PB/G		-		
	12	50...630	EPDM	1x 484TB/G	1x 804PB/G	800SA-10-xxx	-	IEC	110
	24			1x K484TB/G	1x K804PB/G		-		
	36			1x M484TB/G	1x M804PB/G		-		
	38			1x P484TB/G	1x P804PB/G		-		
	12	800...1200	EPDM	1x 489TB/G	1x 809PB/G	800SA-10-xxx	-	IEC	120
	24			1x K489TB/G			-		
	36			1x M489TB/G			-		
	38			1x P489TB/G			-		
NKT	12	25...300	Silicone	1x CB 24-630	1x CC 24-630 M12	CSA 12-x	-	IEC	100
	24					CSA 24-x	-		
	36	35...300		1x CB 36-630	1x CC 36-630 M12	CSA 36-x	-		110
	38					CSA 38-x	-		
	12	95...500	Silicone	1x CB 24-1250/2	1x CC 24-1250/2 M12	CSA 12-x	-	IEC	110
	24	35...500				CSA 24-x	-		
	36	240...630		1x CB 36-630(1250)	1x CC 36-630(1250)	CSA 36-x	-		
	38					CSA 38-x	-		
	12	95...1000	Silicone	1x CB 42-1250/3	1x CC 42-2500/3	CSA 12-x	-	IEC	127
	24					CSA 24-x	-		
	36					CSA 36-x	-		
	38					CSA 38-x	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	1x RSTI-CC-58xx	RSTI-CC-58SAxxxx	-	IEC	100
	24						-		
	36	35...300		1x RSTI-68xx	1x RSTI-CC-68xx	RSTI-CC-68SAxxxx	-		101
	38						-		
	12	400...800	Silicone	1x RSTI-395x	1x RSTI-CC-395x	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	100
	24			1x RSTI-595x	1x RSTI-CC-595x				
	36			1x RSTI-695x	1x RSTI-CC-695x	RSTI-CC-68SAxxxx			120
	38								
	12	25...500	EPDM	1x ELBC-810	1x ELBC-CC-810	ELBC-CC-810-Saxxxx	-	IEC	105
	24	35...400		1x ELBC-824	1x ELBC-CC-824	ELBC-Cc-824-Saxxxx	-		

Circuit-breaker panel 1000 A, 1250 A (up to 38 kV) ● Disconnector panel 630 A, 800 A, 1000 A, 1250 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
3 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	2x 300PB/G	300SA-5(10)SA	-	IEC	105
	24			1x K430TB/G	2x K300PB/G		-		
	36			1x M430TB/G	2x M300PB/G		-		
	12	35...300	EPDM	1x 480TB/G	2x 800PB/G	800SA-10-xxx	-	IEC	105
	24			1x K480TB/G	2x K800PB/G		-		
	36			1x M480TB/G	2x M800PB/G		-		
	38			1x P480TB/G	2x P800PB/G		-		
	12	50...630	EPDM	1x 484TB/G	2x 804PB/G	800SA-10-xxx	-	IEC	110
	24			1x K484TB/G	2x K804PB/G		-		
	36			1x M484TB/G	2x M804PB/G		-		
	38			1x P484TB/G	2x P804PB/G		-		
	12	800...1200	EPDM	1x 489TB/G	2x 809PB/G	800SA-10-xxx	-	IEC	120
	24			1x K489TB/G			-		
	36			1x M489TB/G			-		
	38			1x P489TB/G			-		
NKT	12	25...300	Silicone	1x CB 24-630	2x CC 24-630 M12	CSA 12-x	-	IEC	100
	24					CSA 24-x	-		
	36	35...300		1x CB 36-630	2x CC 36-630 M12	CSA 36-x	-		110
	38					CSA 38-x	-		
	12	95...500	Silicone	1x CB 24-1250/2	2x CC 24-1250/2 M12	CSA 12-x	-	IEC	110
	24	35...500				CSA 24-x	-		
	36	240...630		1xCB 36-630(1250)	2x CC 36-630(1250)	CSA 36-x	-		
	38					CSA 38-x	-		
	12	95...1000	Silicone	1x CB 42-1250/3	2x CC 42-2500/3	CSA 12-x	-	IEC	127
	24					CSA 24-x	-		
	36					CSA 36-x	-		
	38					CSA 38-x	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	2x RSTI-CC-58xx	RSTI-CC-58SAxxxx	-	IEC	100
	24						-		
	36	35...300		1x RSTI-68xx	2x RSTI-CC-68xx	RSTI-CC-68SAxxxx	-		101
	38						-		
	12	400...800	Silicone	1x RSTI-395x	2x RSTI-CC-395x	RSTI-CC-58SAxxxx	RSTI-SA-PIN	IEC	100
	24			1x RSTI-595x	2x RSTI-CC-595x				
	36			1x RSTI-695x	2x RSTI-CC-695x	RSTI-CC-68SAxxxx			101
	38								
4 cables per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	3x 300PB/G	-	-	IEC	105
	24			1x K430TB/G	3x K300PB/G	-	-		
	36			1x M430TB/G	3x M300PB/G	-	-		
	12	35...300	EPDM	1x 480TB/G	3x 800PB/G	-	-	IEC	105
	24			1x K480TB/G	3x K800PB/G	-	-		
	36			1x M480TB/G	3x M800PB/G	-	-		
	38			1x P480TB/G	3x P800PB/G	-	-		
	12	50...630	EPDM	1x 484TB/G	3x 804PB/G	-	-	IEC	110
	24			1x K484TB/G	3x K804PB/G	-	-		
	36			1x M484TB/G	3x M804PB/G	-	-		
	38			1x P484TB/G	3x P804PB/G	-	-		
	12	800...1200	EPDM	1x 489TB/G	3x 809PB/G	-	-	IEC	120
	24			1x K489TB/G		-	-		
	36			1x M489TB/G		-	-		
	38			1x P489TB/G		-	-		

Circuit-breaker panel 1000 A, 1250 A (up to 38 kV) ● Disconnector panel 630 A, 800 A, 1000 A, 1250 A (up to 38 kV)									
Panel spacing 600 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
NKT	12	95...500	Silicone	1x CB 24-1250/2	3x CC 24-1250/2 M12	-	-	IEC	110
	24	35...500				-	-		
	36	240...630		1x CB 36-630(1250)	3x CC 36-630(1250)	-	-		
	38					-	-		
	12	95...1000	Silicone	1x CB 42-1250/3	3x CC 42-2500/3	-	-	IEC	127
	24					-	-		
	36					-	-		
	38					-	-		
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	3x RSTI-CC-58xx	-	-	IEC	100
	24					-	-		
	36	35...300		1x RSTI-68xx	3x RSTI-CC-68xx	-	-		101
	38					-	-		

[1] Observe the actual current and short-circuit carrying capacity of the cables and sealing ends.

Installation possibilities for cable connections and surge arresters, single-core PE-insulated and XLPE-insulated

Auxiliary transformer panel with lateral cable connection (up to 24 kV)									
Panel spacing 900 mm									
Product	**Rated voltage**	**Conductor cross-section[1]**	**Insulation**	**Cable T-plug**	**Coupling plug**	**Surge arrester with coupling inserts**		**According to standard**	**Cable spacing of one phase**
	[kV]	**[mm²]**		**bolted**	**bolted**	**Surge arrester**	**Coupling inserts (additional)**		
1 cable per panel and phase									
Nexans Euromold	12	35...300	EPDM	1x 430TB/G	-	-	-	IEC	-
	24			1x K430TB/G	-	-	-		-
	12	35...300	EPDM	1x 480TB/G	-	-	-	IEC	-
	24			1x K480TB/G	-	-	-		-
NKT	12	25...300	Silicone	1x CB 24-630	-	-	-	IEC	-
	24				-	-	-		-
	12	95...500	Silicone	1x CB 24-1250/2	-	-	-	IEC	-
	24	35...500			-	-	-		-
Tyco Electronics Raychem	12	25...300	Silicone	1x RSTI-58xx	-	-	-	IEC	-
	24				-	-	-		-
	12	25...500	EPDM	1x ELBC-810	-	-	-	IEC	-
	24	35...400		1x ELBC-824	-	-	-		-

[1] Observe the actual current and short-circuit carrying capacity of the cables and sealing ends.

Commercially available bar systems

Bar type	Bar connection				Note
	Product	Type	Conductor material	Maximum rated current	
Solid-insulated busbars	MGC Moser Glaser	Duresca DE	Copper	1250 A / 2500 A	Outer sheath made of polyamide (polyamide tube)
		Duresca DG	Copper	1250 A / 2500 A	Outer sheath made of CrNi steel or aluminum (metal sheath)
	Preissinger	ISOBUS MB	Copper	1250 A / 2500 A	Outer sheath made of epoxy resin (with heat-shrink tube, if required)
	Ritz	SIS	Copper	1250 A / 2500 A	Outer sheath made of epoxy resin (with heat-shrink tube, if required)

Surge-proof caps

Product	Type	Rated voltage	Size	Note
Nexans Euromold	400DR-B	12 kV	Outside cone type "C"	EPDM with conductive layer
	K400DR-B	24 kV		
	M400DR-B	36 kV		
	M400DR-B	38 kV		
	150DR/G	12 kV	Outside cone type "A"	
	K150DR/G	24 kV		
NKT	CBC 40.5-630 M16	12 kV	Outside cone type "C"	Silicone with conductive layer
	CBC 40.5-630 M16	24 kV		
	CBC 40.5-630 M16	36 kV		
	CBC 40.5-630 M16	38 kV		
Tyco Electronics Raychem	RSTI-N66RC	12 kV	Outside cone type "C"	Silicone with conductive layer
	RSTI-N66RC	24 kV		
	RSTI-N66RC	36 kV		
	RSTI-N66RC	38 kV		

☞INFORMATION

For 3-, 4-, 6- or 8-fold cable connection:

⇨ Observe the manufacturer's specifications to the rated normal current of the cable plugs used.

Cable T-plug connection

- Connection of cable T-plugs suitable for bushings with outside cone as interface type C according to EN 50181
- Connection cross-sections up to 1200 mm^2

Surge arresters

- Pluggable on cable T-plug
- Surge arresters recommended if, at the same time,
  - the cable system is directly connected to the overhead line,
  - the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear

Surge limiters

- Pluggable on cable T-plug
- Surge limiters recommended when motors with small starting currents (<600 A) are connected

9.11 Ready-for-service indicator

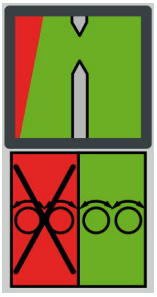
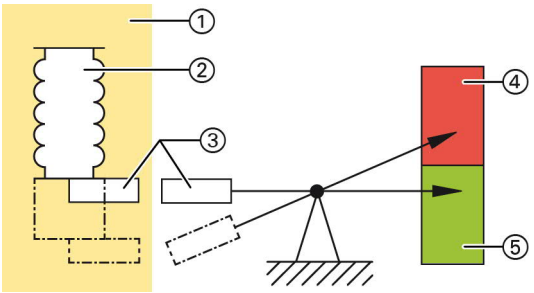


Fig. 13: Ready-for-service indicator in the front cover

Features

- Self-monitoring, easy to read
- Independent of temperature and external pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Contactless acquisition of gas monitoring
- Option: Signaling switch 1 changeover contact for remote electrical indication

Mode of operation



① Switchgear vessel (filled with insulating gas)
② Measurement box
③ Magnetic coupling
④ Red indicator: Not ready for service
⑤ Green indicator: Ready for service

Fig. 14: Principle of gas monitoring with ready-for-service indicator

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

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

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

The same pressure change in both gas volumes compensates for the effect of temperature.

9.12 Interlocks

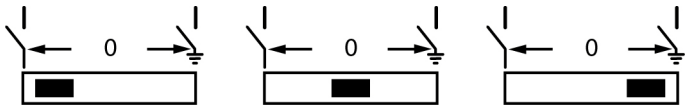
- The three-position switch is equipped with a mechanical interlock. This interlock prevents the circuit-breaker from being closed while the three-position switch is being operated. The mechanical interlock prevents the three-position switch from being operated while the circuit-breaker is closed.
- The control board prevents switching straight from CLOSED to READY-TO-EARTH position or from READY-TO-EARTH to CLOSED position. The operating lever must be exchanged and re-inserted for the OPEN position
- The control gate of the three-position switch can be padlocked in all three positions.

  Position of the control gate:

  Left: The three-position (switch-)disconnector can be operated.

  Center: No switching operation possible

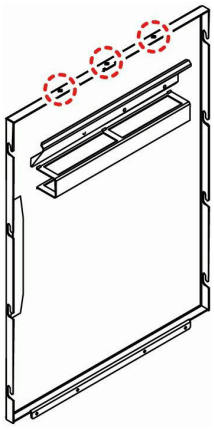
Right: Ready-to-earth or earthing is possible



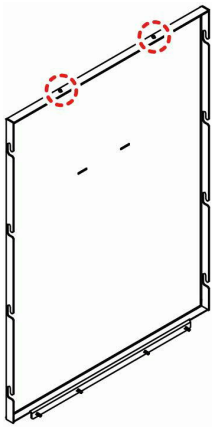
- Interlocking of feeder locking device against three-position disconnector: Circuit-breaker is lockable only in the earthed position
- Interlocking of feeder locking device against three-position disconnector and connection compartment cover: Circuit-breaker is lockable only in the earthed position The connection compartment cover can be removed only in the earthed position.
- Coding for connection compartment covers: Different hole positions prevent confusion between the 600 mm wide connection compartment covers for panels with fuses and those for panels without fuses.

Coding for 600 mm connection compartment covers

Panel with fuses



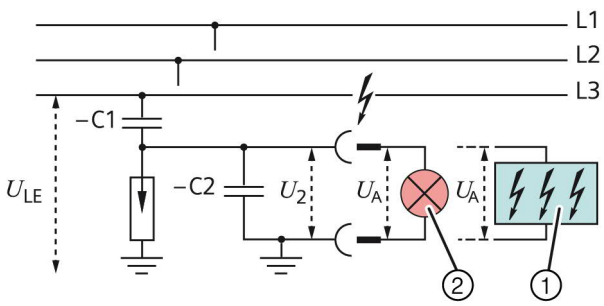
Panels without fuses



9.13 Voltage detecting systems

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

- Plug-in LRM voltage indicator
- Integrated voltage indicators:
  - VOIS
  - CAPDIS
  - WEGA



① Integrated voltage indicator
② Plug-in LRM voltage indicator

Fig. 15: Voltage detecting system via capacitive voltage divider (principle)

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

9.14 Accessories

Standard accessories

The standard accessories are located in the service flap.

- Installation and operating instructions
- Operating lever for disconnector, switch-disconnector (different designs)

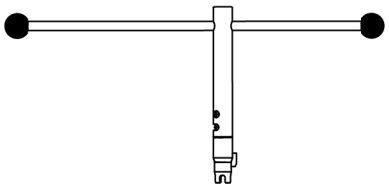
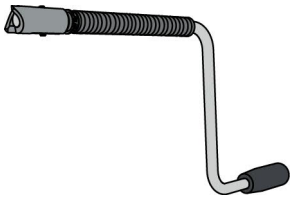
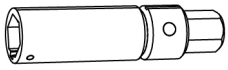


Fig. 16: Example of an operating lever

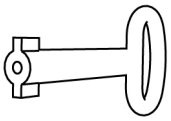
- Hand crank for charging the closing spring on the circuit-breaker



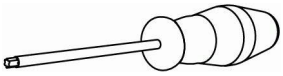
- Adapter for emergency operation (to be used only with motor-operated slow motion mechanism)



- Double-bit key
  - 3 mm diameter for the door of the low-voltage compartment
  - 5 mm diameter for the voltage transformer disconnecting facility and the door of the low-voltage compartment



- Torx screwdriver T25 to open the cable compartment cover

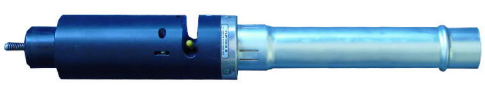


- **Air-insulated metering panel:** An earthing cable for earthing the instrument transformer cassette is located underneath the instrument transformer cassette. The earthing cable is connected with the instrument transformer cassette at the factory and has a length of 4 m.

Other accessories

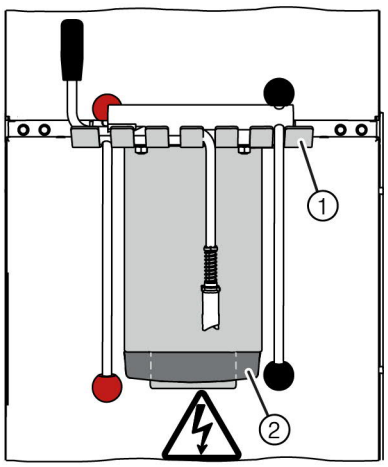
According to the order documents / purchase order (selection):

- Surge arresters
- Surge limiters
- Cable plugs / adapter systems
- Cable plug
- HV HRC fuse-links
- Test fuses for mechanical simulation of the striker of HV HRC fuse-links in the transformer feeder, with extension tube (for slide lengths of 292 mm or 442 mm)



- LRM voltage indicators
- Units to test the capacitive interface and the voltage indicators
- Unit to test the plug-in voltage indicators

- Phase comparison test units
- Holder for operating tool



① Holder for the operating tool
② Handle for the cover on the panel

10 Technical data

10.1 General technical data

Rated voltage U_r			kV	7.2	12	15	17.5	24	27	36	38
Rated insulation level	Rated short-duration power-frequency withstand voltage U_d										
		- phase-to-phase, phase-to-earth, open contact gap	kV	20 (32)	28 (42)	36	38	50	70	70	70
		- across the isolating distance	kV	23 (37)	32 (48)	40	45	60	77	80	77
	Rated lightning impulse withstand voltage U_p										
		- phase-to-phase, phase-to-earth, open contact gap	kV	60	75 (95)	95	95	125	150	170	150
		- across the isolating distance	kV	70	85 (110)	105	110	145	165	195	165
Rated frequency f_r			Hz	50/60							
Rated normal current for busbar I_r			Up to A	2500					1250		
Rated filling pressure p_{re}			kPa	150							
Minimum functional level p_{me}			kPa	130							
Temperature range			°C	(-25) -5 ... +55					-35...+55		

Test voltages for busbar voltage transformers at 50 Hz

The busbar voltage transformers can be tested together with the switchgear at 80% of the rated short-duration power-frequency voltage.

Primary voltage [kV]	Standard	Rated short-duration power-frequency voltage [kV]	80% permissible test value [kV]
Up to 3.6	IEC	10	8.0
Up to 7.2	IEC	20	16.0
	GB	23	18.4
	GOST	32	25.6
Up to 12	IEC	28	22.4
	GB	42	33.6
	GOST	42	33.6
Up to 17.5	IEC	38	30.4
Up to 24	IEC	50	40.0
Up to 36/38 kV	IEC	70	56.0

High-voltage test equipment

The following table shows the current draw per panel for dimensioning the high-voltage test equipment. The test voltage is supplied through a NXPLUS C feeder panel. Further panels to be tested are switched off during the test.

Test voltage [kV]	Current consumption of the incoming panel [mA]	Current consumption of further panels (busbar) [mA]
50	10	5

Power losses per panel

Normal current [A]	Rated voltage [kV]						
	7.2	12	15	17.5	24	27	36/38
400	70 W						
630	160 W						
800	250 W						
1000	400 W						
1250	600 W						

10.2 Circuit-breaker panel

Rated voltage U_r		kV	7.2	12	15	17.5	24	27	36	38
Rated normal current I_r		A	630/800/1000/1250							
Rated short-time withstand current I_k	Panel with t_k = 1 s	kA	20/25/31.5				20/25	20/25[1]		
	Panel with t_k = 3 s	kA	20/25/31.5				20/25	20/25[1]		
Rated peak current I_p	50 Hz	kA	50/63/80				50/63	50/62.5[1]		
	60 Hz	kA	52/65/82				52/65			
Rated short-circuit making current I_{ma}	50 Hz	kA	50/63/80				50/62.5	50/62.5[1]		
	60 Hz	kA	52/65/82				52/65			
Rated short-circuit breaking current I_{sc}		kA	20/25/31.5				20/25	20/25[1]		
Electrical service life of vacuum circuit-breakers										
	at rated normal current		10,000 operating cycles							
	at rated short-circuit breaking current		50 breaking operations							
Endurance classes according to IEC 62271-100			M2, E2, C2							
Endurance classes according to IEC 62271-102	DISCONNECTING		M1							
	READY-TO-EARTH[2]		M0, E0							

[1] Also as 66 kA/26.3 kA at 50 Hz

[2] The EARTHING function with endurance class E2 is reached by closing the circuit-breaker in combination with the three-position disconnector (endurance class E0).

Operating cycles 3AE43

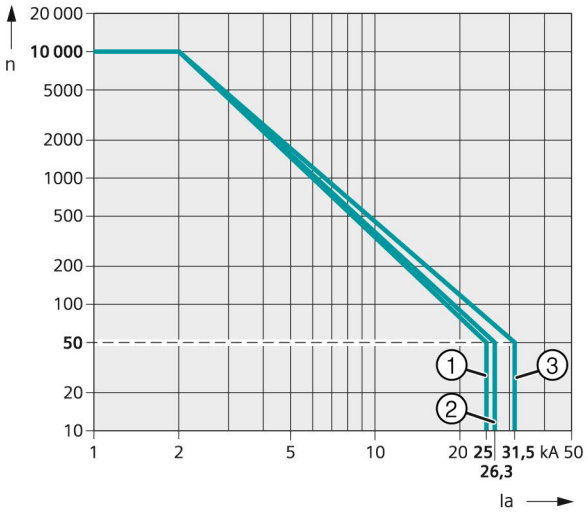
Rated voltage	kV	7.2	12	15	17.5	24
Rated current	A	>800/ ≤ 1250				
Rated short-time withstand current	kA	31.5				25
Rated normal current	Operating cycles	10000				
Short-circuit breaking current	Operating cycles	50				

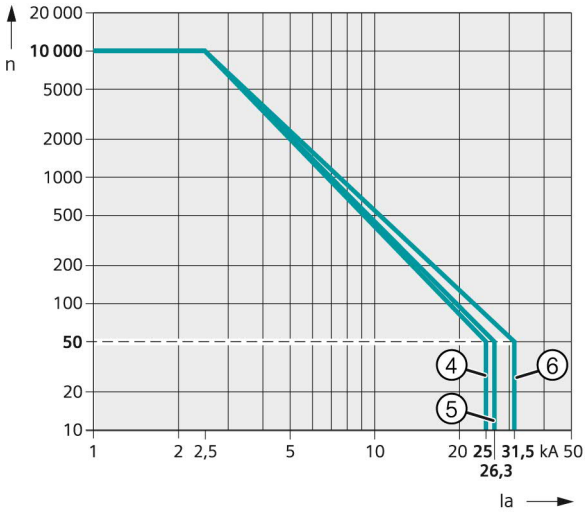
Operating cycles 3AE44

Rated voltage	kV	27	36	38
Rated current	A	630/800/1000/1250		
Rated short-time withstand current	kA	25[1]		
Rated normal current	Operating cycles	10000		
Short-circuit breaking current	Operating cycles	50		

[1] Also as 66 kA/26.3 kA at 50 Hz

Permissible number of operating cycles n as a function of the breaking current I_a (r.m.s. value) in kAI





① • 3AE43 24 kV, 25 kA, 800 A
- 3AE43 24 kV, 25 kA, 1250 A
- 3AE43 24 kV, 25 kA, 2000 A

② • 3AE44 38 kV, 26.3 kA, 800 A
- 3AE44 38 kV, 26.3 kA, 1250 A
- 3AE44 38 kV, 26.3 kA, 2000 A

③ • 3AE43 17.5 kV, 31.5 kA, 1250 A
- 3AE43 17.5 kV, 31.5 kA, 2000 A
- 3AE44 38 kV, 31.5 kA, 1250 A
- 3AE44 38 kV, 31.5 kA, 2000 A

④ 34E43 24kV, 25 kA, 2500 A

⑤ 3AE44 38 kV, 26.3 kA, 2500 A

⑥ 3AE44 38 kV, 31.5 kA, 2500 A

Rated operating sequences:

Rapid transfer (U): O-t-CO-t'-CO (t = 0.3 s, t'= 3 min)

Auto-reclosing (K): O-t-CO-t'-CO (t= 0.3 s, t'= 3 min)

Auto-reclosing (K): O-t-CO-t'-CO (t= 0.3 s, t'= 15 s)

O = OPEN operation

C = CLOSE operation

CO = CLOSE operation with subsequent OPEN operation at the internal close-open time of the vacuum circuit-breaker

Operating times

Operating times	Component	Item designation	Duration		Unit
			3AE44	3AE43	
Closing time	Closing solenoid	(-Y9)	<60		ms
Charging time			<15		s
Opening time	Shunt release	(-Y1)	<60		ms
	Additional release 3AX 11	(-Y2), (-Y4), (-Y6), (-Y7)	<45		ms
Arcing time at 50 Hz			<15		ms
Break time	Shunt release	(-Y1)	<75		ms
	Additional release 3AX 11	(-Y2), (-Y4), (-Y6), (-Y7)	<60		ms
Dead time			300		ms
Minimum command duration					
CLOSED	Closing solenoid	(-Y9)	45		ms
OPEN	Shunt release	(-Y1)	40		ms
OPEN	Additional release 3AX 11	(-Y2), (-Y4), (-Y6), (-Y7)	20		ms
Shortest impulse duration of the circuit-breaker tripping signal			5	10	ms

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

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

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

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

Motor operating mechanism The motor operating mechanism of the circuit-breaker is appropriate for auto-reclosing.

Max. power consumption of the motor operating mechanism

DC voltage	Max. 170 W
AC voltage	Max. 170 VA

The rated currents of the line protection for the motor operating mechanism are listed in the following table.

Fuse protection table: Line protection of motor operating mechanism for vacuum circuit-breaker

	Rated voltage of operating mechanism	Operating voltage[1]		Power consumption of motor		Rated current of operating mechanism	Normal current		Smallest possible rated current of the miniature circuit-breaker
		110%	80%						
	U_a [V]	V_{max} [V]	V_{min} [V]	P [W]	S [VA]	I_{a_A} [A]	I_{max} [A]	I_{min} [A]	I_{a_S} [A]
DC	24	26	19	100	–	3.0	4.0	2.0	8
	30	33	24		–				8
	32	35	26		–				8
	48	53	38		–	1.7	2.2	1.2	4
	60	66	48		–	1.5	2.0	1.0	4
	110	121	88		–	0.7	1.1	0.3	2
	120	132	96		–				2
	125	138	100		–	0.8	1.2	0.4	2
	127	140	102		–				2
	220	242	176		–	0.4	0.6	0.2	1.6
	240	264	192		–				1.6
	250				–				1.6
AC[2]	100	110	80	–	140	1.2	1.7	0.7	3
	110	121	88	–					3
	120	132	96	–					3
	125	138	100	–					3
	230	253	184	–		0.6	0.9	0.3	2
	240	264	192	–					2

[1] The operating voltage may deviate from the rated voltage specified in the table by –20% to +10%.
[2] RMS

Breaking capacity of auxiliary switch 3SV92:

Breaking capacity	Operating voltage [V]	Normal current [A]
AC 40 to 60 Hz	up to 240	10
DC	24	10
	30	10
	32	10
	48	9
	60	7
	110	4
	125	4
	127	4
	220	2
	240	2
Time constant of the auxiliary circuit: t = L/R = 20 ms		

Closing solenoid (-Y9)

The closing solenoid 3AY1410 closes the circuit-breaker. After completion of a closing operation, the closing solenoid is de-energized internally. It is available for AC or DC voltage. The power consumption is ≤ 440 W or ≤ 440 VA.

Shunt release

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

Shunt releases based on two different principles are used:

- The **shunt release (-Y1)** 3AY1410 is used as standard in the basic circuit-breaker version. With this design, the circuit-breaker is opened electrically. The power consumption is ≤ 440 W or ≤ 440 VA.
- The **shunt release (-Y2)** 3AX1101 with energy store is fitted if more than one shunt release is required. With this design, the circuit-breaker is opened by having the electrical opening command transmitted magnetically. The power consumption is ≤ 60 W or ≤ 100 VA.

Undervoltage release

Untervoltage releases (-Y7) 3AX1103 are tripped automatically through an electromagnet or deliberately. The deliberate tripping of the undervoltage release generally takes place via an NC contact in the tripping circuit or via an NO contact by short-circuiting the magnet coil. With this type of tripping, the short-circuit current is limited by the built-in resistors. Power consumption: 20 W or 20 VA.

Circuit-breaker tripping signal

If the circuit-breaker is tripped by a release (e.g. by protection tripping), there is a signal through the NO contact -S6. If the circuit-breaker is tripped with the mechanical pushbutton, there is no signal through the NO contact -S6.

Varistor module

NOTICE

Overvoltages in inductive circuits

Electrical control devices can be damaged by switching overvoltages.

⇨ Do not switch off inductive consumers in DC circuits.

In the case of DC operation, the inductances of the circuit-breaker operating mechanism and the circuit-breaker control system (motor, closing solenoid, shunt release and auxiliary contactor) are equipped with a varistor module. It limits the overvoltage to approx. 500 V, and is available for rated operating voltages from 60 V (DC) up to 220 V (DC). The module contains two separate varistor circuits.

10.3 Switch-disconnector panel

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current I_r[1]		A	200				
Rated short-time withstand current I_k	for switchgear with t_k = 1 s	kA	20/25/31.5				20/25
	for switchgear with t_k = 3 s	kA	20/25/31.5				20/25
Rated peak current I_p	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Rated short-circuit making current I_{ma}	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Endurance classes according to IEC 62271-103			M1, E3				

[1] Depending on the HV HRC fuse-link, observe the maximum permissible let-through current I_D of the HV HRC fuse-links.

10.4 Disconnector panel

Rated voltage Ur		**kV**	**7.2**	**12**	**15**	**17.5**	**24**	**27**	**36**	**38**
Rated normal current I_r		A	630/800/1000/1250							
Rated short-time withstand current I_k	for switchgear with t_k = 1 s	kA	20/25/31.5				20/25[1]			
	for switchgear with t_k = 3 s	kA	20/25/31.5				20/25[1]			
Rated peak current I_p	50 Hz	kA	50/63/80				50/63			
	60 Hz	kA	52/65/82				52/65			
Endurance classes according to IEC 62271-102	DISCONNECTING		M1							
	EARTHING		M0, E0							

[1] For 27 kV, 36 kV and 38 kV also as 66 kA/26.3 kA at 50 Hz

10.5 Vacuum contactor panel with HV HRC fuses

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current[1] I_r		A	200				
Rated short-time withstand current I_k	for switchgear with t_k = 1 s	kA	20/25/31.5				20/25
	for switchgear with t_k = 3 s	kA	20/25/31.5				20/25
Rated peak current I_p	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Rated short-circuit making current I_{ma}	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Electrical service life at rated normal current							
	without mechanical closing latch		500,000 operating cycles				
	with mechanical closing latch		100,000 operating cycles				

[1] Depending on the HV HRC fuse-link, observe the maximum permissible let-through current I_D of the HV HRC fuse-links

Fuse protection table: Line protection of magnet coil for vacuum contactor

	Rated voltage	Operating voltage		Power consumption of main coil		Rated current of main coil	Normal current		Smallest possible rated current of the miniature circuit-breaker
		110%	80%	Pickup	Holding				
	U_a [V]	U_{max} [V]	U_{min} [V]	P [W]		I_a [A]	I_{max} [A] DC	I_{min} [A] DC	I_{a_S} [A]
DC	110	121	88	3100	–	28.18	35.2	25.6	16
				–	120	1.09	1.4	1.0	
	120	132	96	3100	–	25.83	32.3	23.5	16
				–	120	1.00	1.3	0.9	
	125	138	100	3100	–	24.80	31.0	22.5	16
				–	120	0.96	1.2	0.9	
	220	242	176	3700	–	16.82	21.0	15.3	10
				–	145	0.66	0.8	0.6	
				VA			I_{max} [A] AC	I_{min} [A] AC	
AC	110	121	88	3200	–	29.09	36.4	26.4	16
				–	114	1.04	1.3	0.9	
	230	253	184	3200	–	13.91	17.4	12.6	10
				–	114	0.50	0.6	0.5	
	240	264	192	3200	–	13.33	16.7	12.1	10
				–	127	0.53	0.7	0.5	

10.6 Bus sectionalizer panel

Rated voltage U_r		kV	7.2	12	15	17.5	24	27	36	38
Rated normal current I_r		A	1000/1250							
Rated short-time withstand current I_k	for switchgear with t = 1 s	kA	20/25/31.5				20/25	20/25[1]		
	for switchgear with t = 3 s	kA	20/25/31.5				20/25	20/25[1]		
Rated peak current I_p	50 Hz	kA	50/63/80				50/63			
	60 Hz	kA	52/65/82				52/65			
Rated short-circuit making current I_{ma}	50 Hz	kA	50/63/80				50/63			
	60 Hz	kA	52/65/82				52/65			
Rated short-circuit breaking current I_{sc}		kA	20/25/31.5				20/25	20/25[1]		
Electrical service life of vacuum circuit-breakers										
	at rated normal current		10,000 operating cycles							
	at rated short-circuit breaking current		50 opening actions							
Endurance classes according to IEC 62271-100	DISCONNECTING		M1							
	READY-TO-EARTH[2]		M0, E0							

[1] Also as 66 kA/26.3 kA at 50 Hz

[2] The EARTHING function with endurance class E2 is reached by closing the circuit-breaker in combination with the three-position disconnector (endurance class E0)

10.7 Auxiliary transformer panel with HV HRC fuses

Rated voltage U_r		kV	7.2	12	15	17.5	24
Rated normal current I_r		A	200				
Rated short-time withstand current I_k	for switchgear with t = 1 s	kA	20/25/31.5				20/25
	for switchgear with t = 3 s	kA	20/25/31.5				20/25
Rated peak current I_p	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Rated short-circuit making current I_{ma}	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Endurance classes according to IEC 62271-103			M1, E3				

10.8 Metering panel (gas-insulated)

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated short-time withstand current I_k	for switchgear with t = 1 s	kA	20/25/31.5				20/25
	for switchgear with t = 3 s	kA	20/25/31.5				20/25
Rated peak current I_p	50 Hz	kA	50/63/80				50/63
	60 Hz	kA	52/65/82				52/65
Endurance classes according to IEC 62271-103			M1, E3				

10.9 Metering panel (air-insulated)

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current I_r		A	1250				
Rated short-time withstand current I_k	for switchgear with t = 1 s	kA	20/25				
	for switchgear with t = 3 s	kA	20/25				
Rated peak current I_p	50 Hz	kA	50/63				
	60 Hz	kA	52/65				
Endurance classes according to IEC 62271-102	DISCONNECTING		M1				
	EARTHING		M0, E0				

10.10 Ring-main panel

Rated voltage U_r		**kV**	**7.2**	**12**	**15**	**17.5**	**24**
Rated normal current I_r		A	630				
Rated short-time withstand current I_k	for switchgear with t = 1 s	kA	20/25				20
	for switchgear with t = 3 s	kA	20				
Rated peak current I_p	50 Hz	kA	50/63				50
	60 Hz	kA	52/65				52
Rated short-circuit breaking current I_{ma}	50 Hz	kA	50/63				50
	60 Hz	kA	52/65				52
Endurance classes according to IEC 62271-103			M1, E3				

10.11 Current and voltage transformers

Technical data

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

10.12 Classification of NXPLUS C according to IEC 62271-200

Design and construction

Partition class		PM (metallic partition)
Loss of service continuity category	Panels with HV HRC fuses	LSC 2
	Panels without HV HRC fuses	LSC 2
	Air-insulated metering panel	LSC 1
Accessibility to compartments (enclosure)	Busbar compartment	Tool-based
	Switching-device compartment	Non-accessible
	Instrument transformer compartment / transformer compartment	Tool-based
	Fuse compartment	Interlock-controlled and tool-based
	Low-voltage compartment	Tool-based
	Cable compartment	Tool-based

Internal arc classification (IAC) according to IEC 62271-200

Compartment height	Type of installation for the panel	IAC class for rated voltage [kV]							
		7.2	12	15	17.5	24	27[1]	36[1]	38[1]
≥ 2750 mm	Wall-standing arrangement	IAC A FL 31.5 kA, 1 s				IAC A FL 25 kA, 1 s			
	Free-standing arrangement	IAC A FLR 31.5 kA, 1 s				IAC A FLR 25 kA, 1 s			
≥ 2450[2,3] mm	Wall-standing arrangement	IAC A FL 31.5 kA, 1 s				IAC A FL 25 kA, 1 s			
	Free-standing arrangement	IAC A FLR 31.5 kA, 1 s				IAC A FLR 25 kA, 1 s			

[1] Checked at 26.3 kA
[2] With low-voltage compartment, height 761 mm
[3] 2400 mm as option

A	Type of accessibility: Switchgear in closed electrical service location, access "for authorized personnel only"
F	Front
L	Lateral
R	Rear (for free-standing arrangement)
31.5 kA, 25 kA	Test current
1 s	Test duration

10.13 Standards, specifications, guidelines

Prescriptions and standards

NXPLUS C switchgear complies with the following prescriptions and standards:

		IEC standard	VDE standard	EN standard	DIN standard
Switchgear	NXPLUS C	62271-1	0671-1	62271-1	62271-1
		62271-200	0671-200	62271-200	62271-200
		62271-304	-	eLC/TS 62271-304	-
Devices	Circuit-breaker	62271-100	0671-100	62271-100	62271-100
	Vacuum contactor	62271-106	0671-106	62271-106	62271-106
	Disconnector	62271-102	0671-102	62271-102	62271-102
	Earthing switch				
	Switch-disconnector	62271-103	0671-103	62271-103	62271-103
	Switch-fuse combinations	62271-105	0671-105	62271-105	62271-105
	HV HRC fuses	60282-1	0670-4	60282-1	60282-1
	Voltage detecting systems	61243-5	0682-415	61243-5	61243-5
Degree of protection	IP code	60529	0470-1	60529	60529
	IK code	62262	0470-100	50102, 62262	50102, 62262
Insulation		60071-1	0111-1	60071-1	60071-1
Instrument transformers	-	61869-1	0414-9-1	61869-1	61869-1
	Current transformers	61869-2	0414-9-2	61869-2	61869-2
	Voltage transformers	61869-3	0414-9-3	61869-3	61869-3
Air-insulated metering panel	Current transformers	-	-	-	42600-8
	Voltage transformers	-	-	-	42600-9
Installation and erection		61936-1	0101-1	61936-1	61936-1
Insulating gas	Specification for new SF_6	60376	0373-1	60376	60376

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

The vacuum interrupters fitted in the switching devices are type-approved in accordance with §8 of the X-ray Regulations (Röntgenverordnung or RöV) of the Federal Republic of Germany as interference radiators, and they meet the requirements for interference radiators according to Annex 2 No. 5 of the latest RöV up to the rated voltage specified in the approval document. Vacuum interrupters featuring type approval may be operated by the owner of the switchgear without authorization or notification. A printout of the certificate shall be kept on hand at a suitable centralized location.

Electromagnetic compatibility (EMC)

The a.m. standards as well as the "EMC Guide for Switchgear"* are applied during design, manufacture and erection of the switchgear.[1] 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 fulfil the basic protection requirements of the EMC guide.

Protection against solid foreign objects, electric shock and water

The NXPLUS C panels meet the following degrees of protection according to IEC 62271-200, IEC 60529 and DIN VDE 0671-200:

- IP3XD standard for switchgear enclosure of operating front and side walls
- IP31D option for switchgear enclosure of operating front and side walls
- IP32D option for switchgear enclosure of operating front and side walls
- IP65 for parts under high voltage in panels without HV HRC fuses

Seismic withstand capability (option)

NXPLUS C switchgear can be upgraded for regions at risk from earthquakes. For this upgrade, earthquake qualification testing has been carried out in accordance with the following standards:

- IEC 60068-3-3 "Guidance – Seismic test methods for equipment"
- IEC 60068-2-57 "Test Ff: Vibration – Time-history method"
- IEC 60068-2-59 "Test Fe: Vibration – Sine-beat method"
- IEEE 693-2005 "Recommended Practice for Seismic Design of Substations".

For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:

- Uniform Building Code 1997 (UBC) – Zone 4
- California Building Code 1998 (CBC) – Zone 4
- IEEE 693-2005 – High required response spectrum (Figure A.1).

10.14 Selection of HV HRC fuse-links

Note to 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 operating voltage of such a system, this applied voltage may then exceed 87% of the rated voltage.

To be observed during configuration of switching devices and selection of HV HRC fuse-links:

- Use only fuse-links satisfying the stated operating conditions.
- Use only fuse-links whose breaking capacity was tested at least with the maximum system voltage.

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

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with HV HRC fuse-links and tested in accordance with IEC 62271-105.

The following transformer protection table shows HV HRC fuse-links tested by Siemens for protection of transformers, motors, and voltage transformers in the metering panel.

The **fuse protection tables** are valid for:

- Maximum ambient air temperature in the switchgear room of 40 °C according to IEC 62271-1/VDE 0670-1000 considering the influence of the switchgear enclosure. The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)
- Requirements according to IEC 62271-105
- Protection of distribution transformers according to IEC 60787/VDE 0670-402
- Nominal power of transformer (no overload operation)

The specified HV HRC fuse-links make SIBA are type-tested back-up fuses according to IEC 60282-1. The dimensions conform to DIN 43625.

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

The HV HRC fuse-links have a thermal protection in form of a temperature-limiting striker tripping operating in case of defective HV HRC fuse-links or high overload currents.

Please contact the Siemens Service Hotline if you want to use HV HRC fuse-links from other manufacturers.

The selection of HV HRC fuse-links is based on:

- IEC 60282-1
- IEC 62271-105/VDE 0671-105
- IEC 60787/VDE 0670-402
- Recommendations and data sheets of fuse manufacturers
- Permissible power loss in the switchgear enclosure at an ambient air temperature of 40 °C

NOTICE

Use of incorrect fuse-links or extension tubes
Can damage the fuse box or the switchgear.

⇨ Use only fuse-links tested by Siemens, which are listed in the transformer protection table.

⇨ The use of other fuse-links must be checked by Siemens in advance. Contact the Siemens Service Hotline.

Fuse protection table for switch-disconnector panel (with HV HRC fuses make SIBA)

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
3.3...3.6	20	4	3.5	6.3	3...7.2	292	30 098 13.6,3
				10			30 098 13.10
	30	4	5.25	10	3...7.2	292	30 098 13.10
				16			30 098 13.16
	50	4	8.75	16	3...7.2	292	30 098 13.16
				20			30 098 13.20
	75	4	13.1	20	3...7.2	292	30 098 13.20
				25			30 098 13.25
	100	4	17.5	31.5	3...7.2	292	30 098 13.31,5
				40			30 098 13.40
	125	4	21.9	31.5	3...7.2	292	30 098 13.31,5
				40			30 098 13.40
	160	4	28	40	3...7.2	292	30 098 13.40
				50			30 098 13.50
	200	4	35	50	3...7.2	292	30 098 13.50
				63			30 099 13.63
	250	4	43.7	63	3...7.2	292	30 099 13.63
				80			30 099 13.80
	315	4	55.1	80	3...7.2	292	30 099 13.80
				100			30 099 13.100
	400	4	70	100	3...7.2	292	30 099 13.100
4.0...4.8	20	4	2.9	6.3	3...7.2	292	30 098 13.6,3
	30	4	4.4	10	3...7.2	292	30 098 13.10
	50	4	7.3	16	3...7.2	292	30 098 13.16
	75	4	11	16	3...7.2	292	30 098 13.16
				20			30 098 13.20
	100	4	14.5	20	3...7.2	292	30 098 13.20
				25			30 098 13.25
	125	4	18.1	25	3...7.2	292	30 098 13.25
				31.5			30 098 13.31,5
	160	4	23.1	31.5	3...7.2	292	30 098 13.31,5
				40			30 098 13.40
	200	4	28.7	40	3...7.2	292	30 098 13.40
				50			30 098 13.50
	250	4	36.1	50	3...7.2	292	30 098 13.50
				63			30 099 13.63
	315	4	45.5	63	3...7.2	292	30 099 13.63
				80			30 099 13.80
	400	4	57.8	80	3...7.2	292	30 099 13.80
				100			30 099 13.100
	500	4	72.2	100	3...7.2	292	30 099 13.100

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
5.0...5.5	20	4	2.3	6.3	3...7.2	292	30 098 13.6,3
	30	4	3.4	6.3	3...7.2	292	30 098 13.6,3
				10			30 098 13.10
	50	4	5.7	10	3...7.2	292	30 098 13.10
				16			30 098 13.16
	75	4	8.6	16	3...7.2	292	30 098 13.16
				20			30 098 13.20
	100	4	11.5	16	3...7.2	292	30 098 13.16
				20			30 098 13.20
	125	4	14.4	20	3...7.2	292	30 098 13.20
				25			30 098 13.25
	160	4	18.4	31.5	3...7.2	292	30 098 13.31,5
				40			30 098 13.40
	200	4	23	40	3...7.2	292	30 098 13.40
				50			30 098 13.50
	250	4	28.8	40	3...7.2	292	30 098 13.40
				50			30 098 13.50
	315	4	36.3	50	3...7.2	292	30 098 13.50
				63			30 099 13.63
	400	4	46.1	63	3...7.2	292	30 099 13.63
				80			30 099 13.80
	500	4	57.7	80	3...7.2	292	30 099 13.80
				100			30 099 13.100
	630	4	72.74	100	3...7.2	292	30 099 13.100
6.0...7.2	20	4	1.9	6.3	6...12	292	30 004 13.6,3
					3...7.2		30 098 13.6,3
					6...12	442	30 101 13.6,3
	30	4	2.8	6.3	6...12	292	30 004 13.6,3
					3...7.2		30 098 13.6,3
					4...12	442	30 101 13.6,3
	50	4	4.8	10	3...7.2	292	30 098 13.10
					6...12		30 004 13.10
						442	30 101 13.10
				16	3...7.2	292	30 098 13.16
					6...12		30 004 13.16
						442	30 101 13.16
	75	4	7.2	16	3...7.2	292	30 098 13.16
					6...12		30 004 13.16
						442	30 101 13.16
	100	4	9.6	16	3...7.2	292	30 098 13.16
					6...12		30 004 13.16
						442	30 101 13.16
				20	3...7.2	292	30 098 13.20
					6...12		30 004 13.20
						442	30 101 13.20

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
6.0...7.2	125	4	12	20	3...7.2	292	30 098 13.20
					6...12		30 004 13.20
						442	30 101 13.20
				25	3...7.2	292	30 098 13.25
					6...12		30 004 13.25
						442	30 101 13.25
	160	4	15.4	31.5	3...7.2	292	30 098 13.31,5
					6...12		30 004 13.31,5
						442	30 101 13.31,5
	200	4	19.2	31.5	3...7.2	292	30 098 13.31,5
					6...12		30 004 13.31,5
						442	30 101 13.31,5
				40	3...7.2	292	30 098 13.40
					6...12		30 004 13.40
						442	30 101 13.40
	250	4	24	40	3...7.2	292	30 098 13.40
					6...12		30 004 13.40
						442	30 101 13.40
				50	3...7.2	292	30 098 13.50
					6...12		30 004 13.50
						442	30 101 13.50
	315	4	30.3	50	3...7.2	292	30 098 13.50
					6...12		30 004 13.50
						442	30 101 13.50
				63		292	30 012 43.63
	400	4	38.4	63	3...7.2	292	30 099 13.63
					6...12		30 012 13.63
						442	30 102 13.63
						292	30 012 43.63
				80			30 012 43.80
						442	30 102 43.80
	500	4	48	80	6...12	292	30 012 43.80
						442	30 102 43.80
					3...7.2	292	30 099 13.80
					6...12		30 012 13.80
						442	30 102 13.80
				100		292	30 012 43.100
						442	30 102 43.100
	630	4	61	100	3...7.2	292	30 099 13.100
					6...12		30 012 13.100
						442	30 102 13.100
						292	30 012 43.100
						442	30 102 43.100
				125		292	30 020 43.125
						442	30 103 43.125
	800	5...6	77	125	6...12	442	30 103 43.125

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
7.6...8.4	20	4	1.5	6.3	6...12	292	30 004 13.6,3
						442	30 101 13.6,3
	30	4	2.27	5	6...12	292	30 004 13.5
				6.3			30 004 13.6,3
						442	30 101 13.6,3
	50	4	3.7	10	6...12	292	30 004 13.10
						442	30 101 13.10
	75	4	5.7	16	6...12	292	30 004 13.16
						442	30 101 13.16
	100	4	7.6	16	6...12	292	30 004 13.16
						442	30 101 13.16
	125	4	9.5	20	6...12	292	30 004 13.20
						442	30 101 13.20
	160	4	12.1	31.5	6...12	292	30 004 13.31,5
						442	30 101 13.31,5
	200	4	15.2	31.5	6...12	292	30 004 13.31,5
						442	30 101 13.31,5
	250	4	19	40	6...12	292	30 004 13.40
						442	30 101 13.40
	315	4	23.9	50	6...12	292	30 004 13.50
						442	30 101 13.50
	400	4	30.3	63	6...12	292	30 012 13.63
						442	30 102 13.63
	500	4	37.9	80	6...12	292	30 012 43.80
						442	30 102 43.80
	630	4	47.8	100	6...12	292	30 012 43.100
						442	30 102 43.100
8.9	20	4	1.3	6.3	6...12	292	30 004 13.6,3
						442	30 101 13.6,3
	30	4	2	5	6...12	292	30 004 13.5
				6.3			30 004 13.6,3
						442	30 101 13.6,3
	50	4	3.3	10	6...12	292	30 004 13.10
						442	30 101 13.10
	75	4	4.9	16	6...12	292	30 004 13.16
						442	30 101 13.16
	100	4	6.5	16	6...12	292	30 004 13.16
						442	30 101 13.16
	125	4	6.5	16	6...12	292	30 004 13.20
						442	30 101 13.20
	160	4	10.4	25	6...12	292	30 004 13.25
						442	30 101 13.25
	200	4	13	31.5	6...12	292	30 004 13.31,5
						442	30 101 13.31,5
	250	4	16.2	40	6...12	292	30 004 13.40
						442	30 101 13.40
	315	4	20.5	50	6...12	292	30 004 13.50
						442	30 101 13.50
	400	4	26	63	6...12	292	30 012 13.63
						442	30 102 13.63
8.9	500	4	32.5	80	6...12	292	30 012 43.80
						442	30 102 43.80
	630	4	41	100	6...12	292	30 012 43.100
						442	30 102 43.100

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
10.0...12.0	20	4	1.15	4	6...12	292	30 004 13.4
	30	4	1.7	6.3	6...12	442	30 101 13.6,3
	50	4	2.9	10	6...12	292	30 004 13.10
						442	30 101 13.10
					10...17.5	292	30 255 13.10
						442	30 231 13.10
					10...24		30 006 13.10
	75	4	4.3	10	6...12	292	30 004 13.10
						442	30 101 13.10
					10...17.5	292	30 255 13.10
						442	30 231 13.10
					10...24		30 006 13.10
	100	4	5.8	16	6...12	292	30 004 13.16
						442	30 101 13.16
					10...17.5	292	30 255 13.16
						442	30 231 13.16
					10...24		30 006 13.16
	125	4	7.2	16	6...12	292	30 004 13.16
						442	30 101 13.16
					10...17.5	292	30 255 13.16
						442	30 231 13.16
					10...24		30 006 13.16
	160	4	9.3	20	6...12	292	30 004 13.20
						442	30 101 13.20
					10...17.5	292	30 221 13.20
						442	30 231 13.20
					10...24		30 006 13.20
	200	4	11.5	25	6...12	292	30 004 13.25
						442	30 101 13.25
					10...17.5	292	30 221 13.25
						442	30 231 13.25
					10...24		30 006 13.25
	250	4	14.5	25	6...12	292	30 004 13.25
						442	30 101 13.25
					10...17.5	292	30 221 13.25
						442	30 231 13.25
					10...24		30 006 13.25
				31.5	6...12	292	30 004 13.31,5
						442	30 101 13.31,5
					10...17.5	292	30 221 13.31,5
						442	30 231 13.31,5
					10...24		30 006 13.31,5

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
10.0...12.0	315	4	18.3	31.5	6...12	292	30 004 13.31,5
						442	30 101 13.31,5
					10...17.5	292	30 221 13.31,5
						442	30 231 13.31,5
					10...24		30 006 13.31,5
				40	6...12	292	30 004 13.40
						442	30 101 13.40
					10...17.5	292	30 221 13.40
						442	30 231 13.40
					10...24		30 006 13.40
	400	4	23.1	40	6...12	292	30 004 13.40
						442	30 101 13.40
					10...17.5	292	30 221 13.40
						442	30 231 13.40
					10...24		30 006 13.40
				50	6...12	292	30 004 13.50
						442	30 101 13.50
					10...17.5	292	30 221 13.50
						442	30 232 13.50
					10...24		30 014 13.50
	500	4	29	50	6...12	292	30 004 13.50
						442	30 101 13.50
					10...17.5	292	30 221 13.50
						442	30 232 13.50
					10...24		30 014 13.50
				63	6...12	292	30 012 43.63
					10...24	442	30 014 43.63
	630	4	36.4	63	6...12	292	30 012 13.63
						442	30 102 13.63
					10...17.5		30 232 13.63
					6...12	292	30 012 43.63
					10...24	442	30 014 43.63
				80	6...12	292	30 012 43.80
						442	30 102 43.80
					10...24		30 014 43.80
	800	5...6	46.2	63	6...12	292	30 012 13.63
						442	30 102 13.63
				80		292	30 012 43.80
						442	30 102 43.80
	1000	5...6	58	100	6..12	292	30 012 43.100
						442	30 102 43.100
					10...24		30 022 43.100
	1250	5..6	72	125	6..12	292	30 020 43.125
						442	30 103 43.125
12.4...13.4	20	4	0.94	4	10...24	442	30 006 13.4
	30	4	1.4	6.3	10...24	442	30 006 13.6,3
							30 231 13.6,3
	50	4	2.4	10	10...17.5	442	30 231 13.10
					10...24		30 006 13.10

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
12.4...13.4	75	4	3.5	10	10...17.5	442	30 231 13.10
					10...24		30 006 13.10
	100	4	4.7	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16
	125	4	5.9	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16
	160	4	7.5	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16
	200	4	9.4	20	10...17.5	442	30 231 13.20
					10...24		30 006 13.20
	250	4	11.7	25	10...17.5	442	30 231 13.25
				31.5			30 231 13.31,5
				25	10...24		30 006 13.25
				31.5			30 006 13.31,5
	315	4	14.7	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
	400	4	18.7	40	10...17.5	442	30 231 13.40
					10...24		30 006 13.40
	500	4	23.3	50	10...17.5	442	30 232 13.50
					10...24		30 014 13.50
	630	4	29.4	63	10...17.5	442	30 232 13.63
					10...24		30 014 13.63
	800	5...6	37.3	80	10...24	442	30 014 43.80
13.8	20	4	0.8	3.15	10...24	442	30 006 13.3
	30	4	1.25	4	10...24	442	30 006 13.4
	50	4	2.1	6.3	10...17.5	442	30 231 13.6,3
					10...24		30 006 13.6,3
	75	4	3.2	6.3	10...17.5	442	30 231 13.6,3
				10			30 231 13.10
					10...24		30 006 13.10
	100	4	4.2	10	10...17.5	442	30 231 13.10
				16			30 231 13.16
					10...24		30 006 13.16
	125	4	5.3	10	10...17.5	442	30 231 13.10
				16			30 231 13.16
					10...24		30 006 13.16
	160	4	6.7	16	10...17.5	442	30 231 13.16
	200	4	8.4	16	10...17.5	442	30 231 13.16
				20			30 231 13.20
					10...24		30 006 13.20
	250	4	10.5	20	10...17.5	442	30 231 13.20
				25			30 231 13.25
					10...24		30 006 13.25
	315	4	13.2	25	10...17.5	442	30 231 13.25
				31.5			30 231 13.31,5
					10...24		30 006 13.31,5
	400	4	16.8	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
	500	4	21	40	10...17.5	442	30 231 13.40
					10...24		30 006 13.40

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
13.8	630	4	24.4	50	10...17.5	442	30 232 13.50
					10...24		30 014 13.50
	800	5...6	33.5	63	10...17.5	442	30 232 13.63
					10...24		30 014 13.63
							30 014 43.63
	1000	5...6	41.9	80	10...24	442	30 014 43.80
	1250	5..6	52.3	100	10...24	442	30 022 43.100
14.5	20	4	0.8	3.15	10...24	442	30 006 13.3
	30	4	1.2	3.15	10...24	442	30 006 13.3
	50	4	2	6.3	10...17.5	442	30 231 13.6,3
					10...24		30 006 13.6,3
	75	4	3	6.3	10...17.5	442	30 231 13.6,3
					10...24		30 006 13.6,3
	100	4	4	10	10...17.5	442	30 231 13.10
				16			30 231 13.16
					10...24		30 006 13.16
	125	4	5	10	10...17.5	442	30 231 13.10
				16			30 231 13.16
					10...24		30 006 13.16
	160	4	6.5	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16
	200	4	8	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16
				20	10...17.5		30 231 13.20
					10...24		30 006 13.20
	250	4	10	20	10...17.5	442	30 231 13.20
					10...24		30 006 13.20
				25	10...17.5		30 231 13.25
					10...24		30 006 13.25
	315	4	12.6	20	10...17.5	442	30 231 13.20
					10...24		30 006 13.20
				25	10...17.5		30 231 13.25
					10...24		30 006 13.25
	400	4	16.1	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
	500	4	20.1	40	10...17.5	442	30 231 13.40
					10...24		30 006 13.40
	630	4	25.3	50	10...17.5	442	30 232 13.50
					10...24		30 014 13.50
	800	5...6	32.1	63	10...24	442	30 014 43.63
	1000	5...6	40.1	80	10...24	442	30 014 43.80
	1250	5...6	50.2	100	10...24	442	30 022 43.100
15.0...17.5	20	4	0.77	3.15	10...24	442	30 006 13.3
	30	4	1.15	3.15	10...24	442	30 006 13.3
	50	4	1.9	6.3	10...17.5	442	30 231 13.6,3
					10...24		30 006 13.6,3
	75	4	2.9	6.3	10...17.5	442	30 231 13.6,3
	100	4	3.9	10	10...17.5	442	30 231 13.10
	125	4	4.8	16	10...17.5	442	30 231 13.16
					10...24		30 006 13.16

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
15.0...17.5	160	4	6.2	16	10...17.5	442	30 231 13.16
	200	4	7.7	20	10...17.5	442	30 231 13.20
					10...24		30 006 13.20
	250	4	9.7	25	10...17.5	442	30 231 13.25
					10...24		30 006 13.25
	315	4	12.2	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
	400	4	15.5	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
	500	4	19.3	31.5	10...17.5	442	30 231 13.31,5
					10...24		30 006 13.31,5
				40	10...17.5		30 231 13.40
					10...24		30 006 13.40
	630	4	24.3	40	10...17.5	442	30 231 13.40
					10...24		30 006 13.40
				50	10...17.5		30 232 13.50
					10...24		30 014 13.50
				63	10...24		30 014 43.63
	800	5...6	30.9	63	10...24	442	30 014 43.63
	1000	5...6	38.5	63	10...24	442	30 014 43.63
				80	10...24		30 014 43.80
	1250	5...6	48.2	100	10...24	442	30 022 43.100
18.0...19.0	20	4	0.64	3.15	10...24	442	30 006 13.3
	30	4	0.96	3.15	10...24	442	30 006 13.3
	50	4	1.6	6.3	10...24	442	30 006 13.6,3
	75	4	2.4	6.3	10...24	442	30 006 13.6,3
	100	4	3.2	10	10...24	442	30 006 13.10
	125	4	4	10	10...24	442	30 006 13.10
	160	4	5.1	16	10...24	442	30 006 13.16
	200	4	6.4	16	10...24	442	30 006 13.16
	250	4	8.1	20	10...24	442	30 006 13.20
	315	4	10.1	25	10...24	442	30 006 13.25
	400	4	12.9	31.5	10...24	442	30 006 13.31,5
	500	4	16.1	31.5	10...24	442	30 006 13.31,5
				40			30 006 13.40
	630	4	20.2	40	10...24	442	30 006 13.40
				50			30 014 13.50
				63			30 014 43.63
	800	4...5	25.7	50	10...24	442	30 014 13.50
				63			30 014 43.63
	1000	5...6	32.1	63	10...24	442	30 014 43.63
	1250	5...6	40.1	80	10...24	442	30 014 43.80
20	20	4	0.57	3.15	10...24	442	30 006 13.3
	30	4	0.86	3.15	10...24	442	30 006 13.3
	50	4	1.5	6.3	10...24	442	30 006 13.6,3
	75	4	2.2	6.3	10...24	442	30 006 13.6,3
	100	4	2.9	6.3	10...24	442	30 006 13.6,3
	125	4	3.6	10	10...24	442	30 006 13.10
	160	4	4.7	10	10...24	442	30 006 13.10
	200	4	5.8	16	10...24	442	30 006 13.16

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
20	250	4	7.3	16	10...24	442	30 006 13.16
	315	4	9.2	16	10...24	442	30 006 13.16
				20			30 006 13.20
	400	4	11.6	20	10...24	442	30 006 13.20
				25			30 006 13.25
	500	4	14.5	25	10...24	442	30 006 13.25
				31.5			30 006 13.31,5
	630	4	18.2	31.5	10...24	442	30 006 13.31,5
				40			30 006 13.40
	800	5..6	23.1	31.5	10...24	442	30 006 13.31,5
	1000	5...6	29	50	10...24	442	30 014 13.50
	1250	5...6	36	50	10...24	442	30 014 13.50
				63			30 014 43.63
	1600	5...6	46.5	80	10...24	442	30 014 43.80
				100			30 022 43.100
	2000	5...6	57.8	140	10...24	442	30 022 43.140
	2500[1]	5..6	72.2	140	10...24	442	30 022 43.140
22	20	4	0.57	3.15	10...24	442	30 006 13.3
	30	4	0.86	3.15	10...24	442	30 006 13.3
	50	4	1.5	6.3	10...24	442	30 006 13.6,3
	75	4	2.2	6.3	10...24	442	30 006 13.6,3
	100	4	2.9	6.3	10...24	442	30 006 13.6,3
	125	4	3.6	10	10...24	442	30 006 13.10
	160	4	4.7	10	10...24	442	30 006 13.10
	200	4	5.8	16	10...24	442	30 006 13.16
	250	4	7.3	16	10...24	442	30 006 13.16
	315	4	9.2	16	10...24	442	30 006 13.16
				20			30 006 13.20
	400	4	11.6	20	10...24	442	30 006 13.20
				25			30 006 13.25
	500	4	14.5	25	10...24	442	30 006 13.25
				31.5			30 006 13.31,5
	630	4	18.2	31.5	10...24	442	30 006 13.31,5
				40			30 006 13.40
	800	5...6	23.1	31.5	10...24	442	30 006 13.31,5
	1000	5...6	29	50	10...24	442	30 014 13.50
	1250	5..6	36	50	10...24	442	30 014 13.50
				63			30 014 43.63
	1600	5..6	46.5	80	10...24	442	30 014 43.80
				100			30 022 43.100
	2000	5...6	57.8	140	10...24	442	30 022 43.140
	2500	5...6	65.5	140	10...24	442	30 022 43.140
23	20	4	0.57	3.15	10...24	442	30 006 13.3
	30	4	0.86	3.15	10...24	442	30 006 13.3
	50	4	1.5	6.3	10...24	442	30 006 13.6,3
	75	4	2.2	6.3	10...24	442	30 006 13.6,3
	100	4	2.9	6.3	10...24	442	30 006 13.6,3
	125	4	3.6	10	10...24	442	30 006 13.10
	160	4	4.7	10	10...24	442	30 006 13.10
	200	4	5.8	16	10...24	442	30 006 13.16

Transformer				HV HRC fuse-link			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
23	250	4	7.3	16	10...24	442	30 006 13.16
	315	4	9.2	16	10...24	442	30 006 13.16
				20			30 006 13.20
	400	4	11.6	20	10...24	442	30 006 13.20
				25			30 006 13.25
	500	4	14.5	25	10...24	442	30 006 13.25
				31.5			30 006 13.31,5
	630	4	18.2	31.5	10...24	442	30 006 13.31,5
				40			30 006 13.40
	800	5...6	23.1	31.5	10...24	442	30 006 13.31,5
	1000	5...6	29	50	10...24	442	30 014 13.50
	1250	5...6	36	50	10...24	442	30 014 13.50
				63			30 014 43.63
	1600	5...6	46.5	80	10...24	442	30 014 43.80
				100			30 022 43.100
	2000	5...6	57.8	100	10...24	442	30 022 43.100

[1] For fuse protection of transformers with S_r= 2500 kVA, the ambient air temperature of 35°C must not be exceeded.

U_n System operating voltage

S_r Rated power of transformer

u_K Relative impedance voltage of transformer

I_r Rated current of transformer

I_r Rated current of fuse-link

U_r Operating voltage / rated voltage of fuse-link

e Dimension of fuse-link

Fuse protection table for auxiliary transformer panel (with HV HRC fuses make SIBA)

Transformer				HV HRC fuse-link[1]			
Operating voltage	Rated power	Relative impedance voltage	Rated current	Rated current	Min. operating/ rated voltage	Reference dimension	Order No. SIBA
U_N	S_r	u_K	I_r	I_r	U_r	e	
[kV]	[kVA]	%	[A]	[A]	[kV]	[mm]	
3.3...5.0	40	4	7.0	16	3...7.2	292	30 098 13.16
5.5...7.2	40	4	4.2	10	3...7.2	292	30 098 13.10
7.6...8.9	40	4	3.0	10	6...12	442	30 101 13.10
10.0...15.0	40	4	2.3	6.3	10...17.5	442	30 231 13.6,3
15.8...18.0	40	4	1.5	4	10...24	442	30 006 13.4
19.0...23.0	40	4	1.2	3	10...24	442	30 006 13.3

[1] For the part numbers specified her, no extension tubes from SIBA or Siemens are available.

Fuse protection table for vacuum contactor panel (with HV HRC fuses make SIBA)

Motor	Fuse				Number of starts per hour											
					2	4	8	16	2	4	8	16	2	4	8	16
Operating voltage	Max. permissible normal current	Rated current	Reference dimension	Order No. SIBA	HV motors with starting times											
U	I	I_r	e		up to 5 s				up to 15 s				up to 30 s			
[kV]	[A]	[A]	[mm]		Maximum permissible motor starting current in A at rated normal current of HV HRC fuse											
3.3...7.2	30	40	442	30 108 53.40	95	85	75	70	90	80	70	65	80	70	65	60
	38	50	442	30 108 53.50	115	105	95	85	105	95	85	75	100	90	80	75
	47	63	442	30 108 53.63	155	135	125	115	135	120	110	100	120	110	100	95
	60	80	442	30 108 53.80	195	175	160	150	170	155	140	130	155	140	130	120
	75	100	442	30 108 53.100	280	255	230	210	235	215	195	180	210	195	180	165
	85	125	442	30 109 53.125	415	365	335	295	335	300	270	240	300	265	245	205
	109	160	442	30 109 53.160	560	500	455	405	445	400	360	325	390	350	320	265
	130	200	442	30 110 54.200	755	680	630	560	620	550	505	445	550	490	445	315
	137	224	442	30 110 54.224	800	800	740	670	730	655	595	470	645	575	470	335
	157	250	442	30 110 54.250	915	915	915	915	915	890	760	540	865	750	535	380
≥ 7.2...12.0	29	40	442	30 101 53.40	95	85	75	70	90	80	70	65	80	70	65	60
	36	50	442	30 101 53.50	115	105	95	85	105	95	85	75	100	90	80	75
	45	63	442	30 101 53.63	155	135	125	115	135	120	110	100	120	110	100	95
	47	80	442	30 102 53.80	195	175	160	150	170	155	140	130	155	140	130	110
	59	100	442	30 102 53.100	280	255	230	210	235	215	195	180	210	195	180	140
	74	125	442	30 102 53.125	415	365	335	295	335	300	270	240	300	265	245	180
	90	160	442	30 103 53.160	525	500	455	405	445	400	360	310	390	350	305	220
	113	200	442	30 103 54.200	660	660	630	560	620	550	505	390	550	490	385	275
	140	250	442	30 103 54.250	820	820	820	820	820	820	675	480	820	670	480	340
≥ 12.0...23.0	23	40	442	30 006 13.40	95	85	75	70	90	80	70	65	85	75	70	55
	29	50	442	30 014 13.50	115	105	95	85	105	95	85	75	100	90	80	70
	36	63	442	30 014 43.63	135	120	110	95	120	110	100	90	115	105	95	85
	46	80	442	30 014 43.80	160	145	130	115	145	130	120	105	140	125	115	100
	56	100	442	30 022 43.100	210	190	170	150	190	170	155	135	180	160	145	130
	71	140	442	30 022 43.140	250	225	200	180	230	205	185	165	215	190	175	155

Fuse protection table for gas-insulated metering panel (with HV HRC fuses make SIBA)

Voltage transformer		HV HRC fuse-link		
Operating voltage	Rated short-time current"	Rated current	Reference dimension	Order No. SIBA
U_N	I_k	I_r	e	
[kV]	[kA]	[A]	[mm]	* without striker
3.3...5.5	20; 25; 31.5	2.0	292	30 098 13.2
		2.5	292	30 098 13.2,5
		3.15	292	30 098 13.3,15
		4.0	292	30 098 13.4
		5.0	292	30 098 13.5
		6.3	292	30 098 13.6.3
6.0...11.6	20; 25; 31.5	0.5	292	30 004 11.0,5 *
		1.0	292	30 004 11.1
		2.0	292	30 004 13.2
		2.5	292	30 004 13.2,5
		3.15	292	30 004 13.3,15
		4.0	292	30 004 13.4
		5.0	292	30 004 13.5
		6.3	442	30 101 13.6,3

Voltage transformer		HV HRC fuse-link		
Operating voltage	**Rated short-time current"**	**Rated current**	**Reference dimension**	**Order No. SIBA**
U_N	**I_k**	**I_r**	**e**	
[kV]	**[kA]**	**[A]**	**[mm]**	*** without striker**
12.0...16.0	20; 25; 31.5	0.5	442	30 006 11.0,5 *
		1.0	442	30 006 11.1
		2.0	442	30 006 13.2
		2.5	442	30 006 13.2,5
		3.15	442	30 006 13.3,15
		4.0	442	30 006 13.4
		5.0	442	30 006 13.5
		6.3	442	30 006 13.6,3
17.0...23.0	20; 25	0.5	442	30 006 11.0,5 *
		1.0	442	30 006 11.1
		2.0	442	30 006 13.2
		2.5	442	30 006 13.2,5
		3.15	442	30 006 13.3,15
		4.0	442	30 006 13.4
		5.0	442	30 006 13.5
		6.3	442	30 006 13.6,3
17.0...23.0	31.5	no fuse protection available		

10.15 Insulating gas

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

Example for a typical amount of SF_6 gas: NXPLUS C circuit-breaker panel with 3.0 kg SF_6 (CO_2e = 68 t).

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

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

10.16 Rating plates

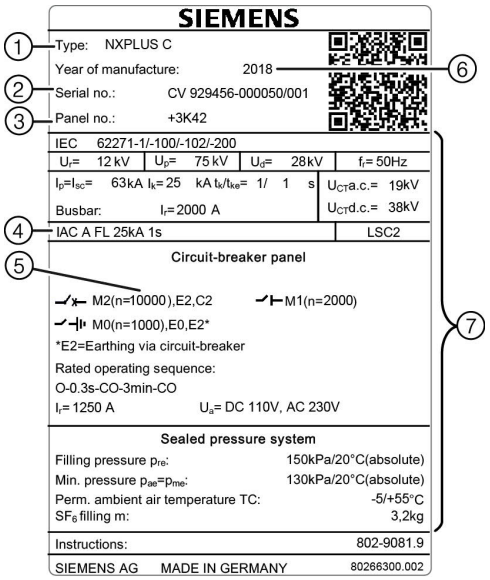


Fig. 17: Rating plate on the inside of the low-voltage compartment

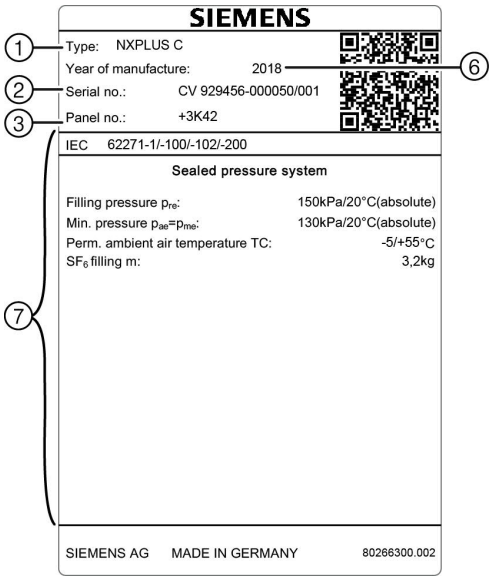


Fig. 18: Rating plate at the switchgear vessel

① Switchgear type
② Serial number
③ Panel number
④ Internal arc classification
⑤ Number of operating cycles
⑥ Year of manufacture
⑦ Technical data

IAC classification

The data ④ describes the internal arc classification of the panel according to IEC 62271-200. The data describes the areas classified for the corresponding panel (see page 45, "Classification of NXPLUS C according to IEC 62271-200").

11 End of life

SF_6 gas

The equipment contains the fluorinated greenhouse gas SF_6 registered by the Kyoto Protocol with a global warming potential (GWP) of 22,800[2] .

⚠CAUTION

Danger of suffocation and risk of environmental damage
A high concentration of SF_6 in the air can cause suffocation. Larger amounts of SF_6 in the atmosphere can cause environmental damage.

⇨ SF_6 has to be reclaimed and must not be released into the atmosphere.

⇨ For use and handling of SF_6IEC 62271-4: High-voltage switchgear and controlgear - Part 4: Use and handling of sulphur hexafluoride (SF6) has to be observed.

Before recycling the materials, evacuate the SF_6 gas professionally and prepare it for further use. For further information, please contact the Siemens Service Hotline.

Recycling

The switchgear is an environmentally compatible product.

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

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

- Galvanized steel (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (busbars)
- Silver (contacts)
- Cast-resin based on epoxy resin (bushings and fuse boxes)
- Plastics (switching chamber und fuse slide)
- Silicone rubber

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

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

Any existing batteries have to be recycled professionally.

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

For further information regarding declarable or restricted substances in this product, please contact **materialcompliance.ms.ehs@siemens.com** .

[2] Source: "Regulation (EU) No. 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No. 842/2006"

Installation

12 Building codes

12.1 Switchgear room

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

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

Preparing the switchgear room

Observe the following points when preparing the switchgear room:

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

Room planning

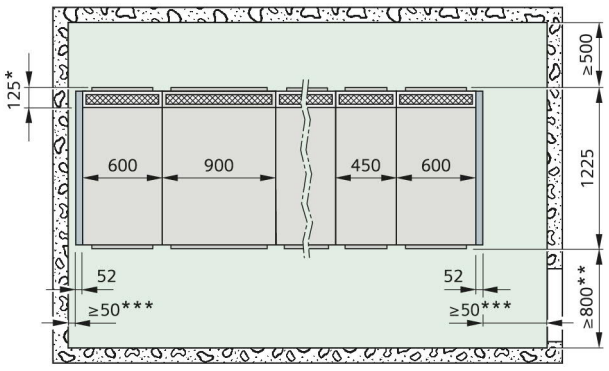


Fig. 19: Free-standing arrangement

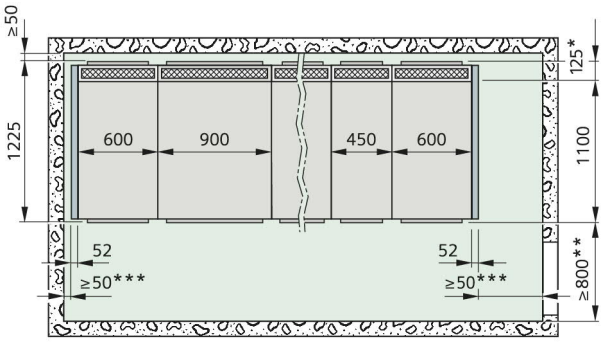


Fig. 20: Wall-standing arrangement

* Pressure relief duct: Depth 125 mm

** Depending on national requirements
Recommendation for replacement in the field or extension:
Control aisle ≥ 1400 mm for panel with 600 mm panel width
Control aisle ≥ 1600 mm for panel with 900 mm panel width

*** For an auxiliary transformer panel with lateral cable connection as left end panel, the left and right wall spacing **must** be at least 500 mm.
For all other panels, a lateral wall distance on the left or right ≥ 500 mm is recommended

Compartment height

Height (min.)	Conditions
≥ 2750 mm	• All technical data • All types of installations • With/without horizontal pressure relief duct
≥ 2450[1] mm	• Wall-standing or free-standing arrangement • Low-voltage compartment 761 mm

[1] 2400 mm as option

Load data

Type of load		Panel width [mm]		
		450	600	900
Constant loads	Vertical single load	7 kN	8 kN	14 kN
Temporary loads	Live load	12 kN/mm^2	12 kN/mm^2	12 kN/mm^2

Minimum distances

		Panel	Minimum dimension
Control aisle[1]		All panels	800 mm
Wall distance[2]	Left	Auxiliary transformer panel	500 mm
		All other panels	50 mm
	Right	Auxiliary transformer panel	500 mm
		All other panels	50 mm

[1] Depending on national requirements. For extension or panel replacement, a control aisle of at least 1400 mm is recommended (at least 1600 mm for panels with a width of 900 mm).

[2] For a wall-standing arrangement, a wall distance (on the left or right) of at least 500 mm is recommended.

Door dimensions

Panel width	Height (min.)	Width (min.)
≤ 600 mm	2500 mm	900 mm
900 mm	2500 mm	1200 mm

Construction of the floor

⚠WARNING

Danger of tipping over while crossing floor openings!
A panel tipping over can cause serious injury.

When it is moved over floor openings, the panel may only have a small standing surface on the base frame.

⇨ While moving over floor openings, support the panel with suitable bridging material.

⇨ Ensure that the load-bearing capacity of the bridging materials is adequate.

⇨ Secure the bridging material against displacement.

The floor covering must have the following characteristics:

- Flat
- Easy to clean
- Pressure-resistant
- Slip-resistant
- Abrasion-resistant
- Electrically dissipative

The following floor constructions are suitable:

Steel girder layer

Suitable for large and numerous floor openings, and advantageous for later modifications or extensions of the switchgear. Recommendation: In order to allow for straightforward panel replacement later on, use a framework construction with longitudinal and cross members. The dimensions are derived from the construction data from NXPLUS C (see page 66, "Construction data for the foundation").

Reinforced-concrete plate

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

Double floor

A double floor is suitable if a cable basement is not available and not enough cable shafts can be accommodated. The double floor consists of removable, flame-retardant floor plates mounted on a supporting structure. The supporting floor is about 30 to 80 cm lower depending on the cable routing (bending radius).

Earthing system

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

Cable basement

NOTICE

Damage due to incorrectly dimensioned cable basement!
A too small cable basement can damage the connection cables or the switchgear.

⇨ The cable basement must allow adequate space for connecting and laying the connection cables.

⇨ Do not violate the minimum cable bending radius of the cables.

The cable basement must have the following characteristics:

- Dry
- Accessible at all times
- Sufficiently illuminated

12.2 Construction data for the foundation

- A suitable foundation can be a false floor, a double floor or a reinforced-concrete foundation. The reinforced-concrete floor must be equipped with foundation rails for supporting the panels.
- For design and construction of the foundation, the relevant standards DIN 43661 "Foundation rails in electrical indoor installations" and DIN 18202 "Measuring tolerances in structural engineering (Sheet 3)" apply.
- Dimensions of the floor opening and the fixing points of the switchgear frame (see page 67, "Floor openings and fixing points" and see page 87, "Fastening the panel to the foundation").

Stipulations for evenness and straightness

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

- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate with shims (0.5 - 1.0 mm).

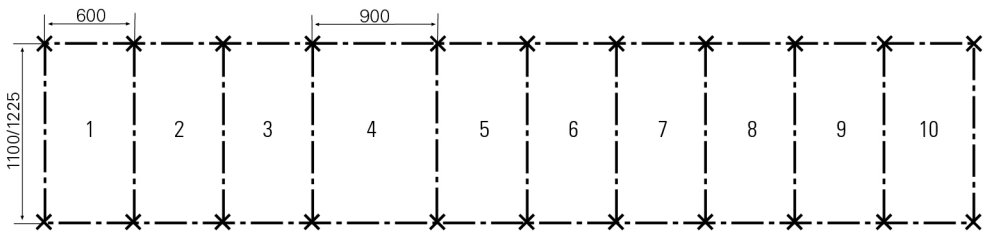
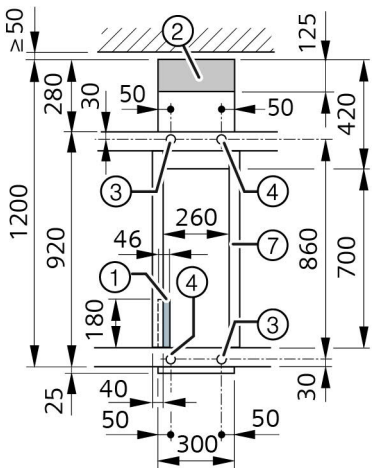


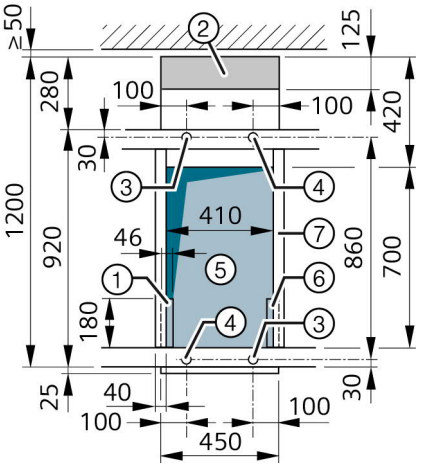
Fig. 21: Measuring sheet for the foundation (example)

Floor openings and fixing points

Panel width	Panel types
300 mm	• Dummy panel

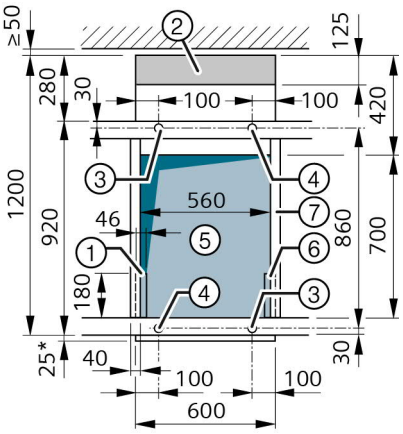


Panel width	Panel types
450 mm	• Circuit-breaker panel 630/800 A • Ring-main panel 630 A

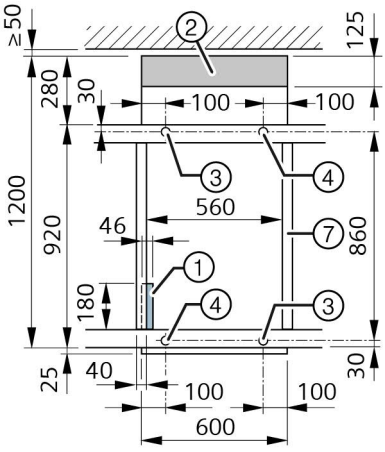


Legend:	
①	Left-hand floor opening for control cables
②	Pressure relief duct
③	Fixing hole for M8/M10
④	Fixing hole for M8/M10 (only for resistance against earthquakes)
⑤	Floor opening for high-voltage cables[3]
⑥	Right-hand floor opening for control cables (only required for zero-sequence current transformers in the cable basement)
⑦	Cross member
*	45 mm for deep cable compartment cover

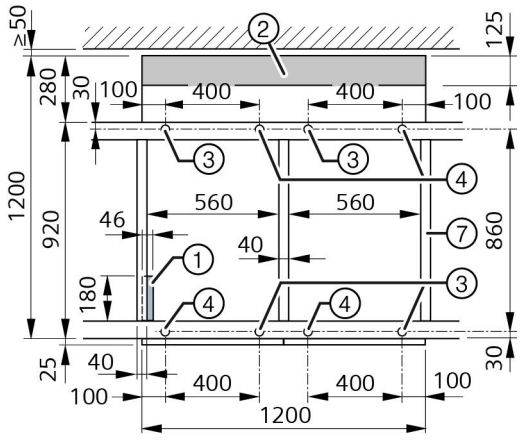
Panel width	Panel types
600 mm	• Circuit-breaker panel 630/800/1000/1250 A • Disconnector panel 1000/1250 A • Switch-disconnector panel with HV HRC fuses • Vacuum contactor panel with HV HRC fuses



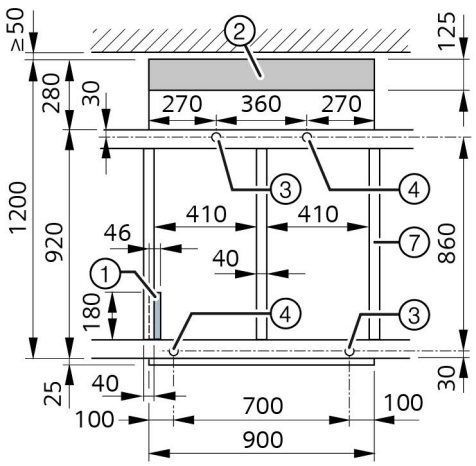
Panel width	Panel types
600	• Bus sectionalizer panel 1000/1250 A • Metering panel (gas-insulated) • Dummy panel



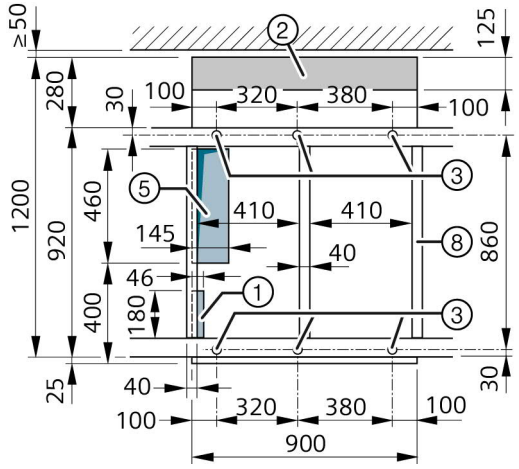
Panel width	Panel types
2x600 mm	• Bus sectionalizer panel 1000/1250 A



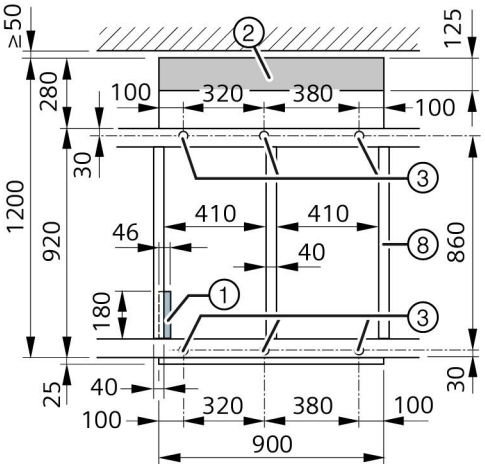
Panel width	Panel types
900 mm	• Bus sectionalizer panel 1000/1250 A



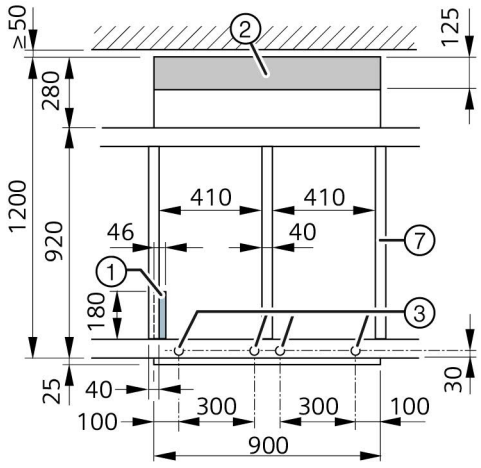
Panel width	Panel types
900 mm	• Auxiliary transformer panel **with** lateral cable connection



Panel width	Panel types
900 mm	• Auxiliary transformer panel **without** lateral cable connection



Panel width	Panel types
900 mm	• Air-insulated metering panel



Legend:	
①	Left-hand floor opening for control cables
②	Pressure relief duct
③	Fixing hole for M8/M10
④	Fixing hole for M8/M10 (only for resistance against earthquakes)
⑤	Floor opening for high-voltage cables[3]
⑥	Right-hand floor opening for control cables (only required for zero-sequence current transformers in the cable basement)
⑦	Cross member

Resistance against earthquakes (option)

For fastening against earthquakes, the panels must be equipped with additional floor bracings. The panel and the floor bracings are bolted together with the foundation rails.

On panels with a panel width of 900 mm, an additional bracing bar must be installed.

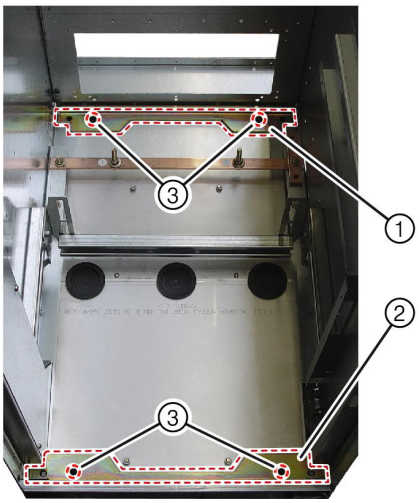


Fig. 22: Floor bracings for a panel with a panel width of 600 mm (view from the front)

① Floor bracing at the rear

② Floor bracing at the front

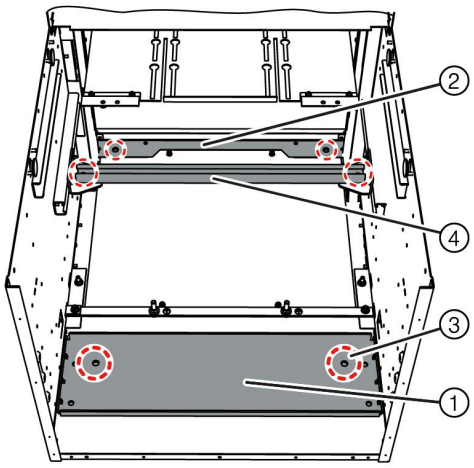


Fig. 23: Floor bracings for a panel with a panel width of 900 mm (view from the rear)

③ Fixing point

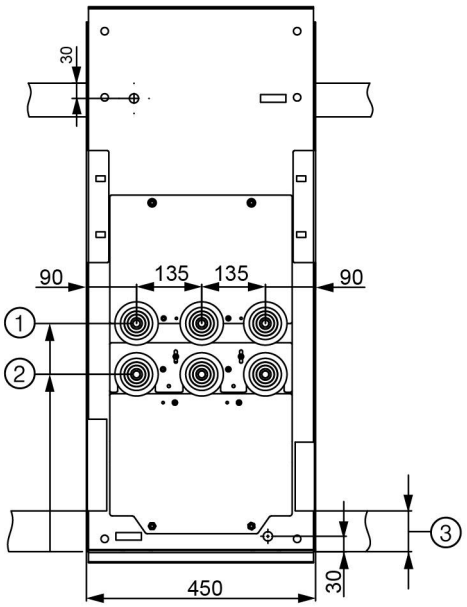
④ Bracing bar (only panel width of 900 mm)

Core drillings (including new plug systems)

☞INFORMATION
For proper installation of the cable plugs, the following must be observed: ⇨ Observe the specifications of the cable manufacturers. ⇨ Drilling diameters depend on the cable cross-section.

Core drillings for 450 mm panel types (7.2 kV...24 kV)

- Circuit-breaker panel 630 A and 800 A (max. 2 cables per phase)
- Ring-main panel (max. 2 cables per phase)



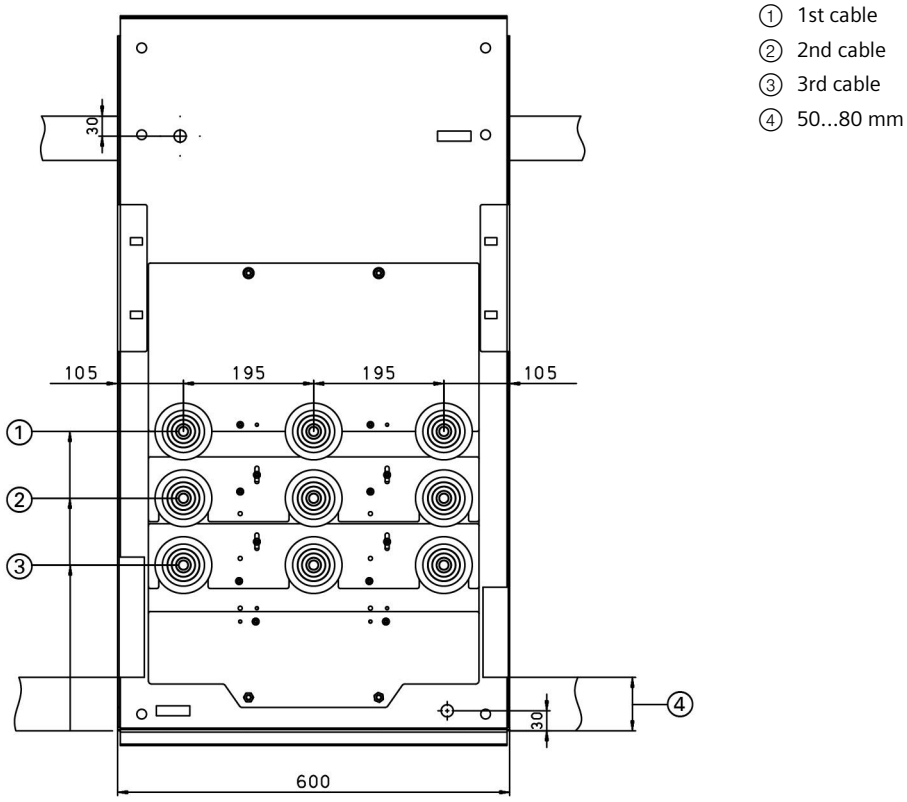
① 1st cable
② 2nd cable
③ 50...80 mm

Conductor distances

Product	1st cable		2nd cable	
	Plug type	Distance [mm]	Plug type	Distance [mm]
Nexans Euromold	(K)(M)430TB/G	380	(K)(M)300PB/G	275
	(K)(M)480TB/G	380	(K)(M)800PB/G	275
	(K)(M)484TB/G	380	(K)(M)804PB/G	270
nkt cables	CB 24-630	380	CC 24-630 M12	280
	CB 24-1250/2	380	CC 24-1250/2 M12	270
	CB 36-630	380	CC 36-630 M12	270
	CB 36-630(1250)	380	CC 36-630(1250)	270
Tyco Electronics Raychem	RSTI-58xx	380	RSTI-CC-58xx	280
	RSTI-68xx	380	RSTI-CC-68xx	279
	RSTI-395x	380	RSTI-CC-395xx	280
	RSTI-595x	380	RSTI-CC-595xx	280
	RSTI-695x	380	RSTI-CC-695xx	260
Solid-insulated bar	Moser-Glaser	371	-	-
	Preissinger	371	-	-
	Ritz	371	-	-

Core drillings for 600 mm panel types (7.2 kV...24 kV)

- Circuit-breaker panel 630 A and 800 A (max. 3 cables per phase)
- Switch-disconnector panel (max. 2 cables per phase)
- Vacuum contactor panel (max. 2 cables per phase)

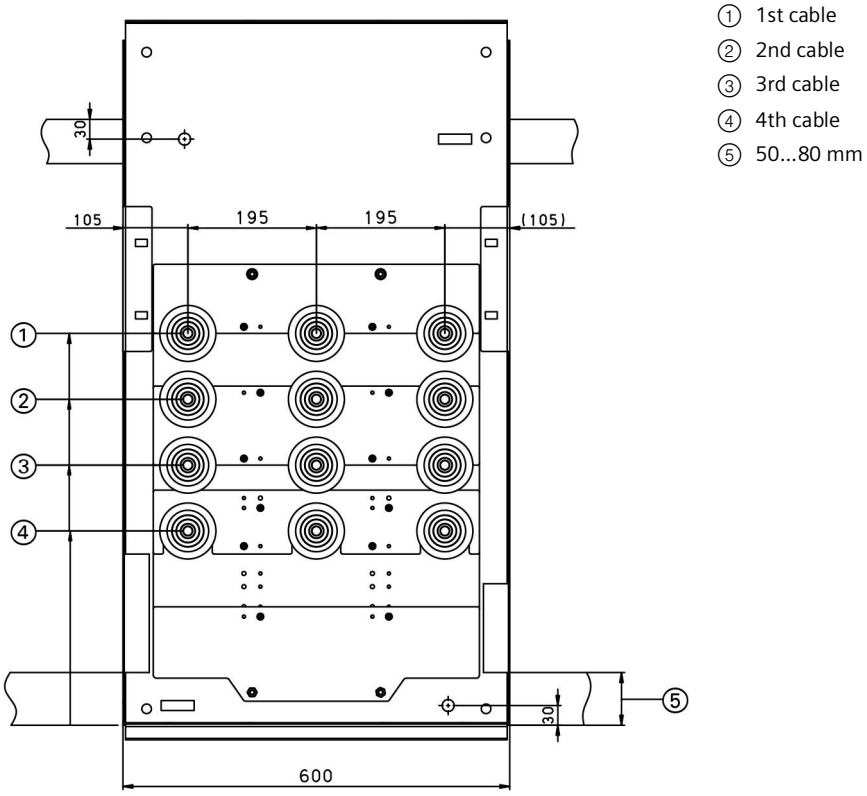


Conductor distances

Product	1st cable		2nd cable		3rd cable	
	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]
Nexans Euromold	(K)(M)(P)430TB/G	448	(K)(M)(P)300PB/G	343	(K)(M)(P)300PB/G	238
	(K)(M)(P)480TB/G	448	(K)(M)(P)800PB/G	343	(K)(M)(P)800PB/G	238
	(K)(M)(P)484TB/G	448	(K)(M)(P)804PB/G	338	(K)(M)(P)804PB/G	228
	(K)(M)(P)489TB/G	448	(K)(M)(P)809PB/G	328	(K)(M)(P)809PB/G	208
nkt cables	CB 24-630	448	CC 24-630	348	CC 24-630	248
	CB 24-1250/2	448	CC 24-1250/2	338	CC 24-1250/2	228
	CB 36-630	448	CC 36-630 M12	338	CC 36-630 M12	228
	CB 36-630(1250)	448	CC 36-630(1250)	338	CC 36-630(1250)	228
	CB 42-1250/3	448	CC 42-2500/3	321	CC 42-2500/3	194
Tyco Electronics Raychem	RSTI-58xx	448	RSTI-CC-58xx	348	RSTI-CC-58xx	248
	RSTI-68xx	448	RSTI-CC-68xx	347	RSTI-CC-68xx	246
	RSTI-395x	448	RSTI-CC-395x	348	RSTI-CC-395x	248
	RSTI-595x	448	RSTI-CC-595x	348	RSTI-CC-595x	248
	RSTI-695x	448	RSTI-CC-695x	328	RSTI-CC-695x	208
Solid-insulated bar	Moser-Glaser	437	-	-	-	-
	Preissinger	437	-	-	-	-
	Ritz	437	-	-	-	-

Core drillings for 600 mm panel types (7.2 kV...24 kV)

- Circuit-breaker panel 1000 A and 1250 A (max. 4 cables per phase)
- Disconnector panel 630 A, 800 A, 1000 A and 1250 A (max. 4 cables per phase)

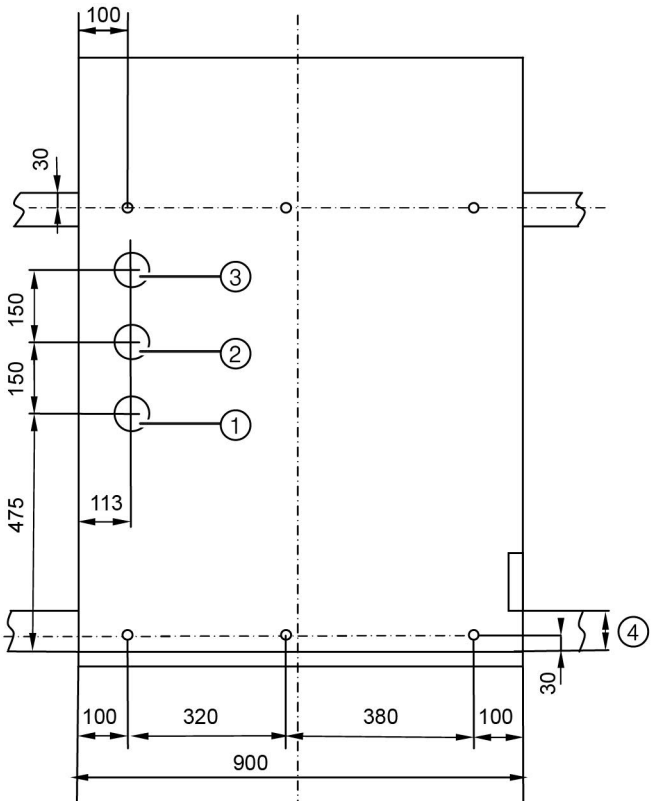


Conductor distances

Product	1st cable		2nd cable		3rd cable		4th cable	
	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]
Nexans Euromold	(K)(M)(P)430TB/G	595	(K)(M)(P)300PB/G	490	(K)(M)(P)300PB/G	385	(K)(M)(P)300PB/G	280
	(K)(M)(P)480TB/G	595	(K)(M)(P)800PB/G	490	(K)(M)(P)800PB/G	385	(K)(M)(P)800PB/G	280
	(K)(M)(P)484TB/G	595	(K)(M)(P)804PB/G	485	(K)(M)(P)804PB/G	375	(K)(M)(P)804PB/G	265
	(K)(M)(P)489TB/G	595	(K)(M)(P)809PB/G	475	(K)(M)(P)809PB/G	355	(K)(M)(P)809PB/G	235
nkt cables	CB 24-630	595	CC 24-630 M12	495	CC 24-630 M12	395	-	-
	CB 24-1250/2	595	CC 24-1250/2	485	CC 24-1250/2	375	CC 24-1250/2	265
	CB 36-630	595	CC 36-630 M12	485	CC 36-630 M12	375	-	-
	CB 36-630(1250)	595	CC 36-630(1250)	485	CC 36-630(1250)	375	CC 36-630(1250)	265
	CB 42-1250/3	595	CC 42-2500/3	468	CC 42-2500/3	341	CC 42-2500/3	214
Tyco Electronics Raychem	RSTI-58xx	595	RSTI-CC-58xx	495	RSTI-CC-58xx	395	RSTI-CC-58xx	295
	RSTI-68xx	595	RSTI-CC-68xx	494	RSTI-CC-68xx	393	RSTI-CC-68xx	292
	RSTI-395x	595	RSTI-CC-395x	495	RSTI-CC-395x	395	-	-
	RSTI-595x	595	RSTI-CC-595x	495	RSTI-CC-595x	395	-	-
	RSTI-695x	595	RSTI-CC-695x	475	RSTI-CC-695x	355	-	-
Solid-insulated bar	Moser-Glaser	584	-	-	-	-	-	-
	Preissinger	584	-	-	-	-	-	-
	Ritz	584	-	-	-	-	-	-

Core drillings for 900 mm panel types (7.2 kV...24 kV)

- Auxiliary transformer panel with lateral cable connection (max. 1 cable per phase)



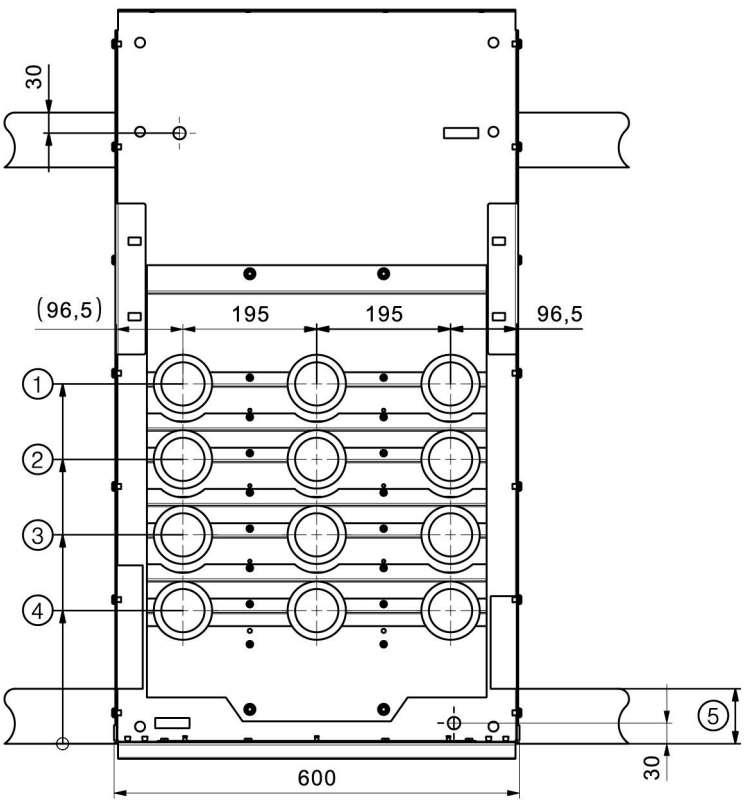
① Cable phase L1
② Cable phase L2
③ Cable phase L3
④ max. 80 mm

Conductor distances

Product	Cable L1		Cable L2		Cable L3	
	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]
Nexans Euromold	(K)430TB/G	475	(K)430TB/G	625	(K)430TB/G	775
nkt cables	CB xx-630	475	CB xx-630	625	CB xx-630	775
Tyco Electronics Raychem	RSTI-58xx	475	RSTI-58xx	625	RSTI-58xx	775

Core drillings for 600 mm panel types (27 kV...38 kV)

- Circuit-breaker panel 630 A, 800 A, 1000 A and 1250 A (max. 4 cables per phase)
- Disconnector panel 630 A, 800 A, 1000 A, 1250 A (max. 4 cables per phase)



① 1st cable
② 2nd cable
③ 3rd cable
④ 4th cable
⑤ 50...80 mm

Conductor distances

Product	1st cable		2nd cable		3rd cable		4th cable	
	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]	Plug type	Distance [mm]
Nexans Euromold	(K)(M)(P)430TB/G	525	(K)(M)(P)300PB/G	420	(K)(M)(P)300PB/G	315	(K)(M)(P)300PB/G	210
	(K)(M)(P)480TB/G	525	(K)(M)(P)800PB/G	420	(K)(M)(P)800PB/G	315	(K)(M)(P)800PB/G	210
	(K)(M)(P)484TB/G	525	(K)(M)(P)804PB/G	415	(K)(M)(P)804PB/G	305	(K)(M)(P)804PB/G	195
	(K)(M)(P)489TB/G	525	(K)(M)(P)809PB/G	405	(K)(M)(P)809PB/G	285	(K)(M)(P)809PB/G	165
NKT	CB 24-630	525	CC 24-630 M12	425	CC 24-630 M12	325	-	-
	CB 24-1250/2	525	CC 24-1250/2	415	CC 24-1250/2	305	CC 24-1250/2	195
	CB 36-630	525	CC 36-630 M12	415	CC 36-630 M12	305	-	-
	CB 36-630(1250)	525	CC 36-630(1250)	415	CC 36-630(1250)	305	CC 36-630(1250)	195
	CB 42-1250/3	525	CC 42-2500/3	398	CC 42-2500/3	271	CC 42-2500/3	144
Tyco Electronics Raychem	RSTI-58xx	525	RSTI-CC-58xx	425	RSTI-CC-58xx	325	RSTI-CC-58xx	225
	RSTI-68xx	525	RSTI-CC-68xx	424	RSTI-CC-68xx	323	RSTI-CC-68xx	222
	RSTI-395x	525	RSTI-CC-395x	425	RSTI-CC-395x	325	-	-
	RSTI-595x	525	RSTI-CC-595x	425	RSTI-CC-595x	325	-	-
	RSTI-695x	525	RSTI-CC-695x	405	RSTI-CC-695x	285	-	-
Solid-insulated bar	Moser-Glaser	514	-	-	-	-	-	-
	Preissinger	514	-	-	-	-	-	-
	Ritz	514	-	-	-	-	-	-

12.3 Transport units

Transport dimensions and transport weights

Transport	Panel spacing	Transport dimensions Width x Height x Depth	Transport weight [approx. kg][1]	
	[mm]	[mm] x [mm] x [mm]	With packing	Without packing
Rail or truck	**24 kV design:**			
	1 x 450	1100 x 2460 x 1450	900	800
	1 x 600	1100 x 2460 x 1450	900	800
	1 x 900[2]	1100 x 2460 x 1450	1300	1200
	Auxiliary transformer	800 x 1200 x 1200	500	425
	36 kV design:			
	1 x 900	1100 x 2460 x 1450	900	800
	1 x 600	1100 x 2460 x 1450	900	800
Ship or airplane	**24 kV design:**			
	1 x 450	1130 x 2550 x 1450	900	800
	1 x 600	1130 x 2550 x 1450	900	800
	1 x 900[2]	1130 x 2550 x 1450	1300	1200
	Auxiliary transformer	800 x 1200 x 1200	500	425
	36 kV design:			
	1 x 900	1130 x 2550 x 1450	900	800
	1 x 600	1130 x 2550 x 1450	900	800

[1] Average value, depends on the equipment level of the panel
[2] Auxiliary transformer panel and air-insulated metering panel

Center of gravity

A panel's center of gravity varies depending on the panel's equipment level. The center of gravity of every panel is marked on the panel.

The center of gravity is indicated by the following symbol (arrow):

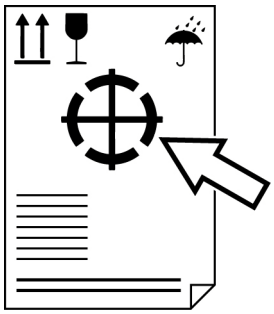


Fig. 24: Symbol for the center of gravity

The symbol for the center of gravity is attached on both sides of the panel.

Transport regulations

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

13 Before installation

13.1 Preliminary clarifications

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

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

13.2 Intermediate storage

⚠WARNING

Overloading of the storage space
Can cause serious injury. Can damage the storage space or the stored goods.

⇨ Observe the load-bearing capacity of the floor.

⇨ Do not stack the transport units.

⇨ Do not overload lighter components by stacking.

⚠WARNING

Fire risk
The transport unit is packed in flammable materials.

⇨ No smoking.

⇨ Keep fire extinguishers in a weatherproof place.

⇨ Mark the location of the fire extinguisher.

NOTICE

Damaged packaging desiccant bags
Can cause corrosion of switchgear parts and formation of creepage distances due to high air humidity.

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

⇨ Do not damage or remove the packaging of desiccant bags.

⇨ Do not unpack desiccant bags before use.

NOTICE

Damage to the switchgear due to outdoor storage!
Outdoor storage of unpacked transport units can damage the switchgear.

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

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

Intermediate storage of the transport units:

- In original packing as far as possible
- Observe the permissible storage temperature from -25 °C to +70 °C in accordance with the installed secondary devices
- In a weatherproof place
- Protected against damage

- If packed in seaworthy crates, the switchgear can be stored for a maximum of 6 months (desiccant bags)
- Store transport units in such a way that they can be taken out later in the correct order for installation

Switchgear storage in closed rooms

Store the switchgear in a closed room. The storage room must have the following characteristics:

- Floor with adequate load-bearing capacity (weights as per delivery note)
- Even floor to enable stable storage.
- Well-ventilated and as free of dust as possible
- Dry and protected against humidity and vermin (e.g. insects, mice, rats)
- Heatable up to at least 2 °C above outside temperature to prevent condensation.
- Check humidity in the packings every 4 weeks (condensation)
- Do not unpack small parts to avoid corrosion and loss.

Outdoor storage of switchgear packed in seaworthy crates

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

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

13.3 Tools and auxiliary means

Before the start of installation work, prepare all necessary tools and equipment.

- Hexagonal screwdriver insert (min. length 140 mm) for 10 mm DIN 7422 hexagon socket head bolt
- TX25 and TX30 Torx screwdrivers
- 20 - 50 Nm torque wrench
- Ratchet, reconnectable DIN 3122
- DIN 312340-125 extension
- DIN 3124 socket spanner inserts, size 17, 18 and 19 socket spanner inserts, min. length 80 mm
- Water level
- Lifting truck
- Reinforcing bars, roller crowbars
- Transport rollers, tubes
- Lifting rods, length 753 mm, Ø 20 mm, e.g. certified lifting rods (order number 802-9047.3, to be procured from the regional Siemens representative)
- Lifting rods, length 1053 mm, Ø 20 mm, e.g. certified lifting rods (order number 804-0011.3, to be procured from the regional Siemens representative)
- Technical requirements for lifting rods:
  - Diameter: 20 mm
  - Loading capability (stretching limit): $R_e \geqq 780$ MPa (N/mm^2)
- Grinding sponge with corundum grit 100
- Abrasive fabric

Set of assembly facilities

The "set of assembly facilities" is recommended (order No.: 802-9204.3, available through the Siemens Service Hotline). The "set of assembly facilities" comprises the following equipment:

- Certified lifting rods (crane rods) for lifting panels with panel widths of 450 mm, 600 mm and 900 mm
  - 2 lifting rods: Length 753 mm, Ø 20 mm
  - 2 lifting rods: Length 1053 mm, Ø 20 mm
- 1 set with 4 ring eyes, washers and hexagon nuts each, for lifting low-voltage compartments
- 1 handle for lifting or lowering voltage transformers of type 4MT2 or 4MT3
- 1 lever for removing the silicone insert of voltage transformers of type 4MT3
- 1 voltage transformer assembly jack (scissor-type jack) for lifting or lowering voltage transformers of type 4MT3 and 4MU1
- 3 extraction tools for the screw-type cone of the busbar
- 2 gauges for assembling the busbars
- 2 gauges for aligning double-busbar panels
- 2 tools for charging the circuit-breaker operating mechanism
- 1 top unit for emergency operation of the three-position switch
- 2 adjustment tools for aligning the switching-device vessels

13.4 Cleaning agents and cleaning aids

☞INFORMATION
For protection of personnel and environment: ⇨ Read the instructions for use of cleaning agents and aids carefully. ⇨ Observe the safety instructions of the cleaning agents.

Activity	Cleaning agents or aids
Cleaning the front covers, cast-resin components, instrument transformers	Mild, customary household cleaner for general degreasing work and cleaning work **(solvent-free)**
Cleaning electrostatically stressed insulation (e.g. epoxy resin)	Dry wiping cloths; plastic cleaner containing alcohol if there is a lot of dirt
Applying and wiping off liquid cleaning agent (single use)	Lint-free cleaning paper
Removing dust	Brush
Damp cleaning, drying	Lint-free wiping cloths
Suction of drilling chips, construction waste, dust	Vacuum cleaner with plastic tip for sensitive components

13.5 Mounting paste

Use mounting paste only according to the installation instructions. Use only the supplied or released mounting paste.

13.6 Tightening torques

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

Joint	Material/material	Thread	Tightening torque
Metal joints	Sheet steel / sheet steel e. g. front plates, top plates, etc.	M5	7 Nm
		M6	12 Nm
		M8	30 Nm
Earthing busbar	Sheet steel / copper	M8	20 Nm
	Copper / copper	M8	20 Nm
		M10	30 Nm
	Sheet steel / copper	M10	30 Nm
Busbar interconnection	Copper / copper	M10	30 Nm
		M 12	50 Nm
Switchgear earthing	Sheet-steel / cable lug	M12	50 Nm*
	Cable shield earthing	M10	30 Nm*
Cable plug		M16	max. 50 Nm*

***The tightening torque at the cable lug joint depends on:**

- Material of cable lug
- Specifications from the sealing end manufacturer
- Specifications from the cable manufacturer

13.7 Comments on electromagnetic compatibility

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

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

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

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

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

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

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

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

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

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

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

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

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

14 Unloading and erecting the switchgear

14.1 Packaging and transport unit

Packaging

The transport units can be packaged as follows:

- On pallets, covered with PE protective film
- In a seaworthy crate (switchgear is sealed with desiccant bags in PE film)
- Other packaging types in special cases

NOTICE
Disposal of packaging and consumables Incorrectly disposed of packaging and consumables can pollute the environment. ⇨ Packaging and consumable materials of the switchgear must be disposed of in an environmentally compatible way or recycled. ⇨ Observe local regulations for disposal and environmental protection.

Transport unit

Transport units consist of:

- Individual panels, with separate low-voltage compartment if applicable
- Accessories, including busbars

14.2 Completeness and transport damage

Checking for completeness

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

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

⇨ Check whether the accessories are complete.

Checking for transport damage

⇨ Temporarily open the packaging in a weatherproof place to identify any hidden damage. Stick the PE protective film back together and do not remove it completely until reaching the final installation position in order to keep the switchgear clean.

⇨ Check the ready-for-service indicator (see page 83, "Checking service readiness").

⇨ Inform the forwarding agent immediately about any defects or transport damage. If required, refuse to accept the delivery.

⇨ Document larger defects and transport damage using photographs. Create a damage log. Report any defects or transport damage through the Siemens Service Hotline.

⇨ Have the transport damage repaired; otherwise installation is not permitted to begin.

⇨ Refit the packaging.

14.3 Unloading and transporting to the place of installation

⚠WARNING

Mortal danger due to transport units falling down!
During transport, the transport units can slip off the lifting gear and cause serious injury or death.

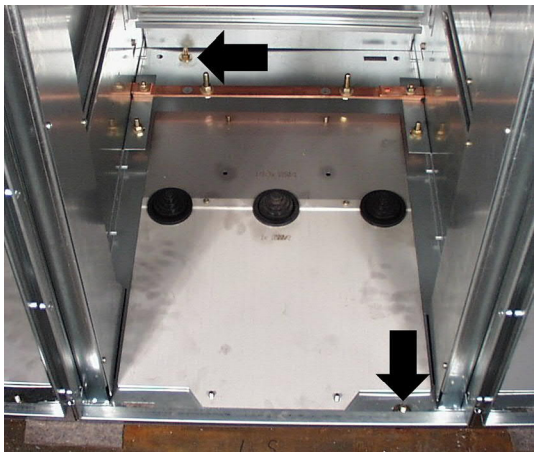
- ⇨ There must be no persons standing in the swinging area of lifted transport units.
- ⇨ Please ensure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity.
- ⇨ Observe the dimensions and weights of the transport unit (delivery note).
- ⇨ Observe the center of gravity of the transport units.
- ⇨ Do not step on the panels.
- ⇨ The lifting gear must not exert any forces on the panel walls under load.
- ⇨ Observe the instructions on the packing.
- ⇨ Move the transport units in packed condition for as long as possible. Leave the transport units packed after unloading for as long as possible.
- ⇨ Do not damage the PE protective film.

- ⇨ Hook the ropes into the hoisting tackle.
- ⇨ Sling the ropes around the ends of the wooden pallets.
- ⇨ Unload the transport units and set them down as close to the switchgear building as possible in order to avoid unnecessarily long travel paths.

- ⇨ Thoroughly clean the switchgear room, since extreme cleanliness is required for installation.
- ⇨ Move the transport units on their wooden pallets as far as possible.
- ⇨ Move the transport units to the switchgear room in the order of installation.
- ⇨ Inside the building, move the transport units to the place of installation using a lifting truck, fork-lift truck or on rollers.
- ⇨ Set the transport units down in the correct sequence directly in front of the place of installation (leave a clearance for installation).

Removing from the wooden pallets

- ⇨ Remove the PE protective film.
- ⇨ Remove the connection compartment cover (see page 185, "Removing and mounting the connection compartment covers").
- ⇨ Label the connection compartment cover with the panel number.
- ⇨ Take out the transport bolts. Remove the metal plates placed underneath.



- ⇨ In order to avoid damage to the panels, put the connection compartment cover back in place.

Further transport without wooden pallets

⚠WARNING

Heavy weight.
Can cause death, serious injury or property damage.

⇨ Observe all handling instructions in this manual to prevent tipping or dropping of equipment.

⚠CAUTION

Incorrect dimensioning of the lifting tools
Can damage the lifting eyes.

If the lifting eyes are damaged, the transport units cannot be aligned properly with other switchgear panels.

⇨ Maximum permissible angle of lifting equipment **at the hook < 60°**.

⇨ Maximum permissible angle **at the switchgear panel > 60°**.

⇨ Minimum permissible length of the **hanging parts > 3000 mm**.

☞INFORMATION

A transport unit standing on roller pads can only be moved straight ahead.

⇨ To change the direction, the position of the roller pads must be changed.

⇨ Lift the transport unit by means of a crane, hydraulic jacks or a fork-lift truck with the help of lifting rods (before lifting, knock the boards marked at the front out of the wooden pallet by means of a fork-lift truck).

For further information to usable lifting rods, see page 76, "Tools and auxiliary means"

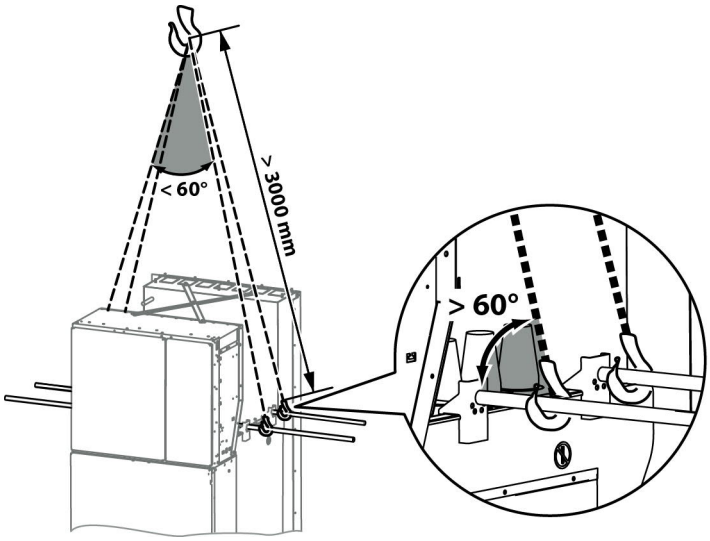


Fig. 25: Cranes with lifting rods (20 mm diameter of lifting rods)

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

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

Installing the transport units

If the following conditions are met, installation of the transport units can begin:

- All transport damage has been repaired.
- The base frame has been leveled (1 mm/m), see DIN 43661
- The service readiness of the switchgear has been checked. (see page 83, "Checking service readiness")
- The accessories and the required material are present (see page 75, "Before installation").

⇨ Place the first (rearmost) transport unit into its final location as precisely as possible so that the units can still be aligned before bolting together. Place the second transport unit next to it with a small spacing in between.

⇨ Remove packaging and transport materials from the place of installation.

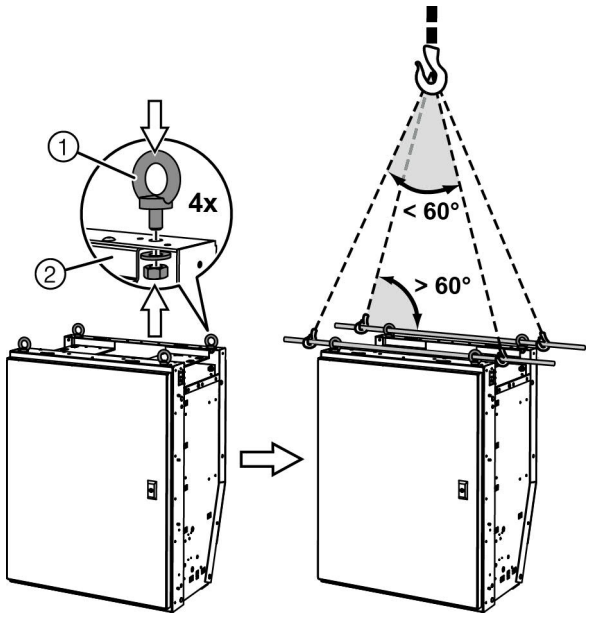
⇨ Remove any dirt resulting from transport, as extreme cleanliness is required during installation.

✔ The transport units are in the correct order for assembly.

Craning the low-voltage compartment

⇨ Mount four ring eyes with washers and hexagon nuts at the low-voltage compartment.

⇨ Insert lifting rods through the ring eyes (diameter of lifting rods: 20 mm).



① Ring eye with hexagon nut and washer

② Low-voltage compartment

Fig. 26: Craning the low-voltage compartment

⇨ Mount the lifting gear.

✔ Now the low-voltage compartment can be lifted onto the panel.

14.4 Checking service readiness

Before starting assembly work, check the service readiness of the switchgear.

⇨ Read the ready-for-service indicator.

✔ If the pointer is in the green area, the gas filling is in order.

✔ If the pointer is in the red area, check the signaling switch. If the problem cannot be resolved, contact the Siemens Service Hotline.

For more information on the ready-for-service indicator, see page 34, "Ready-for-service indicator" or see page 190, "Ready-for-service indicator".

15 Assembling the switchgear

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

For extending or replacing parts of an existing switchgear, the five safety rules must be observed.

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

NOTICE

Functional failure of the switchgear due to pollution!
Pollution or stepping on the switchgear can lead to functional failures during operation.

- ⇨ Avoid any work that could pollute the switchgear (e.g. sawing, filing, painting or plastering in the switchgear room, etc.).
- ⇨ Do not step on the switchgear.

NOTICE

Sheet metal work at the switchgear
The switching-device vessels can be damaged due to sheet metal work.

- ⇨ Do not drill into the switching-device vessel.
- ⇨
- ⇨ Do not leave any metal cuttings on the switching-device vessel in order to avoid rust layers.

NOTICE

Damage to the operating mechanism
Undoing the sealed bolts can damage the Siemens high-voltage vacuum contactor.
Components inside the operating mechanism can come loose.

- ⇨ Do not remove the bolts sealed with wax.
- ⇨ If the sealing wax is broken, contact the regional Siemens representative.

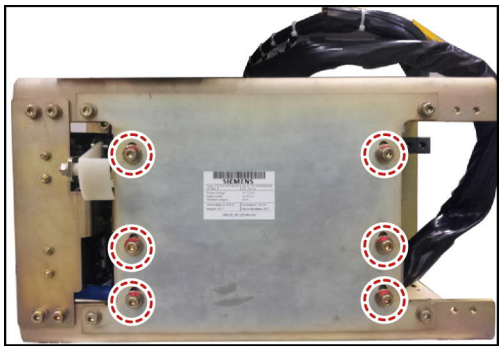


Fig. 27: Bolts with sealing wax at the Siemens high-voltage vacuum contactor

15.1 Aligning and joining the panels

☞INFORMATION
To interconnect the panels (busbar interconnection of panels) more easily, already pre-assembled low-voltage compartments can be removed for interconnecting the panels. Low-voltage compartments on end panels may remain mounted. ⇨ Remove pre-assembled low-voltage compartments.

☞INFORMATION
Lining up the auxiliary transformer panel with lateral cable connection Particularities for lining up depending on the mounting direction and the position of the auxiliary transformer panel: **Auxiliary transformer panel as left or right end panel** • To enable working on the lateral cable connection, a wall distance of ≥ 500 mm must be available. **Auxiliary transformer panel as right end panel** • Lining up from right to left is recommended • Before being able to line up panels to the left, all installation work at the lateral cable connection must be complete. • Lining up from left to right: - Position the right end panel at a distance of ≥ 500 mm from the installed panels. - Install the cable at the lateral cable connection. - Line up the right end panel with the existing panels. - If work has to be performed at the lateral cable connection after lining up the right end panel, the end panel must be removed again.

Aligning the panels

The first panel is on its installation position and the others are placed at a small distance next to it.

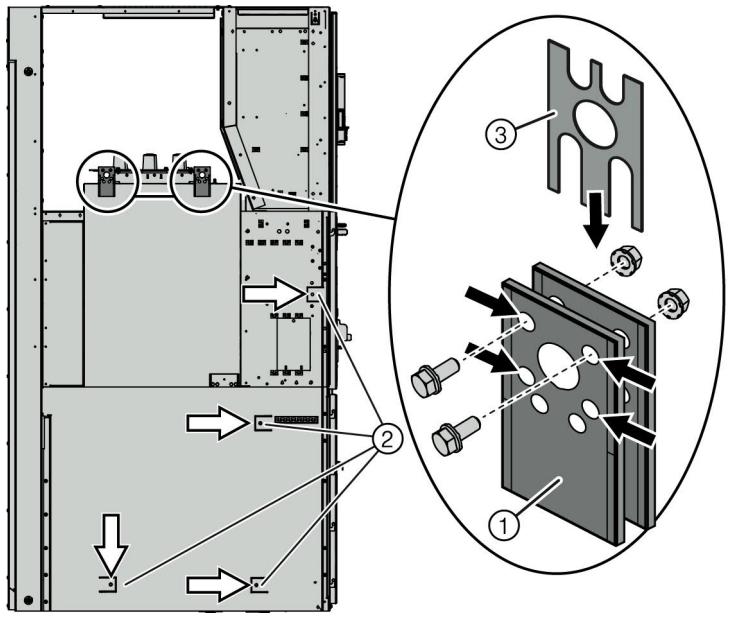
⇨ Align the first panel laterally.

⇨ Lay shims under the panels to align them in the vertical and horizontal position.

⇨ Carefully move the next panel up to the one that has already been aligned.

⇨ Align the moved panel using the alignment brackets provided at the switching-device vessel. If necessary, use shims to align the panel vertically and at the necessary height.

Joining the panels



① Alignment bracket
② Fixing lug
③ Spacer

Fig. 28: Joining the panels

⇨ Bolt the panels together at the alignment brackets ① using 2 M8x20 panel connecting bolts and M8 nut-and-washer assemblies each (tightening torque: 30 Nm). The usable fixing points depend on the panel types.

⇨ Check the reference dimension K1 between the busbars (see page 88, "Installing the busbars"). If applicable, insert spacers between the alignment brackets of the panels. The spacers are supplied with the supplementary equipment.

☞INFORMATION

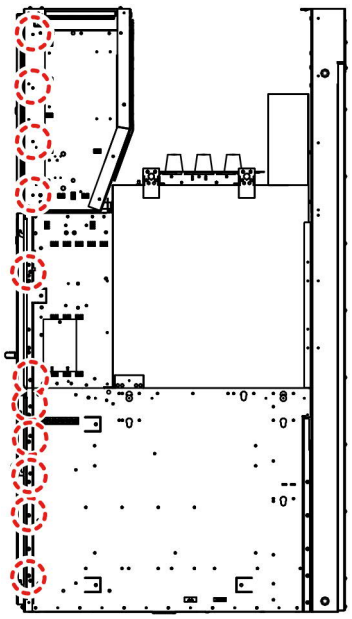
The cable compartment covers can be coded, and the operating mechanism covers are designed specifically for each panel. Any removed cable compartment covers and operating mechanism covers must therefore be mounted on the same panels again.

⇨ Write the corresponding panels numbers on all covers before removal.

⇨ Remove the cable compartment cover and the front cover (see page 184, "Recurring activities").

⇨ Insert the M8x20 panel connecting bolts provided at the 4 fixing lugs ② of the right-hand panel through the switchgear frame and bolt together with the left-hand panel (tightening torque: 30 Nm).

⇨ Bolt using M5x16 panel connecting bolts (tightening torque: 7 Nm).



⇨ Check whether the bolted panels are in vertical position.

⇨ Move each additional panel into position and align with the installed panels. Bolt the alignment brackets and the frames together.

Mounting the sealing strip

☞INFORMATION

Panels that were intended for free-standing arrangement, but implemented in wall-mounting arrangement, cannot be taken out of the switchgear assembly if the sealing strips are mounted.

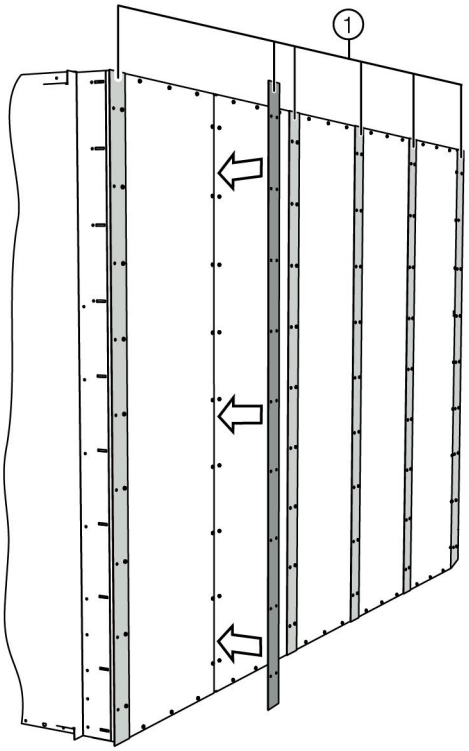
⇨ Do not mount sealing strips on panels provided for wall-standing arrangement.

In case of free-standing arrangement of the switchgear, install the sealing strips on the rear wall of the switchgear.

⇨ Install the sealing strips on the rear wall of the switchgear. To install the sealing strips, use the Torx bolts from the pressure relief duct. Take the other bolts from the supplementary equipment.

Panel type EB and aME: M6x30

All other panel types M5x45



① Sealing strips

Fig. 29: Installing the sealing strips

15.2 Fastening the panel to the foundation

The panel must be bolted together with the foundation rails at the fixing points in the base frame.

⇨ Bolt each panel diagonally to the foundation at 2 fixing points at least, see page 67, "Floor openings and fixing points".

Use at least 2 M8 or M10 fixing bolts (M8 tightening torque: 30 Nm, M10: 60 Nm).

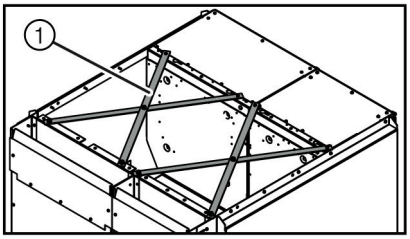
⇨ **Resistance against earthquakes:** Install additional floor bracings in every panel, see page 68, "Resistance against earthquakes (option)".

Bolt each panel to the foundation at 4 fixing points.

Use 4 M8 or M10 fixing bolts (M8 tightening torque: 30 Nm, M10: 60 Nm).

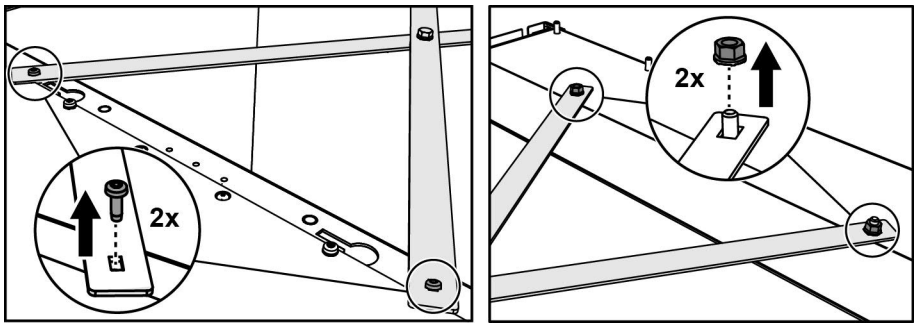
15.3 Removing transport braces

Panels with pre-installed low-voltage compartment and without busbar support must be stabilized for transport. Transport braces are installed at the factory for stabilization.
The transport braces must be removed to install the switchgear.



① Transport braces

⇨ Remove the nuts and bolts of the transport braces.



⇨ Remove the transport braces.

✔ The transport braces are removed.

15.4 Installing the busbars

The components of the busbars are delivered separately with the accessories.

- To simplify installation, remove pre-assembled low-voltage compartments, if required.
- Before installing the busbars, all panels must have been bolted together (see page 85, "Aligning and joining the panels").
- Remove any current transformers pre-assembled on the busbar (for 1250 A busbar system).
- Current transformers in oval design for the twin busbar system can remain installed.

NOTICE

Damage to the switchgear due to flashovers!
Insufficient electrical contact leads to flashovers and damage to the busbars during operation.

⇨ All busbar assembly work must be carried out with particular care.

⇨ Check the contact surfaces and the silicone surfaces for damages before assembly.

⇨ Observe extreme cleanliness.

⇨ No smoking.

⇨ Do not unpack busbar components until right before assembly.

⇨ Brush oxidized copper surfaces bright, clean and grease them with the supplied mounting paste before connection.

⇨ Use the supplied mounting paste only.

⇨ Tighten all bolted joints with correct torque. On all bolted joints, execute a torque test with the torque wrench. Afterwards, mark the bolted joints on the nut with a waterproof pen (perform this step only after consultation with the switchgear operator).

NOTICE

Busbars from different manufacturers
No warranty is provided for combining busbars from different manufacturers.

⇨ Within one switchgear assembly, only install busbars from a single manufacturer; if necessary, contact the Siemens Service Hotline.

NOTICE

Damage to the auxiliary switch at the three-position disconnector
Can cause incorrect electrical switch position indications.

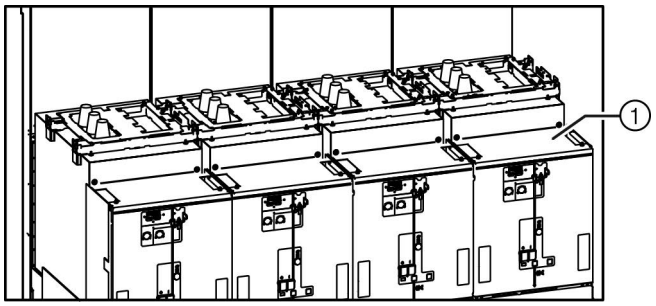
The load can deform the mounting plate for the low-voltage compartment and damage the auxiliary switch in the operating mechanism compartment.

⇨ Do not load the mounting plate directly.

⇨ To distribute the load evenly, place a board on the mounting plates.

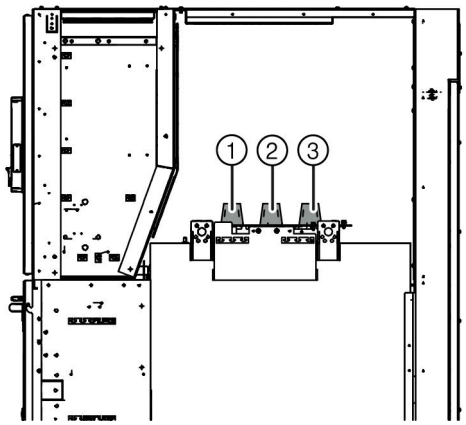
⇨ The board must at least be double the length of the panel.

- Example: Board with min. 1200 mm length for 600 mm wide panels



① Installing the low-voltage compartment mounting plate

Phase sequence



① Phase L1
② Phase L2
③ Phase L3

Fig. 30: Phase sequence of bushings (view from the right)

Busbars (overview)

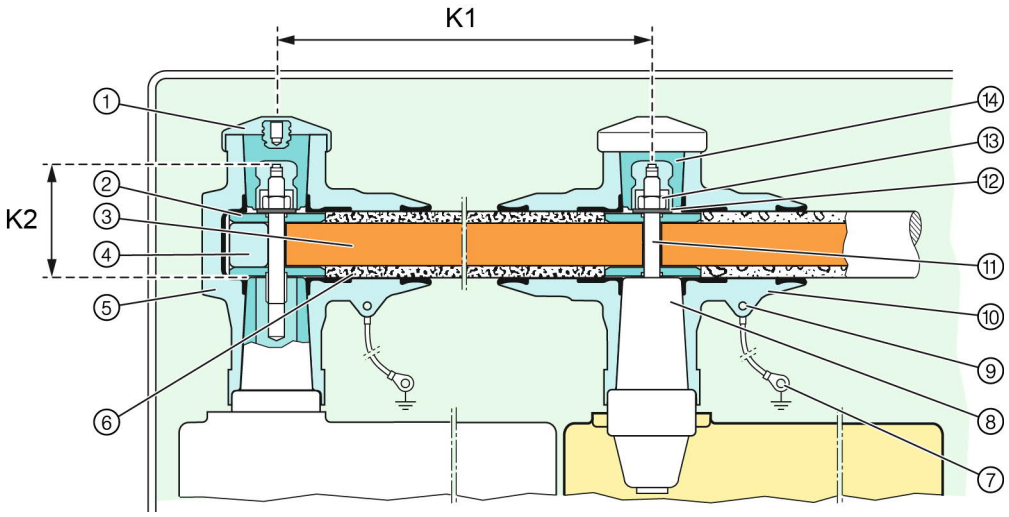


Fig. 31: Busbar for busbar current up to 1250 A

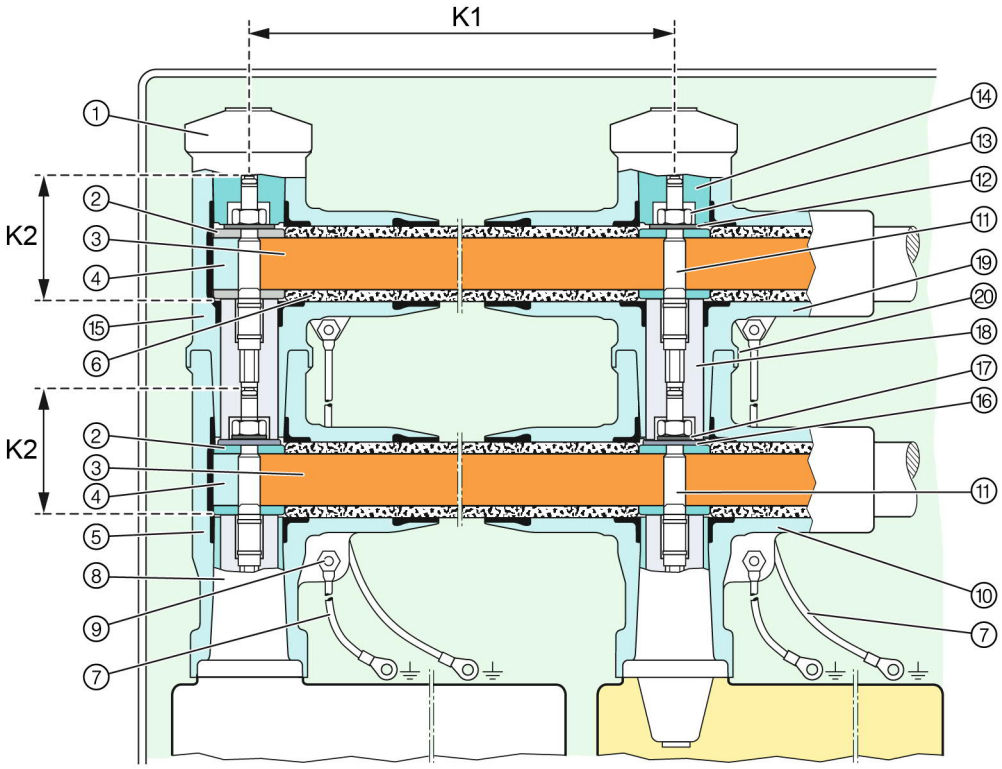


Fig. 32: Busbars for busbar current of 1600, 2000 and 2500 A

① Cap
② Contact half-shell
③ Busbar
④ Adjustment component
⑤ End adapter
⑥ Busbar insulation
⑦ Earthing cable
⑧ Bushing
⑨ Earthing terminal
⑩ Cross adapter
⑪ Threaded stud M12/M16
⑫ Conical spring washer, DIN 6796-12
⑬ Hexagon nut, ISO 4032-M 12
⑭ Screw-type cone
⑮ Coupling end adapter
⑯ Copper washer, galvanized
⑰ Lock washer
⑱ Connection stud
⑲ Coupling cross adapter
⑳ Adapter lip
K1 Reference dimension for busbar length
K2 Reference dimension for threaded stud

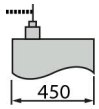
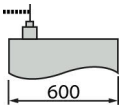
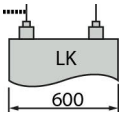
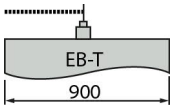
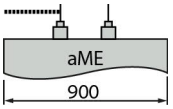
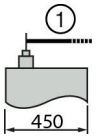
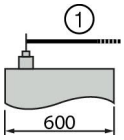
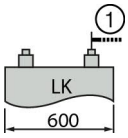
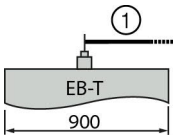
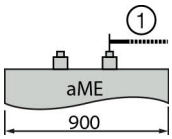
Busbar lengths

With the help of the following tables, the required busbar lengths between two adjacent panels each can be determined by means of the panel width and the arrangement of the bushings at the switching-device vessel.

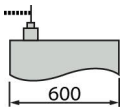
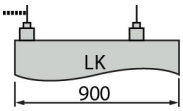
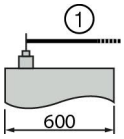
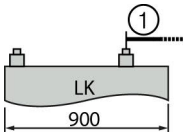
☞ INFORMATION
If a dummy panel is installed between the switchgear panels, a busbar that is longer by the width of a dummy panel must be installed (+300 mm or +600 mm).

The busbar lengths for the provided panels can be found in the order documentation.

Busbar lengths for panel types up to 24 kV

Left-hand panel		**Right-hand panel**				
Busbar lengths Depending on the panel type and panel width						
		LS, RK	LS, TS, TR, VS, ME, EK, QK, LKLS, LKTS	LK	EB-T	aME
	LS, RK	① L5	① L5	① L5	① L15	① L9
	LS, TS, TR, VS, ME, EK, QK, LKLS, LKTS	① L10	① L10	① L10	① L17	① L14
	LK	① L3	① L3	---	① L11	① L6
	EB-T	① L10	① L10	① L10	---	① L14
	aME	① L6	① L6	① L6	---	---

Busbar lengths for panel types up to 38 kV

Left-hand panel		**Right-hand panel**	
Busbar lengths Depending on the panel type and panel width			
		LS, TS	LK
	LS, TS	① L10	① L16
	LK	① L2	---

Busbar	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**	**L11**	**L12**	**L13**	**L14**	**L15**	**L16**	**L17**
Length [mm]	236	281	326	391	436	456	531	541	566	586	626	636	681	716	736	791	886
Reference dimension K1 [mm]	250^{+2}	295^{+2}	340^{+2}	405^{+2}	450^{+2}	470^{+2}	545^{+2}	555^{+2}	580^{+2}	600^{+2}	640^{+2}	650^{+2}	695^{+2}	730^{+2}	750^{+2}	805^{+2}	900^{+2}

LS	Circuit-breaker panel	ME	Metering panel	EB-T	Auxiliary transformer panel
TS	Disconnector panel	aME	Air-insulated metering panel	VS	Vacuum contactor panel
LK	Bus sectionalizer	LKLS	Bus sectionalizer circuit-breaker panel	LKTS	Bus sectionalizer disconnector panel
TR	Switch-disconnector panel	RK	Ring-main panel		

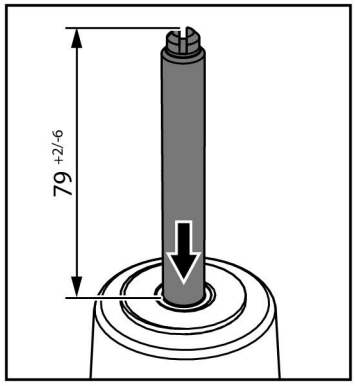
Installing the 1250 A busbar

Preparing busbar elements

⇨ Check all supplied busbar elements for completeness, cleanliness and proper condition.

⇨ Apply mounting paste to the brushed copper surfaces evenly and over the whole surface.

⇨ Screw the M12/M16 threaded stud ⑪ into the bushing with a size 10x1.6 screwdriver with approximately 10 Nm (hand-tight).
Important: Check reference dimension K2 (79 +2/-6 mm).



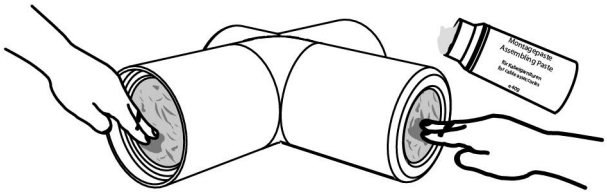
⇨ Check reference dimension K1 from panel to panel.

⇨ Brush oxidized copper surfaces (busbar ends and bushings).

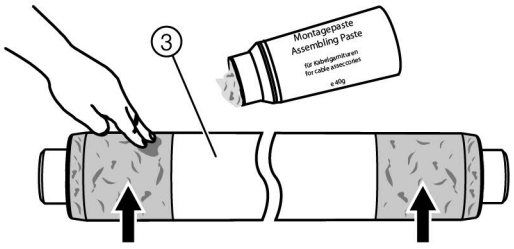
⇨ Clean the push-on surfaces of the busbars (gray surfaces), cast-resin cones and outside cones of the bushings with a lint-free wiping cloth and mounting paste.

☞INFORMATION
⇨ Do not apply mounting paste to the push-on surfaces until right before installation.
⇨ Distribute the mounting paste evenly over the surfaces.

⇨ Apply mounting paste to the lower and lateral push-on surfaces of the end adapters ⑤ and cross adapters ⑩ .

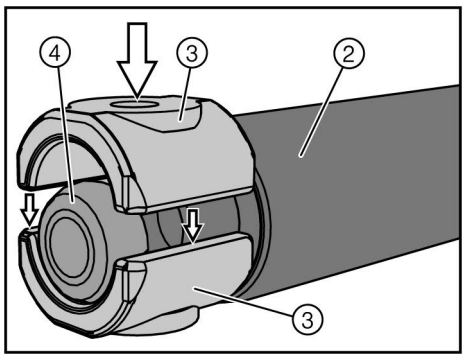


⇨ Apply mounting paste to the push-on surfaces (gray surfaces) of the busbars ③ .

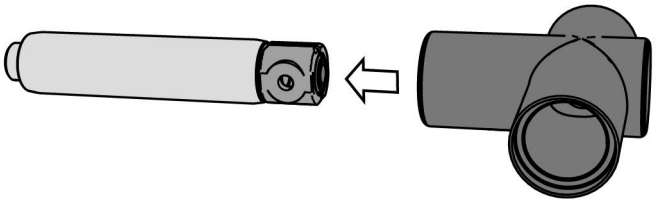


⇨ Lay the contact half-shells ③ on the ends of the busbar ② and hold them.

⇨ In case of end adapters, add the adjustment component ④ to obtain a symmetrical clamping.



⇨ Push the end adapter ⑤ or cross adapter ⑩ onto the end of the busbar.



⇨ If no busbar current transformers are mounted, perform the same assembly operations on the other end of the busbar.

⇨ Remove residual mounting paste.

✔ The busbar unit is assembled.

Installing the current transformer

In switchgear with a busbar current of ≤ 1250 A, the current transformers are pre-assembled at the factory.

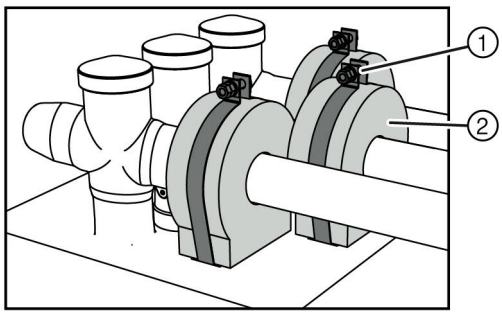
Current transformers that are not pre-assembled at the factory:

- Switchgear with busbar current >1250 A
- Air-insulated metering panel

⇨ If required, install the current transformers together with the busbar, see page 101, "Installing a current transformer on the busbar"

Pre-assembled current transformers

In case of pre-assembled current transformers, the bolted joint of the clamping bracket must be undone before installing the busbar units. If required, pull the current transformer out of the clamping bracket.



① Bolted joint of clamping bracket
② Current transformer

Fig. 33: Pre-assembled current transformers at the busbar (1250 A)

⇨ Push the busbar unit through the current transformer (observe the direction of side P1 at the current transformer).

⇨ Connect the busbar unit with the next end adapter or cross adapter.

⇨ After installing the busbar unit, install the current transformer again.

Installing the busbar run

NOTICE

Pollution through abrasion
Can lead to flashovers and damage the switchgear.

Abrasion can be produced by canting of the busbar units when pushing them onto the bushings.

⇨ Do not cant busbar units.

⇨ Push busbar units carefully and slowly onto the bushings.

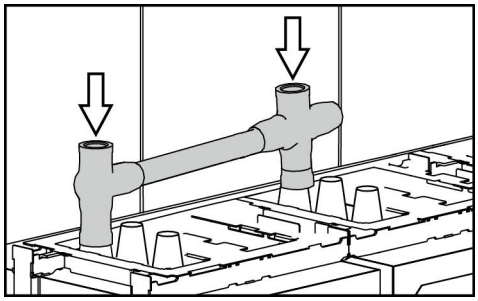
NOTICE

Damage to the end adapters or cross adapters caused by the threaded stud
Can lead to flashovers and damage the switchgear.

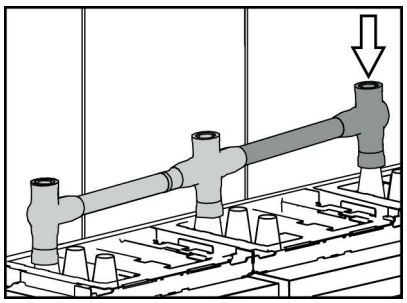
⇨ Avoid touching the threaded stud while pushing on the end adapters or cross adapters.

⇨ Apply mounting paste to the bushing.

⇨ Plug the busbar section loosely over the threaded studs on the bushings of the first two panels.

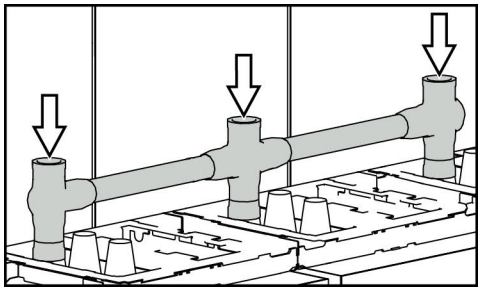


⇨ Insert another busbar section into the first busbar section.



⇨ Insert additional busbar sections until the complete busbar run is loosely plugged on the bushings.

⇨ Press the busbar run onto the bushing.



Bolting the busbar run together

Depending on the type of busbar and the busbar level, the busbar run must be bolted together differently.

Busbar level	Busbar		
	1250 A	1600/2000/2500 A	2500 A (bus sectionalizer)
1	Version A	Version B	Version B
2	—	Version A	Version B
3	—	—	Version A

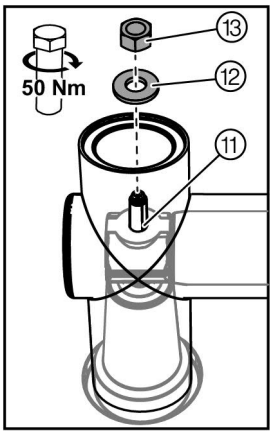


Fig. 34: Version A

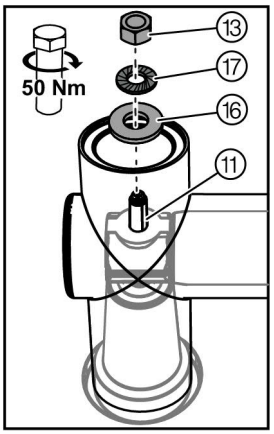


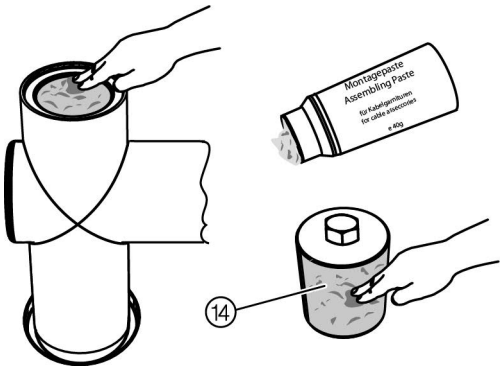
Fig. 35: Version B

⇨ **Version A:** Bolt the threaded stud ⑪ together with the conical spring washer ⑫ (camber upwards) and the hexagon nut M12 ⑬ (tightening torque: 50 Nm).

⇨ **Version B:** Bolt the threaded stud ⑪ together with the tin-plated copper washer ⑯, the lock washer ⑰ and the hexagon nut M12 ⑬ (tightening torque: 50 Nm).

Inserting the screw-type cone

⇨ Apply mounting paste to the screw-type cone ⑭ and the upper push-on surface of the cross adapter or end adapter.



⚠ CAUTION

Disruptive discharges due to air inclusions
Damage to the busbar insulation.

⇨ Let excess air out of the screw-type cone with a cable strap while screwing in.

⇨ Verify intact condition of the cable strap. If the cable strap was damaged when it was pulled out, remove the screw-type cone and eliminate the residues of the cable strap.

Let excess air out of the screw-type cone with a cable strap while inserting:

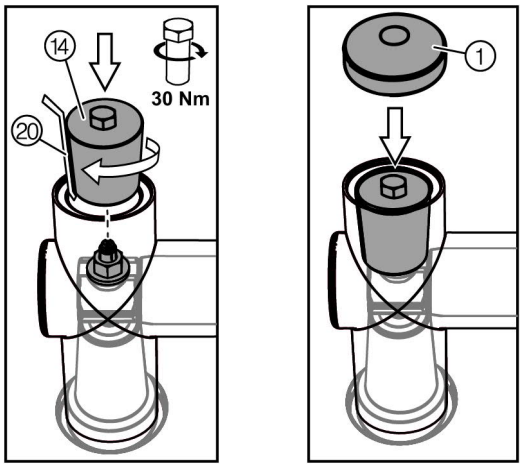
⇨ Tighten the screw-type cone ⑭ . Pull out the cable strap ⑳ slowly at the same time.

⇨ Check whether the cable strap is complete.

⇨ To distribute the mounting paste, turn the screw-type cone back a quarter turn.

⇨ Tighten the screw-type cone ⑭ with 30 Nm.

⇨ Mount the cap ① .



Final work

The earthing cables are bolted to the switchgear differently depending on the panel type.

Earthing cable for air-insulated metering panel

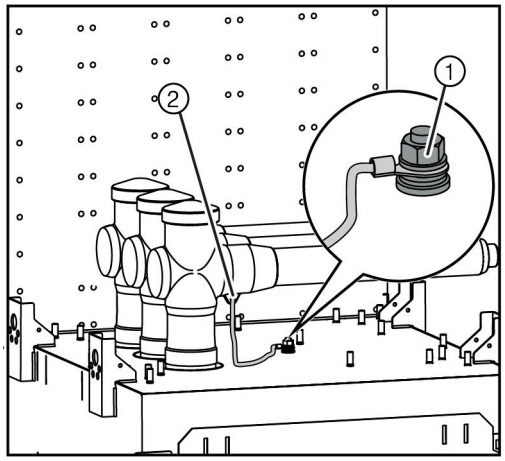


Fig. 36: Earthing cable bolted to welding bolts

① Earthing connection point at the panel

Earthing cable for all other panel types

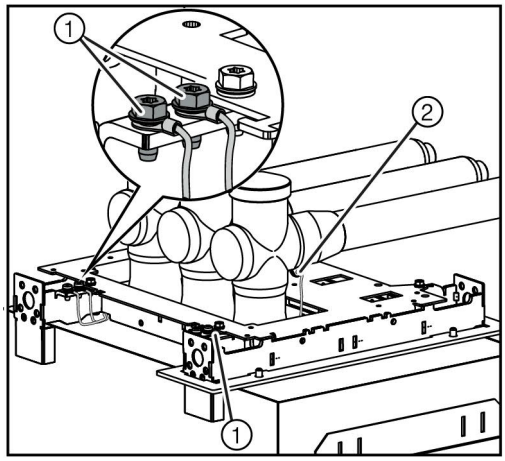


Fig. 37: Earthing cable bolted with self-tapping bolts

② Earthing connection point at the adapter

⇨ Installing the earthing cables of the adapters to the switchgear.
- Earthing cable bolted with self-tapping bolts: Tightening torque: 12 Nm
- Earthing cable bolted to welding bolts: Tightening torque: 17 Nm

⇨ Connect all other panels and phases in the same way.

⇨ Verify that all unused capacitive taps are earthed.

⇨ Install the busbar support (only for 31.5 kA, see page 99, "Installing the busbar support").

⇨ Install the voltage transformer (option, see page 102, "Installing a voltage transformer on the busbar").

⇨ Install the low-voltage compartments (see page 110, "Installing the low-voltage compartment").

⇨ Install the busbar covers (see page 122, "Installing the busbar covers").

✔ The installation of the busbar is completed.

Installing the second busbar level for the 1600/2000/2500 A busbar

For the 1600/2000/2500 A busbar, a second busbar level must be installed. For this purpose, install additional coupling cross adapters and coupling end adapters.

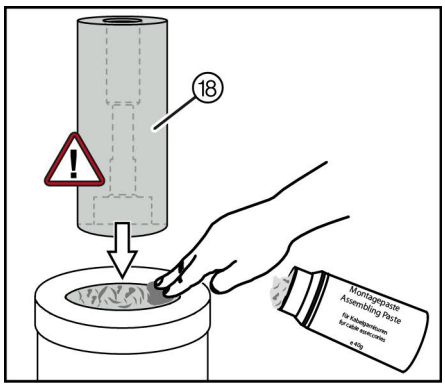
First busbar level

⇨ Install the first busbar level without screw-type cones and caps, see page 92, "Installing the 1250 A busbar".

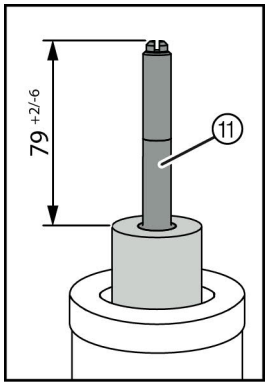
Second busbar level

⇨ Clean the upper push-on surface of the cross adapter or end adapter, and apply mounting paste evenly.

⇨ Screw the connection stud ⑱ onto the threaded stud ⑪ of the first busbar level (tightening torque: 50 Nm; insert the hexagon socket wrench fully into the connection stud).



⇨ Screw the threaded stud ⑪ into the connection stud as far as it will go (tightening torque: 10 Nm). **Important:** Check reference dimension K2 (79 +2/-6 mm).



⇨ Install the busbar units including coupling cross adapters, coupling end adapters and busbars in the same way as for the first busbar level.

NOTICE

Flashovers at the coupling adapters
Can damage the switchgear.

The adapter lip must not move out of place or get caught. The adapter lip of the coupling adapters must be in line with the adapters of the first busbar level without any gaps.

⇨ Check the seating of the adapter lip and adjust if necessary.

⇨ Push the busbar units on the adapters of the first busbar level.

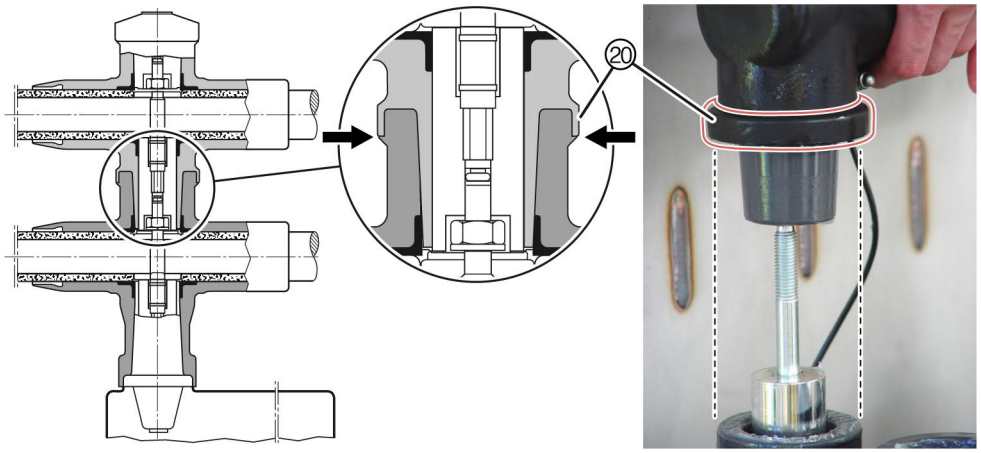


Fig. 38: Push the coupling adapter onto the adapters of the first busbar level

⑳ Adapter lip

Final work

⇨ Fasten the busbar run, see page 95, "Bolting the busbar run together"

✔ The installation of the busbar is completed.

15.5 Installing the busbar support

Busbar 1250 A

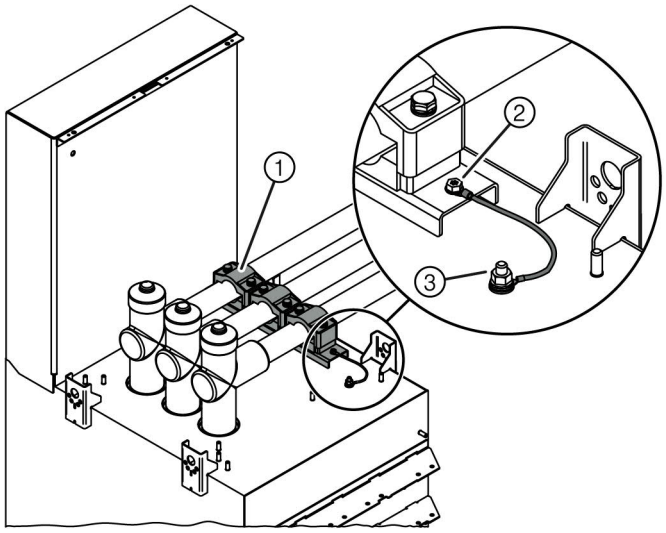
Install the busbar support:

- On panels with 31.5 kA design
- On panels with a busbar length > 700 mm.
- On bus sectionalizer panels (only for double-bay bus sectionalizer panel)

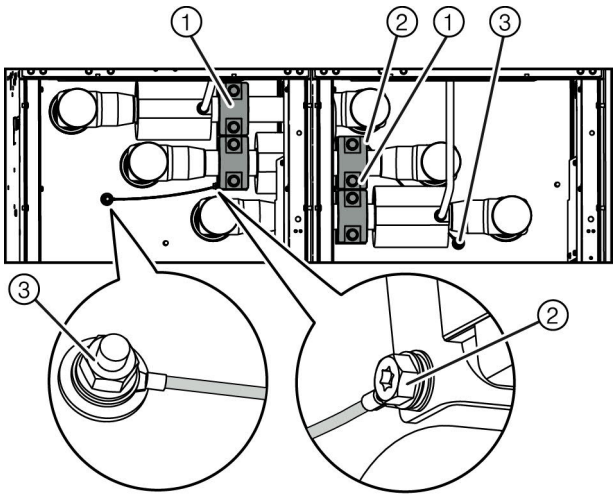
Do **not** install the busbar support:

- On panels with busbar current transformers

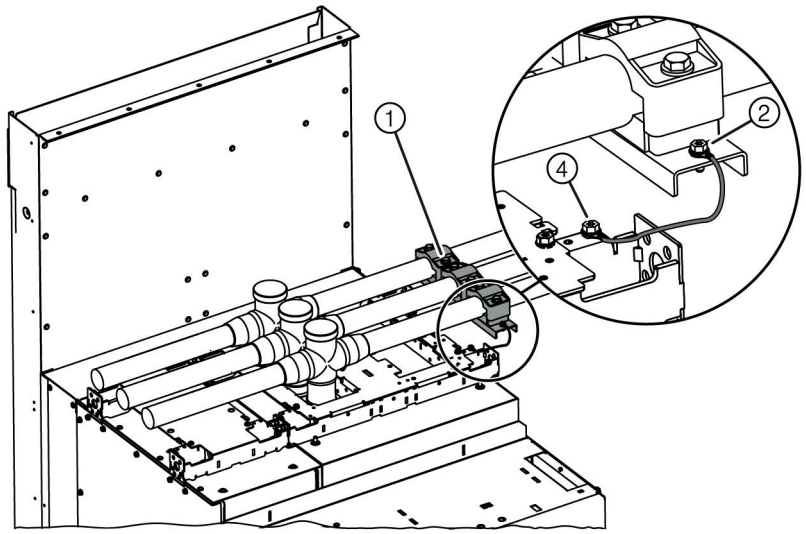
Air-insulated metering panel



Bus sectionalizer panel (2 panel spacings)



All other panel types



① Busbar support
② Earth connection at the busbar support
③ Earth connection at switching-device vessel (welding bolt)
④ Earth connection at the transformer mounting plate (with bolts)

Busbar 1600 A, 2000 A, 2500 A

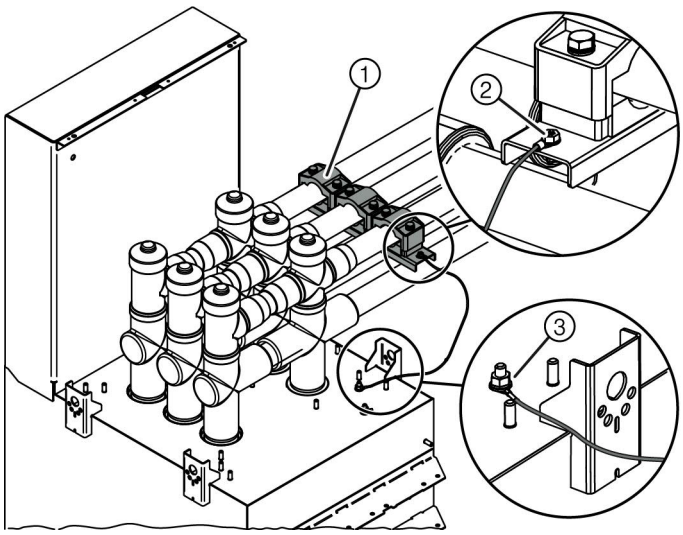
Install the busbar support:

- On all panels of 31.5 kA design
- On panels with a busbar length > 700 mm.

Do **not** install the busbar support:

- On bus sectionalizer panels
- On right-hand end panels
- On panels with busbar current transformers

⇨ Install the busbar support at the upper busbar level according to the enclosed installation instructions



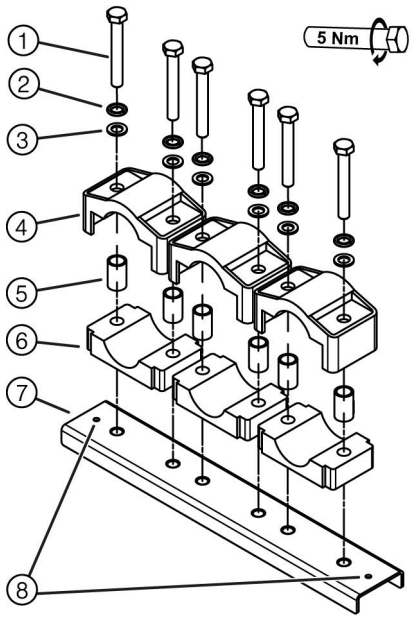
① Busbar support
② Earth connection at the busbar support
③ Earth connection at switching-device vessel

Installing the busbar support

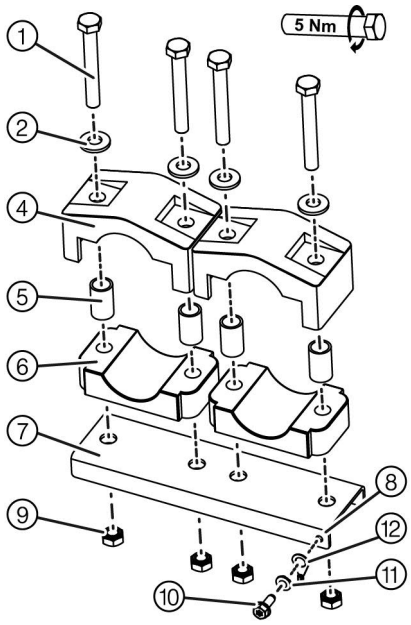
⇨ Install the busbar support centrally on the busbars.

Installing the busbar support

All other panels



Bus sectionalizer panel (2 panel spacing)



① M10x75 hexagon head bolt
② Conical spring washer
③ Washer
④ Cable clamp (upper part)
⑤ Distance sleeve
⑥ Cable clamp (lower part)
⑦ Support
⑧ Earthing connection point
⑨ Setting nut

For the earthing connection:

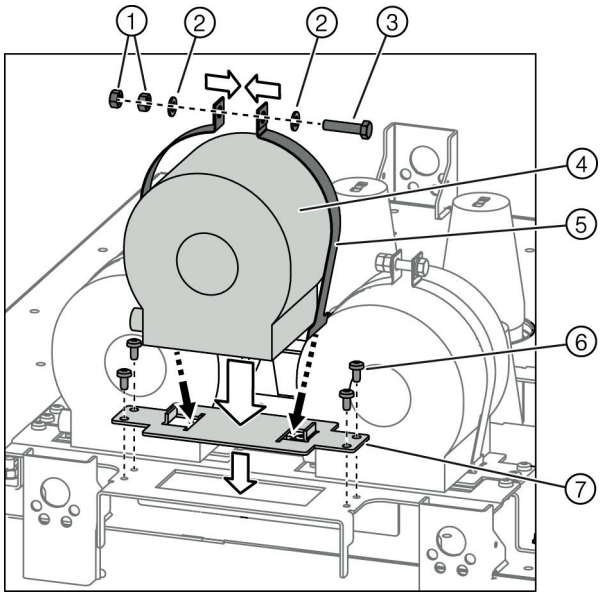
⑩ Hexagon head flange bolt
⑪ Lock washer
⑫ Cable lug

⇨ Install the earthing cable at the earthing connection points of the busbar support and the switching-device vessel or transformer mounting plate.

15.6 Installing a current transformer on the busbar

Installation on 1250 A busbar

- ⇨ Fasten the retainer on the transformer mounting plate using 4 bolts.
- ⇨ Insert 2 clamping brackets in the openings of the retainer.
- ⇨ Set the current transformers down onto the retainer. Bolt both clamping brackets together at the top.

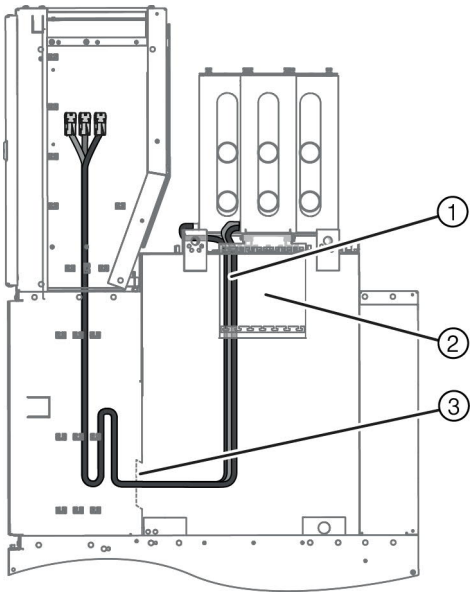


① Hexagon nut M8 (2x)
② Flat washer 8 (2x)
③ Bolt M8x35
④ Current transformer
⑤ Clamping bracket (2x)
⑥ Bolt (4x)
⑦ Retainer

Fig. 39: Installing the current transformers (busbar current 1250 A)

Wire routing

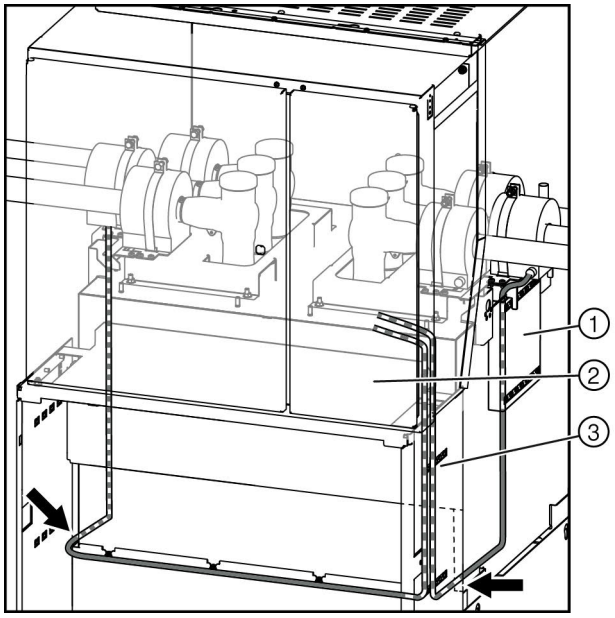
- ⇨ Lead the secondary leads from the instrument transformers into the low-voltage compartment, and connect.



① Secondary leads
② Vertical wiring duct
(only for secondary leads with steel tube)
③ Cutout

Fig. 40: Wire routing into the low-voltage compartment

- ⇨ **Air-insulated metering panel only:** Lead the connecting wires of the current transformers laterally into the operating mechanism compartment and into the low-voltage compartment through the right-hand wiring duct.



① Vertical wiring duct (only for connecting wires with steel tube)
② Low-voltage compartment
③ Right-hand wiring duct

Fig. 41: Wire routing (air-insulated metering panel)

15.7 Installing a voltage transformer on the busbar

The voltage transformers are delivered separately. For installation, the busbars must be installed and accessible from the front. If required, remove any installed low-voltage compartments. If a damping resistor is present, the damping resistor must be removed from the low-voltage compartment.

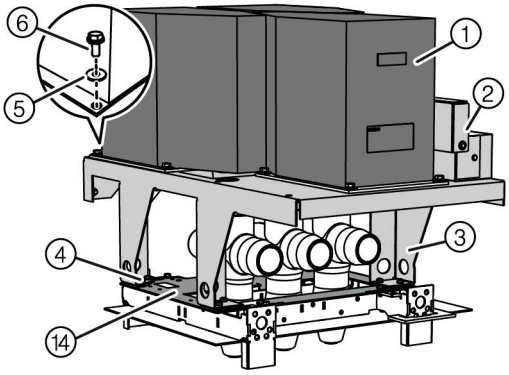


Fig. 42: Voltage transformer installed on the busbar

① Voltage transformer
② Storage box
③ Voltage transformer frame
④ M6 bolt with contact washer
⑤ Plain washer (DIN EN ISO 7093-1-8)
⑥ M8x20 bolt-and-washer assembly
⑦ Cast-resin bushing of the voltage transformer
⑧ Centering nut (tightening torque: 10 Nm)
⑨ M12* hexagon nut (tightening torque: 50 Nm)
⑩ Conical spring washer*
⑪ Contact half-shell*
⑫ M12/M16 threaded stud (tightening torque: 10 Nm)*
⑬ End adapter or cross adapter
⑭ Cover frame
* Component pre-installed on end adapter or cross adapter

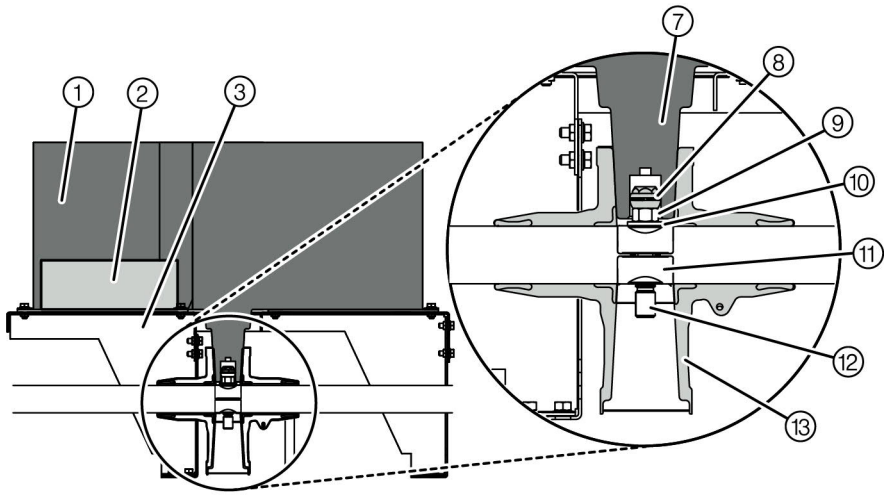
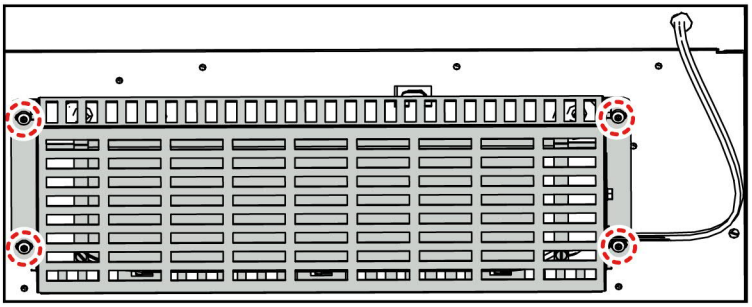


Fig. 43: Detail view from the front: Connection of the busbar to the voltage transformer

Removing the damping resistor

If a damping resistor is pre-installed on the low-voltage compartment, the damping resistor must be re-installed when using voltage transformers on the busbar.

⇨ Remove the 4 bolts on the damping resistor.



Preparing the screw-type cones

☞INFORMATION
To install the voltage transformer on the busbar, the caps and screw-type cones of the busbar are not required. ⇨ Install the busbar according to the installation instructions (see page 88, "Installing the busbars"); do not install caps and screw-type cones. ⇨ If the busbar is already installed, remove the caps and screw-type cones again. ⇨ Put unneeded components into the storage box.

⇨ Remove the cap and the screw-type cone of the end adapter or cross adapter.

⇨ Screw the centering nut ⑧ onto the threaded stud ⑫ in the end adapter or cross adapter (tightening torque: 10 Nm).

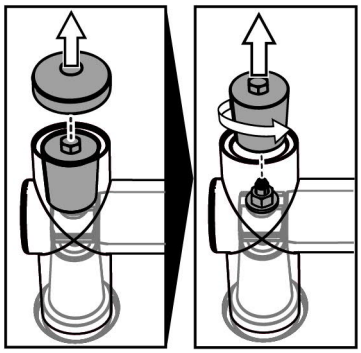


Fig. 44: Removing the cap and the screw-type cone

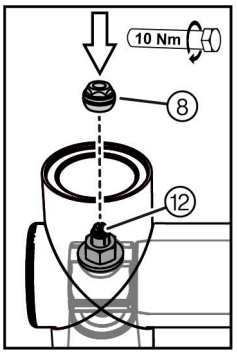
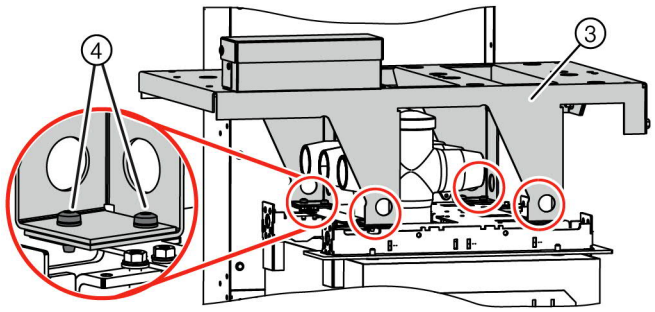


Fig. 45: Screwing on the centering nut

⇨ Place the voltage transformer frame ③ on the cover frame aligned as shown.



⇨ Check whether the wholes in the feet of the frame match the holes in the cover frame.

✔ The frame is positioned correctly.

⇨ Bolt the voltage transformer frame ③ to the cover frame ⑭ with bolts ④ .

Voltage transformer frame for panels in the busbar compartment

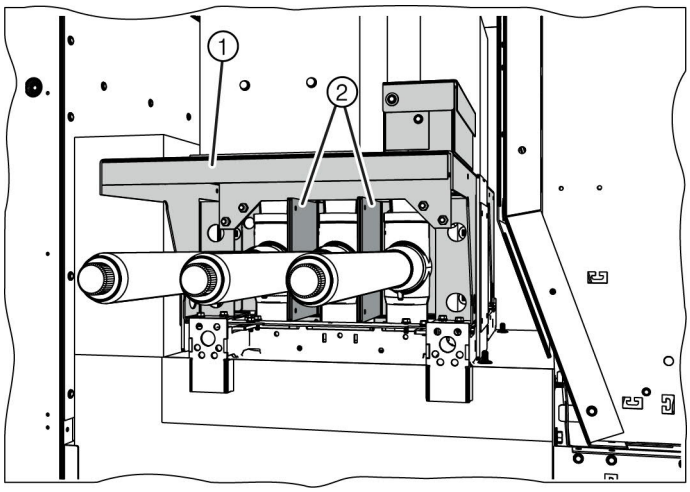
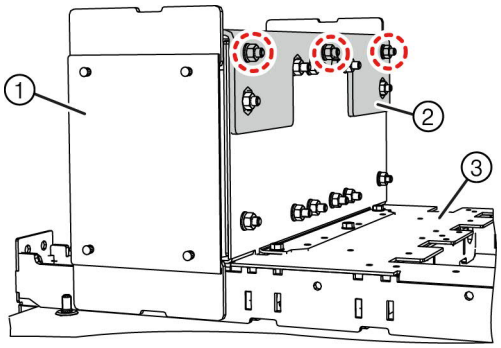


Fig. 46: Example using the right end panel in the overview: Voltage transformer frame ① with arcing plates ②

⇨ The panels are delivered with pre-installed arcing frame. If voltage transformers are installed, the roof plate of the arcing frame must be removed. If no voltage transformers are installed, the roof plate can remain on the arcing frame.

⇨ In order to remove the roof plate, unscrew 3 M8 cup head bolts with washers and nuts. For left-hand end panels, the arcing frame is rotated 180° (not shown here).



① Arcing frame
② Roof plate with arcing frame
③ Panel cover

Fig. 47: As-delivered condition

⇨ Pull out the roof plate.

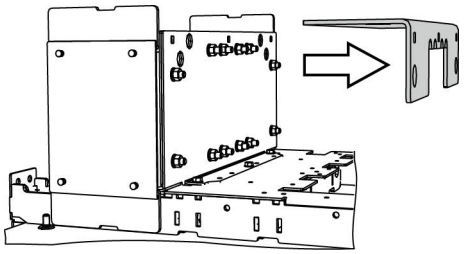


Fig. 48: Removing the roof plate

⇨ In order to install the busbar, the arcing frame of the voltage transformer frame has to be removed from the panel cover. This requires unscrewing 5 M6x16 hexagon head bolts.

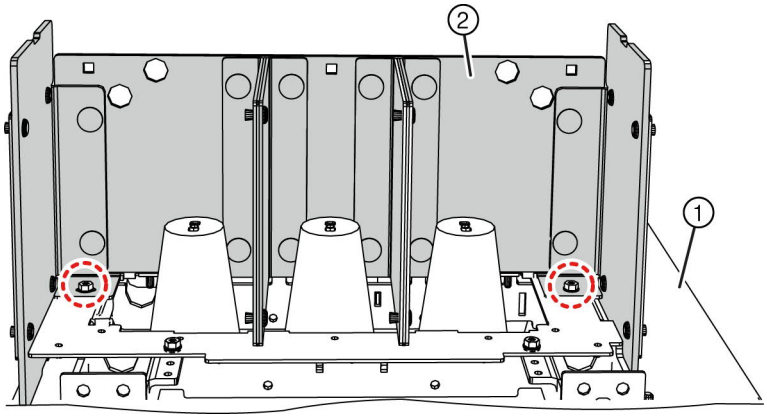


Fig. 49: Remove 2 bolts at the arcing frame (view of the bushings)

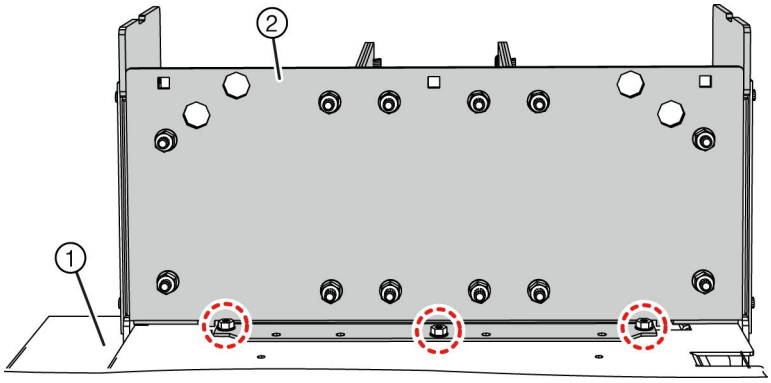


Fig. 50: Remove 3 bolts at the arcing frame (view of the arcing plate behind the bushings)

⇨ For preparing the busbar installation, see page 103, "Preparing the screw-type cones".

⇨ Install the arcing frame back on the panel cover. Bolt the arcing frame in place with 5 M6x16 hexagon head bolts. Use 2 bolts on the side with the bushings and 3 bolts on the other side.

⇨ For bolting the voltage transformer frame onto the panel cover, see page 103, "Preparing the screw-type cones".

⇨ Dispose of the roof plate properly.

Installing voltage transformers

⚠DANGER

Mortal danger due to electric shock!
The metal coating on the outside of voltage transformers is connected to earth potential. Touching a damages metal coating can lead to electric shock.

⇨ Do not damage the metal coating of voltage transformers.

⇨ Do not mount voltage transformers with damaged metal coating. Contact the Siemens Service Hotline.

NOTICE

Flashovers in the adapter due air inclusions
Insufficient busbar insulation can damage the switchgear.

⇨ While installing the voltage transformer, let excess air out of the adapter with a cable strap.

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

☞INFORMATION
To be able to close the busbar in a surge-proof way again, e.g. to remove a defective voltage transformer, keep the following objects in the storage box after installation: • Remaining screw-type cones and caps • Residual mounting paste (tube) • Cable straps

☞INFORMATION
Recommended installation order for voltage transformers: ⇨ In order to better reach the bolted joints, install the voltage transformers on phases L1 and L3 first, and then the voltage transformer on phase L2.

☞INFORMATION
During installation, protect the voltage transformer bushings from damage. ⇨ Plug the removed protective caps of the vessel bushings onto the voltage transformer bushings.

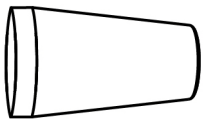


Fig. 51: Protective cap

⇨ Apply mounting paste to the installation surfaces of the voltage transformer and the end adapter or cross adapter before installation.

⇨ While installing the voltage transformer, let excess air out of the end adapter or cross adapter with a cable strap ⑮ .

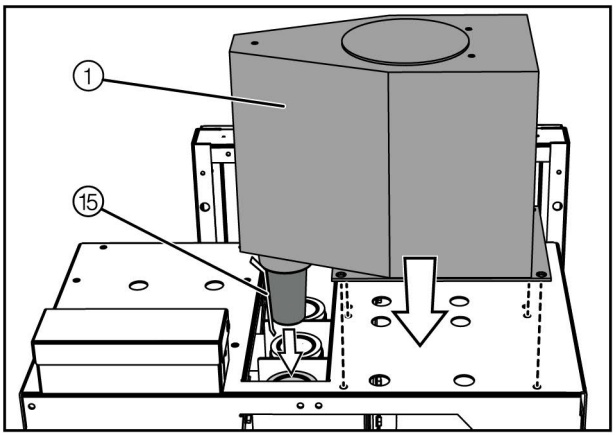


Fig. 52: Setting down the voltage transformer

⇨ Set the voltage transformer ① down on the voltage transformer frame. The voltage transformer's bushing must penetrate into the end adapter or cross adapter.

In the meantime, pull the cable strap ⑮ slowly out of the end adapter or cross adapter. Verify the intact condition of the cable strap.

If parts of the cable strap are missing, remove the voltage transformer again and verify that no cable strap remnants remain in the end adapter or cross adapter.

⇨ The voltage transformer must be correctly seated on its bolted joints.

⇨ Fasten the 3 voltage transformers with 4 bolt-and-washer assemblies ⑥ and washers ⑤ each (tightening torque: 20 Nm).

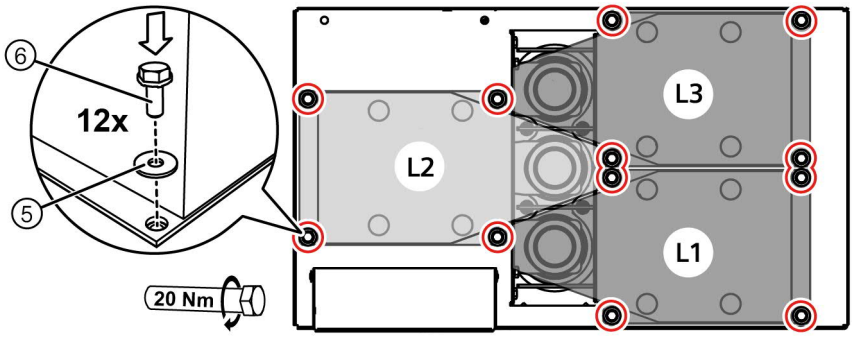


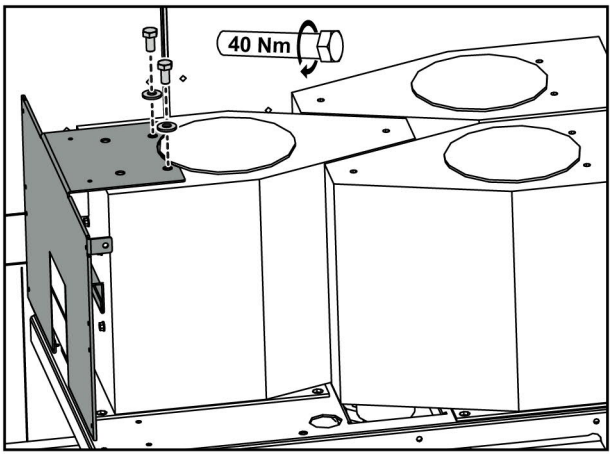
Fig. 53: Bolted joints of voltage transformers

⑤ Plain washer (DIN EN ISO 7093-1-8)

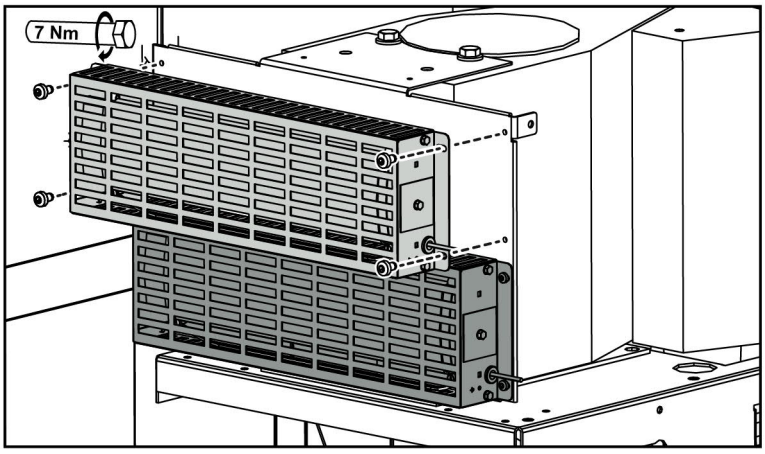
⑥ M8x20 bolt-and-washer assembly

Installing the damping resistor

⇨ Mount the holder of the damping resistor on the instrument transformer for phase L2.



⇨ Mount the damping resistor on the holder. Repeat the work operation for 2 damping resistors.



⇨ If applicable, lead the secondary leads into the low-voltage compartment, and connect.

Connecting secondary leads

Secondary leads are not pre-assembled on all voltage transformer types.

⇨ Connect the secondary leads that have been supplied separately to the voltage transformer.
Observe the phase sequence!

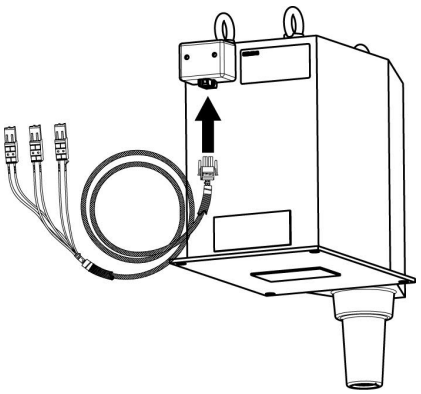
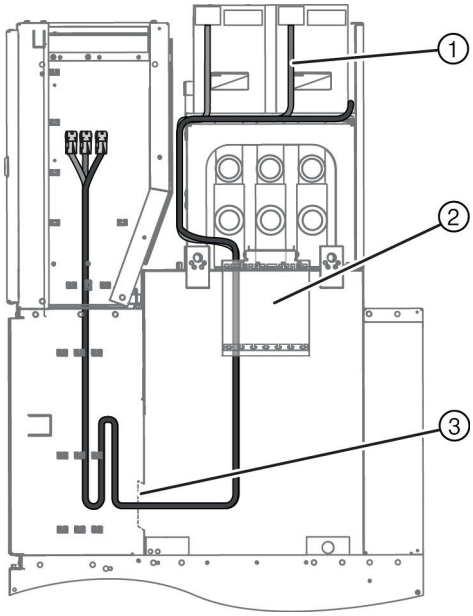


Fig. 54: Connecting secondary leads

⇨ Lead the secondary leads of the instrument transformers into the low-voltage compartment, and connect.
Observe the phase sequence!

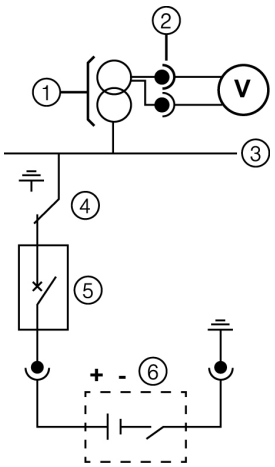


① Secondary leads
② Vertical wiring duct
(only for secondary leads with steel tube)
③ Cutout

Fig. 55: Wire routing into the low-voltage compartment

⇨ If necessary, connect the earthing cable of the end adapters or cross adapters.

Checking the voltage transformer connection



① Voltage transformer
② Plug connection
③ Busbar
④ Three-position switch
⑤ Circuit-breaker
⑥ Battery case (15-20 V)

Fig. 56: Circuit diagram for checking the voltage transformer connection

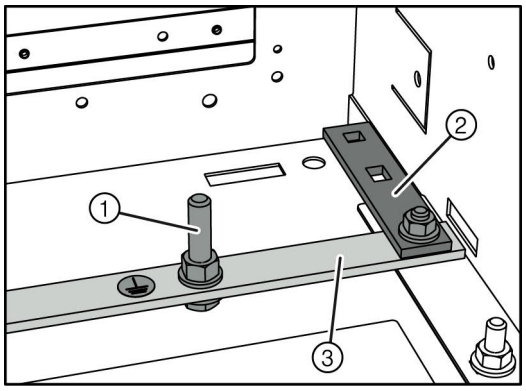
⇨ Switch the circuit-breaker and the three-position switch to the CLOSED position on one panel of the switchgear.

⇨ Connect a voltmeter to the evacuation of the voltage transformer. Set the voltmeter to the mV measuring range.

⇨ Using a battery, apply 15 to 20 V DC at L1, L2, L3 to earth. Observe the voltmeter.

✔ If the pointer moves briefly, the voltage transformer connection is in order.

15.8 Interconnecting the earthing busbars

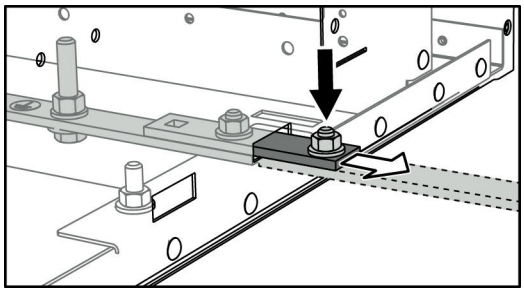


① Earthing connection point
② Link
③ Earthing busbar

Fig. 57: Interconnecting the earthing busbars

⇨ **Auxiliary transformer panel only:** The link for a earthing busbar connection to the left is located in the lateral cable compartment. To connect the earthing busbar, remove the metal cover of the lateral cable compartment.

⇨ Detach the pre-assembled link provided at the joint, and push it through the opening of the side wall.



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

⇨ Bolt the link together with the adjacent unit of the earthing busbar (tightening torque: 50 Nm).

⇨ Proceed in the same way with the other joints.

15.9 Earthing the switchgear

The cross-sections and materials of the earthing conductors are specified in the DIN/VDE 0111 (IEC 61936-1) standard and in the relevant country-specific standards.

The diameter of the earthing cable must be at least 70 mm^2.

NOTICE

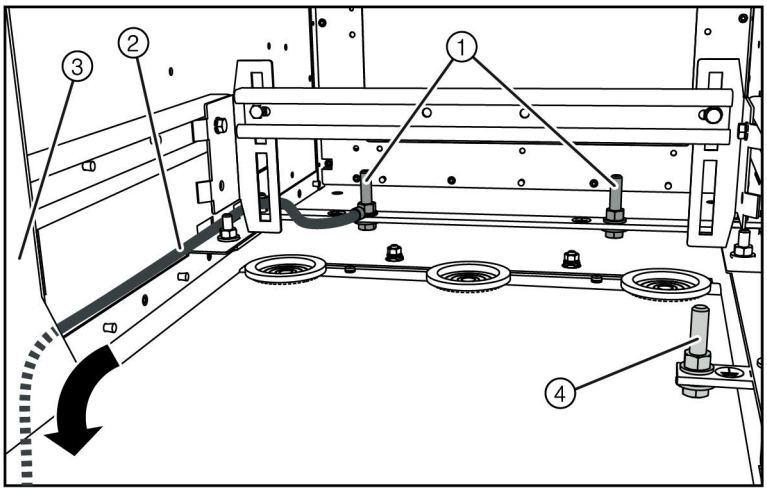
Use of incorrect earthing connection point
Can cause property damage. The earthing connection point for earthing accessories is not dimensioned for earthing at the substation earth.

⇨ Connect the switchgear to the substation earth exclusively at the earthing connection points appropriate for this purpose.

⇨ Connect the earthing busbar of the two end panels to the substation earthing system through one of the earthing connection points ① (M12 bolt). In addition, earth every fifth panel.

⇨ Lay the earthing cable ② through the left-hand wiring duct ③ into the cable basement.

⇨ Connect the earthing cable to the substation earth.



① Earthing connection point
② Earthing cable
③ Left-hand wiring duct
④ Earthing connection point extended to the front for earthing accessories (do not use)

Fig. 58: Earthing the switchgear (example)

15.10 Installing the low-voltage compartment

⇨ Place the low-voltage compartment onto the frame of the associated panel and push it to the rear.

The 2 lugs ① at the rear of the low-voltage compartment must be pushed into the cutouts at the panel. The front of the low-voltage compartment must be in line with the panel front.

⇨ Bolt the low-voltage compartment to the frame ② .

⇨ Install all other low-voltage compartments in the same way.

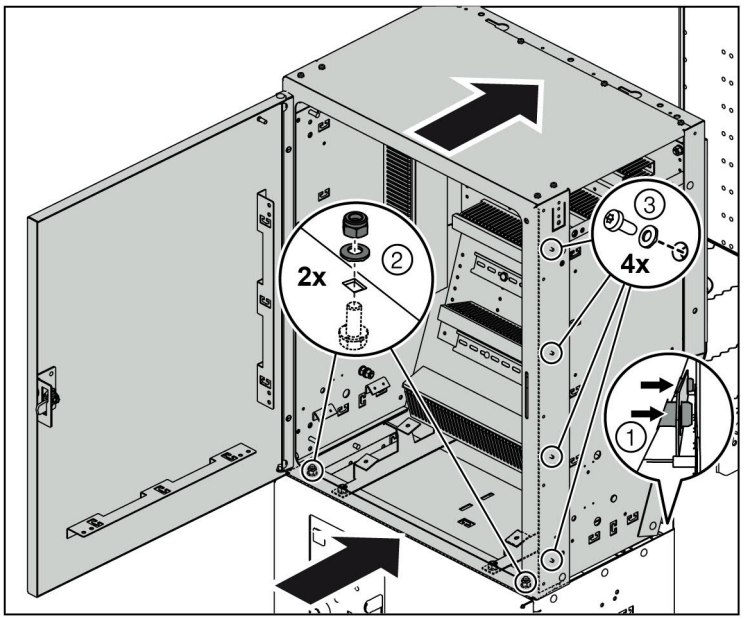
⇨ Bolt each low-voltage compartment to the neighboring low-voltage compartment ③ .

⇨ Route the cables of the switching devices through the right-hand opening in the bottom of the low-voltage compartment.

⇨ Connect the plugs with the corresponding terminals according to the circuit diagram (see page 169, "Connecting the STG plug with the VBSTB4 modular terminal").

⇨ Lay the bus wires in wiring ducts. Connect them with the corresponding terminals according to the circuit diagram.

⇨ Connect the cables of the current transformers and voltage transformers with the corresponding terminals according to the circuit diagram.



① Lugs

② **Lower bolted joint:**
- M8 locknut
- 8 contact washer
- M8 bolt-and-washer assembly

③ **Lateral bolted joint to adjacent panel:**
- M5 self-tapping oval head bolt
- 5 contact washer

Fig. 59: Bolting the low-voltage compartment in place

15.11 Installing the horizontal pressure relief duct

☞INFORMATION
If a horizontal pressure relief duct is installed, the busbar cover is not installed.
⇨ For installing the switchgear termination, see page 121, "Installing the switchgear termination".
⇨ Install the horizontal pressure relief duct.

Panel versions with horizontal pressure relief duct

Design option	Panel width [mm]	Busbar current depending on the panel position[1]		
		Left-hand end panel	Intermediate panel	Right-hand end panel
Standard (without ventilation)	600/450	-	≤ 1250 A	-
With ventilation	600/450	≤ 1250 A	-	≤ 1250 A
	900	2000 A	2000 A	2000 A
		2500 A	2500 A	2500 A
Evacuation at the rear	600	-	≤ 1250 A	-

[1] Regardless of the panel position, the panel types LS/LK(2000 A/2500 A), EB and aME are always equipped with ventilation.

Modular design

The evacuation duct can be set up with modular elements from the switchgear up to the opening in the substation wall.

The individual elements can be combined at will in order to build an evacuation duct matching the switchgear arrangement in the substation.

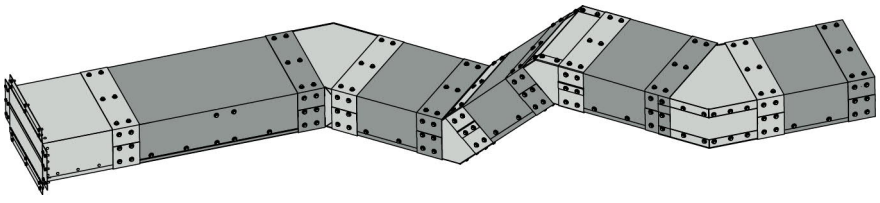
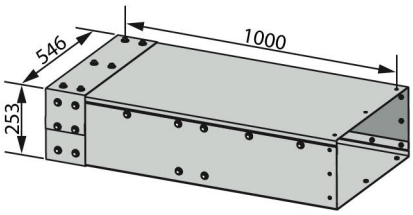
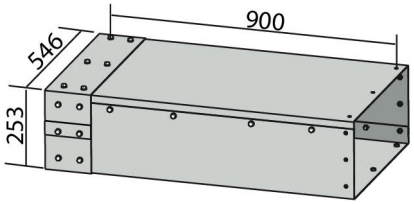
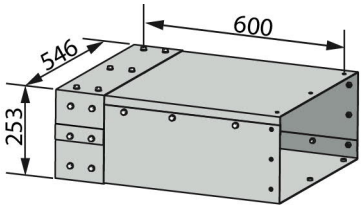
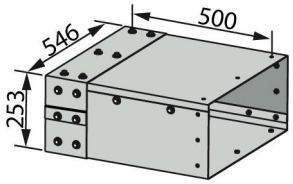
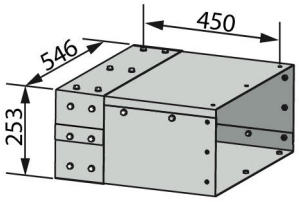
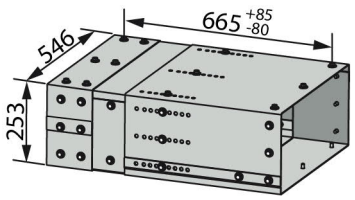
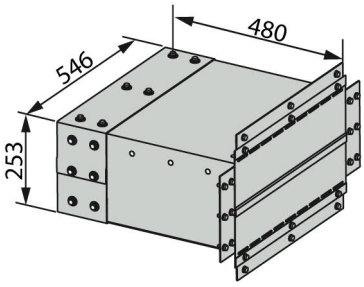
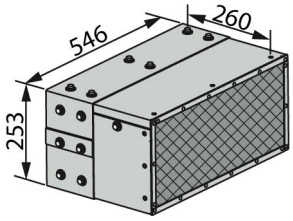
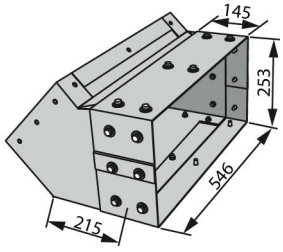
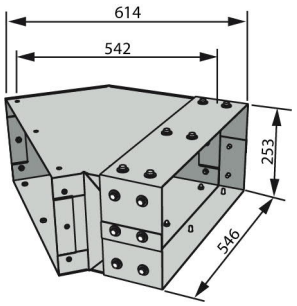


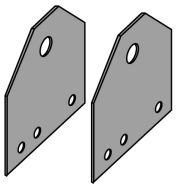
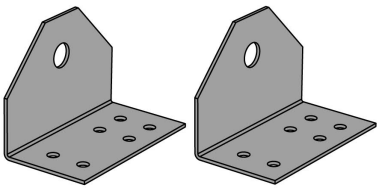
Fig. 60: Possible combinations of evacuation duct elements

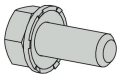
Duct elements

Duct element		Duct element	
Designation	**Length**	**Designation**	**Length**
Evacuation duct 1000 mm	1000 mm	Evacuation duct 900 mm	900 mm
			
Evacuation duct 600 mm	600 mm	Evacuation duct 500 mm	500 mm
			
Evacuation duct 450 mm	450 mm	Evacuation duct, adjustable	585 to 750 mm
			
Evacuation duct, flap, exit	480 mm	Evacuation duct termination, expanded metal	260 mm
			

Angle		
Type designation	**Angle**	**Dimensions**
Evacuation duct angle, vertical	45°	

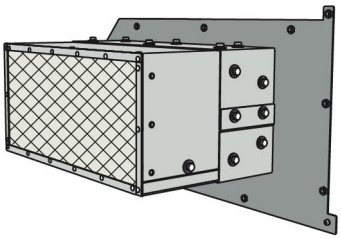
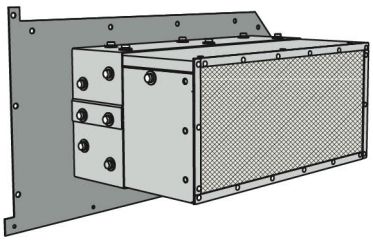
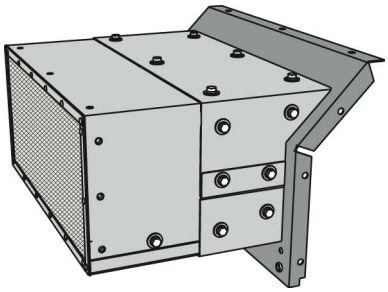
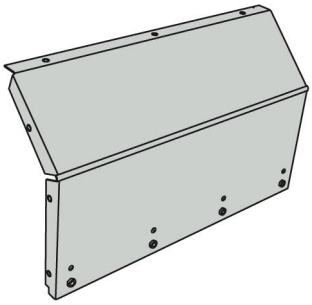
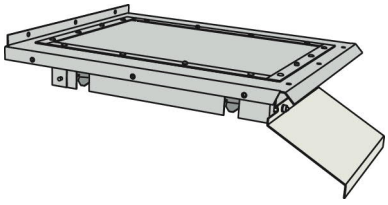
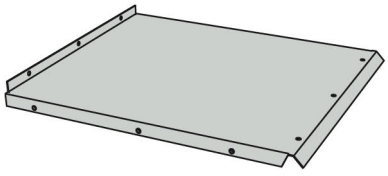
Angle		
Type designation	**Angle**	**Dimensions**
Evacuation duct angle, horizontal	45°	

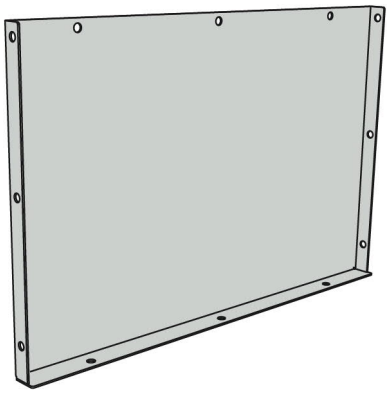
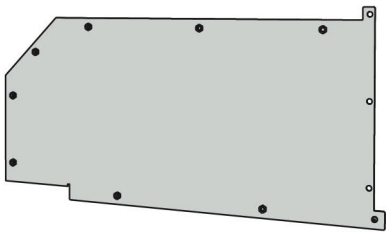
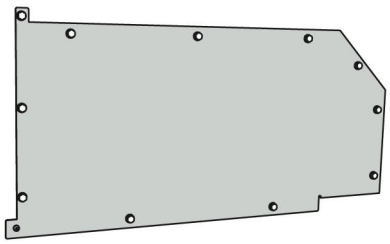
Brackets	
Type designation	**Illustration**
Fixing lugs for evacuation duct	
Fixing bracket, evacuation duct	

Bolting material		
Designation	**Size**	**Illustration**
Bolt-and-washer assembly	M8	
Setting nut	M8	

Duct elements on the switchgear

For installation of the horizontal pressure relief duct on the switchgear, the following elements are required. Here, the elements for a panel width of 600 mm are shown as an example.

Designation	Detailed designation	Illustration
Side plate	Connecting element, lateral evacuation, left side (with pre-installed evacuation duct element)	
Side plate	Connecting element, lateral evacuation, right side (with pre-installed evacuation duct element)	
Rear wall	Connecting element, rear evacuation (with pre-installed evacuation duct element)	
Rear wall	Rear wall, closed	
Top cover	Top cover with ventilation	
Top cover	Top cover, closed	

Designation	Detailed designation	Illustration
Front plate	Front plate, closed	
Side plate	Side plate, closed, left side	
Side plate	Side plate, closed, right side	

Mounting the side plates

Before the horizontal pressure relief duct can be installed, the switchgear termination must be mounted (see page 121, "Installing the switchgear termination").

Perform the installation from the front, starting with the left end panel.

Installation with lateral evacuation to the left is shown here as an example.

☞INFORMATION

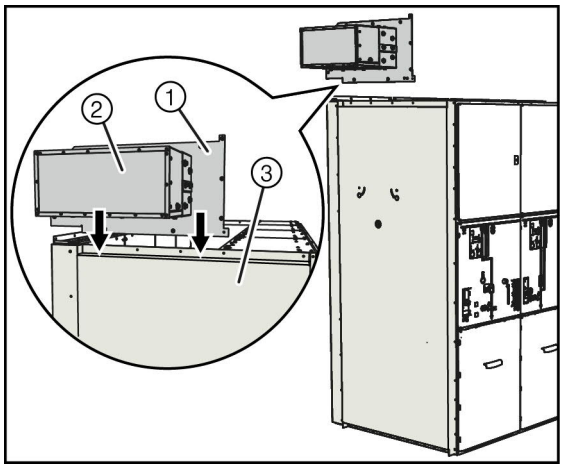
If a higher low-voltage compartment is mounted, it is not possible to install the horizontal pressure relief duct from the front.

➪ Install from the top or from the side.

Or

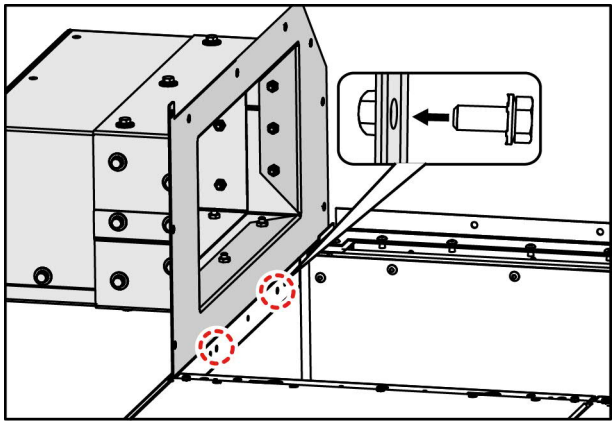
➪ Remove the low-voltage compartment and install from the front.

➪ Place the left-hand side plate ① onto the switchgear termination ③ .

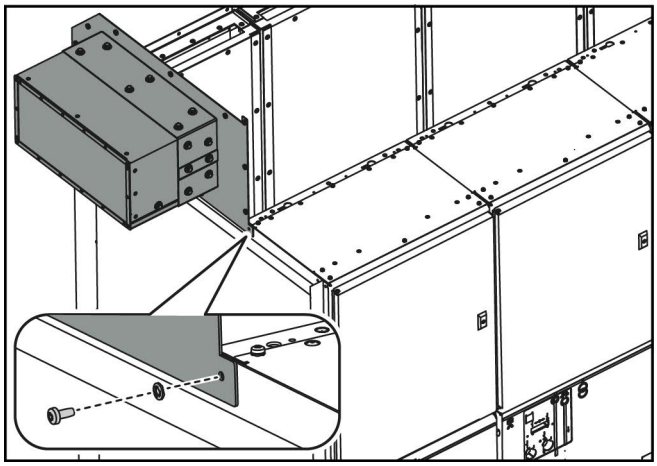


① Side plate
② Pre-assembled evacuation
③ Switchgear termination

⇨ Bolt the side plate together with the switchgear termination using 2 bolts M8x20.



⇨ Bolt the side plate laterally together with the rear wall of the low-voltage compartment using one self-tapping bolt M5 and one washer.



⇨ Mount the right-hand side plate on the right end panel.

✔ The side plates of the horizontal pressure relief duct are installed.

☞INFORMATION

If the installation of the top cover is not possible due to the height of the switchgear room, the rear wall and top cover must be pre-installed.

⇨ Place the top cover on the rear wall.

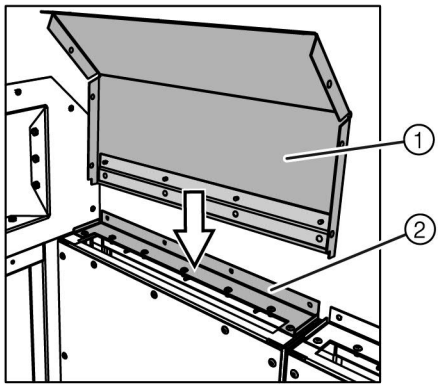
⇨ Bolt the top cover together with the rear wall using 3 M8 bolts, and place it on the switchgear.

Installing the rear walls

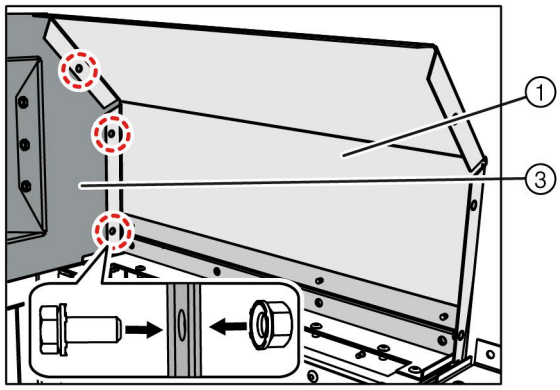
The installation of the rear evacuation is identical to the installation of a rear wall. The number of bolted connections differs depending on the individual panel type and the panel width.

- 600 mm panel width
- 450 mm panel width
- 900 mm panel width
- Air-insulated metering panel (aME)
- Auxiliary transformer panel (EB)

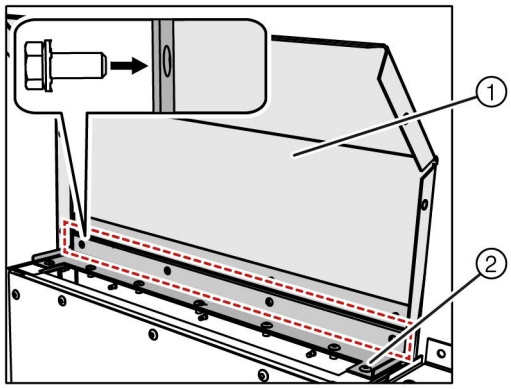
⇨ Push the rear wall ① on the pre-installed fixing bracket ② .



⇨ Bolt the rear wall ① together with the side plate ③ or another rear wall using 3 M8x20 bolts and nut-and-washer assemblies (tightening torque: 20 Nm).



⇨ Bolt the rear wall ① to the fixing bracket ② using M8x20 bolts (tightening torque: 20 Nm).



Number of bolted joints:
600 mm panel width: 4x
450 mm panel width: 3x
900 mm panel width: 6x
aME: 6x
EB = 6x

⇨ Installing additional rear walls.

Checking the ventilation flap

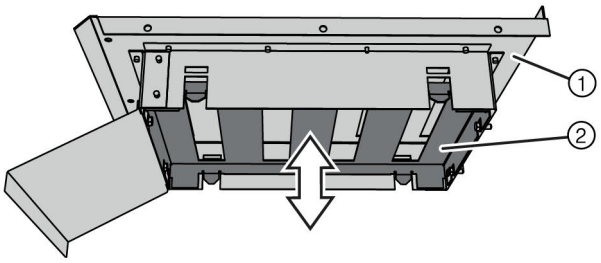
NOTICE

Contamination of the switchgear room
In case of fault, a non-functioning ventilation flap can create a large amount of dirt in the switchgear room.

⇨ Check the smooth operation of the ventilation flap.

⇨ Open the ventilation flap after installation.

⇨ Open and close the ventilation flap ② at the top cover of the pressure relief duct ① several times.



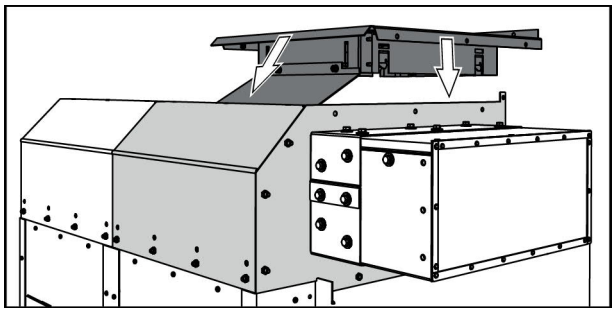
✔ If the ventilation flap can be opened and closed easily, then it is ready for installation.

Installing top covers

To install a top cover, the design option of the top cover is not relevant.

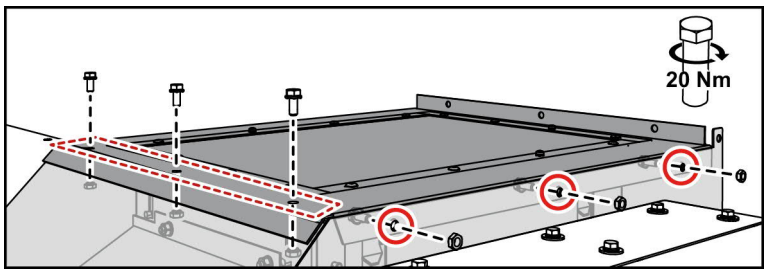
Before installing a top cover with ventilation, the ventilation's operability must be tested.

⇨ Push the top cover from the front to the rear wall, and place it flush on the side plate and the rear wall.



⇨ Bolt the top cover together with the side plate from the inside to the outside using 3 M8x20 bolts and nut-and-washer assemblies (tightening torque: 20 Nm).

⇨ Bolt the top cover together with the rear wall from top to bottom using M8x20 bolts and nut-and-washer assemblies (tightening torque: 20 Nm).



Bolted joint with side plate

Number of bolted joints (rear wall):

600 mm panel width: 3x

900 mm panel width: 4x

450 mm panel width: 2x

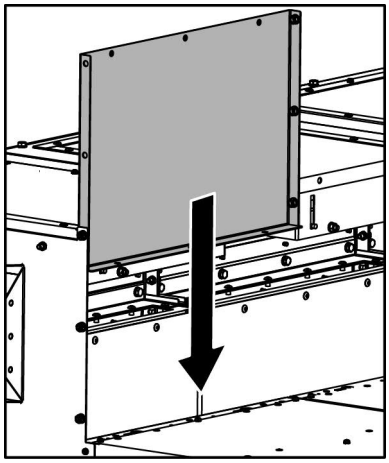
aME: 4x

EB: 4x

⇨ Install any additional top covers.

Installing front plates

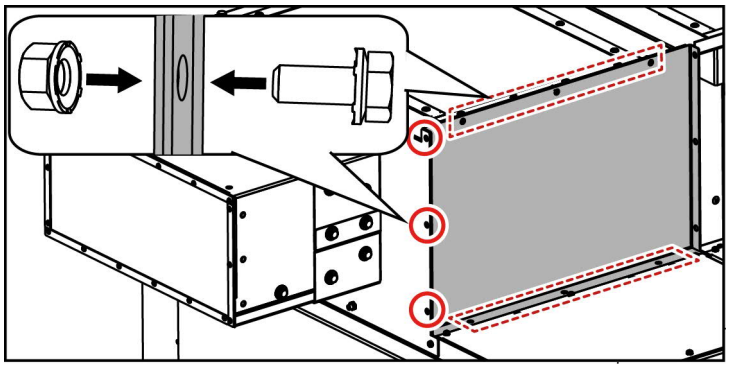
⇨ Place the front plate flush on the top cover, the side plate and the low-voltage compartment.



⇨ Bolt the front plate together with the side plate using 3 M8x20 bolts and nut-and-washer assemblies.

⇨ Bolt the front plate together with the top cover in the upper area using M8x20 bolts and nut-and-washer assemblies.

⇨ Bolt the front plate together with the low-voltage compartment in the lower area using M8x20 bolt-and-washer assemblies.



Bolted joint with side plate

Number of bolted joints:
600 mm panel width: 3x
900 mm panel width: 4x
aME: 4x
EB: 4x
450 mm panel width:
2x up at the top cover and 3x down at the low-voltage compartment

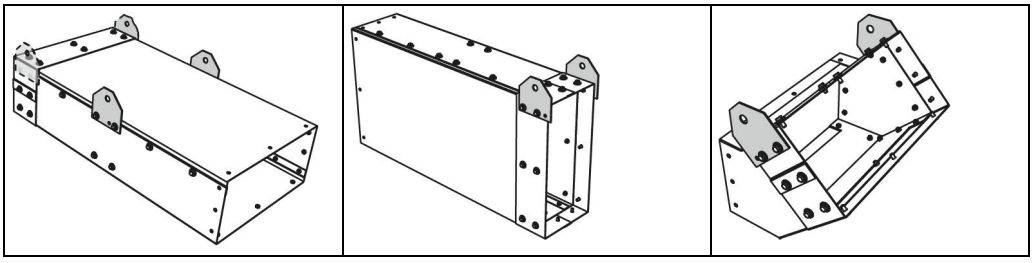
⇨ Install any additional front plates.

Assembling the evacuation duct

In order to install an evacuation duct matching the corresponding switchgear arrangement, the individual duct elements can be combined as needed.

In order to guarantee its stability, the evacuation duct must be supported at regular intervals (recommended value: every 100 cm). Fixing lugs are available for this purpose.

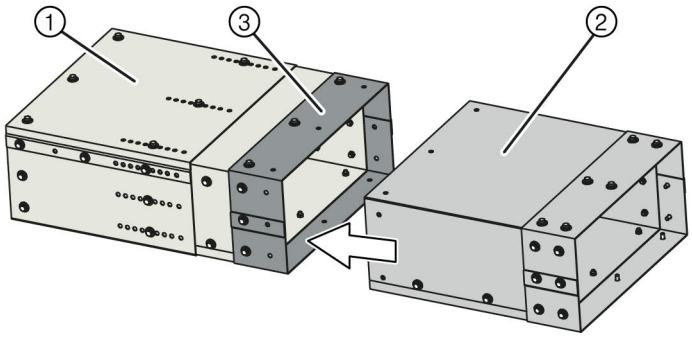
Possible installation positions of the fixing lugs



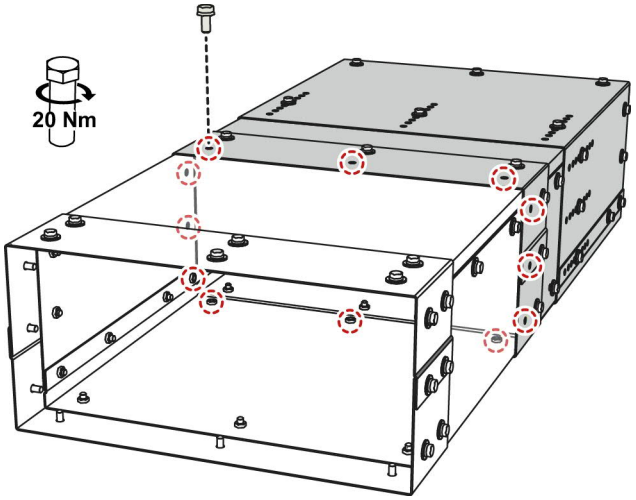
Connecting the duct elements

The installation of the duct elements shown here is illustrated as an example with a 500 mm duct element and an adjustable duct element. Mount other duct elements according to the same principle.

⇨ Push the duct element ② into the joining bracket ③ of the adjustable duct element ① .



⇨ Fasten the duct elements at 12 connecting points using bolt-and-washer assemblies M8x20 (tightening torque: 20 Nm).

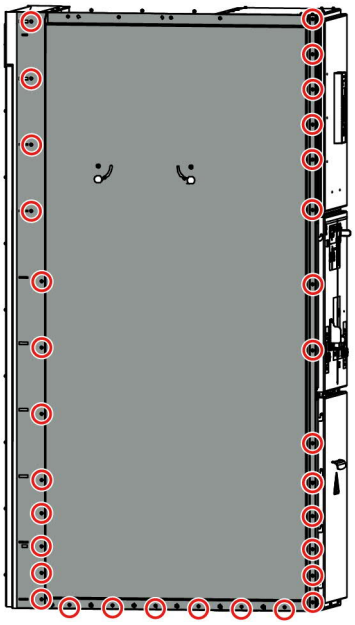


15.12 Installing the switchgear termination

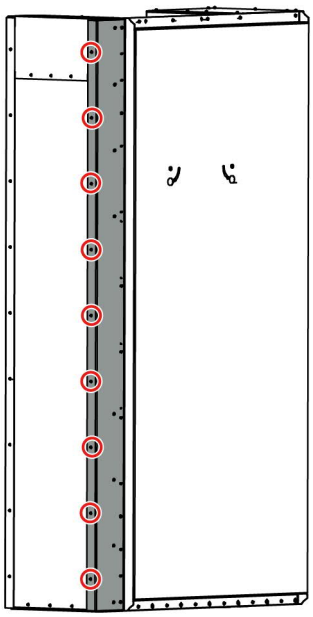
☞INFORMATION
The end panel of the NXPLUS C switchgear is delivered as standard with pre-installed switchgear termination and termination bracket. If the customer ordered without pre-installed switchgear termination and termination bracket, perform the following work operations.

⇨ Position the switchgear termination on the frame and bolt it in place:

- 6 bolts at the bottom
- 12 bolts at the rear
- 14 bolts in front



⇨ Position the sealing bracket. Use 9 bolts for bolting to the pressure relief duct.



✔ The switchgear termination has been installed. All other components are installed with the busbar termination.

15.13 Installing the busbar covers

☞INFORMATION
The components of the busbar cover are delivered with the switchgear accessories and are marked with a component number. With the following component tables, the component numbers of the components required for the corresponding panel can be identified.

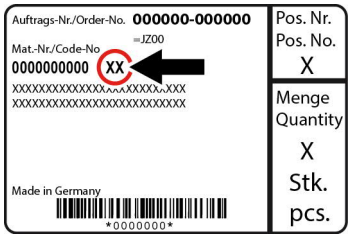
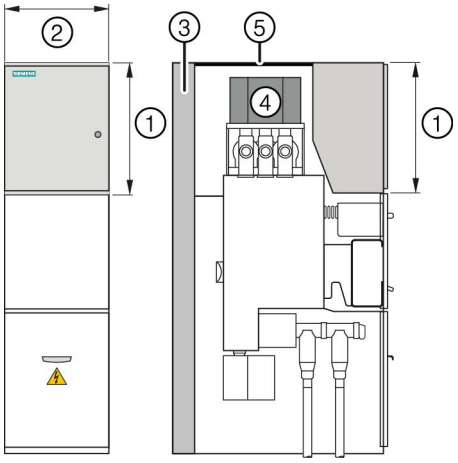


Fig. 61: Position of the component number (arrow)

☞INFORMATION
Before installing the busbar covers, the following information must be on hand for each panel: • Is the panel equipped with voltage transformers at the busbar (yes or no) • Panel width: 450 mm, 600 mm or 900 mm • Height of low-voltage compartment: 760 mm or 1160 mm • Panel degree of protection: IP3XD, IP31D, IP32D or IP34D (see single-line diagram) • Busbar current (see single-line diagram) • Feeder current (see single-line diagram)



① Height of low-voltage compartment
② Panel width
③ Pressure relief duct
④ Voltage transformers at the busbar
⑤ Busbar cover

Preconditions

- Panels are installed and bolted together.
- Panels are fastened to the foundation.
- Voltage transformers (option) are installed at the busbar.
- The switchgear termination is installed at end panels.
- Identify the busbar cover components to be installed for the individual panel using the corresponding component table:

Degree of protection	Busbar current	Voltage transformers at the busbar	Component table
IP3XD	Up to 1250 A	Not relevant	see page 123, "Component table 1"
	1600 A 2000 A 2500 A	yes	see page 125, "Component table 3"
		no	see page 123, "Component table 1"
IP31D IP32D IP34D	Up to 1250 A	Not relevant	see page 123, "Component table 2"
	1600 A 2000 A 2500 A	yes	see page 125, "Component table 4"
		no	see page 123, "Component table 2"

Component table 1

Panel			Components		
Panel type or panel width [mm]	**Feeder current [A]**	**Low-voltage compartment Height [mm]**	**Cover**	**Termination bracket**	**Reinforcing plate[1]**
Number in example illustration			①	②	③
450 mm	—	760	87	75	—
		1160	88	76	—
600 mm (without LK)	—	760	130	75	160
		1160	131	76	161
LK (600 mm)	1000	760	136[2]	—	160
		1160	132[2]	—	161
	1250	760	137[2]	—	160
		1160	133[2]	—	161
LKLS / LKTS (2 panels, 600 mm wide)	—	760	138	—	160
		1160	134	—	161
900 mm	—	760	89/153[3]	75	160
		1160	90/135[3]	76	161

[1] Only to be installed in panels of 31.5 kA design.
[2] Cover consists of 2 components.
[3] Bus sectionalizer panel only, cover consists of 2 components

Component table 2

Panel			Components		
Panel type or panel width [mm]	**Feeder current [A]**	**Low-voltage compartment Height [mm]**	**Cover**	**Termination bracket [1]**	**Reinforcing plate[2]**
Component in example illustration			①	②	③
450 mm	—	760	88	76	—
		1160	88	76	—
600 mm (without LK)	—	760	131	76	160
		1160	131	76	161
LK (600 mm)	1000	760	132[3]	—	160
		1160	132[3]	—	161
	1250	760	133[3]	—	160
		1160	133[3]	—	161
LKLS / LKTS (2 panels, 600 mm wide)	—	760	134	—	160
		1160	134	—	161
900 mm	—	760	90/135[4]	76	160
		1160	90/135[4]	76	161

[1] Installed only for end panels.
[2] Only to be installed in panels of 31.5 kA design.
[3] Cover consists of 2 components.
[4] Bus sectionalizer panel only, cover consists of 2 components

Component tables 1 and 2: Examples of busbar covers (view from the rear)

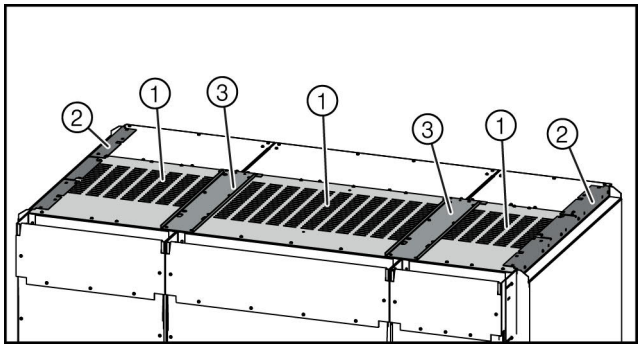


Fig. 62: Busbar covers for short low-voltage compartment

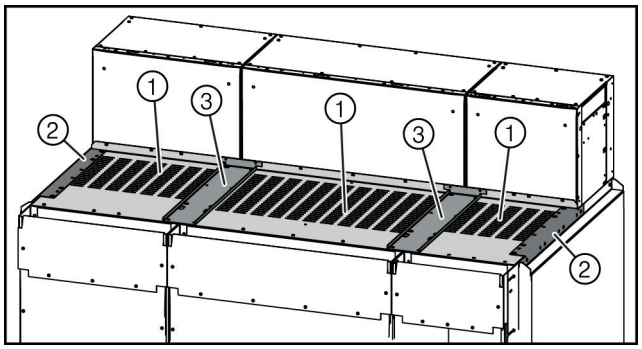


Fig. 63: Busbar covers for tall low-voltage compartment

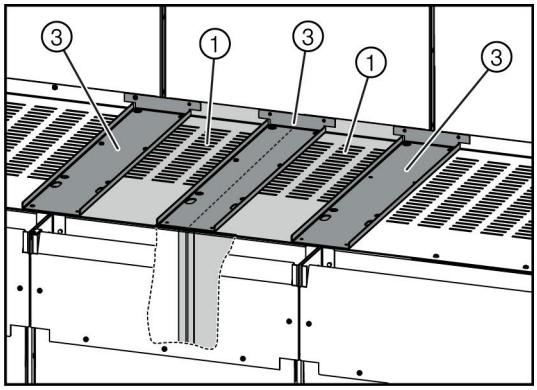


Fig. 64: Busbar cover of 2 components (bus sectionalizer)

Installation for component tables 1 and 2

- ⇨ Bolt the cover ① onto the panel.
- ⇨ **If the panel is an end panel:** Bolt the termination bracket ② in place.
- ⇨ **If the panel is the 31.5 kA design:** Bolt the reinforcing plate ③ onto the covers.
- ⇨ Repeat the installation of the busbar cover for all panels.
- ✔ The installation of the busbar cover has been completed.

Component table 3

Panel			Components						
Panel width [mm]	Position	LV compartment height [mm]	Connection plate	Cover	Side wall		Angle plate		Reinforcing plate
					Left	Right	Left	Right	
Component in example illustration			①	②	③	④	⑤	⑥	⑦
450	Intermediate panel	760	—	143	—	—	170	176	162
		1160	165	144	167	168	171	177	163
600	Intermediate panel	760	—	145	166	166	170	176	162
		1160	84	146	167	168	171	177	163
	Right-hand end panel	760	—	145	166	166	—	178	—
		1160	84	146	167	168	—	179	—
900 (not EB panel)	Intermediate panel	760	—	147[1] 148[1]	166	166	170	176	162
		1160	85/86[2]	149[1] 150[1]	167	168	171	177	163
	Left-hand end panel	760	—	147[3]	166	—	172	—	162
		1160	85/86[2]	151[3]	167	—	173	—	163
	Right-hand end panel	760	—	152[3]	—	166	—	178	—
		1160	86	149[3]	—	168	—	179	—
900 EB panel	Intermediate panel	760	—	154[3]	166	166	170	176	162
		1160	85 + 86	155[3]	167	168	171	177	163
	Left-hand end panel	760	—	154[3]	166	166	172	176	162
		1160	85 + 86	155[3]	167	168	173	177	163
	Right-hand end panel	760	—	154[3]	166	166	170	178	162
		1160	85 + 86	155[3]	167	168	171	179	163

[1] 147/151: For voltage transformer at the busbar in the right-hand adjacent panel.
152/149: For panel with voltage transformer at the busbar or left-hand adjacent panel (450 mm wide) with voltage transformer.
Cover consists of 2 components.
[2] 85: For voltage transformers at the busbar in the right-side adjacent panel.
86: For panel with voltage transformers at the busbar or left-hand adjacent panel (450 mm wide) with voltage transformer.
[3] Cover consists of 2 components.

Component table 4

Panel		Components						
Panel width [mm]	Position	Cover	Side wall		Angle plate		Reinforcing plate	Angle
			Left	Right	Left	Right		
Component in example illustration		②	③	④	⑤	⑥	⑦	⑧
450	Intermediate panel	156	—	—	—	—	164	182
	Left-hand end panel	156	169	—	175	—	164	182
	Right-hand end panel	156	—	169	—	181	—	182
600	Intermediate panel	157	169	169	174	180	164	125
	Right-hand end panel	157	—	169	—	181	—	125
900 (no EB panel)	Intermediate panel	158/159[1]	169	169	174	180	164	126/127[2]
	Left-hand end panel	158[3]	169	—	174	—	164	126
	Right-hand end panel	159[3]	—	169	—	180	—	127

[1] 158: For voltage transformer at the busbar in the right-hand adjacent panel. Cover consists of 2 components.
159: For panel with voltage transformer at the busbar or left-hand adjacent panel (450 mm wide) with voltage transformer.
[2] 126: For voltage transformer at the busbar in the right-hand adjacent panel.
127: For panel with voltage transformer at the busbar or left-hand adjacent panel (450 mm wide) with voltage transformer.
[3] Cover consists of 2 components.

Component tables 3 and 4: Examples of busbar covers (view from the rear)

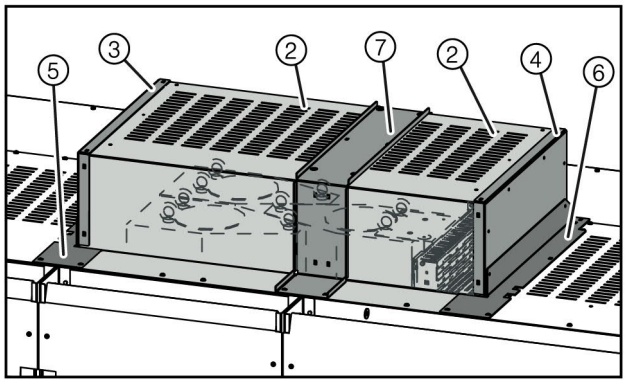


Fig. 65: Busbar cover for short low-voltage compartment

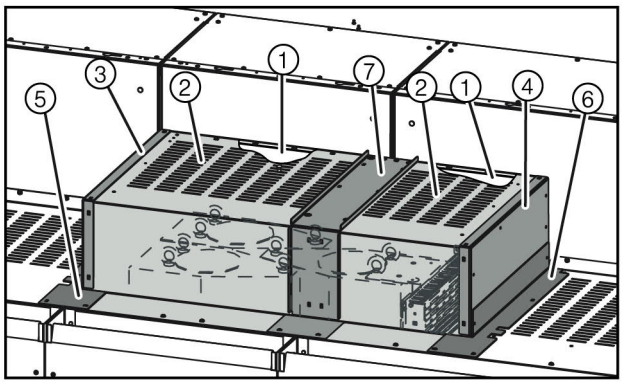


Fig. 66: Busbar cover for tall low-voltage compartment

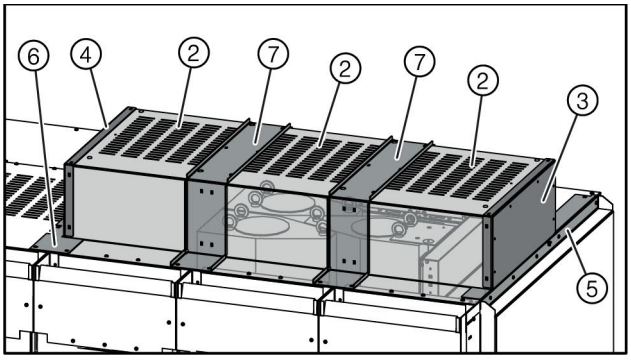


Fig. 67: Busbar cover for voltage transformers in 450 mm wide panel

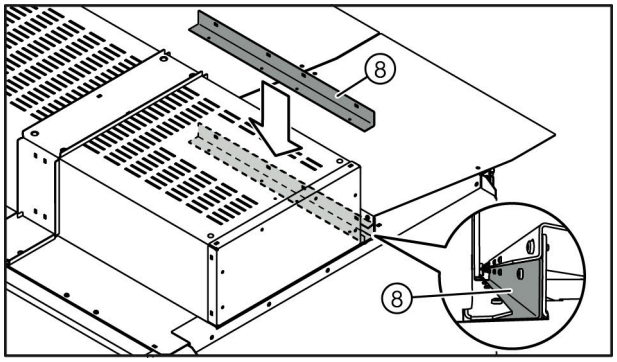


Fig. 68: Additional bracket for busbar cover with degree of protection design

Installation for component tables 3 and 4

⇨ **Panel with 1160 mm tall low-voltage compartment:** Bolt the connection plate ① together with the rear wall of the low-voltage compartment. Bolt the connection plate ① together with the connection plate of the adjacent panel.

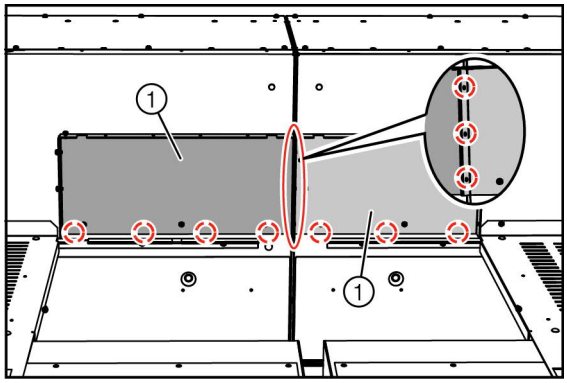


Fig. 69: Installing the connection plate (view from the rear, example)

⇨ Bolt the left-hand ③ or right-hand side wall ④ together with the cover ② .

⇨ **Panel with IP3XD, IP31D, IP32D or IP34D degree of protection:** Bolt the termination bracket ⑧ in place.

⇨ Bolt the cover ② onto the panel.

⇨ Install the left-hand ⑤ or right-hand angle plate ⑥ .

⇨ Install the reinforcing plate ⑦ onto the covers installed previously.

⇨ Repeat the installation of the busbar cover for all panels.

✔ The installation of the busbar cover has been completed.

15.14 Extension with individual panels

If you are going to extend an existing switchgear assembly or replace components, always observe the five safety rules:

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

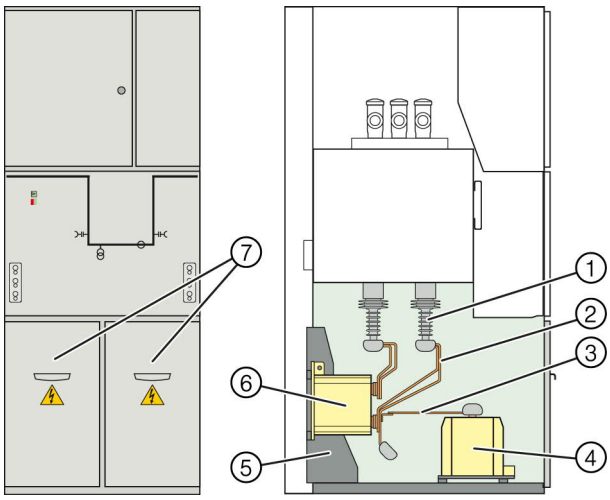
Always observe the Five Safety Rules:

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

- ⇨ Remove the switchgear termination.
- ⇨ Remove the low-voltage compartment, the busbar cover and, if required, the current or voltage transformers of the last panel and the one before last.
- ⇨ Push on the extension panel, align it and bolt it together (see page 85, "Aligning and joining the panels").
- ⇨ Fasten the extension panel to the foundation (see page 87, "Fastening the panel to the foundation").
- ⇨ On the last two panels, remove the cap and the screw-type cone of the busbar.
- ⇨ Undo the M12 nut and take it out.
- ⇨ Remove the conical spring washer (do not use it again).
- ⇨ For further installation, see page 88, "Installing the busbars".
- ⇨ Replace the end adapters of the former end panel with cross adapters.
- ⇨ Grease new components with mounting paste.
- ⇨ Do not forget to let excess air out (see page 95, "Bolting the busbar run together").

16 Installing the air-insulated metering panel

In the air-insulated metering panel, the instrument transformers are mounted on a removable instrument transformer cassette.



① Bushing
② Connecting bars
③ Connecting cable
④ Voltage transformer
⑤ Removable instrument transformer cassette
⑥ Current transformer
⑦ Instrument transformer compartment cover

Fig. 70: Air-insulated metering panel

The direction of the current flow in the air-insulated metering panel can be from the left to the right side of the switchgear or vice versa. The voltage transformers can be connected upstream or downstream from the current transformers via the connecting cable.

16.1 Installing instrument transformers in the metering panel

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

NOTICE

Damage to the switchgear due to inadequate instrument transformers!
Mount only instrument transformers which have been released by Siemens and correspond to the following standards:

⇨ Dimensions according to DIN 42600-8 for current transformers 4MA7
⇨ Dimensions according to DIN 42600-9 for voltage transformers 4MR

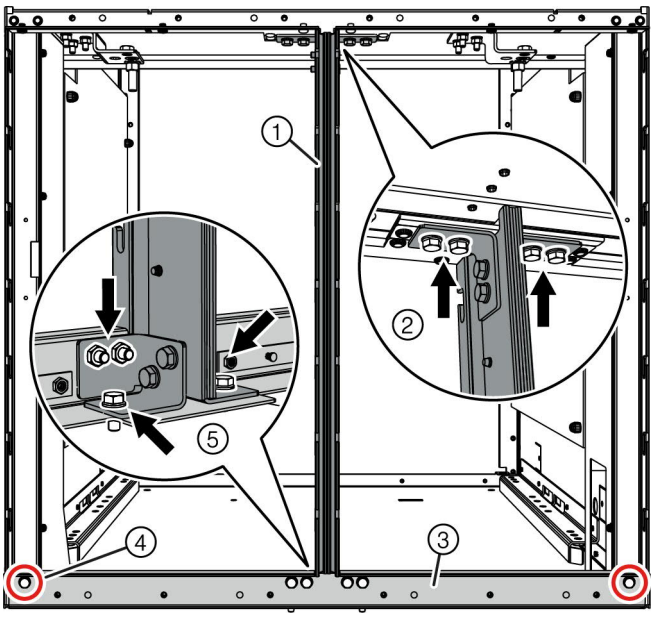
Removing the instrument transformer compartment cover

⇨ Remove the instrument transformer compartment covers in the air-insulated metering panel, see page 185, "Removing and mounting the connection compartment covers".

Removing the members

⇨ Remove the **vertical member** ① .
- Undo 2 hexagon head bolts M8 on each side in the upper area of the vertical member, see illustration zoom ② .
- Undo 3 hexagon head bolts M8 on each side in the lower area of the vertical member, see illustration zoom ⑤ .
- Hold the vertical member at the top, push it backwards and take it out of the instrument transformer compartment.

⇨ Remove the **cross member** ③ .
- Undo 2 hexagon head bolts M8 at the cross member.
- Remove the cross member to the front.



① Vertical member
② Upper bolted joint (bolts secured with setnuts)
③ Cross member
④ Bolted joint of the cross member (bolts secured with setnuts)
⑤ Lower bolted joint

⇨ Keep the disassembled components for later installation.

To simplify installation, the current transformers and the voltage transformers of the metering panel are mounted on a removable instrument transformer cassette.

- C-rails ① are pre-installed on the instrument transformer cassette for installing current transformers
- C-rails ① are pre-installed on the instrument transformer cassette for installing 1-pole voltage transformers
- A mounting plate ② is pre-installed on the instrument transformer cassette for installing 2-pole voltage transformers

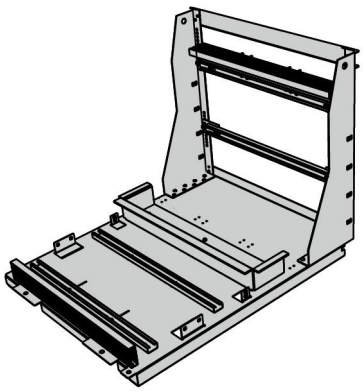
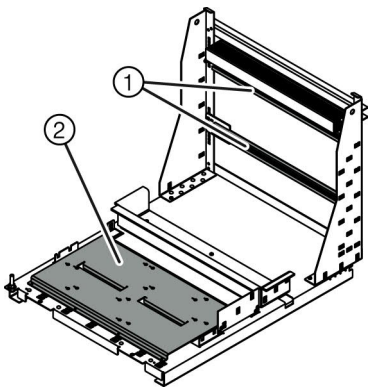


Fig. 71: Instrument transformer cassette with C-rails (as-delivered condition)



① C-rail
② Mounting plate

Fig. 72: Instrument transformer cassette with mounting plate (as-delivered condition)

☞INFORMATION

To pull the instrument transformer cassette out, enough free space must be available in front of the panel (min. 1400 mm).

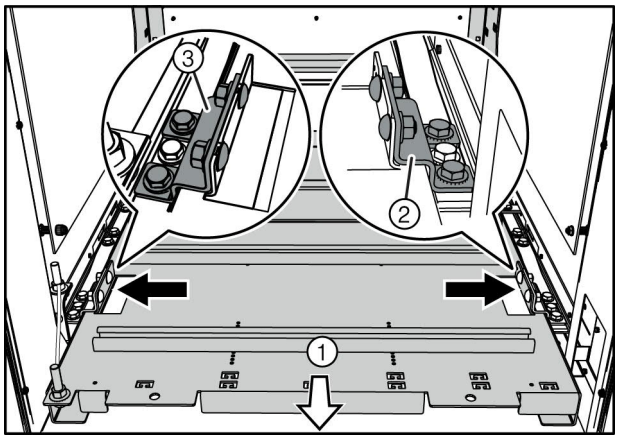
⇨ If the free space in front of the panel is not enough, leave the instrument transformer cassette in the panel and execute all assembly operations inside the panel.

⇨ Undo the bolted joints of the instrument transformer cassette.

Each fixing bracket of the instrument transformer cassette is fastened to the switchgear frame as follows:

- 2 hexagon head bolts M10 with conical spring washers and weld nuts
- 2 pan head bolts M10 with conical spring washers and nuts

⇨ Remove the fixing brackets. Keep the fixing brackets together with the bolting material for later reuse.



① Instrument transformer cassette
② Fixing bracket for instrument transformer cassette (right side)
③ Fixing bracket for instrument transformer cassette (left side)

⇨ Pull the empty instrument transformer cassette out of the panel.

Adjusting the position of the C-rails

The C-rails are pre-assembled at the instrument transformer cassette at the factory. Depending on the switchgear version, the C-rails must be mounted at different positions. To determine the position of the C-rails, holes are provided at the instrument transformer cassette.

☞INFORMATION
The holes on the instrument transformer cassette apply to small instrument transformers according to DIN 42600-8 and DIN 42600-9.

- **12 kV switchgear version:** 2 visible holes each (on both sides)
- **24 kV switchgear version:** 1 visible hole each (on both sides)

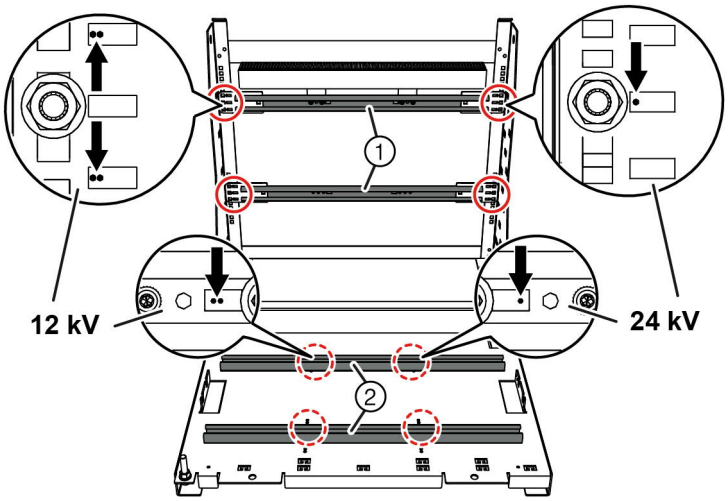


Fig. 73: Mounting position of the C-rails and visible holes

① C-rails for current transformers
② C-rails for voltage transformers

⇨ Adjust and bolt the C-rails at the corresponding positions according to the switchgear version.

Installing the instrument transformers on the C-rails

⚠ CAUTION

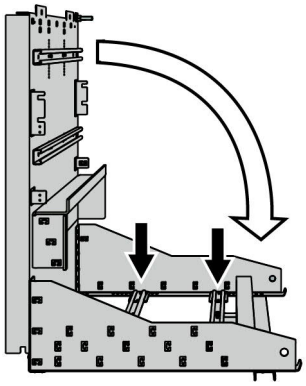
Risk of injury due to falling instrument transformers!
Instrument transformers are very heavy. An instrument transformer falling down can cause injury.

- ⇨ Lift the instrument transformer together with several persons.
- ⇨ Secure the instrument transformer against falling down.

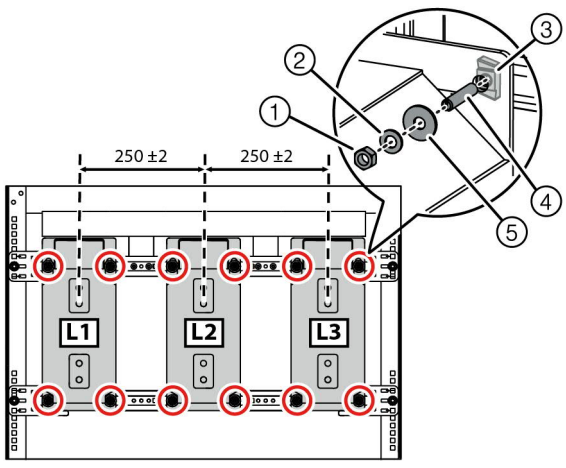
Order of assembly: Fasten the current transformers first and then the 1-pole voltage transformers on the instrument transformer cassette.

- ⇨ In order to mount the current transformers, incline the instrument transformer cassette by 90°.
- ⇨ If necessary, for each instrument transformer, insert 4 sliding nuts with setscrew into every C-rail. Insert the sliding nuts in upright position.
- ⇨ Start with phase L2. Place the current transformer in the middle on the C-rails (arrows).

  The current transformers can be turned by 180° and mounted.



- ⇨ Bolt the current transformers to the C-rail at 4 points.

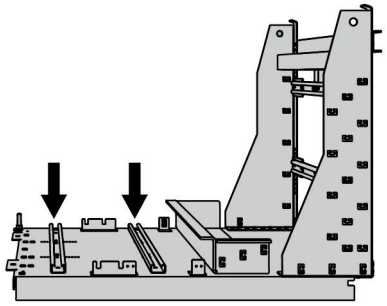


① Hexagon nut M10
② Conical spring washer
③ Sliding nut
④ Setscrew M10x60
⑤ Plain washer (3D washer for 24 kV switchgear version)

Fig. 74: Installing the current transformers (front view)

- ⇨ Then, fasten the instrument transformers for phase L1 and L3 on the left and on the right at a distance of 250 ±2 mm.
- ⇨ For mounting the 1-pole voltage transformers, put the instrument transformer cassette back to vertical position.

⇨ Start with phase L2. Place the 1-pole voltage transformer in the middle on the C-rails (arrows).



⇨ Bolt the 1-pole voltage transformer to the C-rail at 4 points.

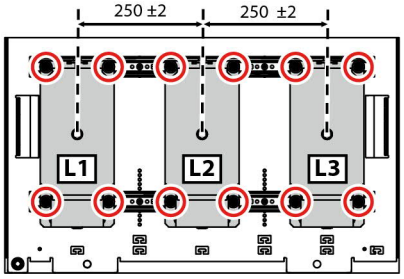


Fig. 75: Installing the 1-pole voltage transformer (top view)

⇨ Then, fasten the 1-pole voltage transformers for phase L1 and L3 on the left and on the right at a distance of 250 ±2 mm.

Installing 2-pole voltage transformers on the mounting plate

The mounting plate is pre-assembled on the instrument transformer cassette at the factory. Depending on the switchgear version, the 2-pole voltage transformers have to be installed on the mounting plate at different positions. Holes are provided in the mounting plate for determining the positions.

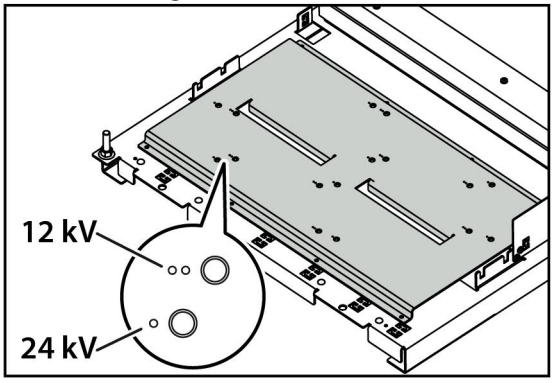
☞INFORMATION
The holes and through-holes on the mounting plate are valid for small instrument transformers according to DIN 42600-8 and DIN 42600-9.

⇨ Complete the installation of the current transformers on the C-rail.

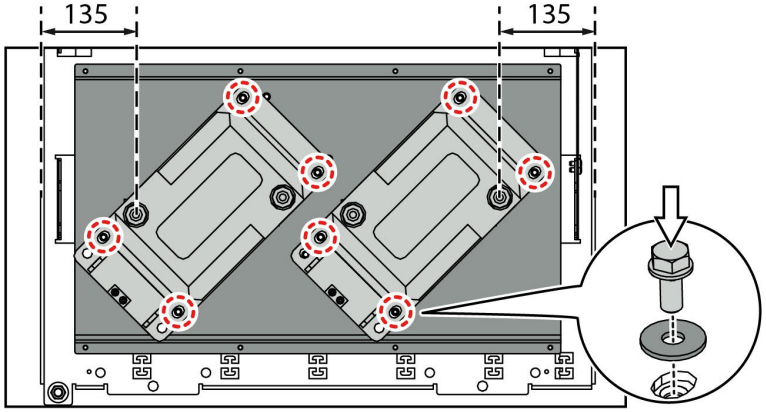
⇨ Put the instrument transformer cassette back to vertical position.

⇨ Determining the bolted joints for the instrument transformers:

- **12 kV switchgear version:** 2 visible holes next to the through hole
- **24 kV switchgear version:** 1 visible hole next to the through hole



⇨ Place the 2-pole voltage transformers on the mounting plate and bolt tight. Keep the minimum distance from the frame of the instrument transformer cassette.



✔ The 2-pole voltage transformers are firmly connected to the mounting plate.

Connecting the current transformers

NOTICE

Damage to the switchgear due to insufficient contact of connection bars!
Insufficient electrical contact increases the contact resistance and can damage the switchgear due to flashovers.

⇨ Clean oxidized contact points.
⇨ Do not damage contact surfaces.
⇨ Mount the connection bars without distortions and gaps.

NOTICE

Damage to the switchgear due to polluted vessel bushings!
Polluted vessel bushings can lead to flashovers.

⇨ Clean the vessel bushings with suitable cleaning agents and a lint-free wiping cloth.

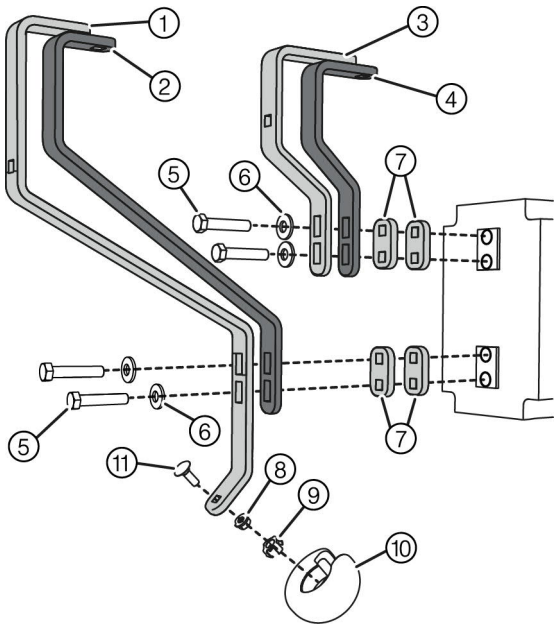
NOTICE

Damage to the switchgear due to low insulation at the connection bars!
Low insulation at the connection bars can lead to flashovers.

⇨ Mount the control cap at the vessel bushing.
⇨ Check the control cap insulation for bad spots.
⇨ Check the minimum distance of the control cap to earthed components (≥ 65 mm).

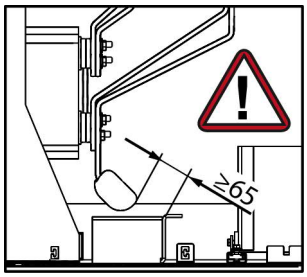
Connecting the current transformers in the metering panel

⇨ Mount the spacers and connection bars on the current transformer; fasten the bolt hand-tight.
⇨ In order to be able to compensate for tolerances after pushing the instrument transformer cassette into the panel, tighten the hexagon head bolts ⑤ hand-tight.



① Lower connection bar (silver-plated)
② Lower connection bar (copper)
③ Upper connection bar (silver-plated)
④ Upper connection bar (copper)
⑤ Hexagon head bolt M12 (4x)
⑥ Conical spring washer (4x)
⑦ Spacer (silver-plated, 4x)
⑧ Nut
⑨ Retaining bracket for control cap
⑩ Control cap
⑪ Pan head bolt

➪ Check the minimum distance from the control cap to the upper edge of the arcing plate (≥ 65 mm).



Connecting the voltage transformers

NOTICE

Risk of flashover
Death, serious injury or damage to the switchgear may result if the distances between the connecting cables of the current and voltage transformers are too small.

➪ Cut to length the connecting cables between the current and voltage transformers such that the required minimum distances to live parts are observed.

➪ The deflection of the connecting cables between the current and voltage transformers may not be more than 10 mm in any direction.

NOTICE

Risk of flashover
Undersized distances between live parts and flexible steel tubes during wire routing can damage the switchgear.

➪ Lay the flexible metal tube while maintaining a sufficient minimum distance from live parts.

The voltage transformers must be connected to the current transformers on site with the connecting cables which are either pre-installed or supplied with the supplementary equipment. In the case of 2-pole voltage transformers, a connection between both 2-pole voltage transformer is also necessary.

The 1-pole voltage transformers can be connected either at the lower or upper terminals of the current transformers, depending on the circuit diagrams.

Installing the control cap

⇨ Undo the hexagon head bolt and conical spring washer at the voltage transformer.

⇨ Install the control cap together with the connecting cable onto the voltage transformer. In the case of a 2-pole voltage transformer, install control cap only on the outer poles.

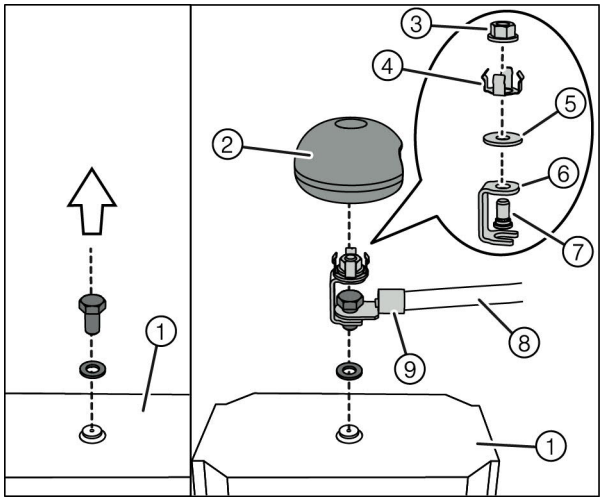


Fig. 76: Installing the control cap

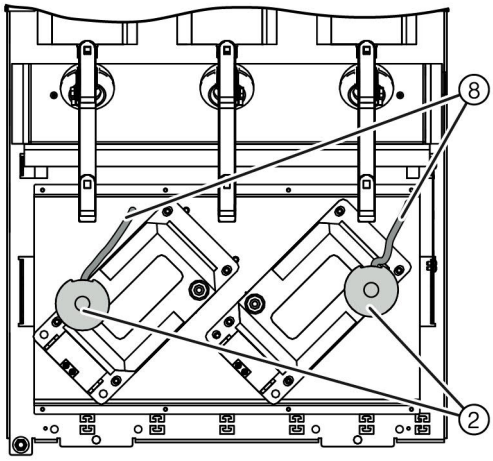


Fig. 77: Installed control caps on a 2-pole voltage transformer

① Voltage transformer
② Control cap
③ M10 nut-and-washer assembly
④ Retaining bracket for control cap
⑤ Plain washer
⑥ Fixing bracket
⑦ M10 threaded stud
⑧ Connecting cable
⑨ Cable lug

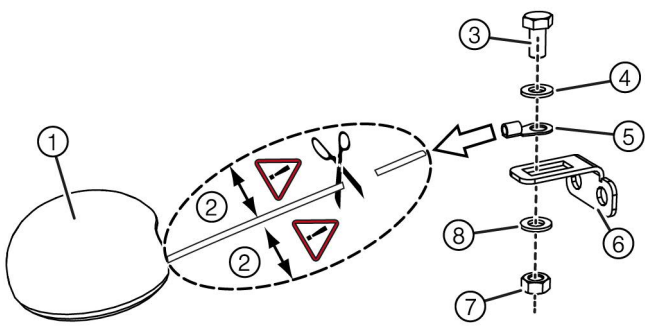
Preparing the connecting cable

The deflection of the connecting cable between the instrument transformers may not be more than 10 mm in any direction.

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

⇨ Cut the connecting cable to length to suit the distance between the instrument transformer terminals.see page 136, "Connection possibilities for the connecting cable").

⇨ Strip the connecting cable. Attach the cable lug.

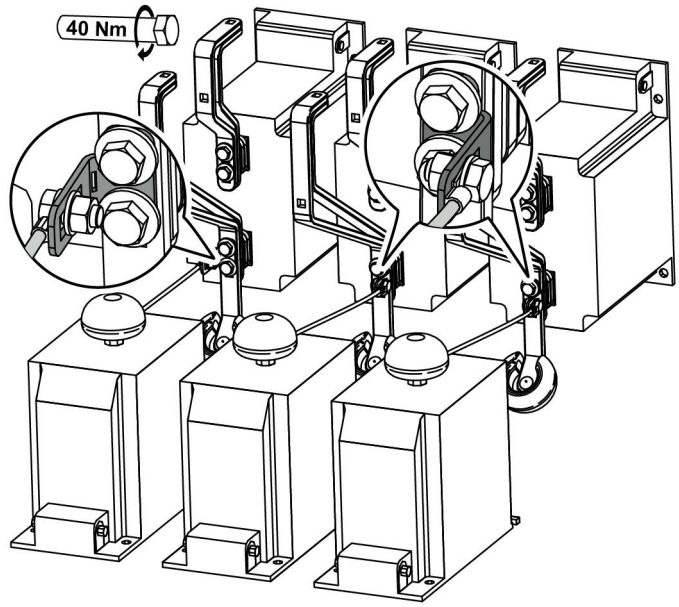
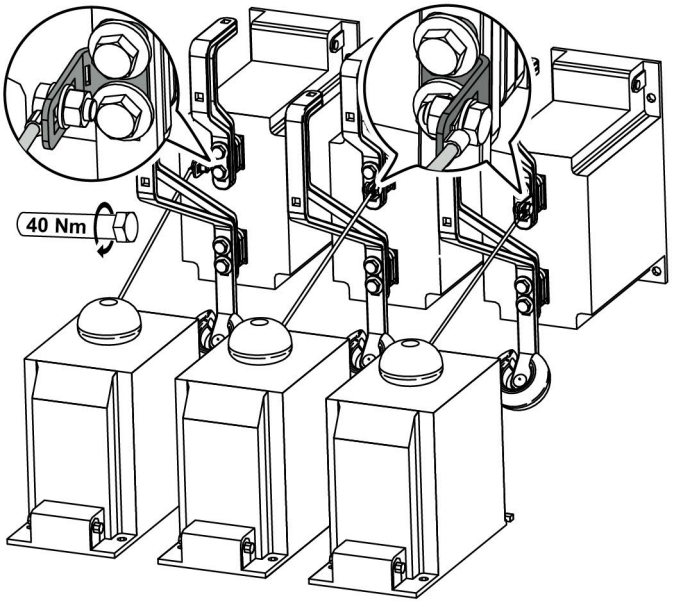


① Control cap
② Deflection of the connecting cable ≤ 10 mm
③ Hexagon head bolt M10x20
④ Conical spring washer M10
⑤ Cable lug
⑥ Fixing bracket
⑦ Nut-and-washer assembly M10
⑧ Plain washer

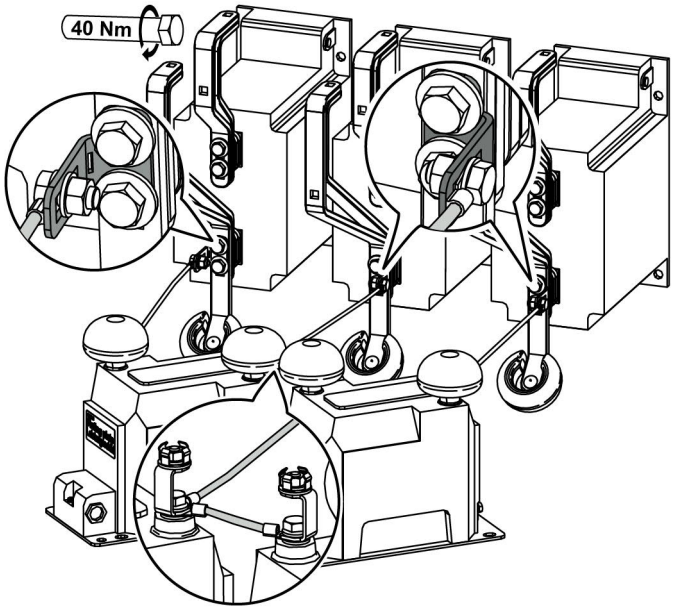
⇨ Connect the connecting cable to the instrument transformers according to the circuit diagrams.

Connection possibilities for the connecting cable

☞INFORMATION
The 1-pole voltage transformers can be connected either at the lower or upper terminals of the current transformers, depending on the circuit diagrams.

Connection possibilities from the 1-pole voltage transformer to the current transformer	
Connecting the voltage transformer at the **lower** terminal of the current transformer	Connecting the voltage transformer at the **upper** terminal of the current transformer
	
IMPORTANT: Observe the alignment of the fixing bracket.	

Installing the 2-pole voltage transformer

Connecting the cables of the 2-pole voltage transformer

IMPORTANT: Observe the alignment of the fixing bracket.

⇨ Cut to length the connecting cables between the 2-pole voltage transformer and the current transformer, and between the inner poles of the 2-pole voltage transformer. Observe the maximum deflection ≤ 10 mm of the connecting cable.

Left-hand voltage transformer:

- Connect the outer pole to the connection bar of phase L2 of the current transformer.
- Connect the inner pole to the inner pole of the other 2-pole voltage transformer.

Right-hand voltage transformer:

- Connect the outer pole to the connection bar of phase L1 of the current transformer.
- Connect the inner pole to the connection bar of phase L2 of the current transformer.

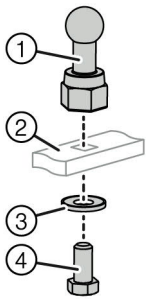
⇨ Mount the control caps on the inner poles.

✔ The 2-pole voltage transformers are connected to the current transformers.

Mounting the spherical connection bolts

To earth the instrument transformer groups, spherical connection bolts can be mounted on the connection bars. The spherical connection bolts are available as accessories.

⇨ Mount the spherical connection bolts on the connection bars (tightening torque: 40 Nm).



① Spherical connection bolt
② Connection bar (metering panel)
③ Conical spring washer M12
④ Hexagon head bolt M12x25

Fig. 78: Mounting the spherical connection bolts

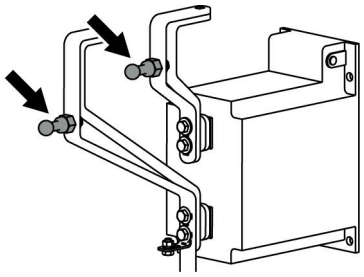


Fig. 79: Mounting positions of the spherical connection bolts

Laying the secondary leads of the instrument transformers

⚠WARNING

Risk of flashover if the distances are too small
Between the flexible steel tubes for wire routing of the instrument transformers and live primary parts, distances must be observed.

⇨ Lay steel tubes according to the basic scheme. Secure them with cable straps.

⇨ The steel tubes may not show any deflection.

☞INFORMATION

If multi-core secondary leads are used by the customer, the secondary leads may not fit in the steel tube (max. inside diameter of 19 mm).

⇨ Strip the secondary leads. Lay the secondary leads in the steel tube.

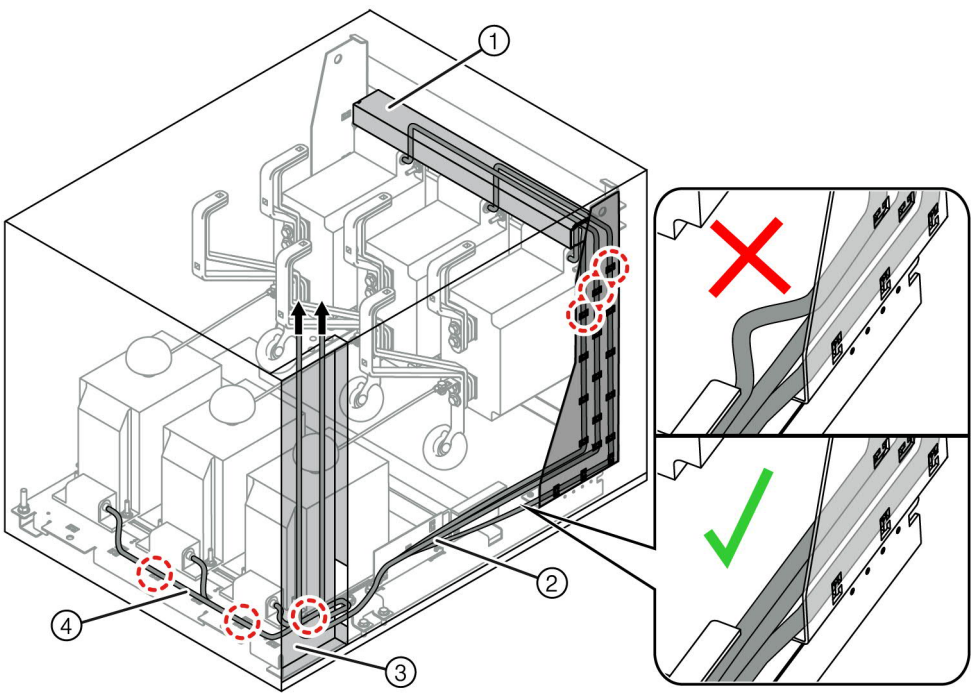
The secondary leads of the instrument transformers are combined in a steel tube. Fasten the steel tube with cable straps at the recesses of the instrument transformer cassette.

⇨ Lead the secondary leads of the current transformers ② downwards through the right-hand wiring duct ① . Then, lead them upwards to the front in the wiring duct ③ .

⇨ Lay the secondary leads of the voltage transformers ④ to the right into the wiring duct ③ .

⇨ For earthing the steel tubes, fix the steel tubes with metallic cable straps at the marked points.

⇨ Then, lead the secondary leads upwards into the low-voltage compartment through the wiring duct ③ .



① Wiring duct of instrument transformer cassette
② Secondary leads of current transformers
③ Wiring duct of metering panel
④ Secondary leads of voltage transformers
◌ Connection point of steel cable strap

Fig. 80: Basic scheme: Wire routing of instrument transformers.

Installing the instrument transformer cassette

⚠WARNING

Risk of flashover

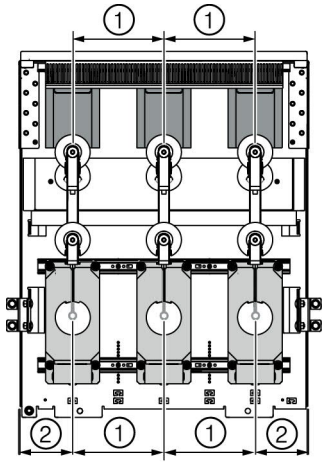
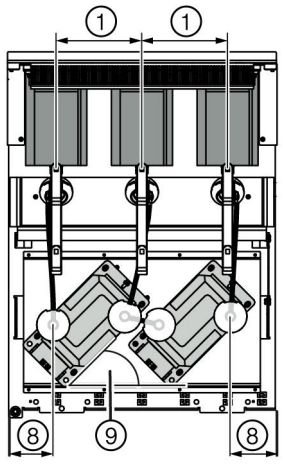
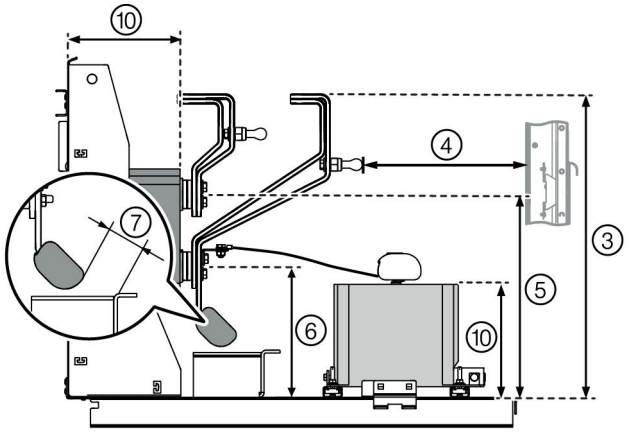
Death, serious injury or property damage may result if the minimum distances between the spherical connection bolts and earthed parts are too small.

⇨ Minimum distances according to IEC 61936 / VDE 0101 must be observed and checked during installation.

- For 24 kV, the minimum distance is ≥ 220 mm
- For 12 kV, the minimum distance is ≥ 120 mm

⇨ Check reference dimensions at the instrument transformer cassette. If applicable, correct the installation.

Reference dimensions for instrument transformer cassette

1-pole voltage transformers	2-pole voltage transformers	Side view of instrument transformer cassette
		

① 250±2 mm
② Min. 144 mm
③ Max. 663 mm
④ Min. 240 mm[1]
⑤ 430 ±2 mm
⑥ 278 ±2 mm
⑦ Min. 65 mm
⑧ Min. 135 mm
⑨ 45°
⑩ 12 kV: Min. 220 mm
24 kV: Min. 280 mm

[1] Check the minimum distance from the spherical connection bolts to the instrument transformer compartment cover. The instrument transformer cassette must be completely inserted in the metering panel.

⇨ Push the instrument transformer cassette into the panel as far as it will go. Check the minimum distance from the spherical connection bolts to the cable compartment cover.

⇨ Fasten the instrument transformer cassette to the panel on both sides using fixing brackets:

- Fastening the fixing brackets to the switchgear frame: 2 hexagon head bolts M10 with conical spring washers
- Fastening the fixing brackets to the instrument transformer cassette: 2 cup head bolts M10 with conical spring washers

Fastening the connection bars

Bolt the connection bars together with the bushings:

⇨ Clean the vessel bushing ① with cleaning agent and a lint-free wiping cloth, and rub dry.

⇨ Install the spacer ② between the vessel bushing and the connection bar (silver-plated) ③ . If required, undo the connection bars, readjust and tighten them.

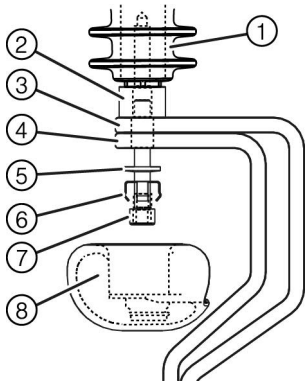
⇨ Push the retaining bracket ⑥ and the conical spring washer ⑤ onto the cheese head bolt with hexagon socket ⑦ .

⇨ Bolt the connection bar and the spacer together with the cheese head bolt at the vessel bushing of the busbar (tightening torque: 40 Nm).

⇨ Put the control cap ⑧ on the retaining bracket.

⇨ Verify firm seat of control cap.

⇨ Tightly fasten the bolted joints of the connection bars at the current transformers (tightening torque: 40 Nm).



① Vessel bushing
② Spacer
③ Connection bar of instrument transformer (silver-plated)
④ Connection bar of instrument transformer (copper)
⑤ Conical spring washer
⑥ Retaining bracket
⑦ Hexagon head bolt M10
⑧ Control cap of vessel bushing

Fig. 81: Fastening the connection bar

⇨ Perform the installation for the other two phases in the same way.

✔ The instrument transformer is connected with the busbar.

⇨ Check if all bolts are firmly tightened. If required, re-tighten the bolts.

⇨ Insert the cross member and fasten it to the switchgear frame using 2 hexagon head bolts M8.

⇨ Insert the vertical member and mount it at the top of the switchgear frame using 4 hexagon head bolts M8.

⇨ Fasten the cross member using 6 hexagon head bolts M8 and nuts.

⇨ Lead the low-voltage cables of the instrument transformers in the right-hand wiring duct of the frame upwards, and connect them to the terminal strip.

Mounting the instrument transformer compartment cover

⇨ Mount the instrument transformer compartment covers in the air-insulated metering panel, see page 185, "Removing and mounting the connection compartment covers".

16.2 Replacing instrument transformers in the air-insulated metering panel

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

⇨ Isolate.

⇨ Secure against reclosing.

⇨ Verify safe isolation from supply.

⇨ Earth and short-circuit.

⇨ Cover or barrier adjacent live parts.

NOTICE

Damage to secondary leads
The secondary leads can be squeezed when pulling the instrument transformer cassette out.

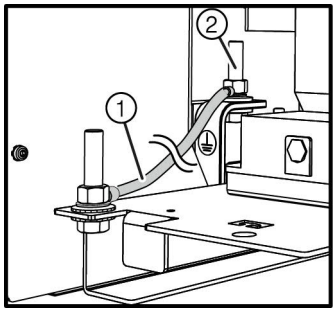
⇨ Remove the secondary leads before pulling the instrument transformer cassette out.

⇨ Earth the panel.

⇨ Remove the instrument transformer compartment cover (see page 185, "Removing and mounting the connection compartment covers").

⇨ Remove the members (see page 128, "Installing instrument transformers in the metering panel ").

⇨ Pull out the earthing cable ① underneath the instrument transformer cassette and connect it at the earthing connection point of the earthing busbar ② .



✔ The instrument transformer cassette and the panel are earthed.

⇨ Pull the secondary leads back from the low-voltage compartment and lay them on the instrument transformer cassette.

⇨ Undo the joint of the connection bars with the bushings (see page 128, "Installing instrument transformers in the metering panel ").

⇨ Remove the fixing brackets of the instrument transformer cassette (see page 128, "Installing instrument transformers in the metering panel ").

⇨ Pull the instrument transformer cassette out of the panel and remove it (see page 128, "Installing instrument transformers in the metering panel ").

⇨ Mount the instrument transformers (see page 128, "Installing instrument transformers in the metering panel ").

16.3 Mounting earthing accessories in the air-insulated metering panel

⚠DANGER

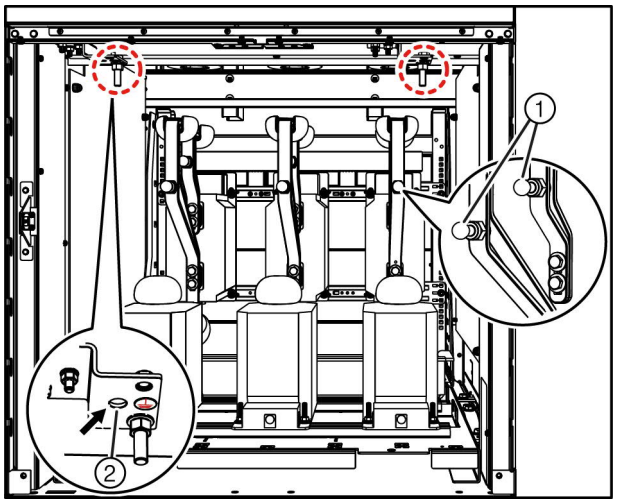
Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

☞INFORMATION

Before mounting the earthing accessories, read the manufacturer's assembly instructions.



① Spherical connection bolts at the upper or lower connection bar
② Earthing connection for earthing accessories on the right and left side of the air-insulated metering panel

Fig. 82: Connection possibilities for earthing accessories

⚠WARNING

Internal arcing and explosion hazard
Can cause death, serious injury or property damage.

If the connecting element of the earthing accessories is not bolted flush to the earthing connection, the current-carrying capacity of the earthing is not sufficient.

- ⇨ Bolt the connecting element of the earthing accessories flush to the earthing connection.

The earthing connection offers different fixing options for the earthing accessories. If the earthing accessories are fastened in another way, this can make installation difficult or diminish the accessibility to the metering panel.

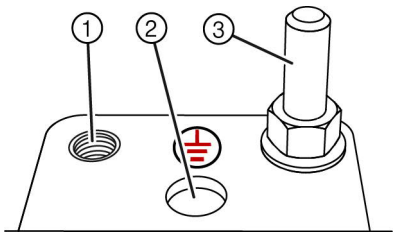


Fig. 83: Connection for earthing accessories

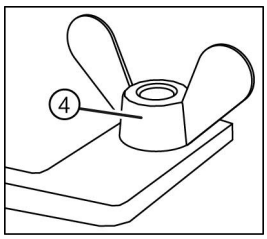


Fig. 84: Connection with wing nut

Connection possibility for:
① Threaded stud M12
② Through stud (Ø16.3 mm max.)
③ Bolt with nut M12
④ Earthing accessories with wing nut

☞INFORMATION

- ⇨ Earthing accessories with wing nuts ④ can be bolted to the earthing point at position ③ . To do this, remove the nut M12 and the washer before.

⇨ Mount the earthing accessories **first** at the earthing connection for the the earthing accessories.

⇨ Then, mount the earthing accessories at the spherical connection bolts (see page 137, "Mounting the spherical connection bolts") on all 3 phases.

Type of earthing accessories

The earthing accessories are not included in the standard accessories. The earthing accessories are supplied by the factory when purchased.

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Please observe the manufacturer information and suitability of the earthing accessories.

⇨ The earthing accesssories must be designed for the short-circuit currents of the respective grid configuration.

⇨ The connections of the earthing accesssories must be suitable for installation at the switchgear.

At the air-insulated metering panel, the installation of earthing accessories has been tested with the following components:

No.	Maximum short-circuit current/ duration	Type	Description	
1	13.8 kA / 1 s for straight spherical connection bolt with a sphere diameter of 20/25 mm **Version number: VK6ESW9**[1]	EKV3+1 70R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 70 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 25 SK	Universal terminal (art. no. 773 034)	• For straight spherical connection bolt • Sphere diameter: 20/25 mm • Spindle with hexagon
		EAS EK FM 12	Earthing connection unit M12 (art. no. 775 621)	• With wing bolt
	Accessories	ES SK 1500	Earthing rod (art. no. 761 015)	• Length: 1500 mm • Spindle with hexagon (SW19)
2	18.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 20 mm **Version number: V5DYR2W**[1]	EKV3+1 95R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 95 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		KKH 20 D SK	Universal terminal (art. no. 772 330)	• For straight spherical connection bolt • Sphere diameter: 20 mm • Spindle with cross-pin
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SK 1000	Earthing rod (art. no. 761 010)	• Length: 1000 mm • Spindle with hexagon (SW19)
3	18.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 25/30 mm **Version number: VSU7LDJ**[1]	EKV3+1 95R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 95 mm^2 / 35 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 30 SK	Universal terminal (art. no. 773 130)	• For straight spherical connection bolt • Sphere diameter: 25/30 mm • Spindle with hexagon
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SK 1500	Earthing rod (art. no. 761 015)	• Length: 1500 mm • Spindle with hexagon (SW19)

No.	Maximum short-circuit current/ duration	Type	Description	
4	23.7 kA / 1 s for straight spherical connection bolt with a sphere diameter of 25/30 mm **Version number: VE6X4KZ[1]**	EKV3+1 120R	3-pole earthing and short-circuiting facility according to EN/IEC 61230 (DIN VDE 0683-100)	• Cross-section of rope: 120 mm^2 / 50 mm^2 • Length of rope, phase side: 600 mm • Length of rope, earthing side: 1800 mm
		UK 30 SQ	Universal terminal (art. no. 773 330)	• For straight spherical connection bolt • Sphere diameter: 25/30 mm • Spindle with cross-pin
		EAS EK FS 12	Earthing connection unit M12 (art. no. 775 626)	• With wing bolt
	Accessories	ES SQ 1500	Earthing rod (art. no. 761 016)	• Length: 1500 mm • Spindle with hexagon (SW19)

1) Manufacturer: DEHN + SÖHNE GmbH + Co. KG, Hans Dehn-Str. 1, Postfach 1640, 92306 Neumarkt, Germany, www.dehn.de

17 Installing the auxiliary transformer panel

☞INFORMATION
Lining up the auxiliary transformer panel with lateral cable connection as an end panel Particularities for lining up depending on the mounting direction and the position of the auxiliary transformer panel as an end panel: **Auxiliary transformer panel as left or right end panel** • To enable working on the lateral cable connection, a wall distance of ≥ 500 mm must be available. **Auxiliary transformer panel as right end panel** • It is recommended to line up from right to left • Before being able to line up panels to the left, all installation work at the lateral cable connection must have been completed. • Lining up from left to right: - Position the right end panel at a distance of ≥ 500 mm from the installed panels. - Mount the cable at the lateral cable connection. - Line up the right end panel with the existing panels. - If work has to be executed at the lateral cable connection after lining up the right end panel, the end panel must be removed again.

17.1 Mounting the lateral cable connection

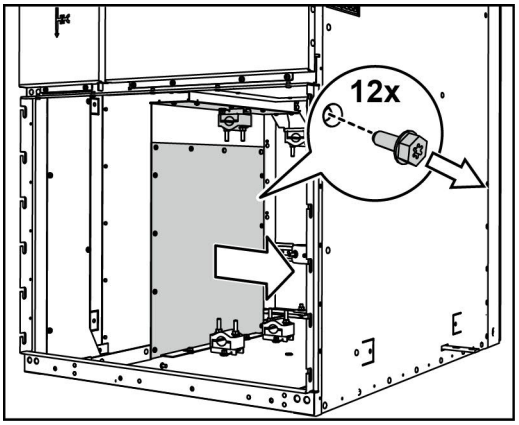
Preparations

⇨ Remove the switchgear termination.

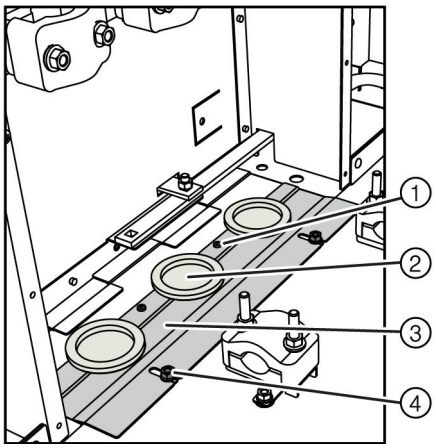
⇨ Remove the transformer room cover (see page 184, "Removing and mounting the front cover").

⇨ If required, remove the transport angles of the connection cables, see page 149, "Installing the transformer in the auxiliary transformer panel".

⇨ Remove the metal cover of the lateral cable compartment.



⇨ Undo 2 nut-and-washer assemblies ④ and the 2 bolts ① of the front floor plate ③ .

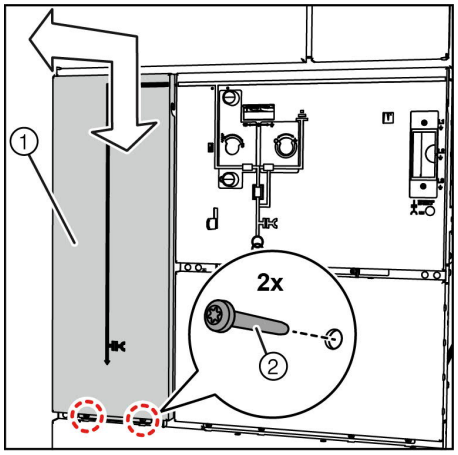


① Bolts
② Rubber sleeve
③ Floor plate
④ Nut-and-washer assembly

⇨ Take the floor plate ③ out.

⇨ Pull out the rubber sleeves ② .

⇨ Dismantle the left-hand front cover ① , undo 2 bolts ② and remove the front cover.



⇨ Dismantle the side wall, undo all bolts and remove the side wall to the left.

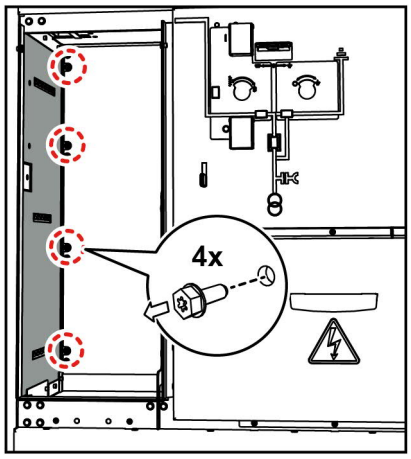


Fig. 85: Dismantling the side wall (front view)

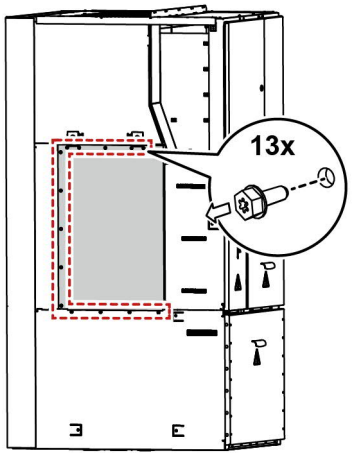


Fig. 86: Dismantling the side wall (side view)

⇨ With a knife, cut an opening into the removed rubber sleeves that fits the diameter of the cable.

☞INFORMATION
The rings in the rubber sleeves are not adjusted to the cable diameters, but serve only as rough orientation.

⇨ Push rubber sleeves onto the cables.

✔ The panel is prepared for connecting the cable T-plugs.

Phase sequence

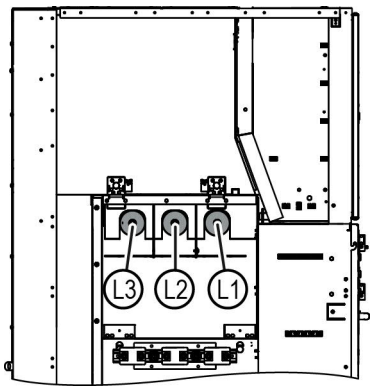


Fig. 87: Phase sequence of bushings (view from the left)

Preparing cable installation

⇨ Dismantle all upper parts of the cable clamps in the lateral cable compartment.

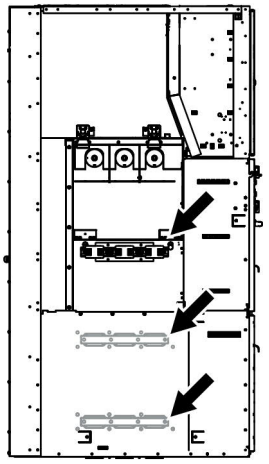


Fig. 88: Position of the cable clamps

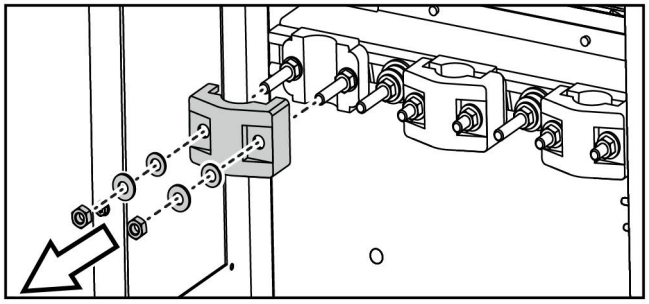
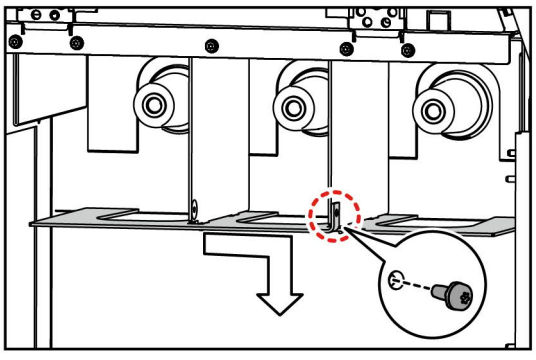


Fig. 89: Removing a cable clamp

⇨ Remove the lower part of the arcing plate in the lateral cable compartment.



Installing cable T-plugs on cable ends

⚠DANGER

Life-endangering high voltage

Will cause death, serious injury or considerable property damage.

Do not energize the switchgear as long as no cables or surge-proof caps are mounted.

⇨ If the panel has to be live without connected cables, close the outside-cone bushings in a surge-proof way.

⇨ Mount surge-proof caps onto bushings type C (with bolted contact M16).

NOTICE

Flashovers due to insufficient electrical contact, abrasion or pollution of the push-on surfaces (high-quality joints)
Will cause damage to the bushings in operation.

- ⇨ All assembly work at the bushings must be carried out with particular care. Avoid damaging the contact surfaces and the silicone surfaces.
- ⇨ Avoid damage caused by the threaded stud while pushing on.
- ⇨ Observe extreme cleanliness.
- ⇨ No smoking.

NOTICE

Inappropriate installation of the plug sets
Damage to the plug sets due to thermal overloading.

If the electrical contact of the surfaces of the high-quality joints is insufficient, the plug sets can overheat.

- ⇨ The cable T-plugs must only be mounted by instructed personnel.
- ⇨ Do not mount cable plugs in bent or twisted manner.

NOTICE

Removed protection ring
Will cause damages at the connection of the capacitive voltage detecting system.

A white plastic protection ring may be factory-assembled on the outside-cone bushing type C. The protection ring serves as a stop for the plug, and protects the connection of the capacitive voltage detecting system from damages when the cable plugs are mounted.

- ⇨ Do not remove the protection ring.

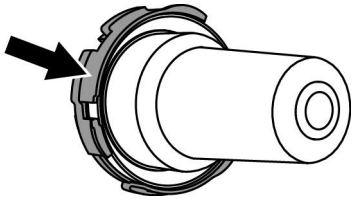
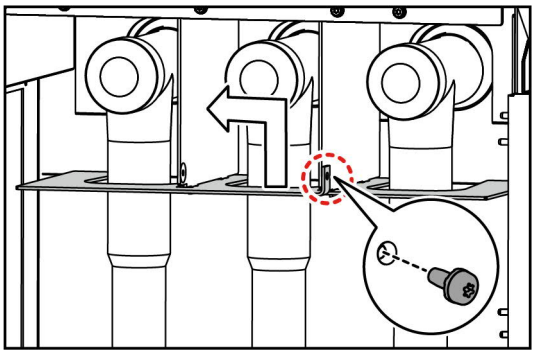


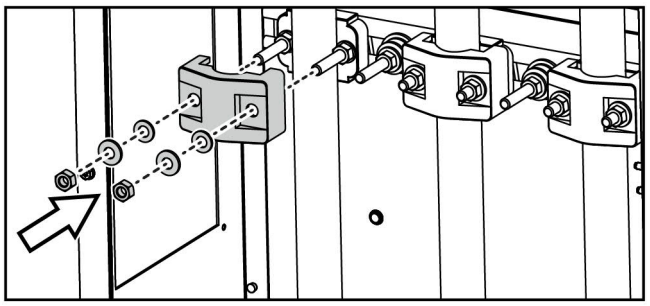
Fig. 90: Protection ring

- ⇨ Lead the cable upwards through the lateral cable compartment.
- ⇨ Fit the cable T-plugs on the cable ends according to the manufacturer's instructions.
- ⇨ Install the cable T-plugs one after the other on the phases L1 to L3 according to the manufacturer's instructions.

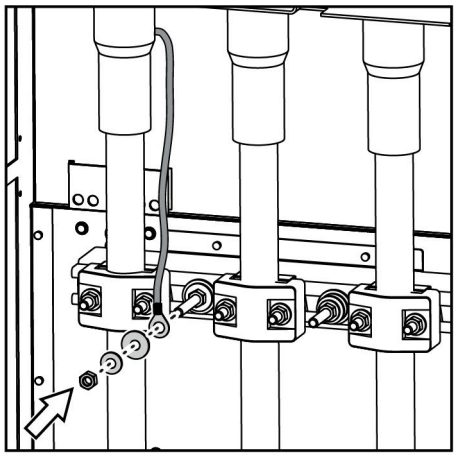
  NOTE: Excessive torque can cause damage to the bushing. Tighten the cable plug with a torque according to the manufacturer's specifications (max. 50 Nm).
- ⇨ Remove the lower part of the arcing plate.



⇨ Install all upper parts of the cable clamps (tightening torque: 5 Nm).



⇨ Connect the cable shield and the earthing of the plug housing of all cables to the cable bracket.



⇨ Insert the rubber sleeves into the recess of the floor plate.

⇨ Bolt the floor plate back in place.

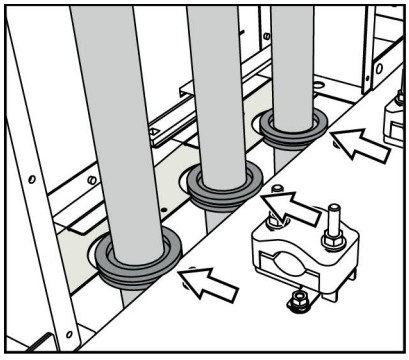


Fig. 91: Inserting the rubber sleeves

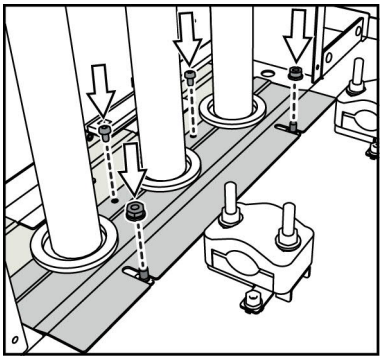


Fig. 92: Fastening the floor plate

⇨ Re-install the metal cover of the lateral cable compartment.

⇨ Install the side wall.

⇨ Install the switchgear termination.

⇨ Install the cable compartment cover (see page 184, "Removing and mounting the front cover").

✔ The installation of the lateral cable connection has been completed.

17.2 Installing the transformer in the auxiliary transformer panel

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

NOTICE

Hazard due to internal arc
Can damage the switchgear.

Do not put the auxiliary transformer panel into operation without a completely mounted transformer.

- ⇨ Mount and connect the transformer and the connection cables.
- ⇨ Remove the transport angles of the connection cables.

⚠WARNING

Cracking of the floor cover due to too heavy transformer
Will damage the switchgear. Can cause serious injury.

If the transformer is lifted with inserted transformer, the floor cover of the panel will crack. While lifting the panel, the transformer falls out of the panel.

- ⇨ Lift or transport the panel **without** the transformer.
- ⇨ Transport the transformer separately.

⚠CAUTION

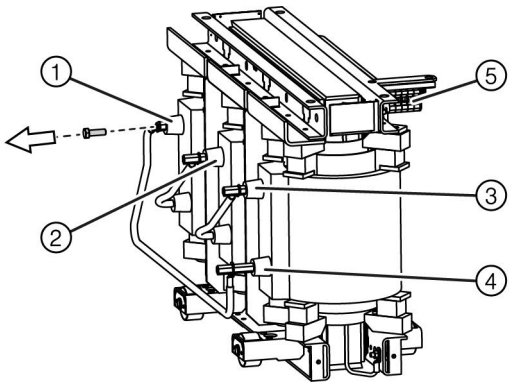
The transformer is very heavy, approx. 425 kg.
Incorrect transportation can cause serious injury.

- ⇨ Transport the transformer with several persons or use suitable transport gear.

Preconditions

- The panel must be connected to the foundation.
- All earthing busbars to the adjacent panels must be mounted.
- All installation work in the lateral cable compartment must be completed.

Preparation

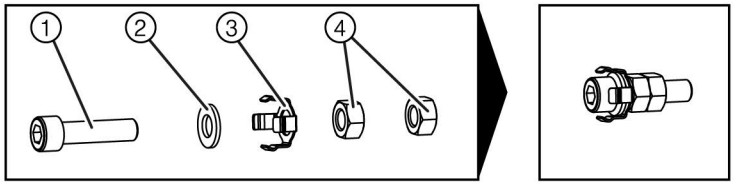


① Phase L1
② Connection point of phase L2
③ Connection point of phase L3
④ Connection point of phase L1
⑤ Connection for secondary leads

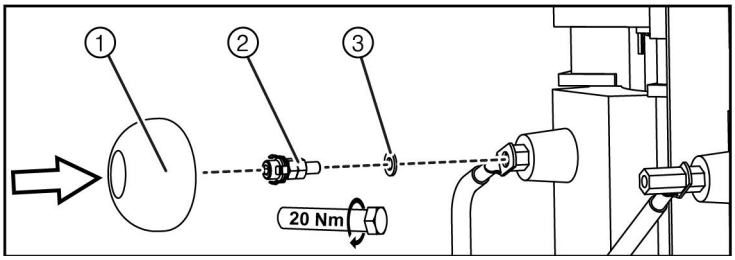
Fig. 93: Transformer

- ⇨ Remove and dispose of the pre-assembled bolt on phase L1 ① at the transformer.

⇨ Prepare 4 bolts. Mount the conical spring washer ② , retaining bracket ③ and 2 nuts ④ onto the supplied bolt ① .



⇨ Mount the prepared bolt ② and conical spring washer ③ on phase L1. After that, mount the control cap ① .



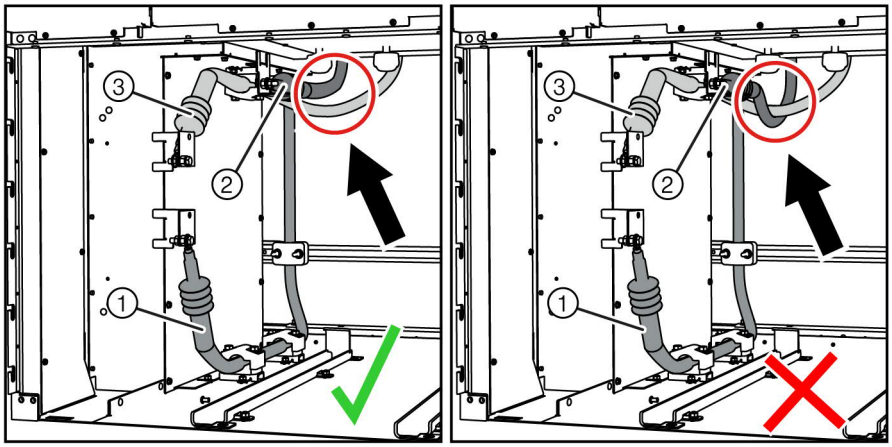
⇨ Earth the panel, see page 247, "Earthing the feeder".

⇨ If required, remove the transformer room cover (see page 185, "Removing and mounting the connection compartment covers").

☞INFORMATION
For easier installation of the transformer, re-install the transport angles with the connection cables.

Checking the position of the cables

⇨ Check whether the connection cables are arranged correctly; phase L2 must be located over phase L3. If required, correct the arrangement. If the connection cables are not correctly arranged, the cables cannot be connected to the transformer.

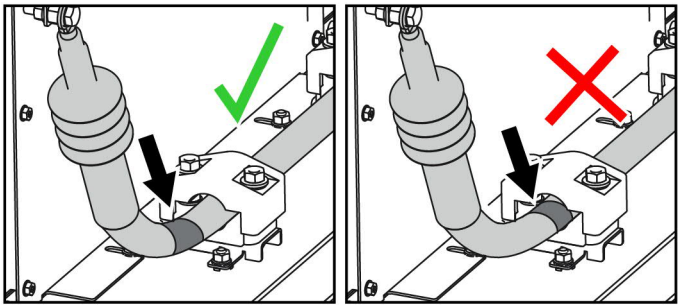


① Phase L1
② Phase L2
③ Phase L3

Fig. 94: Correct and exemplary incorrect cable arrangement

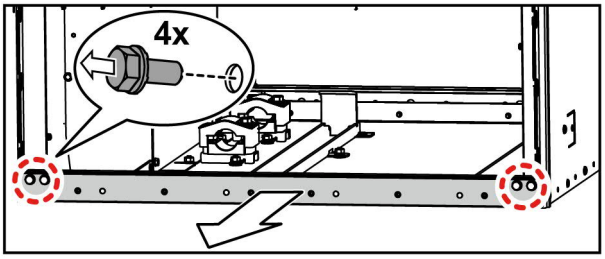
⇨ Check the position of the connection cables. The black marking at the cables must be completely visible **in front of** the cable clamp.

Remedy: Undo the cable clamps and pull the cables to the front until the black marking is completely visible.

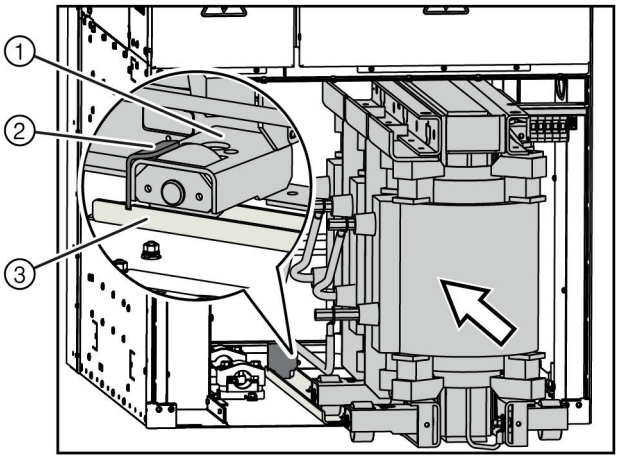


Installing the transformer

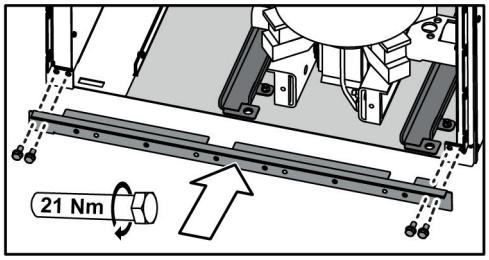
⇨ Remove the cross member down at the panel.



⇨ Set the transformer ① down on the rails ③ . Roll the transformer into the panel as far as it will go ② .



⇨ Push the cross member between the base plate and the rails. After this, fasten the cross member with 4 bolts.



Assembling the retainer

⇨ Bolt the retainer to the foundation. Remove the floor fixing bolts. Fasten the floor fixing bolts again together with the retainer.

⇨ Bolt the retainer together with the transformer. Before that, 2 bolts may have to be removed from the floor fixing.

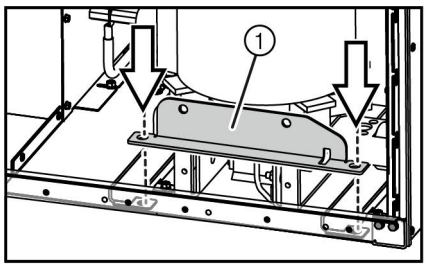


Fig. 95: Bolted joint with the foundation

① Retainer
② Washer

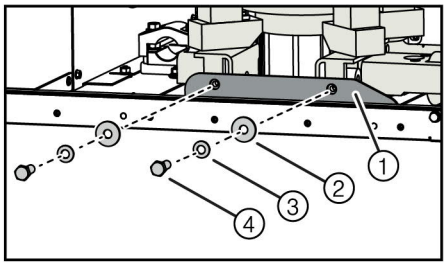
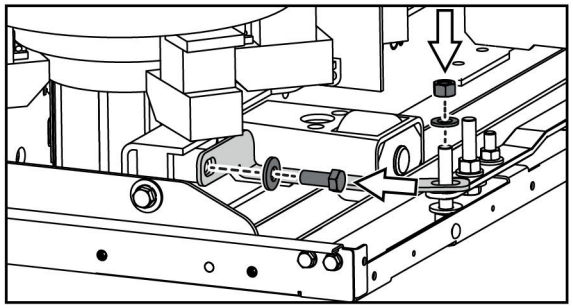


Fig. 96: Bolted joint with the transformer

③ Lock washer
④ Hexagon head bolt M10x30

Mounting the earthing bar

⇨ Remove the nut and washer at the connection of the earthing bar. Mount the earthing bar between the transformer and the earthing connection point.



Removing the transport angles

For panel transport, the connection cables for the transformer are fastened to transport angles.

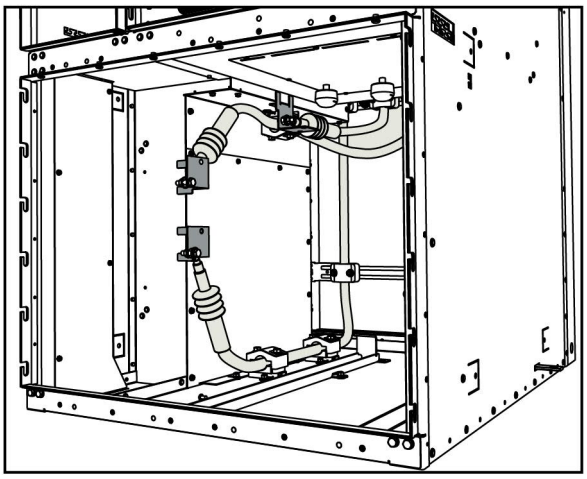
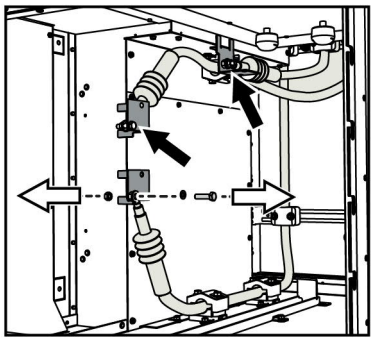
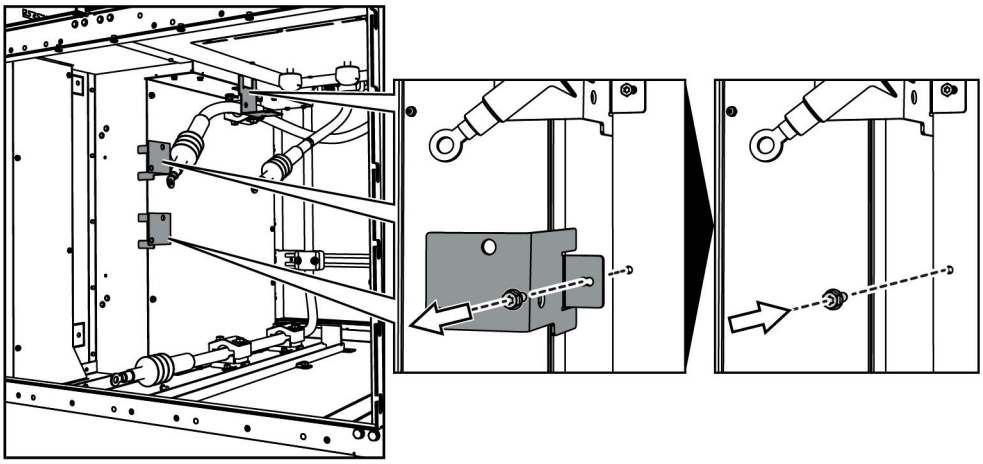


Fig. 97: As-delivered condition with removed transformer room cover

⇨ Remove all connection cables from the transport angles.



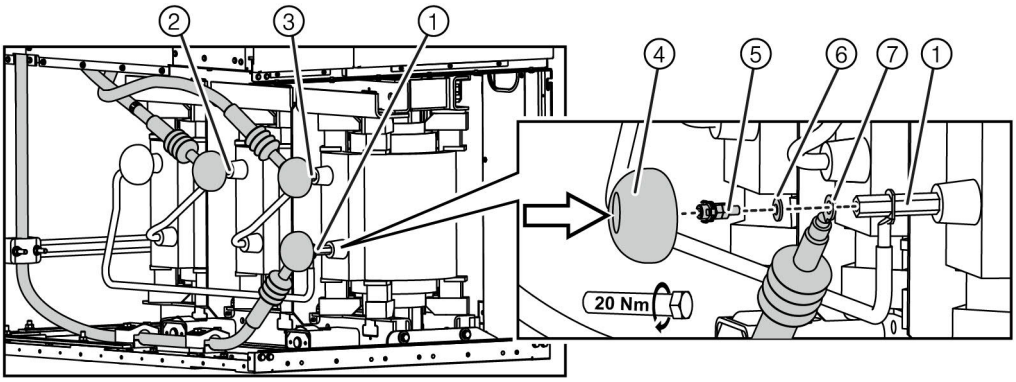
⇨ Remove all transport angles. Re-fasten the removed bolts.



⇨ The bolting material of the connection cables and the transport angles can be disposed of.

Mounting the cables and control caps

⇨ Mount the cables and control caps at the 3 cable connection points. Order of assembly: Connection point of phase L2, connection point of phase L3, connection point of phase L1



① Connection point of phase L1
② Connection point of phase L2
③ Connection point of phase L3
④ Control cap
⑤ Prepared bolt
⑥ Conical spring washer
⑦ Cable

⚠WARNING

Risk of flashover by too small minimum distances and insulation

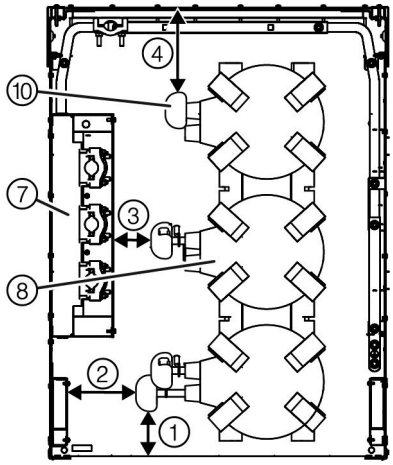
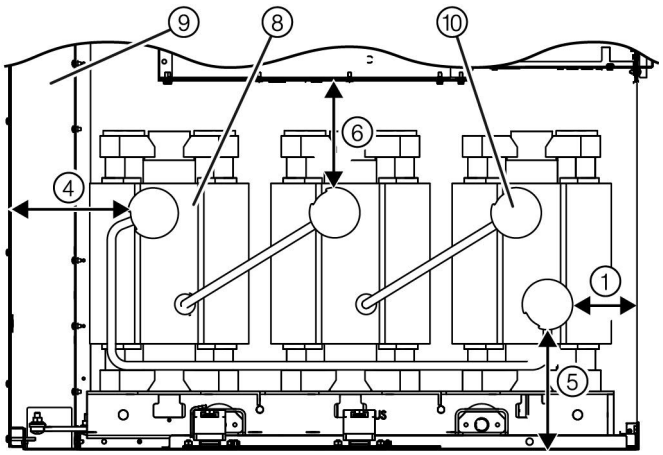
Minimum distances must be observed between the cable connection points at the transformer and the panel enclosure and installed components.

The cable connection points of the cables must be screened for operation.

⇨ Keep the specified minimum distances.

⇨ Mount the control caps. Even if the minimum distances are fulfilled, without control caps there is risk of flashover.

Basic scheme of minimum distances

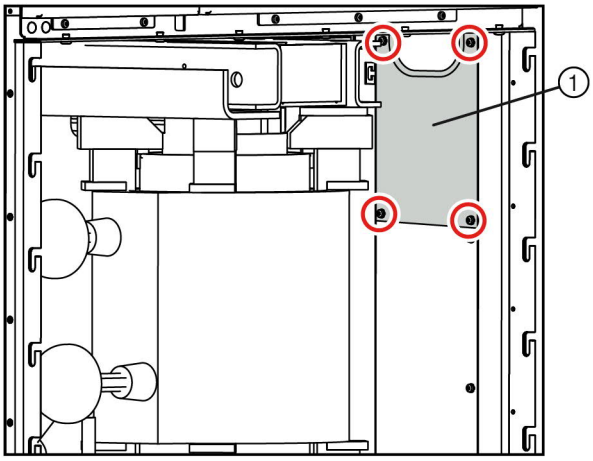
Top view	Side view from the left
	

① Minimum distance between the foremost control cap and the transformer room cover: 128±3 mm
② Minimum distance between the control cap and the lateral wiring duct (front-left): 186±3 mm
③ Minimum distance between the control cap and the lateral cable compartment: 94±3 mm
④ Minimum distance between the rearmost control cap and the rear wall of the pressure relief duct: 222±3 mm
⑤ Minimum distance between the lowest control cap and the panel base: 227±3 mm
⑥ Minimum distance between the topmost control cap and the transformer compartment ceiling: 202±3 mm
⑦ Lateral cable compartment
⑧ Transformer
⑨ Pressure relief duct
⑩ Control cap

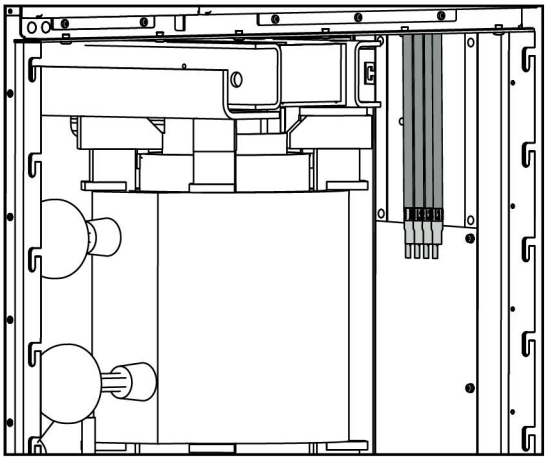
Connecting secondary leads

For transport, the secondary leads for connection to the transformer are accommodated in the right-hand wiring duct.

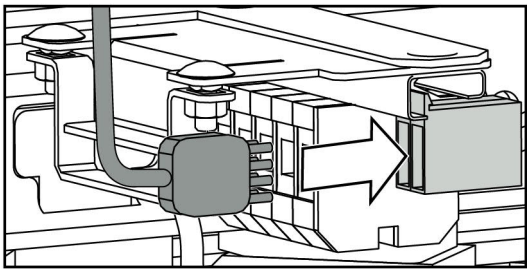
⇨ Remove the upper cover of the right-hand wiring duct ① . Undo the bolts and remove the cover.



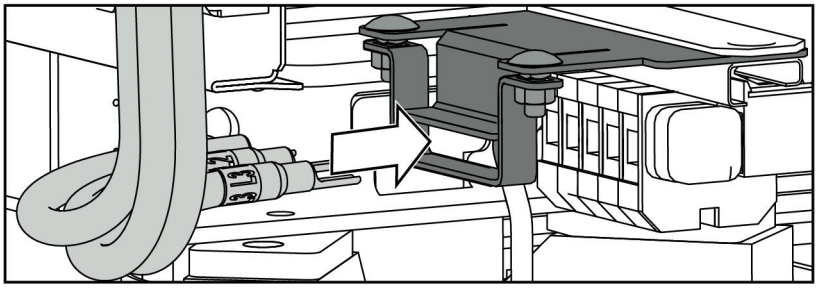
⇨ Pull the secondary leads for the transformer, the temperature indicator and the temperature supervision out of the wiring duct.



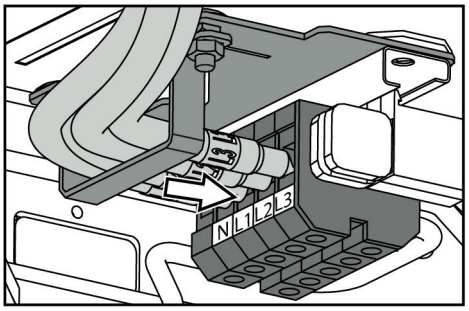
⇨ Connect the secondary leads of the temperature indicator (option) and the temperature supervision (option) to the transformer.



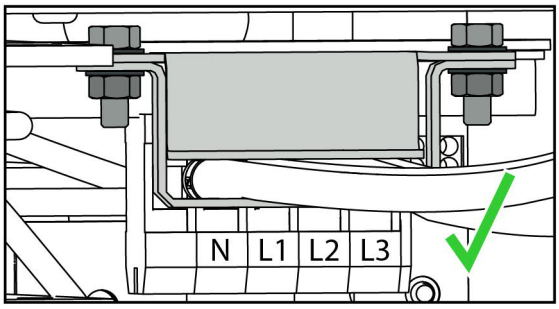
⇨ Lead the secondary leads for the transformer through the cable holder.



⇨ Connect the secondary leads for the transformer according to the phases.

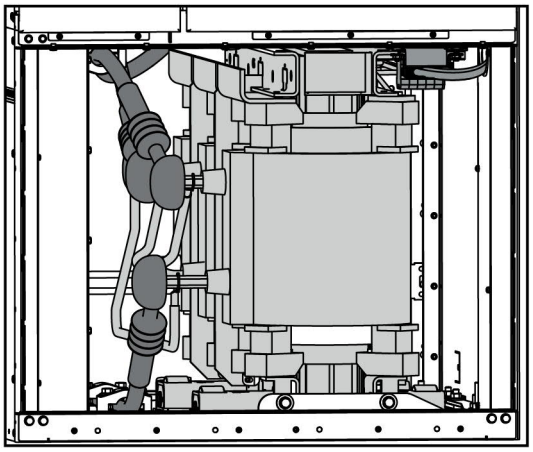


⇨ For fixing the cables, screw the bolt in as far as it will go.



⇨ Re-install the cover of the wiring duct.

✔ The installation of the transformer is completed.



⇨ Mount the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").

18 Electrical connections

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

For extending or replacing parts of an existing switchgear, the Five Safety Rules must be observed:

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

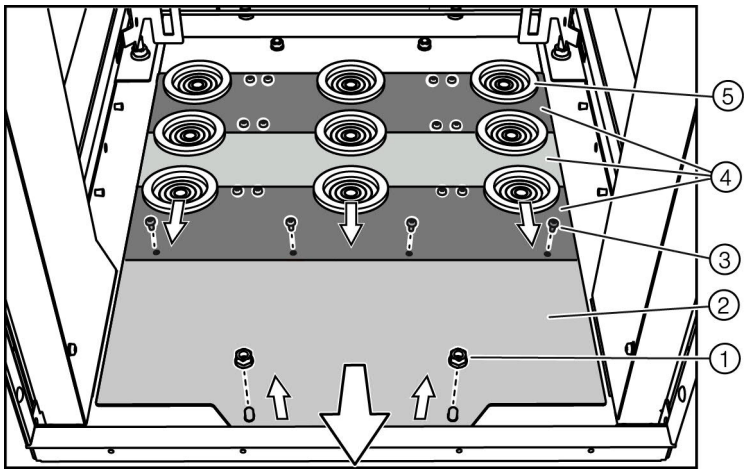
Always observe the Five Safety Rules:

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

18.1 Installation work at the floor cover

The floor cover is pre-installed at the factory. Before starting with the installation of cable T-plugs, the floor cover must be removed. The floor cover is installed in the course of the installation of the cable T-plugs.

Removing the floor cover



① Nut-and-washer assembly
② Front floor plate
③ Bolts
④ Floor plates
⑤ Rubber sleeves

Fig. 98: Removing the floor cover (example using 600 mm panel width)

- ⇨ Undo 2 nut-and-washer assemblies ① and all bolts ③ of the front floor plate ② .
- ⇨ Lift the front floor plate ② and pull it out.
- ⇨ Remove all other floor plates ④ . Undo all of the screws for each. Pull out the floor plate. Then pull out the rubber sleeves ⑤ to the front.
- ✔ The panel is ready for connecting the cable T-plugs.

Cutting the rubber sleeves to size

☞INFORMATION

The rings in the rubber sleeves are not adjusted to the cable diameters, but serve only as rough orientation.

- ⇨ With a knife, cut an opening into the rubber sleeve that fits the diameter of the cable.

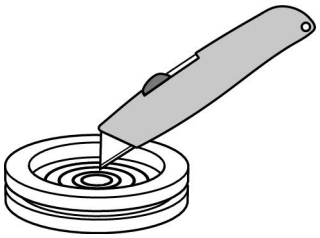
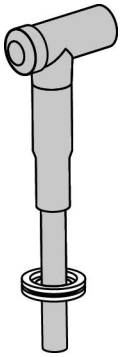


Fig. 99: Cutting the rubber sleeves to size

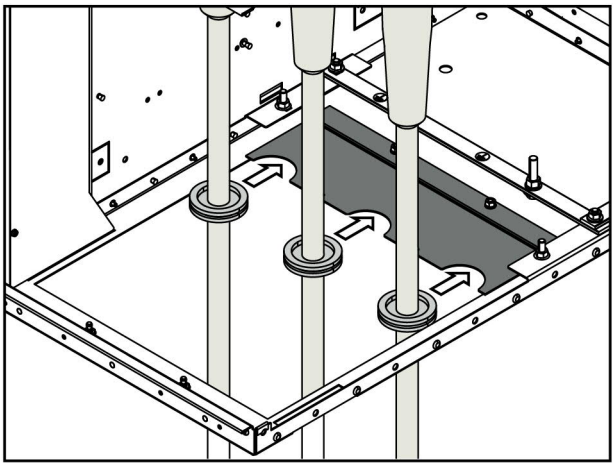
Installing the floor plates

⇨ Push the rubber sleeve onto the cable T-plug.

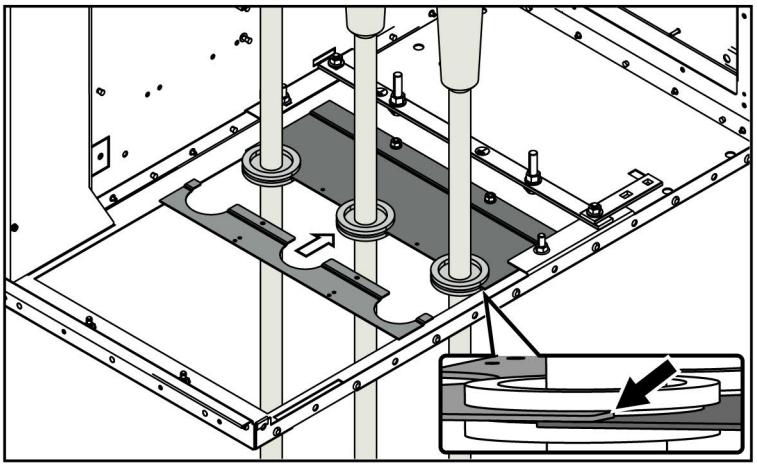


⇨ Connect the cable T-plug (see page 159, "Connecting cable T-plugs").

⇨ Insert the rubber sleeve into the recess of the floor plate.



⇨ Insert the next floor plate in the notch of the rubber sleeve. The attached floor plate must always be positioned over the existing floor plate.

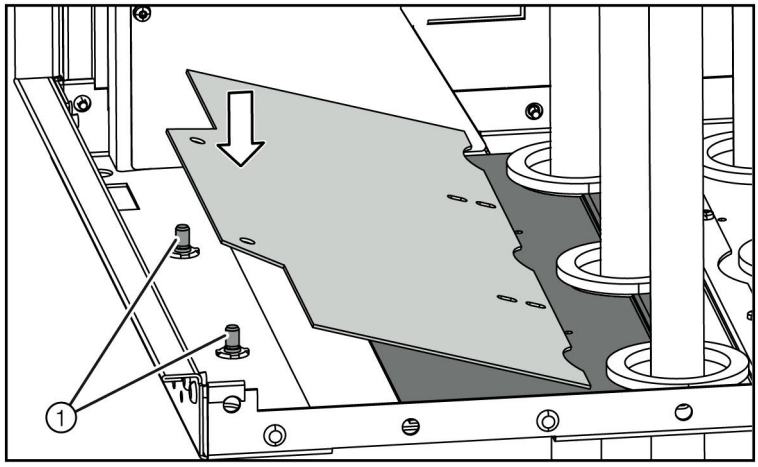


⇨ Fasten the floor plates to each other.

⇨ Install additional floor plates.

Installing the front floor plate

⇨ Place the front floor plate on the existing floor plate. Then place the floor plate on the bolts ① . If necessary, insert the floor plate into the rubber sleeve.



⇨ Fasten the floor plates to each other.

⇨ Screw the nut-and-washer assemblies onto the studs.

✔ The installation of the floor cover has been completed.

18.2 Connecting cable T-plugs

For NXPLUS C switchgear, only cable T-plugs shielded by means of an external conductive layer may generally be used. The suitable cable plugs for outside-cone bushings of interface type C according to EN 50181 are listed in the section "Description" (see page 22, "Cable connection" NXPLUS C).

Please select the tightening torque of the "cable T-plug - bushing" bolted joint according to the specifications of the respective cable T-plug manufacturer.

If there are no specifications from the cable T-plug manufacturer, tighten the bolted joint with 50 Nm.

Phase sequence

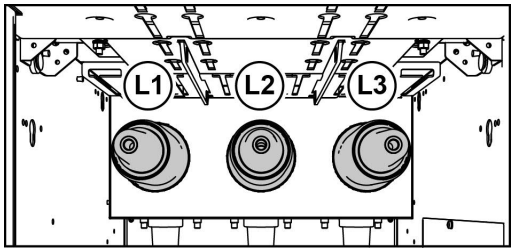


Fig. 100: Phase sequence in the cable compartment

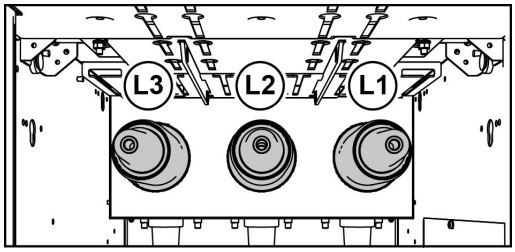


Fig. 101: Rotated phase sequence for disconnector panel (option)

Preparations

⇨ Earth the feeder.

⇨ Remove the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").

⇨ Remove the floor cover (see page 157, "Removing the floor cover").

⇨ Cut rubber sleeves to size (see page 157, "Cutting the rubber sleeves to size").

Installing cable T-plugs on cable ends

⚠DANGER

Life-endangering high voltage

Will cause death, serious injury or considerable property damage.

Do not energize the switchgear as long as no cables or surge-proof caps are mounted.

⇨ If the panel has to be live without connected cables, close the outside-cone bushings in a surge-proof way.

⇨ Mount surge-proof caps onto bushings type C (with bolted contact M16).

NOTICE

Flashovers due to insufficient electrical contact, abrasion or pollution of the push-on surfaces (high-quality joints)
Will cause damage to the bushings in operation.

⇨ All assembly work at the bushings must be carried out with particular care. Avoid damaging the contact surfaces and the silicone surfaces.

⇨ Avoid damage caused by the threaded stud while pushing on.

⇨ Observe extreme cleanliness.

⇨ No smoking.

NOTICE

Inappropriate installation of the plug sets
Damage to the plug sets due to thermal overloading.

If the electrical contact of the surfaces of the high-quality joints is insufficient, the plug sets can overheat.

⇨ The cable T-plugs must only be mounted by instructed personnel.

⇨ Do not mount cable plugs in bent or twisted manner.

NOTICE

Removed protection ring
Will cause damages at the connection of the capacitive voltage detecting system.

A white plastic protection ring may be factory-assembled on the outside-cone bushing type C. The protection ring serves as a stop for the plug, and protects the connection of the capacitive voltage detecting system from damages when the cable plugs are mounted.

⇨ Do not remove the protection ring.

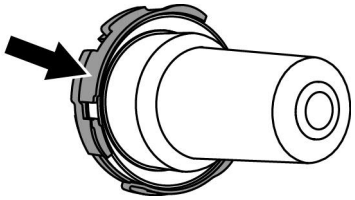


Fig. 102: Protection ring

⇨ Push the rubber sleeve onto the cable.

⇨ Fit the cable T-plugs on the cable ends according to the manufacturer's instructions.

⇨ Install the cable T-plugs one after the other on the phases L1 to L3 according to the manufacturer's instructions.

NOTE: Excessive torque can cause damage to the bushing. Tighten the cable plug with a torque according to the manufacturer's specifications (max. 50 Nm).

Mounting the arcing plate

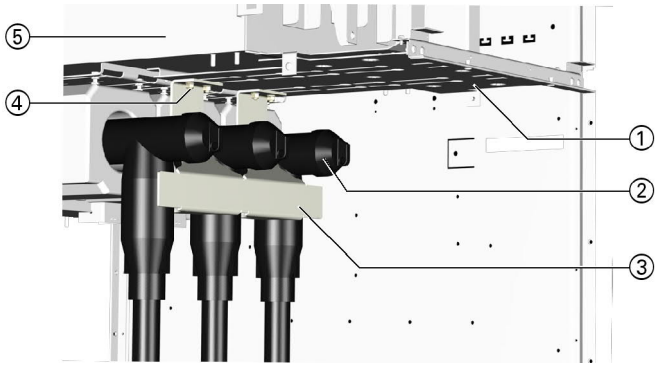
☞INFORMATION

⇨ In panels with HV HRC fuses, do not mount arcing plates in the cable compartment.

After installation of the cable T-plugs of phases L1 to L3, one arcing plate each must be installed in the cable compartment. The arcing plates are fitted on the mounting plate below the operating mechanism box (tightening torque for the arcing plates: 20 Nm).

The associated floor plate of the floor cover must be installed after installation of a row of cable T-plugs (see page 158, "Installing the floor plates").

☞INFORMATION
The arcing plates in the cable compartment have been pre-assembled at the factory. For cable installation, the arcing plates must be removed. ⇨ After cable installation, position the arcing plates as close as possible to the front in the cable direction according to the cable T-plugs used. ⇨ The distance between the arcing plates and the cable T-plugs must not exceed a maximum of 15 mm. ⇨ The installed arcing plates must not touch the cable T-plugs. ⇨ Do not damage the cable T-plugs while installing the arcing plates.



① Mounting plate
② Cable T-plug
③ Arcing plate
④ Fixing at the switchgear vessel
⑤ Switchgear vessel

Fig. 103: Arcing plate at the cable connection (one cable per phase)

⇨ In the cable compartment, install the arcing plate on the mounting plate (tightening torque: 20 Nm).

⇨ Install the floor plate of the floor cover (see page 158, "Installing the floor plates").

Aligning and installing the cable bracket

The cable bracket can be installed in the cable compartment at two different heights:

- Upper position: For panels with cable-type current transformers at the panel connection
- Lower position: For panels without cable-type current transformers at the panel connection

⇨ Align the cable bracket and bolt it tight.

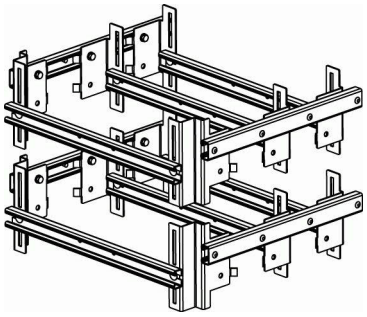
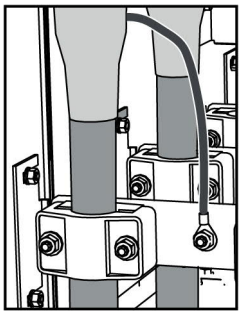


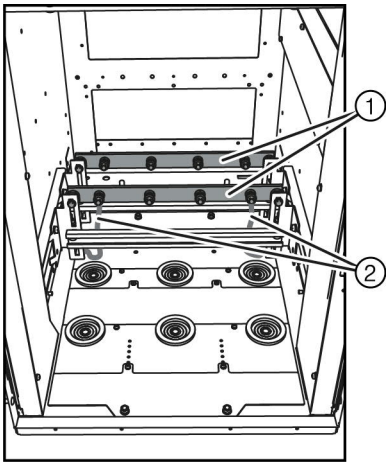
Fig. 104: Cable bracket, type C40

⇨ Install the cable clamps. Use cable clamps made of non-magnetizable materials (plastic, aluminum) to fasten the high-voltage cables at the panel's cable bracket, e.g. plastic clamps from id-Technik (cable clamp K26-38 mm, cable clamp K36-52 mm).

⇨ Connect the cable shield and the earthing of the plug housing to the cable bracket.



⇨ Option: Install the insulated earthing bar ① onto the cable bracket.



The use of an insulated earthing bar ① makes the connection of the cable shields to the zero-sequence current transformer easier. All cable shields are connected to the insulated earthing bar. A earthing cable ② leads from the earthing bar into the cable basement to the zero-sequence current transformer. The zero-sequence current transformer earths all cable shields through its own electric cable and leads them back. Without the use of the insulated busbar, each individual cable shield must be led to the zero-sequence current transformer and earthed.

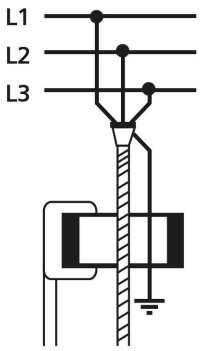


Fig. 105: Basic scheme

⚠DANGER

Internal arcing hazard and explosion hazard
Will cause death, injury or considerable property damage.

If the cable compartment cover is not bolted tight, the switchgear is not arc-resistant.

⇨ Bolt the cable compartment cover together with the switchgear frame. Use the bolts with cutting ring supplied with the switchgear.

⇨ Install the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").

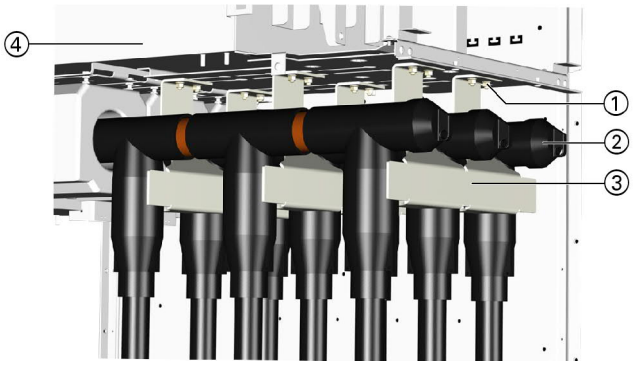
Connecting up to four cables per phase

For 600 mm wide panels, up to 4 cables (cable plugs) can be connected per phase.

After each three-phase cable connection, another arcing plate must be installed in the cable compartment. In like manner, the associated floor plate of the floor cover must be installed after each installed row of cables (see page 158, "Installing the floor plates").

☞INFORMATION
The arcing plates in the cable compartment have been pre-assembled at the factory. For cable installation, the arcing plates must be removed. ⇨ After cable installation, position the arcing plates as close as possible to the front in the cable direction according to the cable T-plugs used. ⇨ The distance between the arcing plates and the cable T-plugs must not exceed a maximum of 15 mm. ⇨ The installed arcing plates must not touch the cable T-plugs. ⇨ Do not damage the cable T-plugs while installing the arcing plates.

Example: Installation of 3 cable plugs per phase



① Fastening at the partition to the operating mechanism compartment
② Cable plug
③ Arcing plate
④ Switching-device vessel

Fig. 106: Arcing plates at the cable connection: 3 cable plugs per phase

Installing the first row of cables

⇨ Push rubber sleeves onto the cables.
⇨ Install the first row of cable plugs on phases L1 to L3.
⇨ Install the floor plate of the floor cover (see page 158, "Installing the floor plates").
⇨ Pre-install cup head bolts on the first arcing plate. To do this, turn the nut so far that the bolt heads can still be fitted into the mounting plate later.
⇨ Hook the arcing plate into the mounting plate. Then, push the arcing plate into the correct position.

Installing the second row of cables

⇨ Push rubber sleeves onto the cables.
⇨ Install the second row of cable plugs on phases L1 to L3.
⇨ Install the floor plate of the floor cover (see page 158, "Installing the floor plates").
⇨ Pre-install cup head bolts on the second arcing plate. To do this, turn the nut so far that the bolt heads can still be fitted into the mounting plate later.
⇨ Hook the arcing plate into the mounting plate. Then, push the arcing plate into the correct position.
⇨ Tighten the nuts for the arcing plate. Tightening torque: 20 Nm.

Installing the third row of cables

⇨ Push rubber sleeves onto the cables.
⇨ Install the third row of cable plugs on phases L1 to L3.
⇨ Install the floor plate or termination plate of the floor cover (see page 158, "Installing the floor plates").
⇨ Install the third arcing plate in the same way as the second arcing plate.

18.3 Installing the surge arresters

Suitable surge arresters are listed in the operating instructions (see page 22, "Possible combinations of cable connection types (T-plugs, coupling inserts) and surge arresters up to 38 kV").

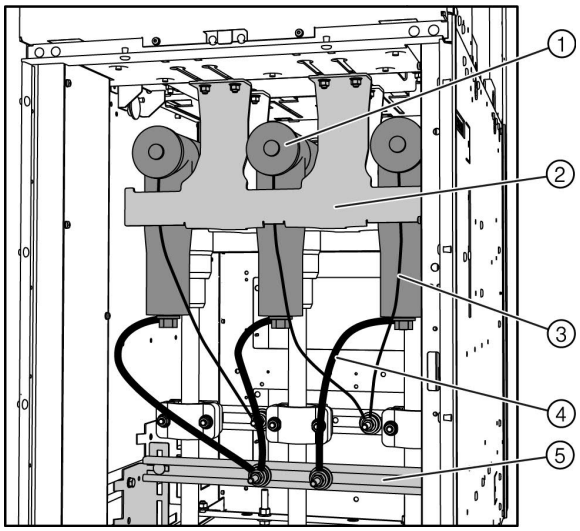
The surge arresters are supplied with the supplementary equipment. Depending on their version, they are pre-installed with a support.

☞INFORMATION
If a power-frequency voltage test is performed after installing the switchgear, the surge arresters **must not be mounted before the test**.

⇨ Install the surge arresters according to the manufacturer's installation instructions.

⇨ Install the earthing cable and cable shield for the surge arresters according to the manufacturer's installation instructions and connect them to the cable bracket.

⇨ Install an additional arcing plate in front of the surge arresters.



① Surge arresters
② Arcing plate
③ Cable shield
④ Earthing cable
⑤ Cable bracket

Fig. 107: Surge arrester (example)

18.4 Installing the surge limiter

Only a Siemens 3EH5 ... -5BA0 surge limiter (rated voltage U_r = 3.6 kV / 4.8 kV / 7.2 kV) can be connected.

Surge limiters can be installed on the cable connection together with the following cable T-plugs:

Product	Cable T-plug (coupling plug)	Note
Euromold	300PB-630A-U-BEGRENZ	
nkt cables	CC 12-630 CC 17.5-630 CC 24-630	In combination with installation kit 26 500 33
Tyco Electronics Raychem	SMOE 63862	

⇨ Install the surge limiters and cable T-plugs according to the manufacturer's specifications.

18.5 Connecting auxiliary circuits

The NXPLUS C circuit-breaker switchgear is delivered with operating and control elements as ordered.

The operating and control elements as well as the terminals in the switchgear are identified in the same way as in the associated circuit diagrams.

If the low-voltage compartment is installed later, the connections of the auxiliary circuits are completed on site.

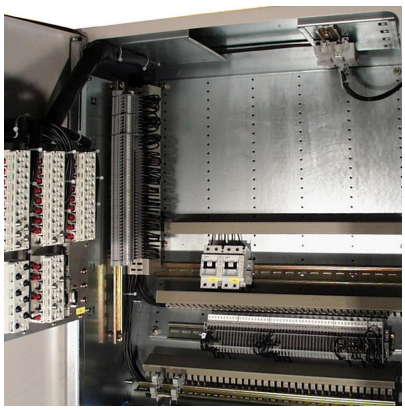


Fig. 108: Auxiliary circuits in the 600 mm low-voltage compartment

Fig. 109: Auxiliary circuits in the 900 mm low-voltage compartment

Lay, fix and connect the external cables in accordance with the national standards and specifications (conductor, shielding, earthing).

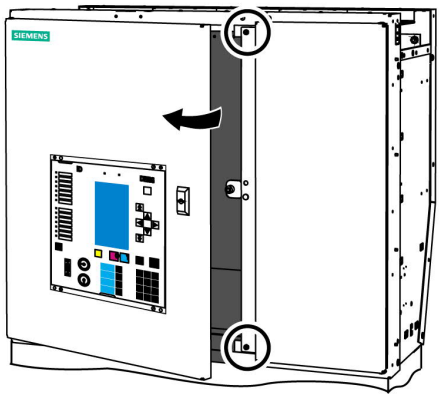


Fig. 110: Opening the right-hand door of the 900 mm low-voltage compartment (opening the left-hand door and unscrewing two bolts on the right-hand door)

There are wiring ducts on the right and on the left inside the cable compartment. The left-hand duct is left empty at the factory and can be used for external cables. The right-hand duct contains the internal panel wiring provided at the factory. For zero-sequence current transformers in the cable basement, the associated cables are routed through the right-hand wiring duct.

⇨ Lay the external cables in the left-hand wiring duct and fix them with cable straps.

Laying the cables in the right-hand wiring duct

⇨ Use a meandering path when laying current and voltage transformer leads with excess, as shown at position ③ .

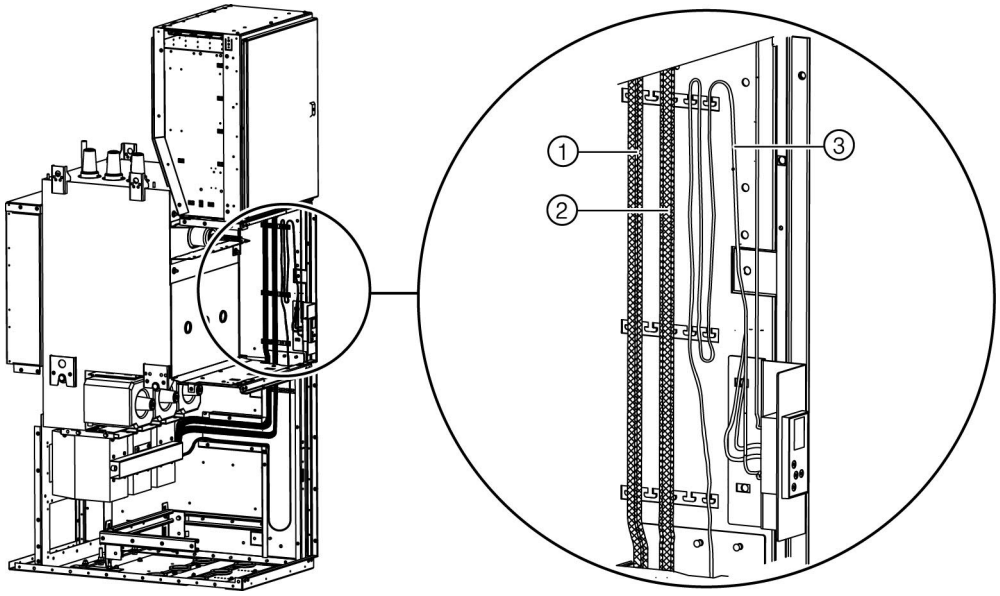


Fig. 111: Cables in the right-hand wiring duct

① Current transformer lead
② Voltage transformer lead
③ Lead of capacitive voltage detecting system

⇨ Lay cable groups keeping the maximum possible distance between them, and tight on the earthed plate.

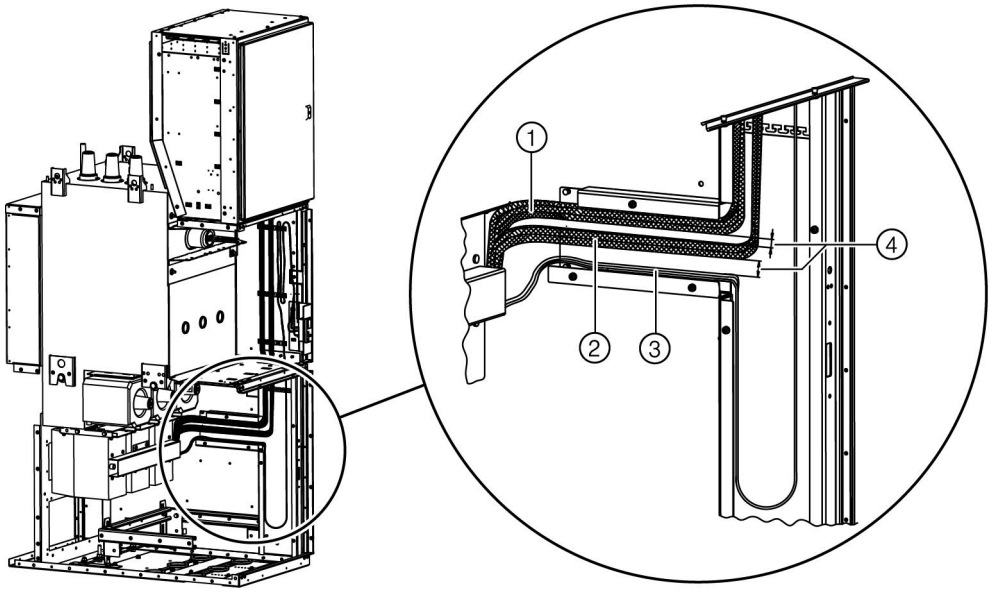


Fig. 112: Cable groups in right-hand wiring duct

① Current transformer lead
② Voltage transformer lead
③ Lead of capacitive voltage detecting system
④ Laying cable groups keeping the maximum possible distance between them

Laying secondary customer cables in the left-hand wiring duct

For EMC-compatible laying, the cables are divided into functional groups: e.g. group 1 (signal cables), group 2 (control cables), etc.

⇨ Lay cable groups keeping the maximum possible distance between them, and tight on the earthed plate.

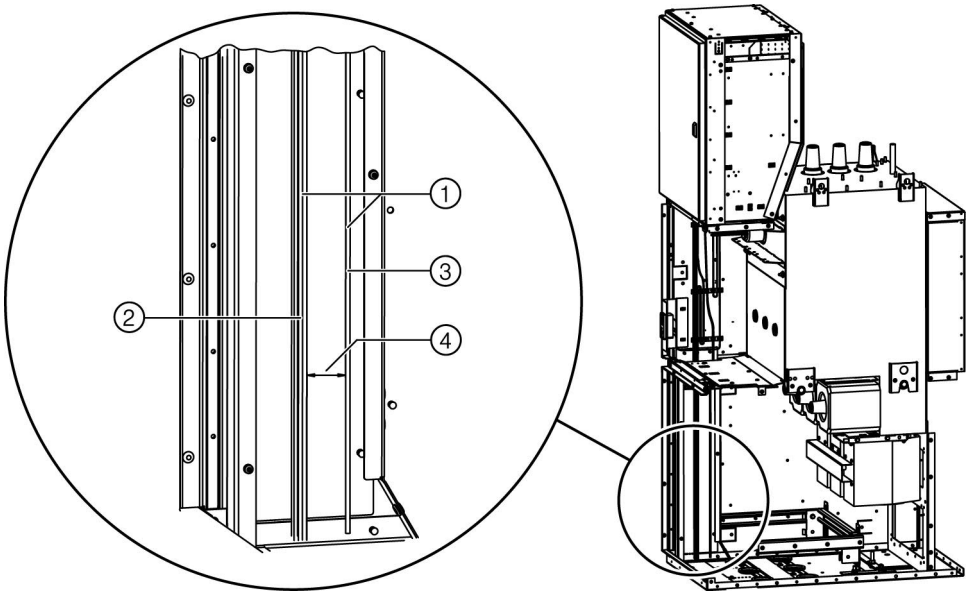


Fig. 113: Cable groups in left-hand wiring duct

① Customer cable
② Group 1
③ Group 2
④ Maximum possible distance between cable groups

The bus cables and the cables for the circuit-breaker and the three-position switch are pluggable. The terminals are located in the low-voltage compartment.

⇨ Lay the cables for the three-position switch and, if required, for the current and voltage transformers in the low-voltage compartment.

⇨ Plug pre-wired bus cables onto the bus cable terminals. Observe the coding of the 2-pole, 4-pole and 10-pole plugs.

⇨ Plug the cables for the circuit-breaker and the three-position switch onto the associated terminals.

⇨ If required, connect the cables for current and voltage transformers.

Connecting the STG plug with the VBSTB4 modular terminal

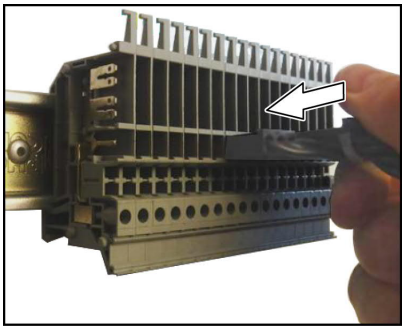
For 2-pole, 4-pole and 10-pole STG plugs from PHOENIX CONTACT, observe the instructions for installation and removal provided below.

☞INFORMATION
The information provided here is based on user instructions from PHOENIX CONTACT. The user is required to review the latest state of the instructions before installation or removal of the STG plugs, and to observe the manufacturer's instructions. ⇨ Manufacturer's website: https://www.phoenixcontact.com

Installing the STG plug

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

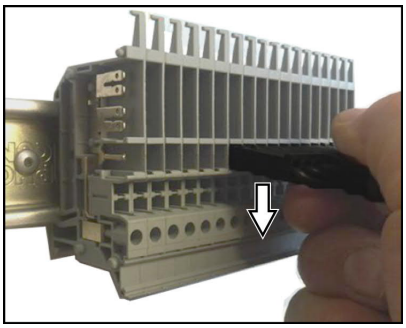
⇨ Push the STG plug horizontally into the modular terminal until the STG plug latches in.



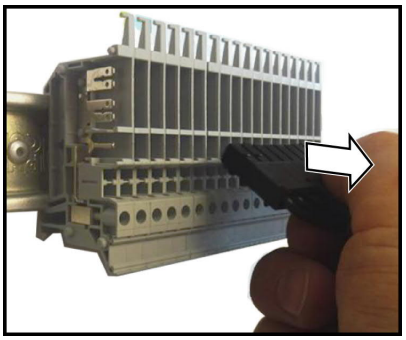
✔ The STG plug is latched into the modular terminal and installed.

Removing the STG plug

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



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



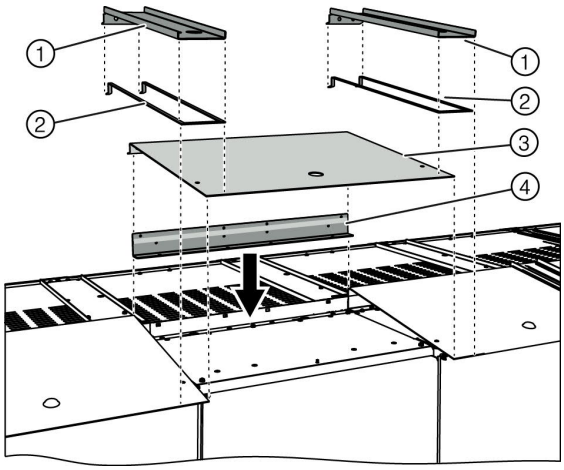
✔ The STG plug is removed.

19 Installation of the IP31D, IP32D and IP34D degree of protection designs

If not stated otherwise, the assembly of the protection against vertically falling water drops is shown by the example of a switchgear design with a small low-voltage compartment.

19.1 IP31D - protection against vertically falling water drops

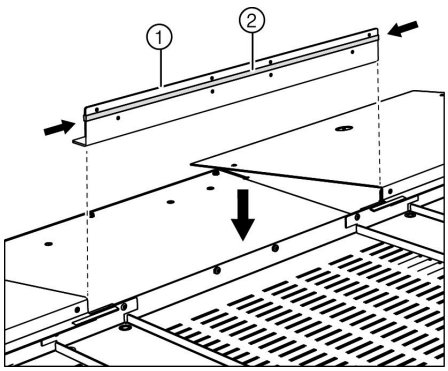
☞INFORMATION
Mount the switchgear termination and busbar cover before the protection against vertically falling water drops is mounted.



① Connecting plate
② Sealing strap for connecting plates
③ Roof plate
④ Angle plate

Fig. 114: Setup of a protection against vertically falling water drops

⇨ Stick the sealing strap onto rear side of angle plate. The sealing strap must be in line with the angle plate on the left and on the right.



① Angle plate
② Sealing strap

Fig. 115: Installing the sealing strap on the angle plate (view from the rear)

⇨ **For 450 mm and 600 mm panel width:** Install the angle plate on the low-voltage compartment using 4 M5x16 self-tapping bolts. **For a 900 mm panel width:** Use 5 M5x16 self-tapping bolts.

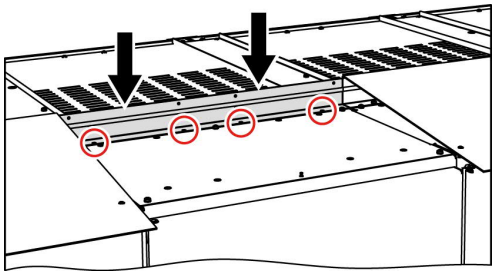


Fig. 116: Installing the angle plate

⇨ **For a 900 mm panel width:** Additionally, fasten the angle plate at the busbar cover using 3 M5x10 bolts. **For 450 mm and 600 mm panel width:** Use 4 M5x10 bolts.

⇨ Align the roof plate on the low-voltage compartment, and fasten it.

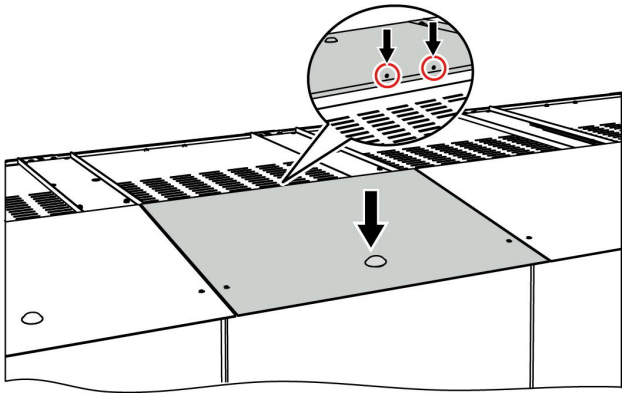
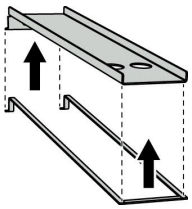


Fig. 117: Fastening the roof plate (view from the rear)

⇨ Stick the sealing strap on the connecting plates.



⇨ Bolt the connecting plates together with the roof plates and the angle plates on the right and on the left. Use 4 M5x16 self-tapping bolts for this.

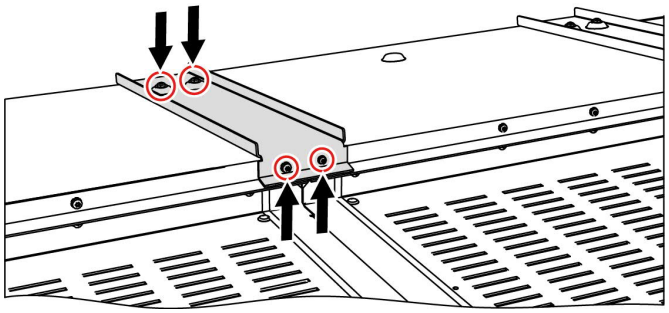


Fig. 118: Fastening the connecting plates (view from the rear)

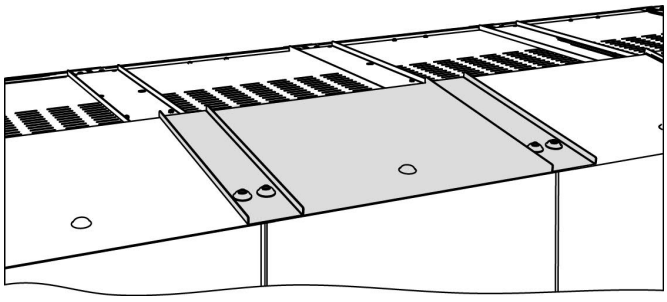
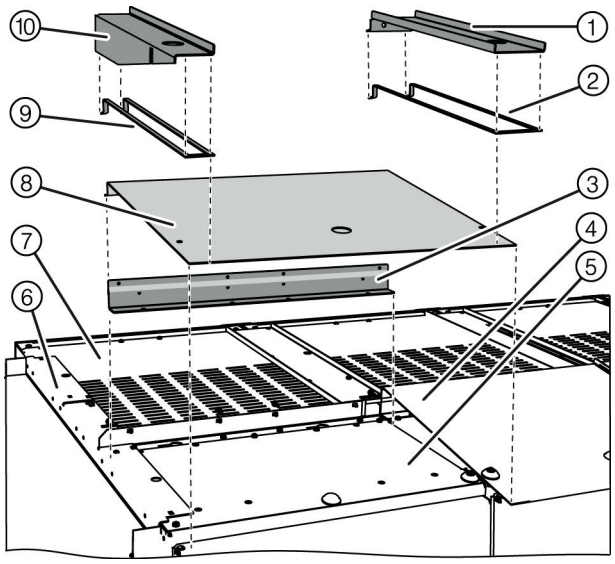


Fig. 119: Completed protection against vertically falling water drops

Installing the protection against vertically falling water drops on end panels

☞INFORMATION
In end panels, the angle plate must be mounted underneath the termination angle. ⇨ If the termination angle is pre-assembled, remove the termination angle in advance. ⇨ After mounting the angle plate, refit the termination angle.

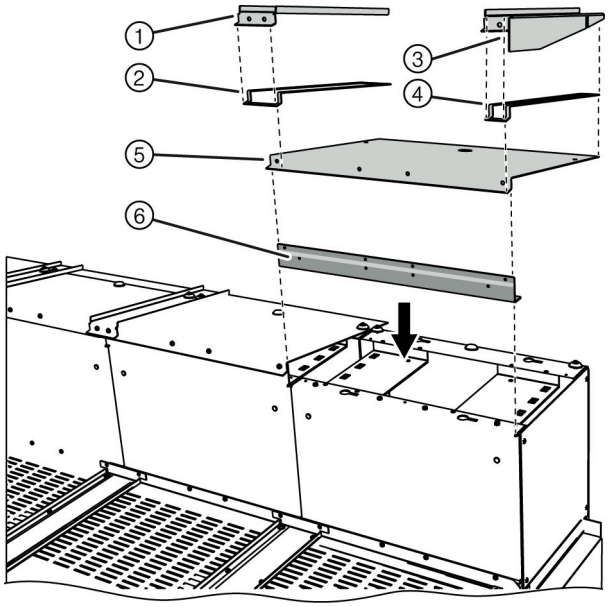


① Connecting plate
② Sealing strap for connecting plate
③ Angle plate with sealing strap
④ Installed roof plate
⑤ Low-voltage compartment
⑥ Termination bracket
⑦ Busbar cover
⑧ Roof plate
⑨ Sealing strap for left end plate
⑩ Left end plate

Fig. 120: Installing the protection against vertically falling water drops on the left end panel

Installing the protection against vertically falling water drops on the high low-voltage compartment

☞INFORMATION
If the low-voltage compartment is pre-installed, perform the installation steps for the protection against vertically falling water drops for a short low-voltage compartment.



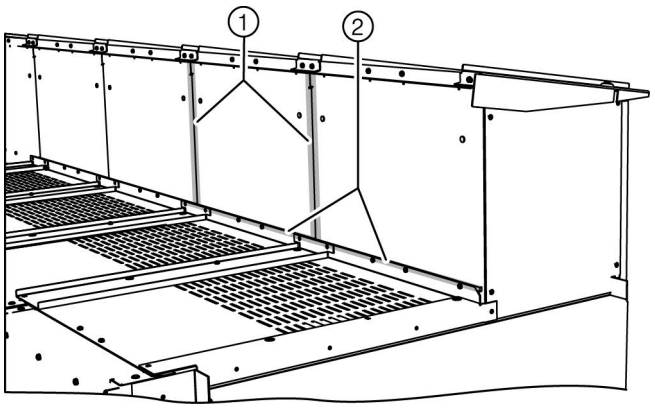
① Connecting plate
② Sealing strap for connecting plate
③ Left end plate
④ Sealing strap for left end plate
⑤ Roof plate
⑥ Angle plate with sealing strap

Fig. 121: Protection against vertically falling water drops on the left end panel (view form the rear)

Attaching the sealing straps

⇨ Stick a sealing strap ① between the panels on the rear wall of the low-voltage compartment, in line with the partition plate.

⇨ Stick a sealing strap ② flush with the upper edge of the busbar cover and the rear wall of the low-voltage compartment.



① Sealing straps between the panels

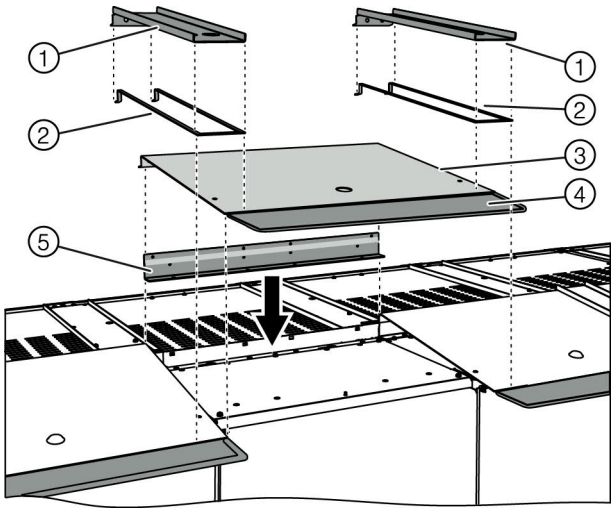
② Sealing straps on the rear wall of the low-voltage compartment

Fig. 122: Positions of the sealing straps

19.2 IP32D - protection against vertically falling water drops for switchgear inclined up to 15°

If the switchgear is inclined by 15°, an edge protection provides personal safety and prevents the ingress of vertically falling water drops in the switchgear.

⇨ The installation steps correspond to those for installing the protection against vertically falling water drops with IP31D.



① Connecting plates

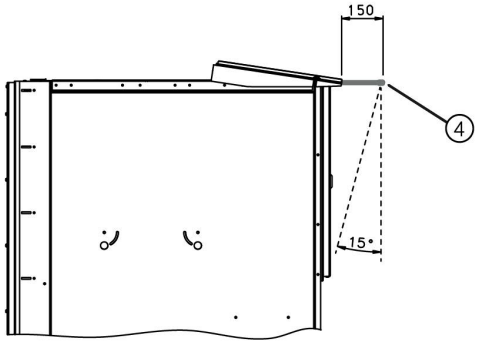
② Sealing strap for connecting plates

③ Roof plate

④ Edge protection

⑤ Angle plate

Fig. 123: Roof plates with edge protection



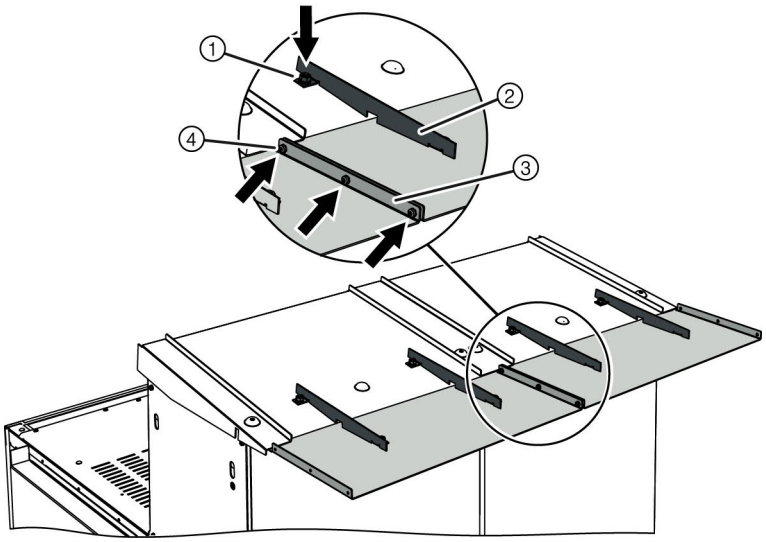
④ Edge protection

Fig. 124: Edge protection when the switchgear is inclined by 15°

Protection against vertically falling water drops IP32D for tall low-voltage compartment

⇨ Installation is performed in the same way as for the protection against vertically falling water drops for the tall low-voltage compartment.

⇨ Additionally, bolt the roof plates together and mount connecting braces.



① M8 nut-and-washer assembly
② Connecting brace
③ Bolted joint of roof plates
④ M5 self-tapping bolt

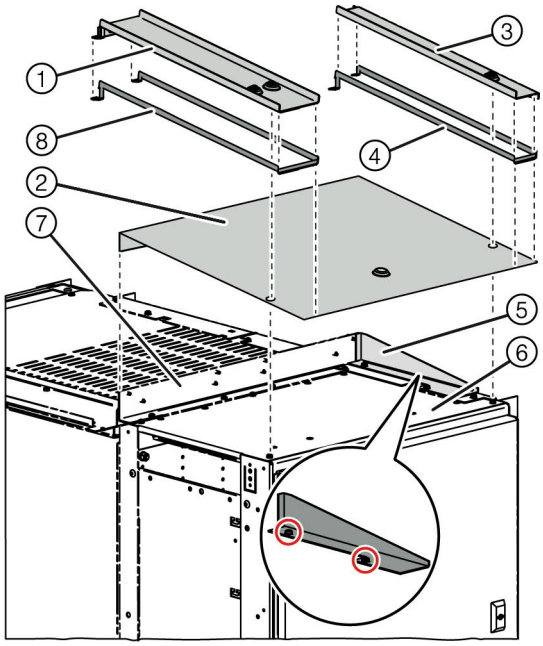
Fig. 125: Installation of the roof plate for protection against vertically falling water drops on the tall low-voltage compartment

19.3 IP34D - Protection against splashing water from any direction

To protect the switchgear against splashing water from any direction, an additional sealing bracket must be mounted on the end panels before installing the roof plates.

⇨ Install the sealing bracket ⑤ on the low-voltage compartment using 2 M5x12 self-tapping bolts.

⇨ The other installation steps correspond to those for installing the protection against vertically falling water drops with IP31D.



① Connecting plate
② Roof plate
③ Right end plate
④ Sealing strap for right end plate
⑤ Sealing bracket, right side
⑥ Low-voltage compartment
⑦ Angle plate
⑧ Sealing strap for connecting plate

Fig. 126: Installing the sealing bracket (example: right end panel)

20 Commissioning

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

⚠WARNING

Risk of injury due to high-speed moving parts
Parts behind covers can automatically move quickly and cause serious injury.

- ⇨ Do not remove any covers from the switchgear.
- ⇨ Do not reach into openings.

20.1 Final work

⇨ Check the data on the rating plate and the auxiliary voltage of the control and end devices against the requirements.

⇨ Check the service readiness (see page 190, "Ready-for-service indicator").

⇨ Check the switchgear fixing.

⇨ Check the earthing connections.

⇨ Check the bolted joints of the low-voltage equipment at random.

⇨ Check all switchgear parts that have been removed and installed again on site or that have been installed subsequently during installation work, in order to verify correct installation and completeness.

⚠DANGER

Internal arcing hazard and explosion hazard
Will cause death, injury or considerable property damage.

If the front cover is not bolted tight, the switchgear is not arc-resistant.

- ⇨ Bolt the front cover together with the switchgear frame. Use the bolts with cutting ring supplied with the switchgear.

⇨ Install the front cover (see page 184, "Removing and mounting the front cover").

⚠DANGER

Internal arcing hazard and explosion hazard
Will cause death, injury or considerable property damage.

If the cable compartment cover is not bolted tight, the switchgear is not arc-resistant.

- ⇨ Bolt the cable compartment cover together with the switchgear frame. Use the bolts with cutting ring supplied with the switchgear.

⇨ Install the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").

Auxiliary transformer panel

Do only put the auxiliary transformer panel into operation when the transformer is completely mounted.

⇨ Check whether the transformer and the connection cables are completely mounted and connected.

⇨ Check whether the transport angles of the transformer connection cables are removed.

Checking secondary lead connections

⇨ Check for correct wiring according to the circuit diagrams.

⇨ Check clamping and plug connections at random (perfect contact, labels, etc.).

Checking high-voltage connections

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

⇨ If applicable, test cables (see page 248, "Cable testing").

Feeder without cables

⇨ Earth and terminate the feeder. Cover the bushings with surge-proof caps.

Clean-up and visual inspection

⇨ Remove any attached instruction labels or documents that are no longer required for operation.

⇨ Remove any tools, materials etc. that are no longer required from the area of switchgear.

⇨ Remove any external dirt (ARAL 4005 or HAKU 1025 cleaner and lint-free rag/brush).

⇨ Fit all covers.

⇨ Place caps on the plug-in sockets the capacitive voltage detecting systems.

⇨ Touch up scratches and impacts in the surface painting. Available kit: Touch-up set (spatula and paint) and paint pen.

Checking protection devices

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

20.2 Checking the accessories

⇨ Keep the following accessories on hand:

- Installation and operating instructions
- Operating levers for three-position disconnector
- Hand crank for charging the circuit-breaker closing spring
- Top unit for emergency operation (only for panels with motor-operated slow motion mechanism)
- Double-bit key, diameter of 3 mm (for the door of the low-voltage compartment)
- Double-bit key, diameter of 5 mm (for the voltage transformer disconnector and the door of the low-voltage compartment)
- Circuit diagrams
- T25 Torx screwdriver

20.3 Instructing operating personnel

⇨ Instruct operating personnel in theory and practice of switchgear operation.

20.4 Functional test/test operation

⚠WARNING

Mortal danger due to internal arc!
Putting defective switchgear into operation can cause serious injury and property damage.

- ⇨ Perform mechanical function test with primary part de-energized and without auxiliary voltage. Do not perform mechanical function test while energized.
- ⇨ Never put switchgear into operation if during the mechanical function test or test operation a part of the switchgear does not work as described.
- ⇨ If there are any faults that cannot be cleared on site:
  - Do not put the switchgear into operation.
  - Contact the Siemens Service Hotline.

⚠WARNING

Risk of injury due to high-speed moving parts
Parts behind the front cover can automatically move quickly and cause serious injury. Do not remove the front cover of the operating mechanism until the following actions have been performed:

- ⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.:
  - Switch off the auxiliary voltage supply of the motor.
  - Trip the MCB.
  - Disconnect the control cables from the low-voltage compartment.
- ⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:
  - Push the manual OFF pushbutton.
  - Push the manual ON pushbutton.
  - Push the manual OFF pushbutton again.
- ⇨ Check if the "spring charged" indicator shows "spring not charged".

⇨ Before the function test and the test operation, operators must make themselves familiar with switchgear operation, see page 187, "Operation".

Mechanical functional test

⇨ Switch the three-position switch and the circuit-breaker several times to the CLOSED and OPEN position. Observe the correct indication of the associated switch position indicator.

⇨ Check mechanical interlocks and covers for ease of movement.

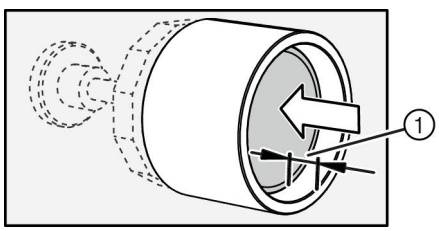
⇨ Test fuse tripping with test fuse.

⇨ Check HV HRC fuse-links.

Changing the idle stroke of the pushbuttons

The idle stroke of the pushbuttons on the circuit-breaker panel must be 4...7 mm. Correct the idle stroke of the pushbuttons if necessary.

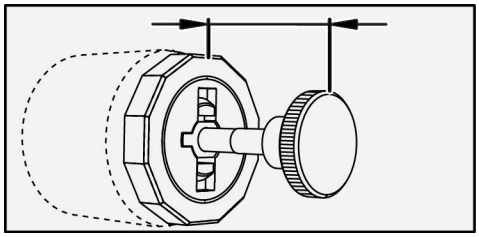
⇨ Measure the idle stroke of both pushbuttons (e.g. by means of a tape measure or vernier caliper).



① Idle stroke (approx. 4...7 mm)

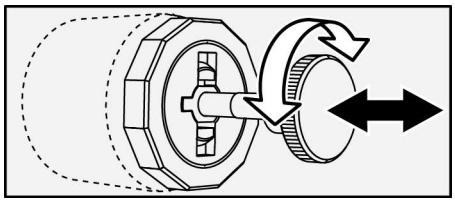
⇨ Remove the front cover of the circuit-breaker panel.

⇨ Measure the distance from the knurled bolt to the plastic nut.



⇨ Hold the housing of the pushbutton at the front.

⇨ To adjust the idle stroke to the requested dimension, turn the knurled bolt (recommendation: Wear a glove to turn the bolt more easily).



⇨ Refit the front cover.

Unlocking the interlocking solenoids

If the interlock of the three-position switch or circuit-breaker is equipped with an interlocking solenoid (-Y1, -Y5, -Y16, -Y8E) and if there is no auxiliary voltage available, the control gate is blocked. The interlocking can be bypassed as follows:

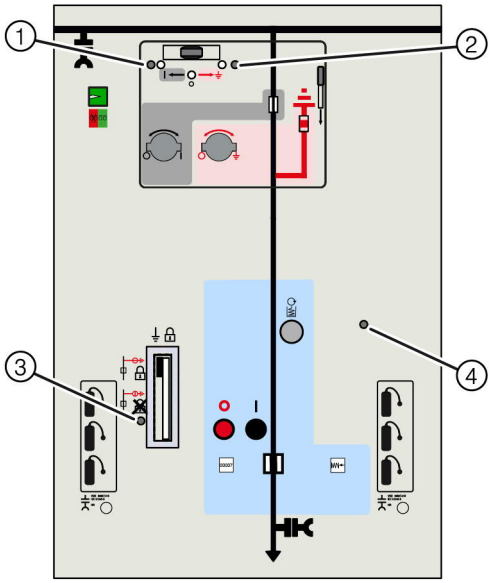


Fig. 127: Positions of the expanding rivets

⚠ CAUTION

Danger due to internal arc!
If the interlock is bypassed, switching operations are possible that can lead to an internal arc and cause injury.

⇨ Only bypass the interlock when the feeder is in no load condition and not carrying current.

Interlocking at the three-position switch (-Y1, -Y5)

- **Push the control gate from center position to right position:**

⇨ Remove the left-hand expanding rivet ① . Insert the screwdriver (Ø 3 mm) into the left-hand opening. Push the interlocking solenoid back. Push the control gate to the **right**. The left-hand interlocking solenoid is released again, blocking further movements.

- **Push the control gate from center position to left position:**

⇨ Remove the right-hand expanding rivet ② . Insert the screwdriver (Ø 3 mm) into the right-hand opening. Push the interlocking solenoid back. Push the control gate to the **left**. The right-hand interlocking solenoid is released again, blocking further movements.

✔ After work completion, insert the expanding rivet again.

Interlocking at the circuit-breaker (-Y16)

⇨ Remove the expanding rivet ③ . Insert the screwdriver (Ø 3 mm) about 60 mm deep into the opening. Push the interlocking solenoid back. Push the locking device upwards and secure it with a padlock.

⇨ To unlock, remove the lock. Push the locking device downwards. The interlocking solenoid is released again, blocking further movements.

✔ After work completion, insert the expanding rivet again.

Interlocking at the circuit-breaker (-Y8E)

⇨ Remove the expanding rivet ④ . Insert the screwdriver (Ø 3 mm) about 35 mm deep into the opening. Push the interlocking solenoid back. Close the circuit-breaker.

⇨ To unlock, open the circuit-breaker. The interlocking solenoid is released again, blocking further movements.

✔ After work completion, insert the expanding rivet again.

Activating the undervoltage release

NOTICE

Blocked undervoltage release
Can cause property damage.

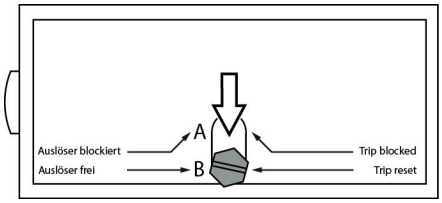
The undervoltage release will not function if its retaining bolt is inserted in position A. After test operation without auxiliary voltage, the undervoltage release must be activated.

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

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

⇨ Remove the front cover of the circuit-breaker (see page 184, "Removing and mounting the front cover").

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



⇨ Refit the front cover.

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

Electrical functional test

Before commissioning, verify correct operation of the switchgear by test operation. Perform test operation without high voltage.

☞INFORMATION

For test operation, switch the three-position disconnector to the basic position.

⇨ Switch the three-position disconnector to OPEN position by hand for the DISCONNECTING and EARTHING functions.

⇨ Switch on all auxiliary voltages and control voltages and verify correct polarity.

✔ The motor of the circuit-breaker operating mechanism charges the closing spring.

⇨ Check panels with electromagnetically interlocked three-position switch only with applied auxiliary voltage.

⇨ Check whether the mechanical and/or electrical interlocking conditions are fulfilled without using excessive force.

⇨ Check the switch position indicators of the three-position switch.

⇨ Switch the three-position switch and the circuit-breaker several times to the CLOSED and OPEN position, both directly at the panel and remotely.
- Check whether the positions are correctly indicated on the panel and in the control room, if applicable.
- Check whether the auxiliary switches and the position switches are operating correctly.

⇨ After operating the three-position switch, check whether the operating levers can be pushed onto the operating shafts.

If not, the motor may have jumped over due to reverse polarity. Inform the regional Siemens representative.

⇨ Check the function of the closing solenoid by electrical operation.

⇨ Check the function of the shunt releases, current transformer-operated releases and undervoltage releases by electrical operation.

Faults during test operation

- The three-position disconnector does not move to the desired position during the first electrical operation. (Example: The three-position disconnector moves to the "EARTHING SWITCH CLOSED" position instead of the "DISCONNECTOR CLOSED" position).
- The motor control unit of the three-position disconnector has detected the incorrect execution of the command and is in fault mode. In this condition, no further electrical switching operations are possible.

⚠WARNING

Mortal danger due to internal arc!
Putting defective switchgear into operation can lead to an internal arc.

⇨ Execute a mechanical function test or test operation successfully before commissioning. Never put switchgear into operation if during the mechanical function test or test operation a part of the switchgear does not work as described.

⇨ If there are any faults that cannot be cleared on site.
- Do not put the switchgear into operation.
- Contact the Siemens Service Hotline.

Fault clearing

⇨ Check the polarity of the auxiliary voltage and the motor connection.

⇨ Switch the operating mechanism **manually** back to the basic position. The switch position indicator for the DISCONNECTING and EARTHING functions shows OPEN (see page 197, "Operating the three-position disconnector").

Clearing fault mode

Once the cause for fault mode has been eliminated, fault mode can be cleared in 2 ways:

- Switch the auxiliary voltage off and on again.
- Press the MCU's reset button: Insert a thin, pointed object through the opening on the front of the MCU.

✔ The three-position disconnector can be put into operation again.

⇨ Perform test operation of the three-position disconnector.

Ending test operation

⇨ Switch all switching devices to the OPEN position.

20.5 Performing the power-frequency voltage test

If required, a test with rated short-duration power-frequency withstand voltage test can be performed at the readily installed switchgear on site. The busbar voltage transformers are designed for a repeat test at 80% U_D at 50 Hz according to IEC 62271-200.

At the factory, the individual feeders are routinely tested by means of a rated short-duration power-frequency voltage test.

As a rule, the test with these high power-frequency voltage test levels is performed before connecting the cables. If the cables are already connected, power-frequency voltage test equipment with a very high rating is necessary, and the permissible test voltage of the connected cables would be exceeded.

For detailed information about cable tests, see page 248, "Cable testing".

NOTICE

Damage to the voltage indicators by test voltage!
The voltage indicators can be damaged by the test voltage during the cable test.

⇨ Short-circuit the voltage indicators at the earthing points of the test sockets using short-circuit plugs.

Fig. 128: Short-circuit plug, from Kries, order number 2500029

Fig. 129: Short-circuit plug, from Horstmann, order number 51-9904-001

Preparing the test

⇨ Switch the circuit-breaker and three-position switch to the CLOSED position at the incoming feeder.

⇨ Switch all other three-position switches to the EARTHED position.

⇨ Earth the voltage transformers at the feeder over the voltage transformer isolating device.

⇨ If applicable, remove the surge arresters from the busbar and the incoming feeder.

⇨ Cover the coupling units of the surge arresters with surge-proof caps.

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

✔ The test can be performed.

Performing the test

⇨ Earth adjacent phases.

⇨ Test phases L1, L2 and L3 consecutively for 60 seconds each with the rated short-duration power-frequency voltage.

Completing the test

⇨ Switch the voltage transformer disconnector to the CLOSED position.

⇨ Install the surge arresters.

20.6 Primary injection test

A primary injection test can be performed on the panels.

Performing the test

To test the current transformers, switch the three-position switch of the panel to be tested to the "EARTHED" position and the circuit-breaker to the "CLOSED" position.

After that, the test current is applied through the bushings of the cable connection against the earthing busbar by means of a suitable test unit. Power supply can take place over one or three phases.

After applying the test current, the secondary measuring devices and tripping systems can be tested.

20.7 Correcting circuit diagrams

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

⇨ To have the modifications in the circuit diagrams included, send the corrected circuit diagrams to the regional Siemens representative.

20.8 Applying operating voltage

⚠DANGER

Hazardous voltage and internal arcing
Will cause death, serious injury or property damage.

Do not apply operating voltage before the following instructions have been executed:

- ⇨ Observe the specifications for prevention of accidents.
- ⇨ Observe the operating instructions and work instructions of the switchgear operator.
- ⇨ Install the switchgear according to the installation instructions and drawings supplied.
- ⇨ Perform electrical and mechanical and function test successfully.
- ⇨ Instruct the operating personnel in theory and practice of switchgear operation.
- ⇨ Fit all covers and bolt them tight.
- ⇨ Switch all circuit-breakers and vacuum contactors to OPEN position.
- ⇨ Switch the three-position switches in all panels to OPEN position.
- ⇨ Earth feeders without connected cables. Close all bushings in a surge-proof way.
- ⇨ Switch off connected consumers in all outgoing feeders.
- ⇨ Short-circuit unused current transformers on the secondary side.
- ⇨ Operate unused voltage transformers open on the secondary side.
- ⇨ To assure a consistent phase sequence in the entire switchgear assembly, check the phase sequence in all incoming and outgoing feeders before connecting them to the busbar.

Energizing incoming feeders

⇨ Energize all incoming feeders in the respective opposite substation.

Verifying correct terminal-phase connections

Verify correct terminal-phase connections of all incoming feeders:

Preconditions

- Use the phase comparison test unit according to IEC 61243-5 or VDE 0682-415.
- The panel of the incoming feeder to be tested must be in the OPEN position.
- The opposite substation must be de-earthed and live.

Performing the test

- ⇨ Remove the covers of the capacitive test sockets from phase L1 on the incoming feeder to be tested and on an already energized incoming feeder.
- ✔ The plug-in sockets of the capacitive test sockets on phase L1 are accessible.
- ⇨ Plug the measuring cables of the phase comparison test unit into the plug-in sockets of the capacitive test sockets according to the operating instructions.
- ⇨ Perform phase comparison according to the operating instructions of the phase comparison test unit and read the indication.
- ⇨ Remove the measuring cables from the plug-in sockets.
- ⇨ Refit the covers of the capacitive test sockets on both incoming feeders.

Checking further phases

- ⇨ Perform phase comparison for the phases L2 and L3 in the same way.
- ✔ If the phase comparison test unit has shown coincidence on all 3 phases, the phase sequence of the tested incoming feeder is correct.
- ✔ The incoming feeder can be energized.

Applying voltage to the busbar

If the phase sequence of all incoming feeders is correct, the incoming feeders can be connected to the busbar:

- ⇨ Close the three-position disconnector (the three-position disconnector must be operated in no-load condition, see page 187, "Operation").
- ⇨ Close the circuit-breaker or superior circuit-breaker.
- ✔ The busbar of the switchgear is live.

Energizing consumer feeders

When all incoming feeders are connected to the busbar:

⇨ One after the other, energize all consumer feeders with connected consumers.

✔ When all consumer feeders are energized, the switchgear is completely in operation.

Documenting the commissioning

⇨ Document any modifications that took placed due to installation or commissioning.

⇨ Document the modifications in the circuit diagram.

⇨ Send the modifications to the regional Siemens representative.

After commissioning

⇨ Observe the Five Safety Rules for working in the switchgear:

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

⇨ Observe the locally applicable specifications for prevention of accidents.

⇨ If after commissioning further work is required in the area of the switchgear, install warning signs on the switchgear.

Access for working in the area of the switchgear must only be granted to the following persons:

- Electricians and persons who have been properly instructed in electrical engineering
- Persons under the supervision of electricians and persons who have been properly instructed in electrical engineering

21 Recurring activities

21.1 Removing and mounting the front cover

⚠WARNING

Risk of injury due to high-speed moving parts
Parts behind the front cover can automatically move quickly and cause serious injury. Do not remove the front cover of the operating mechanism until the following actions have been performed:

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

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

⇨ Check if the "spring charged" indicator shows "spring not charged".

⚠DANGER

Internal arcing hazard and explosion hazard
Will cause death, injury or considerable property damage.

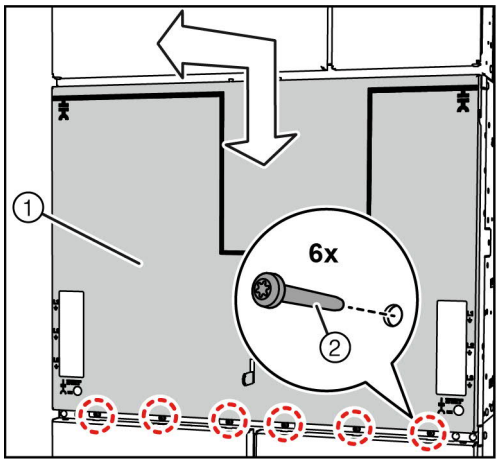
If the front cover is not bolted tight, the switchgear is not arc-resistant.

⇨ Bolt the front cover together with the switchgear frame. Use the bolts with cutting ring supplied with the switchgear.

Removing the front cover

⇨ Depending on the panel, undo 2, 4 or 6 bolts down at the front cover. Keep the bolts for later reuse.

⇨ Lift the front cover and take it off by bringing it forward.



① Front cover
② M5 bolt (tightening torque: 7 Nm)

Fig. 130: Example illustration: Air-insulated metering panel

Hooking the front cover in

⇨ Hook the front cover in from above.

⇨ Fasten all bolts down at the front cover.

21.2 Removing and mounting the connection compartment covers

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

The following connection compartment covers are removed and hooked in in the same way:

- Cable compartment cover
- Instrument transformer compartment cover
- Transformer compartment cover
- HV HRC fuse compartment cover

Precondition To remove the cover, the associated feeder must be earthed.

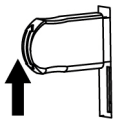
Removing the cover

⇨ Earth the feeder.

⇨ Undo all bolts ② down at the cover. Keep the bolts for later reuse.

Air-insulated metering panel: Undo all bolts ② at each cover. Keep the bolts for later reuse.

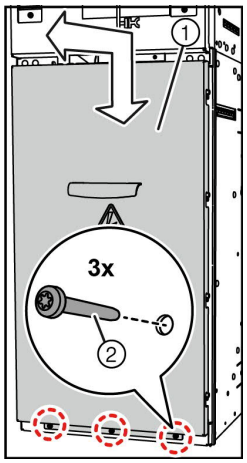
⇨ Push the lever of the locking device or the control gate upwards and hold it; if required, padlock it.

Locking device with padlock	Control gate
Circuit-breaker panel	Air-insulated metering panel with disconnectors Auxiliary transformer panel
	

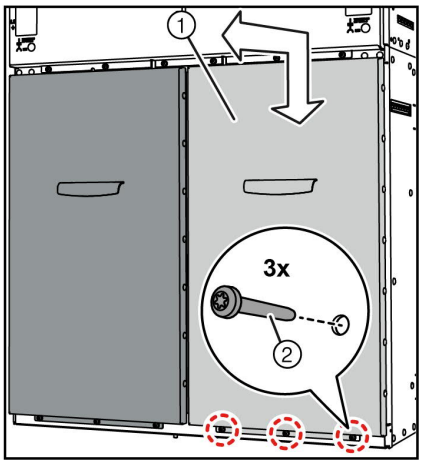
⇨ Lift the cover ① and remove it to the front.

Examples of connection compartment covers

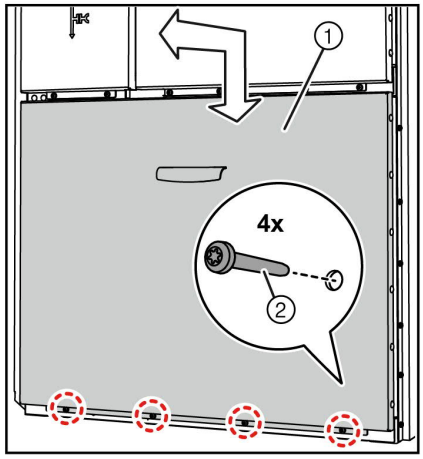
Circuit-breaker panel: Cable compartment cover



Air-insulated metering panel: Instrument transformer compartment cover



Auxiliary transformer panel Transformer compartment cover



① Cover

② Bolt M5 (tightening torque: 7 Nm)

⇨ Mark the cover with the panel number.

Hooking the cover in

- ⇨ Identify the cover using the panel number and assign it to the panel.
- ⇨ Hook the cover in from above.
- ⇨ Fasten the cover at the panel using the bolts ② removed before.

  Air-insulated metering panel: Fasten each cover at the panel using the bolts ② removed before.

Operation

⚠DANGER

Internal arcing hazard and explosion hazard
Will cause death, serious injury or property damage.

The internal arc classification of the switchgear has only been verified for the switchgear sides qualified according to IEC 62271-200 and with closed compartments.

- ⇨ Determine the IAC classification of the switchgear by means of the data on the rating plate.
- ⇨ With internal arc classification IAC A FL, no persons are allowed to stay in the area behind the switchgear.
- ⇨ The switchgear must have been installed in accordance with the instruction manuals and drawings.
- ⇨ All covers of the switchgear must be closed.
- ⇨ Regulations for access to switchgear areas without internal arc classification according to IEC 62271-200 must be defined by the switchgear operator.

⚠CAUTION

Internal arcing hazard and explosion hazard
Switching without service readiness can cause serious injury or property damage.

- ⇨ Check the service readiness of the switchgear before performing any switching operation. The pointer of the ready-for-service indicator must be in the green area.
- ⇨ If the pointer of the ready-for-service indicator is in the red area:
  - **All panel types except circuit-breaker panels and bus sectionalizer panels:** Do **not** operate the switchgear.
  - Contact the Siemens Service Hotline.

22 Control elements and indicators

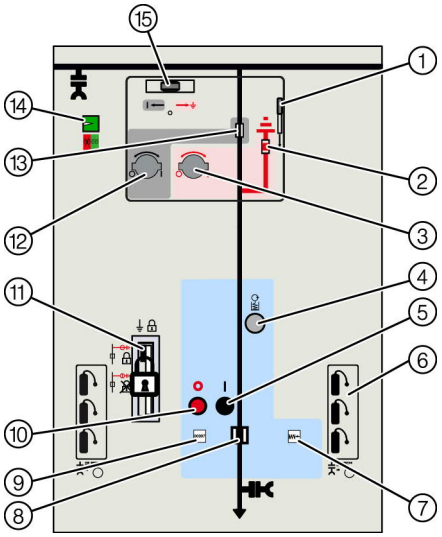


Fig. 131: Control board of circuit-breaker panel (450 mm)

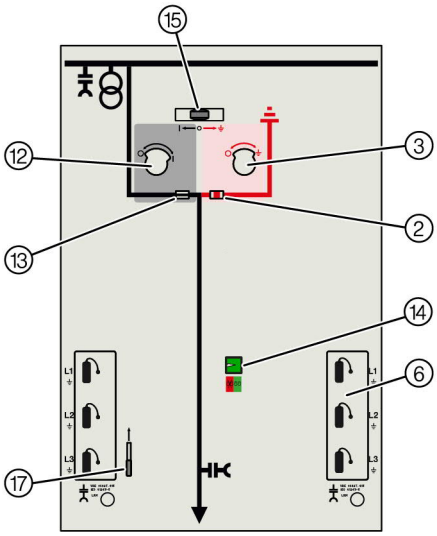


Fig. 132: Control board of ring-main panel

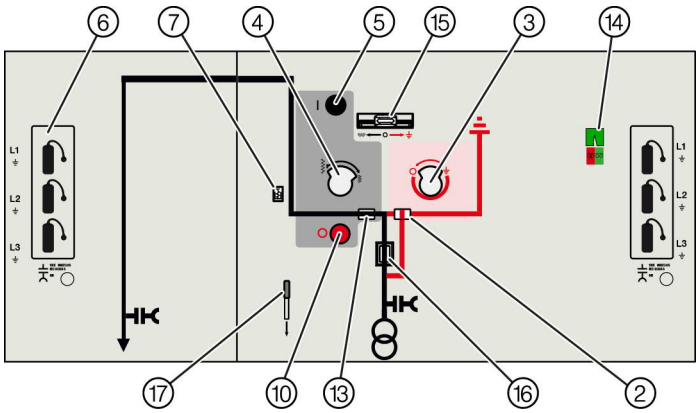


Fig. 133: Control board of auxiliary transformer panel

① Interrogation lever
② Switch position indicator for the EARTHING or READY-TO-EARTH function
③ Actuating opening for EARTHING or READY-TO-EARTH function
④ Actuating opening for charging the spring
⑤ CLOSE pushbutton
⑥ Capacitive voltage detecting system
⑦ "Spring charged" indicator
⑧ Switch position indicator for circuit-breaker
⑨ Operations counter for circuit-breaker
⑩ OPEN pushbutton
⑪ "Feeder earthed" locking device
⑫ Actuating opening for DISCONNECTING function
⑬ Switch position indicator for the DISCONNECTING function
⑭ Ready-for-service indicator
⑮ Control gate/locking device for DISCONNECTING and EARTHING functions
⑯ Fuse trip indicator
⑰ Interlocking lever for HV HRC fuse compartment

22.1 Position indicators

Switch position	CLOSED	OPEN	EARTHED READY-TO-EARTH	Faulty position[1]
Disconnector			—	
Earthing switch	—			
Circuit-breaker[2]			—	

[1] Contacts are not in defined end position.
[2] No circuit-breaker for air-insulated metering panel

Switch position	CLOSED	OPEN	EARTHED
Switch-disconnector			—
Earthing switch	—		
Vacuum contactor			

"Fuse tripped" indicator	Not tripped	Tripped
Switch-disconnector panel with fuse		

22.2 "Spring charged" indicator

Closing spring charged	Closing spring not charged
	

22.3 Operations counter

One operating cycle corresponds to one closing operation and one opening operation of the circuit-breaker.

Number of operating cycles


22.4 Ready-for-service indicator

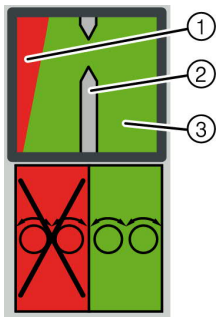
⚠ CAUTION

Internal arcing hazard and explosion hazard
Switching without service readiness can cause serious injury or property damage.

⇨ Check the service readiness of the switchgear before performing any switching operation. The pointer of the ready-for-service indicator must be in the green area.

⇨ If the pointer of the ready-for-service indicator is in the red area:

- **All panel types except circuit-breaker panels and bus sectionalizer panels:** Do **not** operate the switchgear.
- Contact the Siemens Service Hotline.



① Red area
② Pointer
③ Green area

Fig. 134: Ready-for-service indicator

Reading the ready-for-service indicator:

- If the pointer is in the **green area**, the panel is **ready for service**.
- If the pointer is in the **red area**, the panel is **not ready for service**. **Do not operate** the panel and contact the Siemens Service Hotline.

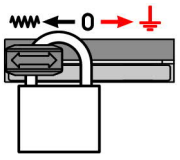
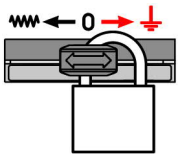
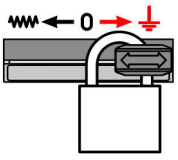
22.5 Control gate with locking device

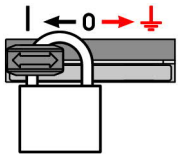
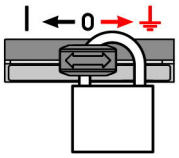
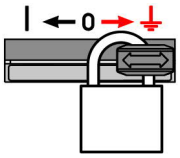
The locking device at the control gate can be padlocked in all three switch positions.

The locking device can be padlocked so that no operation of the DISCONNECTING or EARTHING functions is possible with the three-position switch.

The padlock can also be fitted in such a way that no switching operation can be performed.

- Shackle diameter of the padlock: Min. 6 mm.

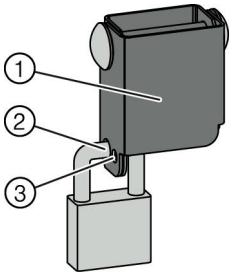
Switching device	Switch-disconnector		
Padlock position	**Left**	**Center**	**Right**
			
Possible switching operations	• Charging the spring Only possible if the switch-disconnector is open.	No switching operations possible. **Precondition:** Spring energy store not charged.	• EARTHING • DE-EARTHING

Switching device	Disconnector		
Padlock position	**Left**	**Center**	**Right**
			
Possible switching operations	• Switching to CLOSED • Switching to OPEN Only possible if the circuit-breaker is open.	No switching operations possible.	• READY-TO-EARTH • Deactivating READY-TO-EARTH

22.6 Locking device for pushbutton

The pushbuttons of the circuit-breaker and of the three-position switch-disconnector can be equipped with a device for padlocking or for sealing (option).

- Shackle diameter of the padlock: Min. 4 mm



① Flap at the pushbutton
② Hole for padlock
③ Hole for sealing

Fig. 135: Locking the pushbutton

Locking the pushbutton

⇨ Close the flap at the pushbutton.

⇨ Hook the padlock in and lock it, or fit the sealing.

22.7 Circuit-breaker locking device for "feeder earthed"

The circuit-breaker locking device for "feeder earthed" is operated to lock a circuit-breaker panel with earthed feeder and secure it against de-earthing.

The operated locking device can be padlocked.

As standard, the locking device can only be operated when the three-position disconnector is in READY-TO-EARTH position and the circuit-breaker is in CLOSED position. Operating the locking device in other switch positions is locked as standard.

NOTICE

Maloperation of the locking device
Can cause considerable property damage.

For a panel optionally equipped **without interlocking between locking device and three-position disconnector**: If the circuit-breaker and the three-position disconnector are in CLOSED position, do **not** operate the locking device.

If the locking device is operated, all electrical and mechanical opening commands (e.g. protection tripping) are ineffective.

⇨ Operate the locking device only under the following conditions:

- Three-position disconnector switched to READY-TO-EARTH position.
- Circuit-breaker switched to CLOSED position.

Preconditions

- Three-position disconnector in "READY-TO-EARTH" position
- Circuit-breaker in CLOSED position
- Shackle diameter of the padlock: Min. 6 mm.

Actuating the locking device

⇨ Push the lever of the locking device upwards.

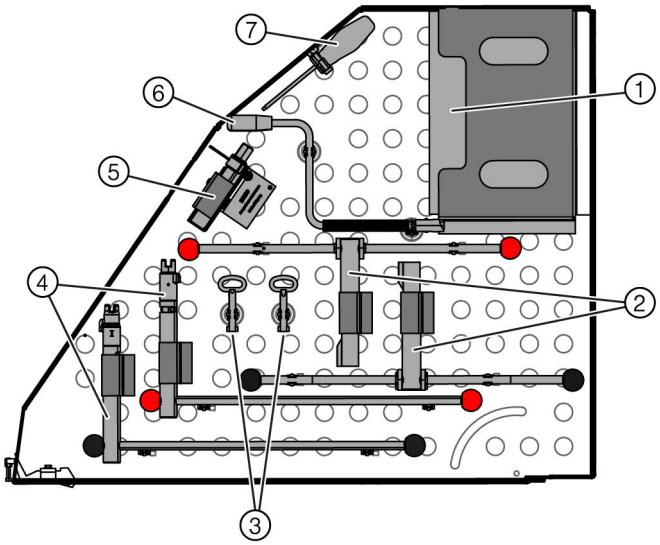
Fig. 136: Circuit-breaker locking device

⇨ Fit and lock the padlock.

22.8 Service flap

The standard accessories are located in the service flap in the switchgear termination.

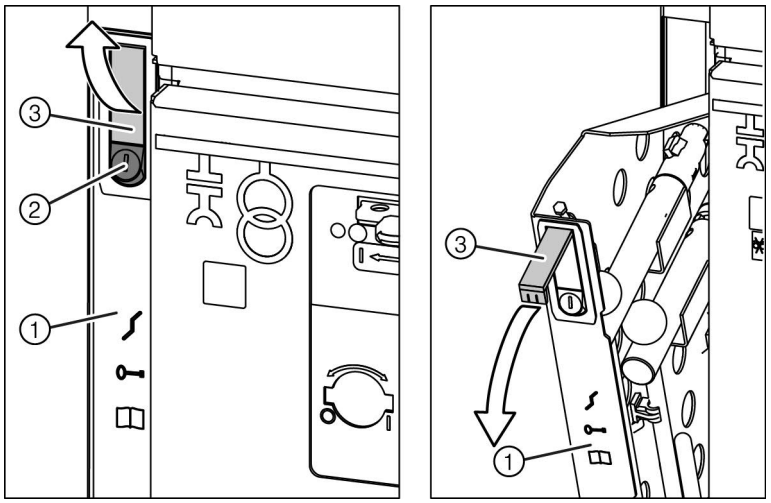
Equipment of service flap



① Installation and operating instructions
② Operating lever for slow motion mechanism (DISCONNECTING and EARTHING functions)
③ Double-bit keys (diameter of 3 mm and 5 mm)
④ Operating lever for spring-operated mechanism (DISCONNECTING and EARTHING functions)
⑤ Adapter for emergency operation
⑥ Hand crank
⑦ Torx screwdriver

Opening the service flap

⇨ If applicable, open the lock ② on the service flap.
⇨ Press on the lock. The handle ③ folds out.
⇨ Carefully pull out the service flap ① by the handle ③ .



① Service flap
② Lock
③ Handle

Fig. 137: Opening the service flap

✔ The service flap is open. The handle folds in automatically.

Closing the service flap

⚠ CAUTION

Risk of injury when closing the service flap
Fingers can be trapped between service flap and switchgear front.

⇨ Hold the service flap firmly by the provided handle when closing it and close it in a controlled manner.

NOTICE

Service flap slamming closed
Can damage the switchgear.

⇨ Hold the service flap firmly by the provided handle and close it in a controlled manner.

⇨ Carefully close the service flap ① by the handle ③ .

⇨ Fold in the handle ③ .

⇨ If applicable, close the lock ② on the service flap.

22.9 Operating tools

Operating lever

NOTICE

Use of incorrect operating levers
Using incorrect operating levers can damage or deactivate the safety equipment of the switchgear.

⇨ Use only the original Siemens operating levers corresponding to the switchgear type.

Operating lever for slow motion mechanism

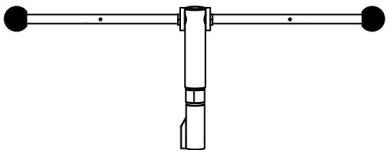


Fig. 138: Operating lever for DISCONNECTING function (black handles)

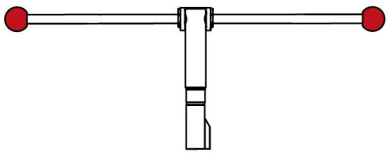


Fig. 139: Operating lever for EARTHING or READY-TO-EARTH function (red handles)

Switching operation	Color of the handles	Operation
DISCONNECTING	Black	Turn the operating lever 180°.
EARTHING/READY-TO-EARTH	red	

Operating levers for spring-operated mechanism and spring-operated/stored-energy mechanism

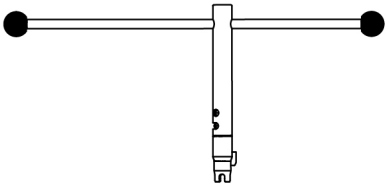


Fig. 140: Operating lever for charging the operating spring (black handles)

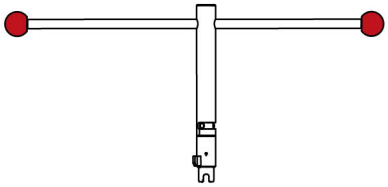
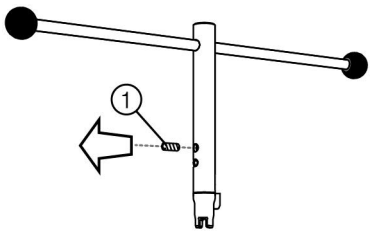


Fig. 141: Operating lever for EARTHING function (red handles)

Switching operation	Color of the handles	Operation
Charging the operating spring	Black	Turn the operating lever straight as far as it will go.
EARTHING	red	

Anti-reflex levers: The operating levers of the spring-operated mechanism and spring-operated/stored-energy mechanism can be retrofitted to an anti-reflex lever. Anti-reflex levers prevent a direct inversion of the operating direction during a switching operation.

To retrofit, remove the setscrew ① from the standard operating lever.



① Setscrew

Fig. 142: Retrofitting to an anti-reflex lever

Hand crank

The hand crank is used for charging the operating spring.

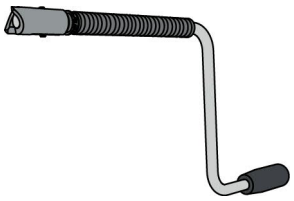


Fig. 143: Hand crank

23 Operating the circuit-breaker

23.1 Closing the circuit-breaker

If there is no block active from the mechanical interlock, the circuit-breaker can be closed electrically (if provided) or mechanically.

Control voltage failure

If the control voltage fails, the circuit-breaker must be closed mechanically (pushbutton).

Closing the circuit-breaker

⇨ Operate the ON pushbutton in the mechanical or electrical control board.

✔ The circuit-breaker is closed.

23.2 Opening the circuit-breaker

The circuit-breaker can be opened electrically (if provided) or mechanically.

Control voltage failure

If the control voltage fails, the circuit-breaker must be opened manually.

Locking device

If the feeder is earthed through the three-position disconnector and the circuit-breaker, and if the "feeder earthed" locking device is fitted, all electrical opening commands are ineffective.

If the locking device is padlocked, the circuit-breaker cannot be opened mechanically either.

Opening the circuit-breaker

⇨ Operate the OFF pushbutton in the mechanical or electrical control board.

✔ The circuit-breaker is open.

23.3 Charging the closing spring

Closing spring

The closing spring is charged automatically after applying control voltage. The energy required for the operating sequence OPEN-CLOSE-OPEN (auto-reclosing) is stored in the closing spring about 15 seconds after closing the circuit-breaker operating mechanism.

Control voltage failure

If the control voltage fails, the closing spring can be charged with the hand crank. The hand crank supplied features a freewheel function. The freewheel function disconnects an inserted hand crank from the charging system if the motor is charging the closing spring. If the motor restarts when the control voltage returns, the freewheel prevents injuries caused by an inserted hand crank.

⚠ CAUTION

Parts moving at high speed

Using an incorrect hand crank can cause injury.

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

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

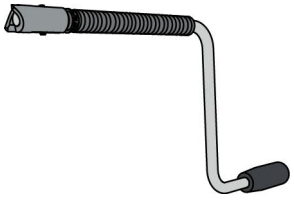


Fig. 144: Hand crank

Charging the closing spring

⇨ Remove the locking cap from the actuating opening.
⇨ Insert the hand crank.
⇨ Turn the hand crank clockwise approximately 30 times.
✔ The "closing spring charged" indicator appears in the inspection window.

⇨ Remove the hand crank.
⇨ Close the actuating opening with the locking cap.

23.4 Circuit-breaker test operation

Without auxiliary voltage

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

⇨ Charge the closing spring (see page 195, "Charging the closing spring").
⇨ Operate the ON pushbutton in the mechanical control board.
✔ The circuit-breaker is closed.
⇨ Operate the OFF pushbutton in the mechanical control board.
✔ The circuit-breaker is open.

On circuit-breakers with undervoltage release 3AX1103:

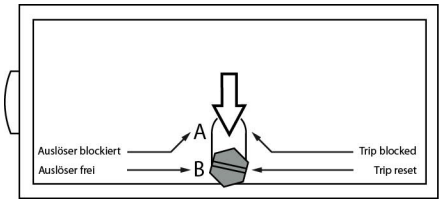
NOTICE

Blocked undervoltage release
Can cause property damage.

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

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

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



With auxiliary voltage (motor operating mechanism)

⇨ Switch on the supply voltage.
✔ The motor operating mechanism starts up and charges the closing spring.
⇨ Check whether the "spring charged" indication appears.

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

24 Operating the three-position disconnector

☞INFORMATION
Operating the three-position disconnector When the circuit-breaker is in CLOSED position, the three-position disconnector cannot be operated. ⇨ Switch the circuit-breaker to OPEN position.

☞INFORMATION
Operating the air-insulated metering panel In order to execute switching operations at the air-insulated metering panel, the busbar of the air-insulated metering panel must be isolated from supply or earthed.

24.1 Switching the three-position disconnector from OPEN to CLOSED position

Preconditions

⇨ Check the service readiness (see page 190, "Ready-for-service indicator").

⇨ Isolate or earth the feeder.

- **For panels with circuit-breaker:** Switch the circuit-breaker to the OPEN position.
- **For an air-insulated metering panel:** Isolate or earth the busbar.

Releasing the actuating opening

⇨ Push the interrogation lever downwards.

⇨ Push the control gate to the left.

✔ The opening for the DISCONNECTING operation is free.

Performing the switching operation

⇨ Insert the operating leaver for the DISCONNECTING operation (black handles) into the actuating opening and turn 180° clockwise.

✔ The three-position disconnector is closed.

Final activities

⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position.

⇨ **For air-insulated metering panel:** Execute the same operations with the second three-position switch.

24.2 Switching the three-position disconnector from CLOSED to OPEN position

Preconditions

⇨ Check the service readiness (see page 190, "Ready-for-service indicator").

⇨ Isolate or earth the feeder.

- **For panels with circuit-breaker:** Switch the circuit-breaker to the OPEN position.
- **For an air-insulated metering panel:** Isolate or earth the busbar.

Performing the switching operation

⇨ Push the interrogation lever downwards.

⇨ Push the control gate to the left.

✔ The opening for the DISCONNECTING operation is free.

⇨ Insert the operating leaver for the DISCONNECTING operation (black handles) into the actuating opening and turn 180° counter-clockwise.

✔ The three-position disconnector is open.

Final activities

⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position.

⇨ **For air-insulated metering panel:** Execute the same operations with the second three-position switch.

24.3 Switching the three-position disconnector from OPEN to READY-TO-EARTH position

⚠ WARNING

Mortal danger due to electric shock!
Touching live parts can lead to electric shock. In panels with circuit-breaker, the earthing process is not completed until the circuit-breaker is closed.

⇨ Switch the three-position disconnector to READY-TO-EARTH position.

⇨ Close the circuit-breaker.

⚠ CAUTION

Internal arcing hazard and explosion hazard
Operating the three-position disconnector under load can cause injury or property damage.

A mechanical interlock prevents, as standard, the three-position disconnector from being operated under load. The switchgear can optionally be equipped in accordance with a customer-specific intrlocking and control scheme.

⇨ If the customer-specific interlocking and control scheme requires that the panel be provided without electromechanical or mechanical interlocks, the three-position disconnector can be operated under load.

⇨ Do NOT operate the three-position disconnector under load.

Preconditions

⇨ Check the service readiness (see page 190, "Ready-for-service indicator").

⇨ Isolate or earth the feeder.

- **For panels with circuit-breaker:** Switch the circuit-breaker to the OPEN position.
- **For an air-insulated metering panel:** Isolate or earth the busbar.

Performing the switching operation

⇨ Push the interrogation lever downwards.

⇨ Push the control gate to the right.

✔ The actuating opening for the READY-TO-EARTH operation is free.

⇨ Insert the operating lever for the READY-TO-EARTH operation (red handles) into the actuating opening and turn 180° clockwise.

✔ The three-position switch is in the READY-TO-EARTH position.

Final activities

⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position.

⇨ **For an air-insulated metering panel:** Execute the same operations with the second three-position disconnector.

Earthing the feeder

⇨ **For circuit-breaker panel:** To earth the feeder, close the circuit-breaker and lock it.

24.4 Switching the three-position disconnector from READY-TO-EARTH to OPEN position

Preconditions

⇨ Check the service readiness (see page 190, "Ready-for-service indicator").

⇨ Isolate or earth the feeder.

- **For panels with circuit-breaker:** Switch the circuit-breaker to the OPEN position. The feeder is de-earthed.
- **For an air-insulated metering panel:** Isolate or earth the busbar.

Performing the switching operation

⇨ Push the interrogation lever downwards.

⇨ Push the control gate to the right.

✔ The opening for the READY-TO-EARTH operation is free.

⇨ Insert the operating lever for the READY-TO-EARTH operation (red handles) into the actuating opening and turn 180° counterclockwise.

✔ The three-position disconnector is open.

Final activities

⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position.

⇨ **For an air-insulated metering panel:** Execute the same operations with the second three-position disconnector.

24.5 Operating the three-position switch with motor-operating mechanism

The switching operations DISCONNECTING and READY-TO-EARTH of the three-position disconnector can be performed by means of a motor operating mechanism (option).

Three-position disconnectors with motor operating mechanism can also be controlled from remote depending on their design.

24.6 Emergency operation of the three-position switch with slow motion mechanism

The following section describes emergency operation of the three-position switch with slow motion mechanism and motor control.

If the three-position switch is not in either of the end positions (fault position), emergency operation has to be carried out. This is necessary, for example, if the motor power supply has failed.

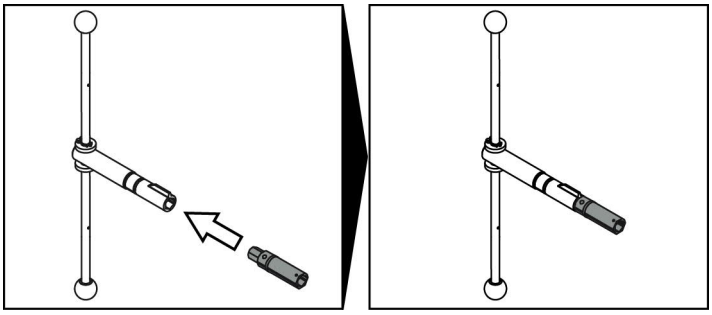
Emergency operation is done by hand. Using an emergency adapter for the operating lever, the three-position switch is switched to the end position. The emergency adapter is in the service flap at the factory.

Switch position indicators

Disconnector fault position	Earthing switch fault position
	

Preparing the operating lever

⇨ Put the emergency adapter on the operating lever. The positions of the slots and protrusions on the operating lever and emergency adapter are not relevant.



NOTICE

Incorrect alignment of the emergency adapter

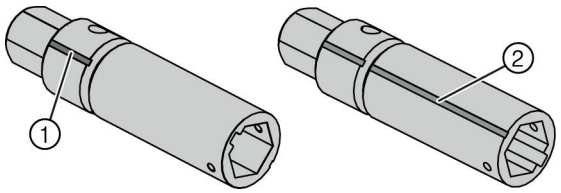
Incorrect alignment of the emergency adapter on the operating shaft can damage the switch position indicator or the three-position switch operating mechanism during switching.

⇨ **Attaching**: Align the operating lever with the emergency adapter to the operating shaft based on the inner slot of the emergency adapter.

⇨ **Switching**: Use the outer slots of the emergency adapter to identify the switching position.

Adapter for emergency operation

The adapter for emergency operation is stored in the service flap. On the outside of the adapter, there is a long and a short slot. During emergency operation, the OPEN position can be determined by the position of the slots.



① Short slot
② Long slot

Fig. 145: Emergency adapter

Switching using the emergency adapter

NOTICE

Switching from an undefined switching position
Switching from an undefined position to CLOSED or EARTH can damage the switchgear.
⇨ Always switch the three-position switch to the OPEN position.

⇨ Open the actuating opening of the affected DISCONNECTING or EARTHING function.

⇨ Insert the operating lever with emergency adapter in such a way that the inner slot of the emergency adapter fits on the pin of the operating shaft.

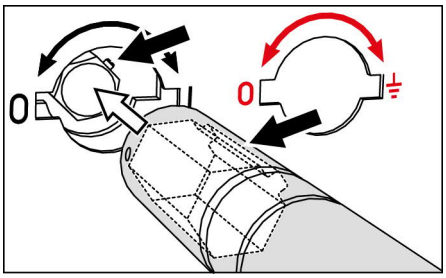
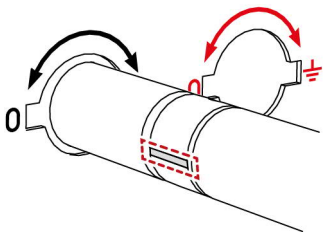
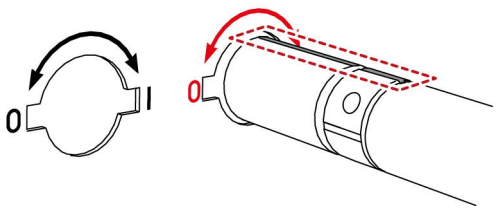
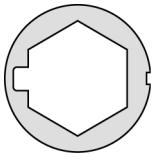
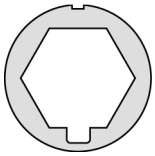


Fig. 146: Push the emergency adapter onto the operating shaft for the DISCONNECTING function.

NOTICE

The operating lever with emergency adapter does not have a stop.
Switching beyond the end position of the three-position switch will damage the three-position switch.
⇨ Observe the slots on the emergency adapter.

End positions

Disconnector		Earthing switch	
			
Adapter position 	Position of long slot: Right Position of short slot: Left	Adapter position 	Position of long slot: Top Position of short slot: Bottom
The disconnector is in the OPEN position.		**The earthing switch is in the OPEN position.**	

⇨ **DISCONNECTING function**: Turn the operating lever with emergency adapter counterclockwise until the outer slots on the emergency adapter are both horizontal.

⇨ **EARTHING function**: Turn the operating lever with emergency adapter counterclockwise until the outer slots on the emergency adapter are both vertical.

✔ The switch position indicator is in the OPEN position.

⇨ Remove the operating lever.

⇨ Pull the emergency adapter off of the operating lever. Place the emergency adapter in the service flap.

✔ The three-position switch can be operated electrically again.

Switching after emergency operation

Perform additional switching operations by hand without the emergency adapter.

25 Operating the three-position switch-disconnector

⚠ CAUTION

Internal arcing hazard and explosion hazard
Switching without service readiness can cause serious injury or property damage.

⇨ Check the service readiness of the switchgear before performing any switching operation. The pointer of the ready-for-service indicator must be in the green area.

⇨ If the pointer of the ready-for-service indicator is in the red area:

- **All panel types except circuit-breaker panels and bus sectionalizer panels:**

  Do **not** operate the switchgear.

- Contact the Siemens Service Hotline.

☞ INFORMATION

The operating mechanism is equipped with an operating lever ejection system. The operating lever ejection system prevents the operating lever from being left inserted accidentally.

⇨ To insert the operating lever, a spring resistance must be overcome in the actuating opening.

☞ INFORMATION

For the three-position switch-disconnector, more force is required to turn the operating lever than for the three-position disconnector.

25.1 Switching the three-position switch-disconnector from OPEN to CLOSED position

Preconditions

⇨ Check service readiness (see page 190, "Ready-for-service indicator").

⇨ Remove the padlock (optional) from the locking device.

Releasing the actuating opening

⇨ Push the control gate to the left and hold it.

✔ The actuating opening for "spring charging" is free.

Performing the switching operation

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

✔ The "spring charged" indicator shows "spring charged".

⇨ Remove the operating lever.

The control gate returns to its initial position.

✔ The feeder is ready to close.

NOTICE

No-load switching operations with the three-position switch-disconnector
Can damage the three-position switch-disconnector.

After charging the spring energy store, do not open the three-position switch-disconnector directly.

⇨ After charging the spring energy store, close the three-position switch-disconnector first, and then open it.

⇨ Actuate the ON pushbutton.

✔ The position indicator of the three-position switch-disconnector shows the CLOSED position.

✔ The feeder is connected with the busbar.

Final activities

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 190, "Control gate with locking device").

✔ The "spring charged" indicator still shows "spring charged".

25.2 Switching the three-position switch-disconnector from CLOSED to OPEN position

Preconditions

- "Spring charged" indicator shows "spring charged"

⇨ Check service readiness (see page 190, "Ready-for-service indicator").

Performing the switching operation

⇨ Actuate the OFF pushbutton.

✔ "Spring charged" indicator shows "spring not charged".

25.3 Switching the three-position switch-disconnector from OPEN to EARTHED position

Preconditions

⇨ Check service readiness (see page 190, "Ready-for-service indicator").

⇨ Verify safe isolation from supply of the feeder (see page 207, "Verification of safe isolation from supply").

⇨ Remove the padlock (optional) from the locking device.

Releasing the actuating opening

⇨ Push the control gate to the right and hold it.

✔ The actuating opening for the EARTHING function is open.

Performing the switching operation

⇨ Insert the operating lever and turn straight clockwise as far as it will go.

✔ The position indicator of the three-position switch-disconnector shows the EARTHED position.

✔ The feeder is earthed.

Final activities

⇨ Remove the operating lever.

The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 190, "Control gate with locking device").

25.4 Switching the three-position switch-disconnector from EARTHED to OPEN position

Preconditions

⇨ Check service readiness (see page 190, "Ready-for-service indicator").

⇨ Remove the padlock from the locking device (optional).

Releasing the actuating opening

⇨ Push the control gate to the right and hold it.

✔ The actuating opening for the EARTHING function is open.

Performing the switching operation

⇨ Insert the operating lever and turn straight counter-clockwise as far as it will go.

✔ The position indicator of the three-position switch-disconnector shows the OPEN position.

✔ The feeder is de-earthed.

Final activities

⇨ Remove the operating lever.

The control gate returns to its initial position.

⇨ Fit the padlock (optional) on the locking device in the desired position (see page 190, "Control gate with locking device").

25.5 Operating the three-position switch with motor-operating mechanism

The DISCONNECTING operation of the three-position switch-disconnector can be performed by means of a motor operating mechanism (option).

Three-position switch-disconnectors with motor operating mechanism can also be controlled from remote depending on their design.

25.6 Protection tripping of the switch-fuse combination

If the switch-fuse combination was tripped by a fuse-link, the "fuse tripped" indicator shows a red transverse bar.

Electrical switching commands to the motor operating mechanism (option) are suppressed.

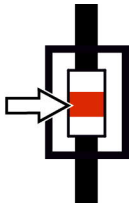


Fig. 147: "Fuse tripped" indicator

Re-establishing service readiness

⇨ Switch the switching device to EARTHED position.

⇨ Replace **all** HV HRC fuse-links (see page 212, "Replacing HV HRC fuse-links"). The fuse-links may also be damaged if their striker was not tripped.

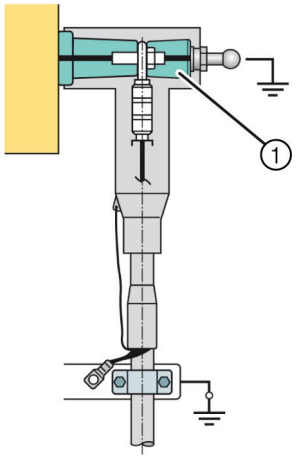
26 Work-in-progress earth

☞INFORMATION
The work-in-progress earth in the air-insulated metering panel is established in a different way (see page 141, "Mounting earthing accessories in the air-insulated metering panel").

Visible earthing without removing the cables

⇨ Earth the panel.

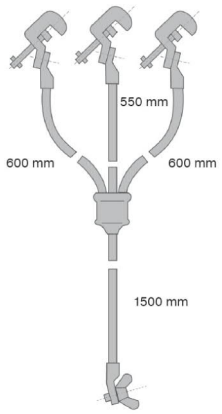
⇨ Install the adapter for the work-in-progress earth onto the cable T-plugs of the connected cables.



① Adapter for work-in-progress earth

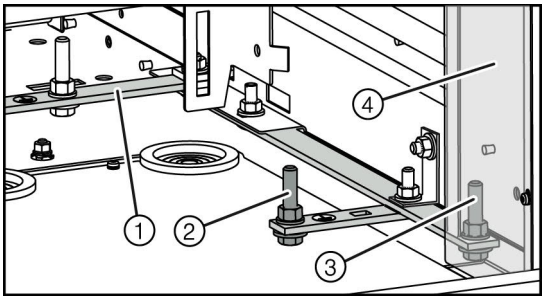
⇨ Earthing accessories from different manufacturers can be connected to the spherical bolts of the adapters. Diameter of spherical bolts: 20 or 25 mm.

Example of earthing accessories:



⇨ Connect earthing accessories with the earthing busbar and with one of the connection points of the pulled-out earthing bar (option).

⚠CAUTION
Thermal overload due to excessive short-circuit current at the connection point of the pulled-out earthing bar. Can cause serious injury or property damage. ⇨ Load the pulled-out earthing bar with a short-circuit current of 25 kA for 3 s at most. ⇨ Another connection point of the pulled-out earthing bar, which can be loaded with up to 31.5 kA for 3 s, is located behind the cover of the wiring duct on the right. To use the connection point, remove the cover of the wiring duct.



① Earthing busbar
② Connection point (M12) for earthing accessories (max. 25 kA 3s)
③ Connection point (M12) for earthing accessories (max. 31.5 kA 3s)
④ Cover of right-hand wiring duct

Product	Adapter for work-in-progress earth	Diameter of spherical bolt	For cable T-plugs
Nexans Euromold	300GP-B-KB-20	20 mm	430TB/G; 300PB/G
	300GP-B-KB-25	25 mm	K430TB/G; K300PB/G
	800GP-B-KB-20	20 mm	480TB/G; 800PB/G
	800GP-B-KB-25	25 mm	484TB/G; 804PB/G489TB/G; 809PB/GK480TB/G;K800PB/GK484TB/G; K804PB/GK489TB/G; K809PB/GM480TB/G; M800PB/GM484TB/G; M804PB/GM489TB/G; M809PB/GP480TB/G;P800PB/GP484TB/G; P804PB/GP489TB/G; P809PB/G
NKT	E 20 M12	20 mm / 25 mm	CB 24-630; CC 24-630CB 24-1250/2; CC 24-1250/2CB 36-630; CC 36-630
	E 20 M16	20 mm / 25 mm	CB 36-630(1250); CC 36-630(1250)CB 42-1250/3, CC 42-2500/3
Tyco Electronics Raychem	RSTI-68EA20RSTI-68EA25	20 mm / 25 mm	RSTI-58xx; RSTI-CC-58xxRSTI-68xx; RSTI-CC-68xxRSTI-395x; RSTI-CC-395xRSTI-595x; RSTI-CC-595xRSTI-695x; RSTI-CC-695x

27 Verification of safe isolation from supply

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Verify safe isolation from supply.

⇨ Possible sources of failure:
- Defective voltage indicator (or device for function testing of the coupling section)
- Maloperation of the voltage indicator (or device for function testing of the coupling section)

⇨ Test the function of the voltage indicator and the coupling section in accordance with national standards:
- On a live panel
- With a test unit according to IEC 61243-5/EN 61243-5
- On all phases

⇨ Use only voltage indicators or devices according to EN 61243-5 / IEC 61243-5 / VDE 0682-415 to test the function of the coupling section. The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.

⇨ Perform repeat test of interface conditions at the capacitive interfaces, as well as on the indicators according to the customer's specifications or national standards.

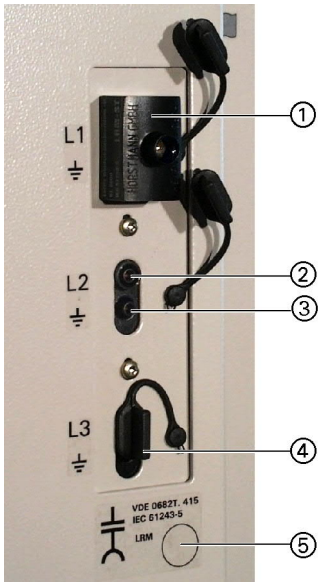
⇨ Do not use short-circuiting jumpers as separate plugs. The function of the surge arrester installed is not provided if short-circuiting jumpers are used.

☞INFORMATION

The following descriptions do not substitute reading the manufacturer documentation.

⇨ Before using the voltage detecting systems, read the supplied manufacturer documentation.

27.1 LRM plug-in sockets



① LRM voltage indicator
② Plug-in socket (interface phase L2)
③ Earthing socket (interface phase L2)
④ Cover
⑤ Documentation to repeat test of interface condition

Fig. 148: LRM plug-in sockets

⇨ Remove the covers from the plug-in sockets (interfaces of phases L1, L2 and L3).

⇨ Insert the LRM voltage indicator consecutively into the plug-in sockets of the phases L1, L2 and L3.

✔ If the LRM voltage indicator does **not** flash or light up in any of the 3 phases, the phases are not live.

⇨ Refit the covers on the plug-in sockets.

Indication of LRM voltage indicator		Description of the indication
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	No lighting up or flashing of the indication	Phase isolated from supply

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

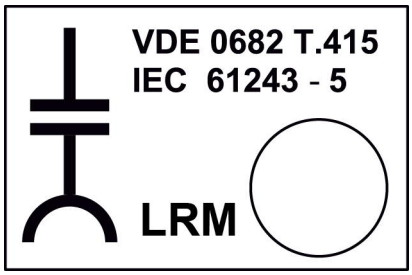


Fig. 149: Documentation to repeat test of interface condition

27.2 VOIS and CAPDIS indications

⚠DANGER

Hazardous voltage
Will cause death, injury or property damage.

Only valid for voltage indicators CAPDIS-S1+/S2+.

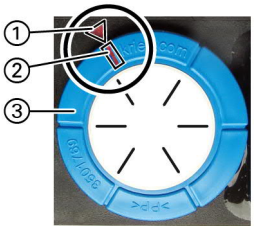
⇨ Do not modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ except with consultation with the regional Siemens representative.

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

- Pull out the C2 module at the rear side of CAPDIS-S1+/S2+.

  ATTENTION: Open printed circuit board may be energized.

- Plug the C2 module into CAPDIS-S1+/S2+ so that the marked arrow on the housing points to the marking on the C2 module.



① Arrow
② Marking on the C2 module
③ C2 module

Fig. 150: Marking of the factory setting on the C2 module (example)

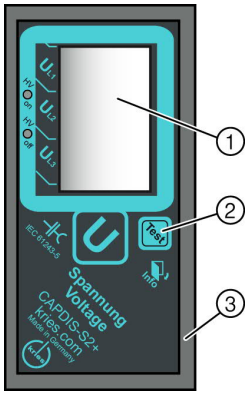
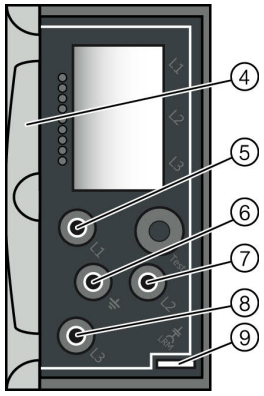
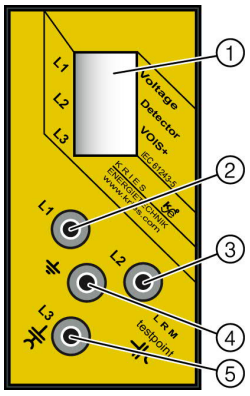


Fig. 151: CAPDIS-S2+: Cover closed



① LC display
② "Test" button
③ Cover
④ Short instructions
⑤ Test socket L1
⑥ Earth socket
⑦ Test socket L2
⑧ Test socket L3
⑨ Duct for signaling cables CAPDIS-M

Fig. 152: CAPDIS-S2+: Cover opened



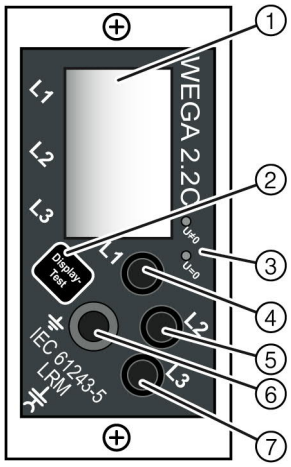
① LC display
② Test socket L1
③ Test socket L2
④ Earth socket
⑤ Test socket L3

Fig. 153: VOIS+: Cover opened

Indication	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+			State of the relay contacts[1]		Description of the indication
	L1	L2	L3	L1	L2	L3	L1	L2	L3	Red	Green	
A0							000			U ≠ 0 ○	U = 0 ●	Operating voltage not present.
A1	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	Operating voltage present.
A2										U ≠ 0 ○	U = 0 ○	• Operating voltage not present. • Auxiliary voltage not available (only CAPDIS-S2+).
A3		ϟ	ϟ		ϟ	ϟ		ϟ	ϟ	U ≠ 0 ●	U = 0 ●	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication).
A4	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ○	Voltage (**not** operating voltage) present.
A5	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "Test" passed (lights up shortly).
A6	-			ϟ ERROR	ϟ	ϟ	ϟ ERROR	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "Test" not passed (lights up shortly).
A7	-			ϟ	ϟ	ϟ	ϟ	ϟ	ϟ	U ≠ 0 ●	U = 0 ●	Overvoltage present (lights up permanently).
A8	-			-			ϟ ERROR	ϟ	ϟ	U ≠ 0 ○	U = 0 ○	Indication: "ERROR" e.g. in case of missing auxiliary voltage.

[1] ○ ○ LED does not light up, ● ● LED lights up

27.3 WEGA indications



① LC display (illuminated for WEGA 2.2C)
② "Display Test" button
③ Test socket L1
④ Test socket L2
⑤ Earth socket
⑥ Test socket L3

Fig. 154: Operating elements WEGA 1.2C/2.2C

Indication	WEGA 1.2C			WEGA 2.2C					Description of the indication
	L1	L2	L3	L1	L2	L3	State of the relay contacts[1]		
							Red	Green	
A0							U ≠ 0 ○	U = 0 ●	• Operating voltage not present.
A1	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	• Operating voltage present. • Integrated repeat test passed.
A2							U ≠ 0 ○	U = 0 ○	• Operating voltage not present.
A3	ϟ ϟ			ϟ ϟ			U ≠ 0 ●	U = 0 ●	• Failure of the operating voltage at phase L1 • Operating voltage present at phases L2 and L3. • Integrated repeat test passed (L2 and L3).
A4	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	• Voltage present, current monitoring of coupling section below limit value.
A5	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ●	U = 0 ○	If "Display Test" button is pressed: • Display test passed.
A6	ϟ ϟ ϟ			ϟ ϟ ϟ			U ≠ 0 ○	U = 0 ●	In operation: • Voltage present and integrated repeat test passed. • Voltage signal too high.
A7				ϟ ϟ ϟ			U ≠ 0 ○	U = 0 ○	• Auxiliary voltage missing.

[1] ○ ○ LED does not light up, ● ● LED lights up

28 Replacing HV HRC fuse-links

The text below describes replacing the fuse-links in the auxiliary transformer panel.
The procedure is identical for all other panel types with HV HRC fuse-links.

For data to usable HV HRC fuse-links see page 47, "Selection of HV HRC fuse-links".

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

NOTICE

Use of incorrect fuse-links or extension tubes
Can damage the fuse box or the switchgear.

- ⇨ Use only fuse-links tested by Siemens, which are listed in the transformer protection table.
- ⇨ The use of other fuse-links must be checked by Siemens in advance. Contact the Siemens Service Hotline.

NOTICE

Damage to the switchgear due to stressed HV HRC fuse-links!
When a HV HRC fuse-link has tripped, the HV HRC fuse-links in the two other phases may also have been stressed.

- ⇨ Replace the HV HRC fuse-links in all 3 phases.

⚠CAUTION

Explosion hazard due to internal arc
Can cause injury and property damage.

If panels with fuses are equipped with an incorrect cable compartment cover, the fuse slide located inside the fuse box can detach and slip out.

- ⇨ In panels with fuses, use the cable compartment cover intended for this purpose.

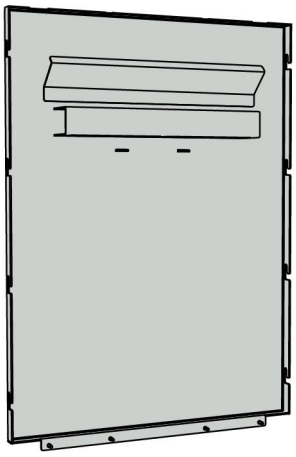


Fig. 155: Example of HV HRC fuse compartment cover, view from the rear

Motor operating mechanism

With the cable compartment cover removed, the electrical power supply of the motor operating mechanism is interrupted by an auxiliary switch located at the cable compartment cover (option).

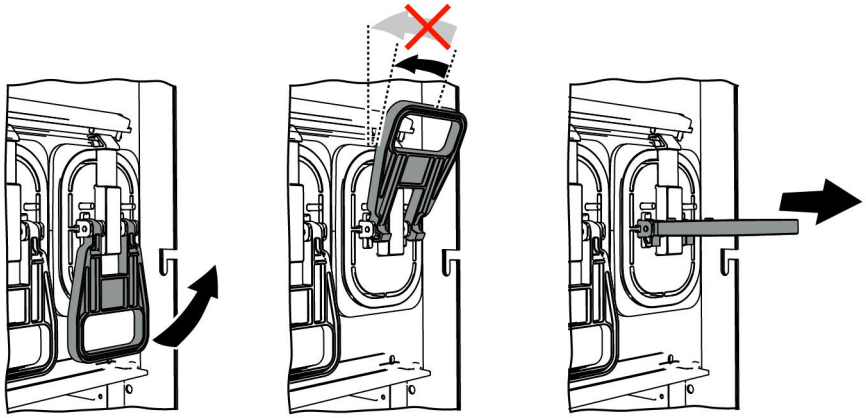
Opening the HV HRC fuse compartment

⇨ Isolate and earth the feeder.

⇨ Remove the HV HRC fuse compartment cover (see page 185, "Removing and mounting the connection compartment covers").

Detaching the gasket of the fuse slide

⇨ Push the handle of the fuse slide **slightly** upwards towards the stop in order to detach the gasket in this way and be able to pull the fuse slide out more easily.



⚠CAUTION

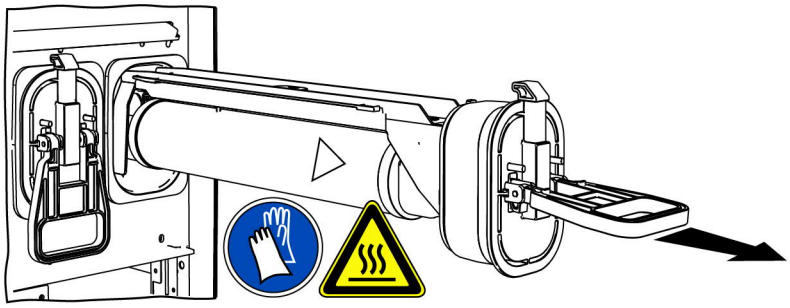
Risk of burning
Hot fuse-links can cause burns during replacement.

⇨ Wear gloves.

⇨ Let hot fuse-links cool down before replacing.

Removing the fuse slide

⇨ Withdraw the fuse slide with the HV HRC fuse-link.

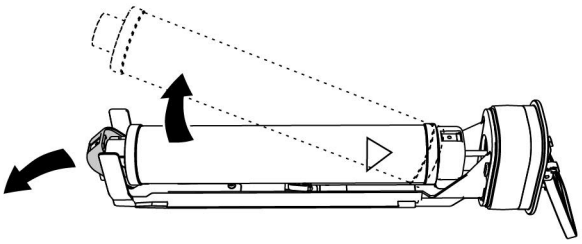


Replacing the HV HRC fuse-links

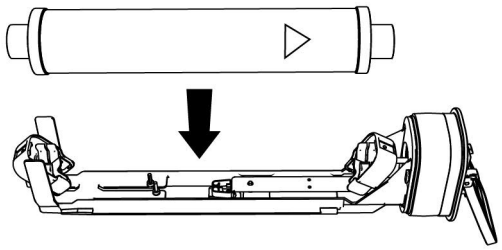
When a HV HRC fuse-link has tripped, replace the HV HRC fuse-links in all three phases.

⇨ Lay the HV HRC fuse-link on a flat, clean and firm underground.

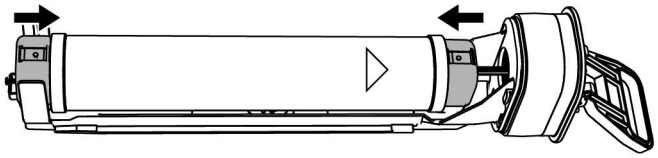
⇨ Push the cover of the HV HRC fuse-link (on the opposite side of the housing cover) aside, and pull the HV HRC fuse-link out of the fuse slide.



⇨ Fit new HV HRC fuse-link into the contact springs and observe the striker position. The arrow on the HV HRC fuse-link must point towards the box cover.

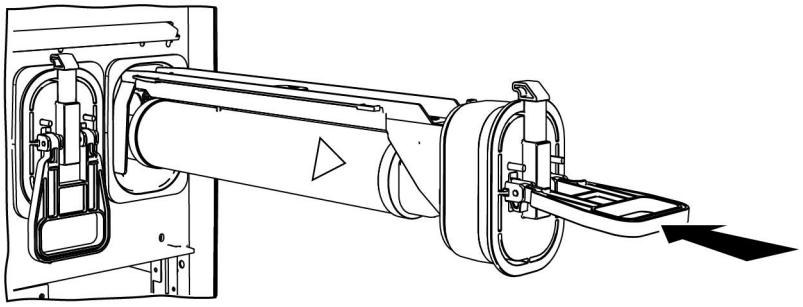


⇨ Verify correct seating of the covers and the HV HRC fuse-link.



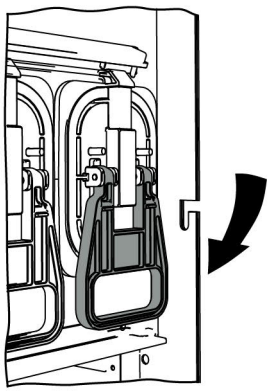
Inserting the fuse slide

⇨ Push the fuse slide into the guide slot of the fuse box.



⇨ Push the fuse slide into the fuse box as far as it will go. The collar of the fuse slide cover must rest on the cast-resin frame of the fuse box.

⇨ Push the handle of the fuse slide down until it latches tight.



Closing the HV HRC fuse compartment cover

The HV HRC fuse compartment cover can only be hooked in correctly if all fuse slides are properly latched in.

⇨ Pull the locking lever of the HV HRC fuse compartment upwards and hold it.

⇨ Hook the HV HRC fuse compartment cover in, see page 185, "Removing and mounting the connection compartment covers".

⇨ Release the interlocking lever.

✔ Replacing the HV HRC fuse-links is completed.

29 Operating the feeder voltage transformer

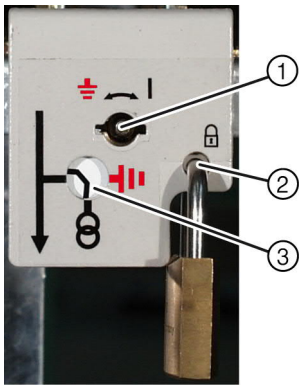
29.1 Switching off the feeder voltage transformer

⚠DANGER

Mortal danger due to internal arc when the cover is open!
When the panel is live, operating the voltage transformer disconnecting facility device can cause serious injury or death due to an internal arc.

⇨ Operate the voltage transformer disconnecting facility only when the feeder is earthed.

Voltage transformers can be disconnected from the feeder and earthed via the voltage transformer disconnecting facility. The voltage transformer disconnecting facility is located in the cable compartment.



① Actuating opening for double-bit key
② Opening for padlock
③ Position indicator

Fig. 156: Voltage transformer disconnecting facility for the voltage transformer

⇨ Earth the feeder.
⇨ Remove the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").
⇨ Insert the double-bit key (5 mm diameter) into the actuating opening.
⇨ Remove the padlock.
⇨ Turn the double-bit key swiftly and continuously 180° counter-clockwise.

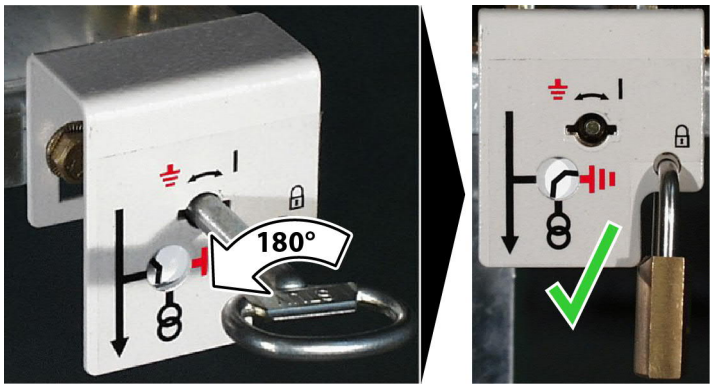


Fig. 157: Switch the three-position disconnecting facility to EARTHED position.

✔ The position indicator shows the EARTHED position.
⇨ Refit and lock the padlock.
⇨ Remove the double-bit key.
✔ The voltage transformer is isolated from high-voltage, earthed, and secured against reclosing.

29.2 Switching on the feeder voltage transformer

⚠DANGER

Mortal danger due to internal arc when the cover is open!
When the panel is live, operating the voltage transformer disconnecting facility device can cause serious injury or death due to an internal arc.

⇨ Operate the voltage transformer disconnecting facility only when the feeder is earthed.

To reconnect a earthed voltage transformer to the feeder, switch the voltage transformer disconnector on again.

⇨ Earth the feeder.

⇨ Remove the cable compartment cover (see page 185, "Removing and mounting the connection compartment covers").

⇨ Insert the double-bit key (5 mm diameter) into the actuating opening of the voltage transformer isolating device.

⇨ Remove the padlock from the voltage transformer isolating device.

⇨ Turn the double-bit key clockwise 180° swiftly and continuously.

✔ The switch position indicator of the voltage transformer isolating device shows the CLOSED position.

⇨ Refit and lock the padlock.

⇨ Remove the double-bit key.

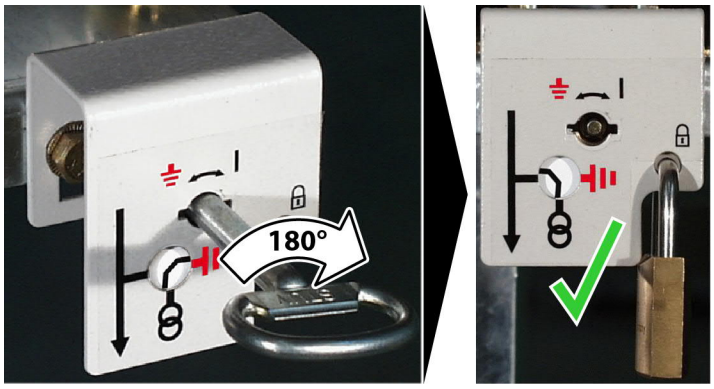


Fig. 158: Switching the voltage transformer isolating device to the CLOSED position

✔ The voltage transformer is connected to high voltage and secured against unauthorized opening.

⇨ Re-install the connection compartment cover (see page 185, "Removing and mounting the connection compartment covers").

30 Short instructions

☞INFORMATION
The short instructions in this section give just an overview of the sequence of switching operations. ⇨ Read the description of the control elements, and observe the instructions for the switching operations and the warnings specified in there (see page 187, "Operation" and following).

30.1 Switching circuit-breaker panels and bus sectionalizer panels with one three-position disconnector

This chapter describes the manual operation of the following panel types:

- Bus sectionalizer panels with one three-position disconnector:
  (a forced sequence circuit is possible)
- Circuit-breaker panels

The operations are shown using a circuit-breaker panel as an example.

Connecting the feeder to the busbar

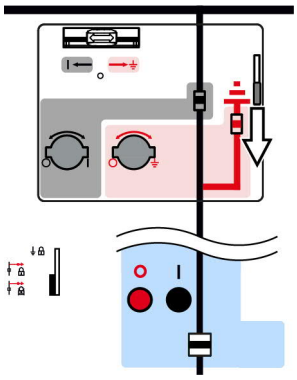
Precondition

- Three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

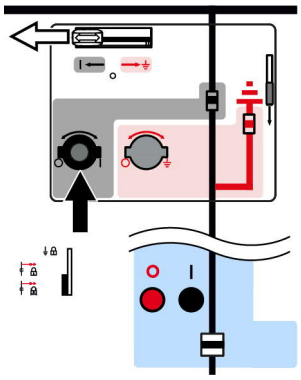
- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Push the interrogation lever downwards and hold it.

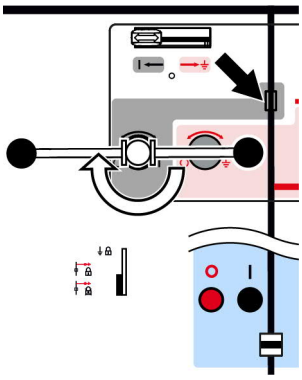
2



⇨ Push the control gate to the left and hold it.

✔ The actuating opening of the disconnector is free.

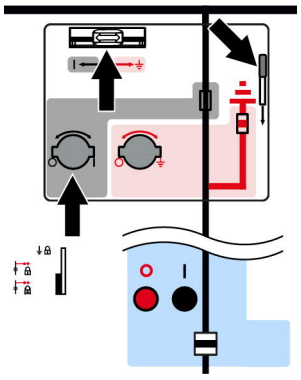
3



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The disconnector is in the CLOSED position.

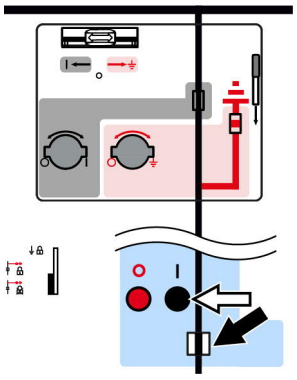
4



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

5



⇨ To connect the feeder to the busbar, close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The feeder is connected to the busbar.

Disconnecting the feeder from the busbar

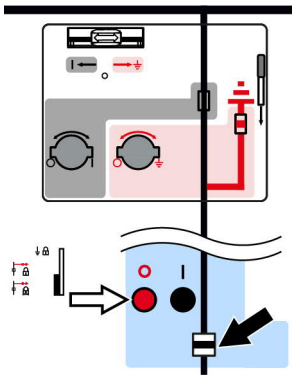
Precondition

- Three-position disconnector in the CLOSED position
- Circuit-breaker in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

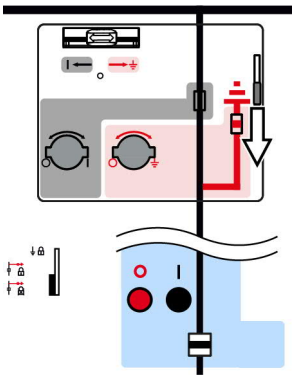
1



⇨ To disconnect the feeder from the busbar, open the circuit-breaker.

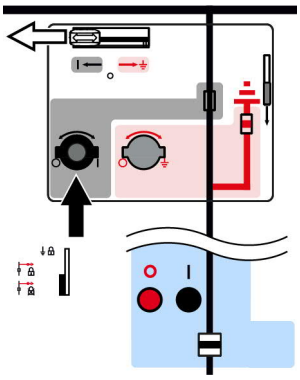
✔ The circuit-breaker is in the OPEN position. The feeder is disconnected from the busbar.

2



⇨ Push the interrogation lever downwards and hold it.

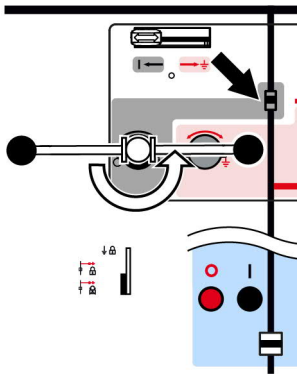
3



⇨ Push the control gate to the left and hold it.

✔ The actuating opening of the disconnector is free.

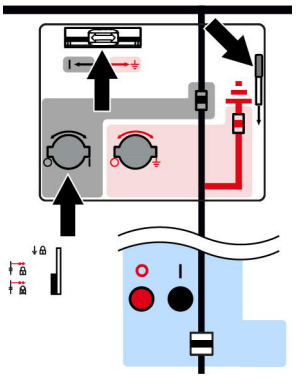
4



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The disconnector is in the OPEN position.

5



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

Earthing the feeder

NOTICE

Maloperation of the locking device
Can cause considerable property damage.

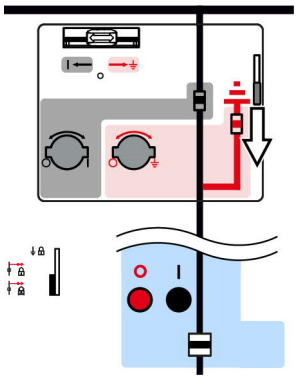
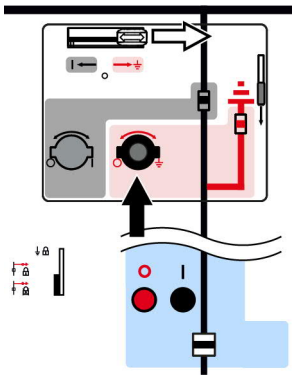
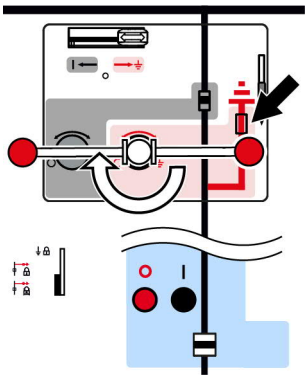
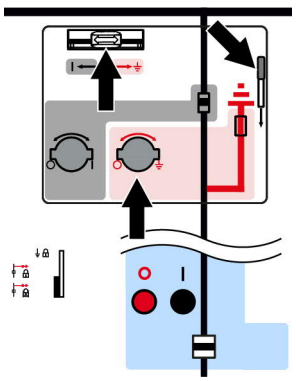
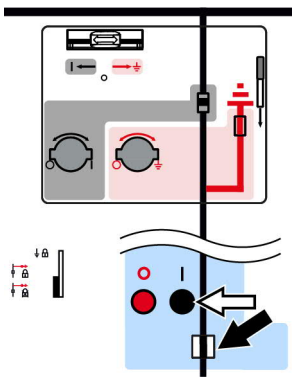
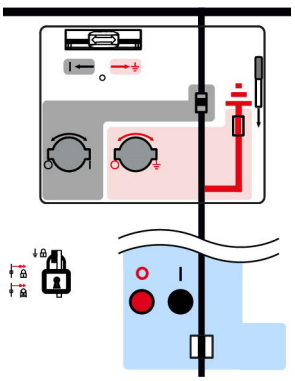
For a panel optionally equipped **without interlocking between locking device and three-position disconnector**: If the circuit-breaker and the three-position disconnector are in CLOSED position, do **not** operate the locking device.

If the locking device is operated, all electrical and mechanical opening commands (e.g. protection tripping) are ineffective.

⇨ Operate the locking device only under the following conditions:
- Three-position disconnector switched to READY-TO-EARTH position.
- Circuit-breaker switched to CLOSED position.

Precondition
- Three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

1  ⇨ Push the interrogation lever downwards and hold it.	2  ⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch is open.	3  ⇨ Insert the operating lever. Turn it clockwise 180°. ✔ The disconnector is in the READY-TO-EARTH position.
4  ⇨ Remove the operating lever. ✔ The interrogation lever and the control gate move to their initial position.	5  ⇨ To earth the feeder, close the circuit-breaker. ✔ The circuit-breaker is in the CLOSED position. The feeder is earthed.	6  ⇨ Push the locking device upwards. Fit a padlock.

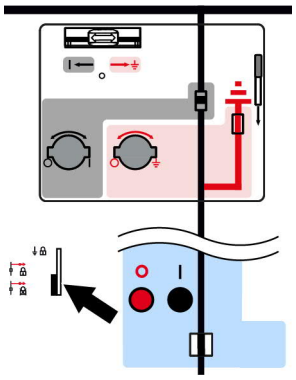
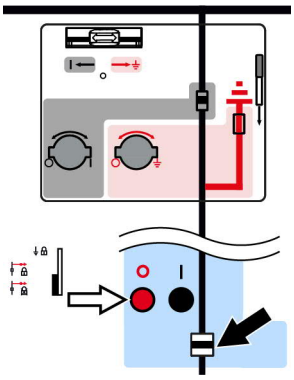
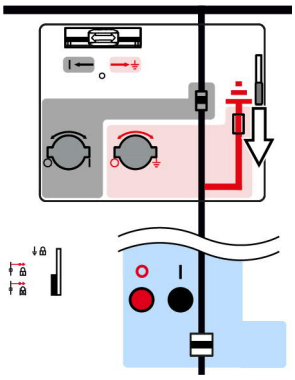
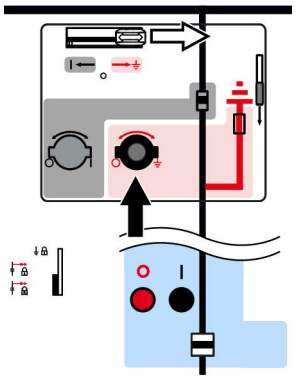
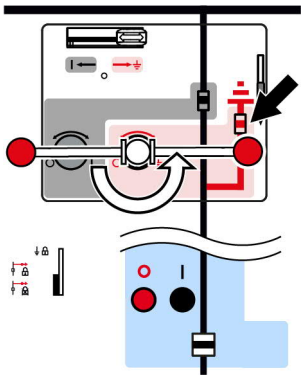
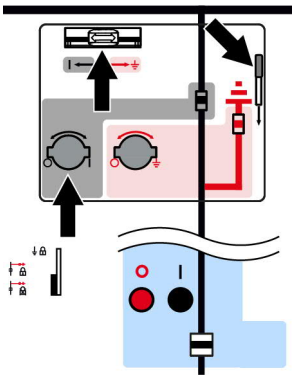
De-earthing the feeder

Precondition

- Three-position disconnector in the READY-TO-EARTH position
- Circuit-breaker in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1  ⇨ Remove the padlock. ✔ The locking device goes down.	2  ⇨ To de-earth the feeder, open the circuit-breaker. ✔ The circuit-breaker is in the OPEN position. The feeder is de-earthed.	3  ⇨ Push the interrogation lever downwards and hold it.
4  ⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch is open.	5  ⇨ Insert the operating lever. Turn it counterclockwise 180°. ✔ The disconnector is in the OPEN position.	6  ⇨ Remove the operating lever. ✔ The interrogation lever and the control gate move to their initial position.

Circuit-breaker panel: Earthing the feeder (with forced sequence circuit)

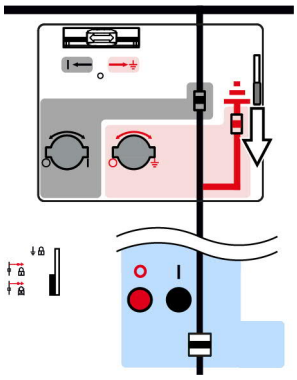
Precondition

- Three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

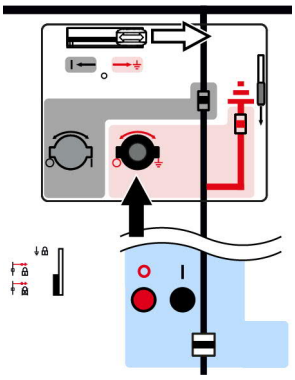
- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Push the interrogation lever downwards and hold it.

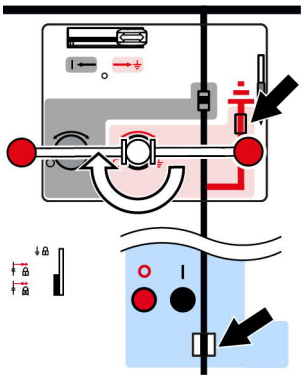
2



⇨ Push the control gate to the right and hold it.

✔ The actuating opening of the earthing switch is open.

3

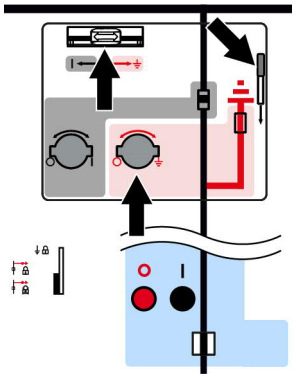


⇨ Insert the operating lever. Turn it clockwise 180°.

The circuit-breaker closes automatically (time relay adjustable; factory setting: 1 second).

✔ The earthing switch is in the READY-TO-EARTH position. The circuit-breaker is in the CLOSED position. The feeder is earthed.

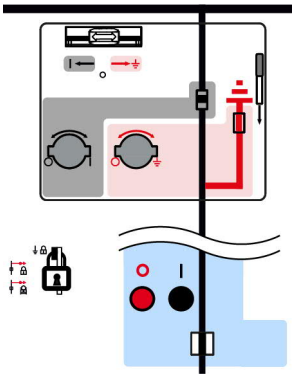
4



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position

5



⇨ Push the locking device upwards. Fit a padlock.

Circuit-breaker panel: De-earthing the feeder (with forced sequence circuit)

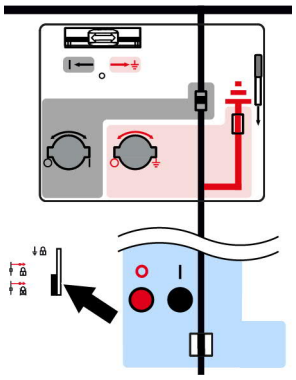
Precondition

- Three-position disconnector in the READY-TO-EARTH position
- Circuit-breaker in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

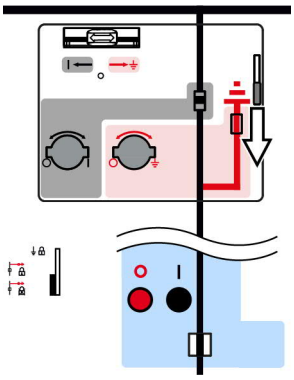
1



⇨ Remove the padlock.

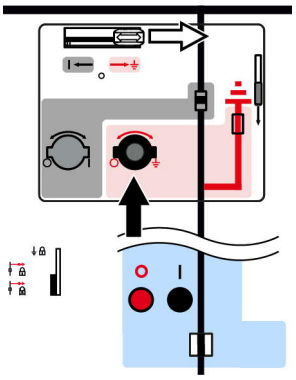
✔ The locking device goes down.

2



⇨ Push the interrogation lever downwards and hold it.

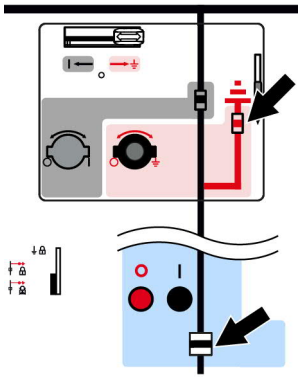
3



⇨ Push the control gate to the right and hold it.

✔ The actuating opening of the earthing switch is open.

4

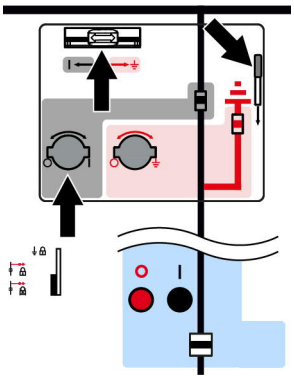


⇨ Insert the operating lever.
Turn it counterclockwise 180°.

The circuit-breaker opens automatically before the disconnector opens.

✔ The earthing switch is in the OPEN position.
The circuit-breaker is in the OPEN position.
The feeder is de-earthed.

5



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate return to their initial position

30.2 Operating vacuum contactor panels

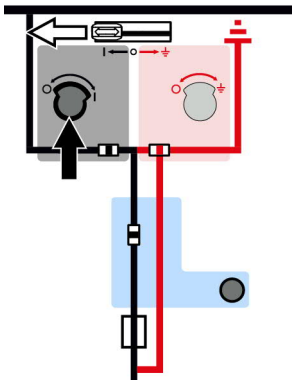
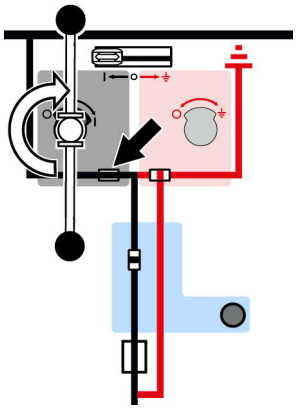
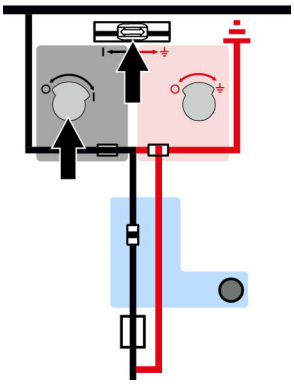
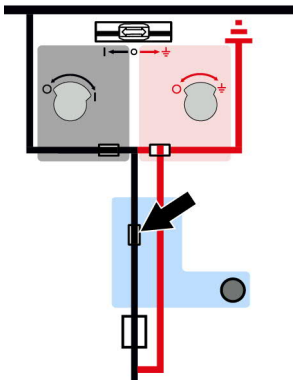
Connecting the feeder to the busbar

Precondition

- Three-position switch-disconnector in OPEN position
- Vacuum contactor in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3	4
			
⇨ Push the control gate to the left and hold it. ✔ The actuating opening of the switch-disconnector opens automatically.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The switch-disconnector is in the CLOSED position.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.	⇨ To connect the feeder to the busbar, close the contactor using the bay controller (e.g. SIPROTEC). ✔ The vacuum contactor is in the CLOSED position The feeder is connected to the busbar.

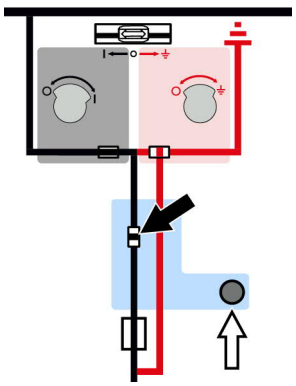
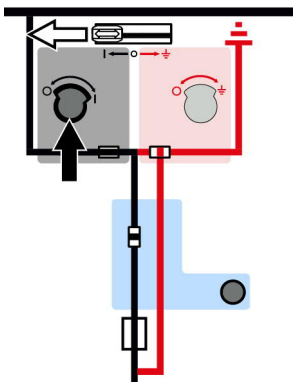
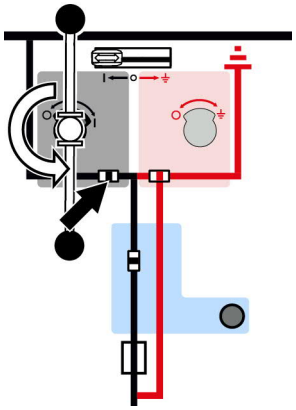
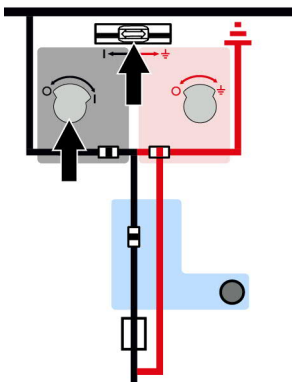
Disconnecting the feeder from the busbar

Precondition

- Three-position switch-disconnector in the CLOSED position
- Vacuum contactor in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3	4
			
⇨ To disconnect the feeder from the busbar, open the contactor with the pushbutton. ✔ The vacuum contactor is in the OPEN position The feeder is disconnected from the busbar.	⇨ Push the control gate to the left and hold it. ✔ The actuating opening of the switch-disconnector opens automatically.	⇨ Insert the operating lever. Turn counterclockwise as far as it will go. ✔ The switch-disconnector is in the OPEN position.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

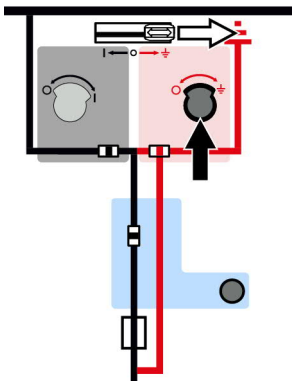
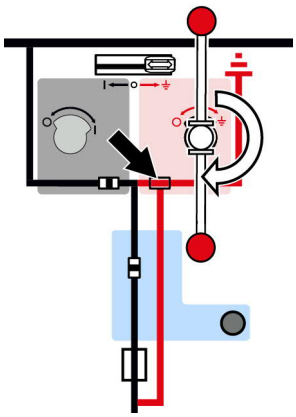
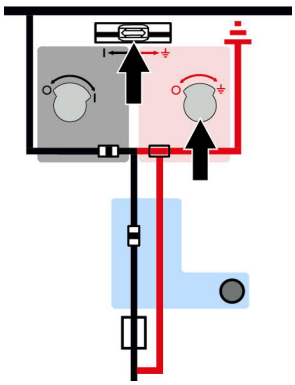
Earthing the feeder

Precondition

- Three-position switch-disconnector in OPEN position
- Vacuum contactor in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch opens automatically.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The switch-disconnector is in the EARTHED position. The feeder is earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

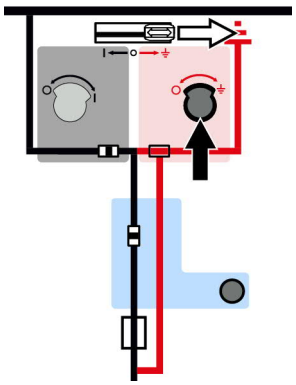
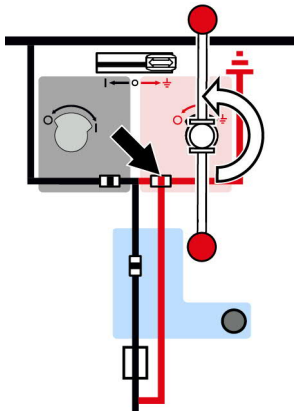
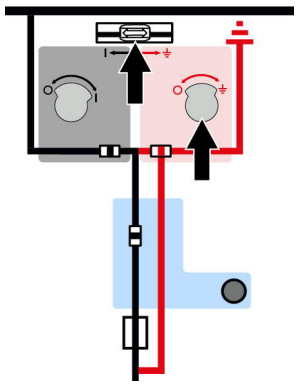
De-earthing the feeder

Precondition

- Three-position switch-disconnector in the EARTHED position
- Vacuum contactor in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

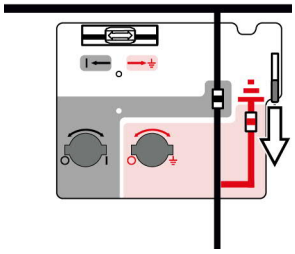
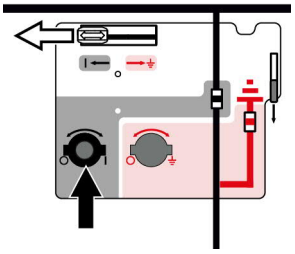
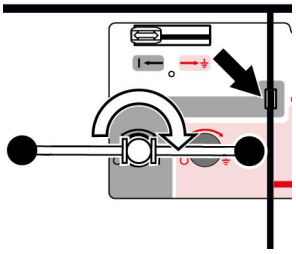
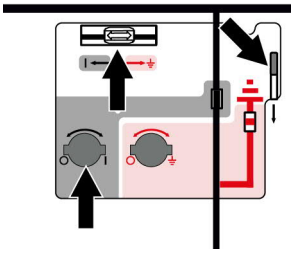
1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch opens automatically.	⇨ Insert the operating lever. Turn counterclockwise as far as it will go. ✔ The switch-disconnector is in the OPEN position. The feeder is de-earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

30.3 Operating the disconnector panel

Connecting the feeder to the busbar

Precondition
- Three-position disconnector in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

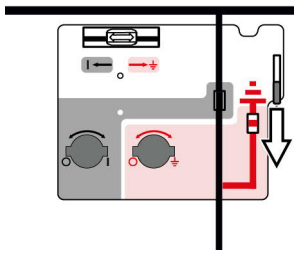
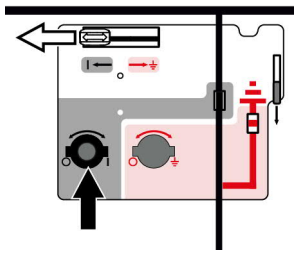
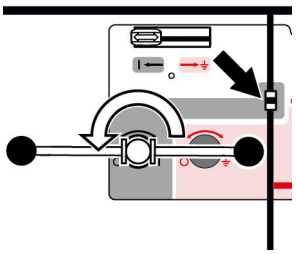
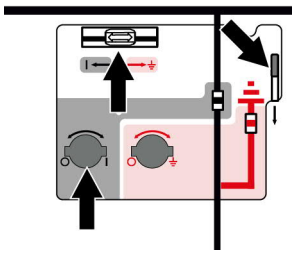
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

2	3	4	5
			
⇨ Push the interrogation lever downwards and hold it.	⇨ Push the control gate to the left and hold it. ✔ The actuating opening of the disconnector is free.	⇨ Insert the operating lever. Turn it clockwise 180°. ✔ The disconnector is in the CLOSED position. The feeder is connected to the busbar.	⇨ Remove the operating lever. ✔ The interrogation lever and the control gate return to their initial position

Disconnecting the feeder from the busbar

Precondition
- Three-position disconnector in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

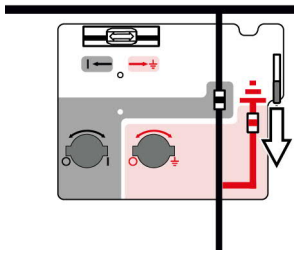
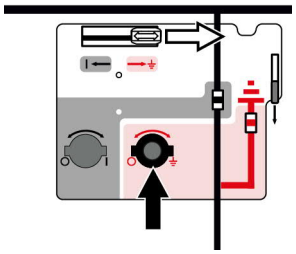
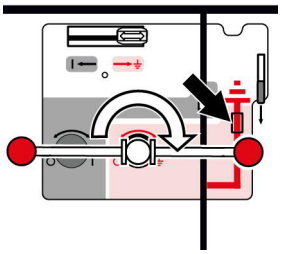
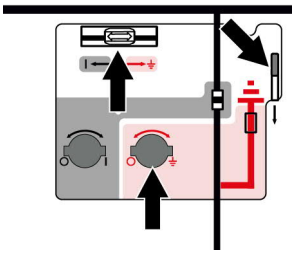
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

2	3	4	5
			
⇨ Push the interrogation lever downwards and hold it.	⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the disconnector is free.	⇨ Insert the operating lever. Turn it counterclockwise 180°. ✔ The disconnector is in the OPEN position. The feeder is disconnected from the busbar.	⇨ Remove the operating lever. ✔ The interrogation lever and the control gate return to their initial position

Earthing the feeder

Precondition
- Three-position disconnector in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

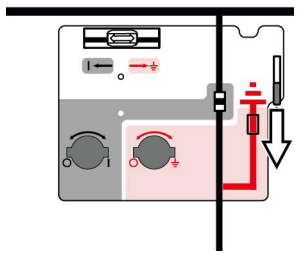
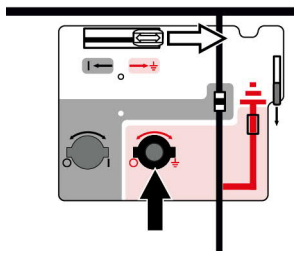
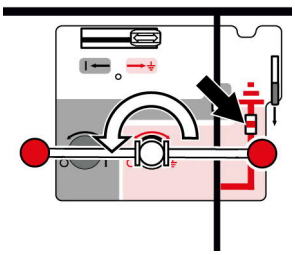
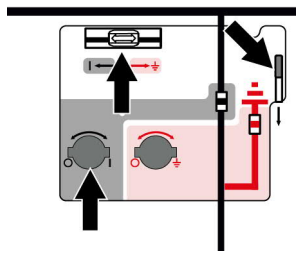
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

2	3	4	5
			
⇨ Push the interrogation lever downwards and hold it.	⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch is open.	⇨ Insert the operating lever. Turn it clockwise 180°. ✔ The disconnector is in the EARTHED position. The feeder is earthed.	⇨ Remove the operating lever. ✔ The interrogation lever and the control gate move to their initial position.

De-earthing the feeder

Precondition
- Three-position disconnector in the EARTHED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

2	3	4	5
			
⇨ Push the interrogation lever downwards and hold it.	⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch is open.	⇨ Insert the operating lever. Turn it counterclockwise 180°. ✔ The disconnector is in the OPEN position.	⇨ Remove the operating lever. ✔ The interrogation lever and the control gate move to their initial position.

30.4 Operating ring-main panels and metering panels (gas-insulated)

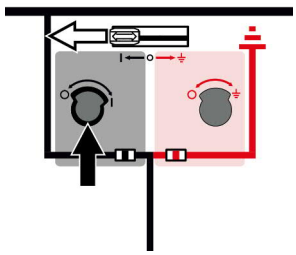
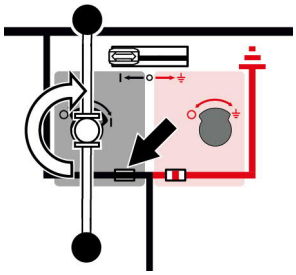
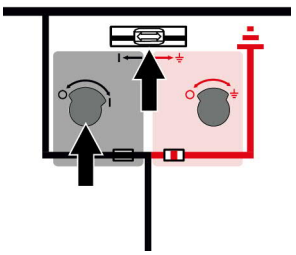
This chapter describes the manual operation of the following panel types:
- Ring-main panel
- Metering panel (gas-insulated)

The operations are shown using a ring-main panel as an example.

Connecting the feeder to the busbar

Precondition
- Three-position disconnector in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

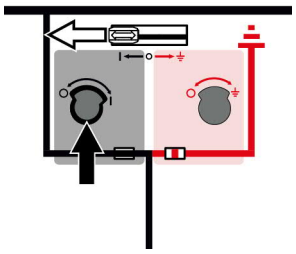
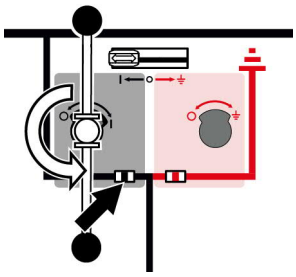
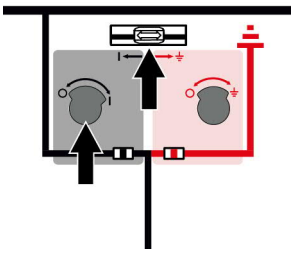
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the left and hold it. ✔ The actuating opening of the disconnector is free.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The disconnector is in the CLOSED position. The feeder is connected to the busbar.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

Disconnecting the feeder from the busbar

Precondition
- Three-position disconnector in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

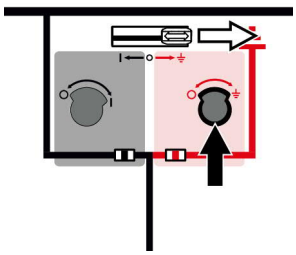
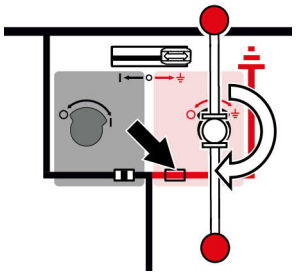
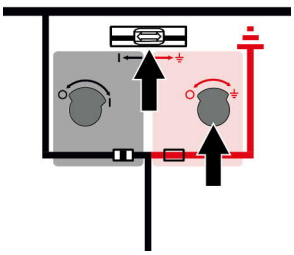
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the left and hold it. ✔ The actuating opening of the disconnector is free.	⇨ Insert the operating lever. Turn counterclockwise as far as it will go. ✔ The disconnector is in the OPEN position. The feeder is disconnected from the busbar.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

Earthing the feeder

Precondition
- Three-position disconnector in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

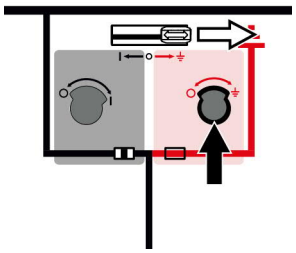
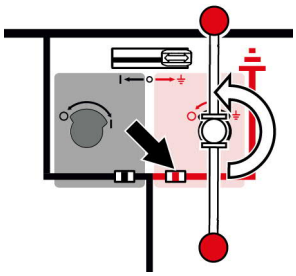
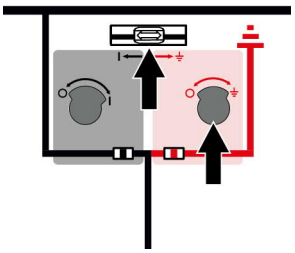
Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch opens automatically.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The disconnector is in the EARTHED position. The feeder is earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

De-earthing the feeder

Precondition
- Three-position disconnector in the EARTHED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")

Preparation
- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch opens automatically.	⇨ Insert the operating lever. Turn counterclockwise as far as it will go. ✔ The disconnector is in the OPEN position. The feeder is de-earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

30.5 Operating the bus sectionalizer panel with 2 three-position disconnectors

Coupling the busbars

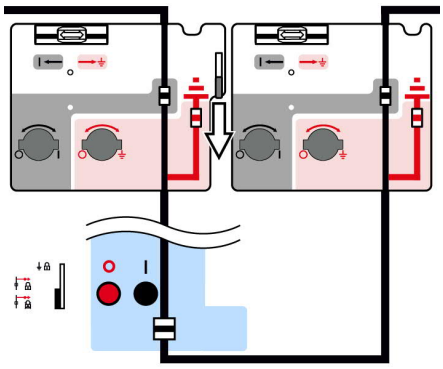
Precondition

- Left-hand three-position disconnector in the OPEN position
- Right-hand three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- "Spring charged" indicator shows "spring charged"

Preparation

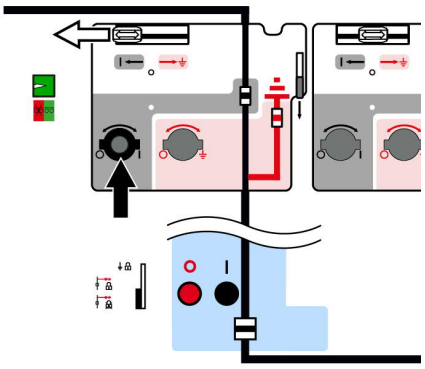
- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Push the interrogation lever downwards and hold it.

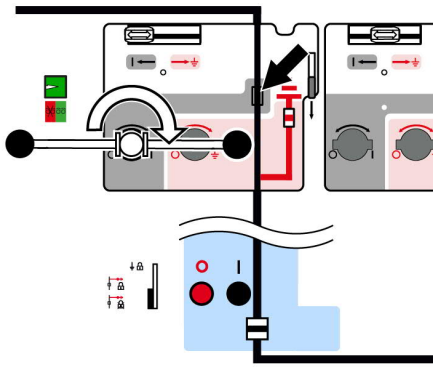
2



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

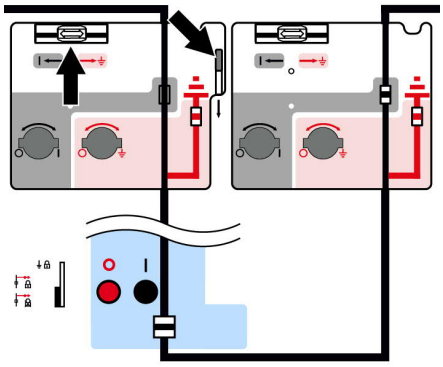
3



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The left-hand disconnector is in CLOSED position.

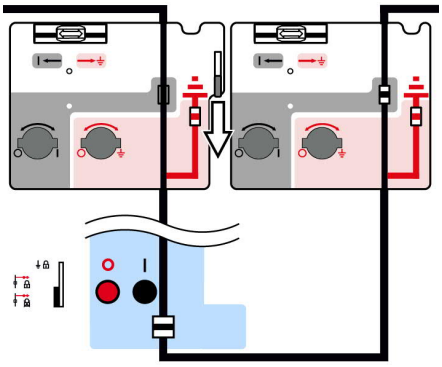
4



⇨ Remove the operating lever.

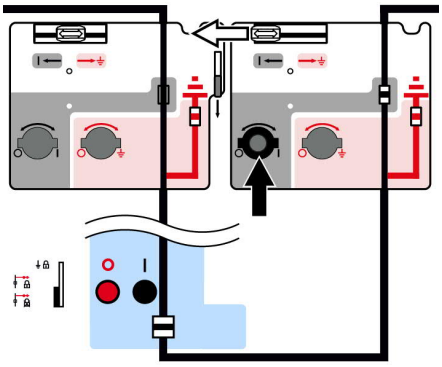
✔ The interrogation lever and the control gate move to their initial position.

5



⇨ Push the interrogation lever downwards again and hold it.

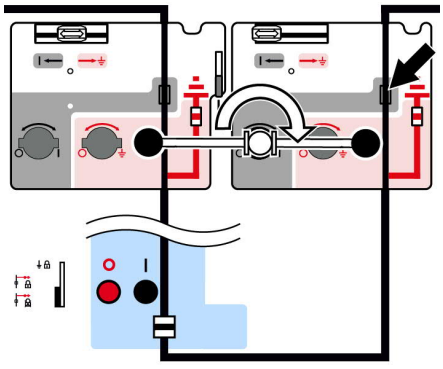
6



⇨ Push the right-hand control gate to the left and hold it.

✔ The actuating opening of the right-hand disconnector is open.

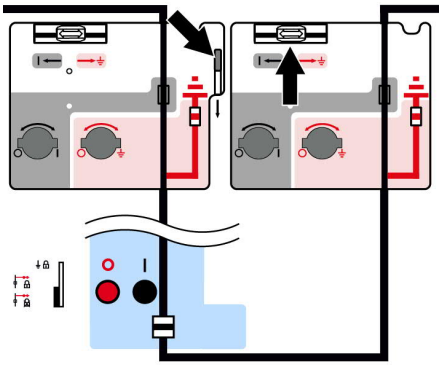
7



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The right-hand disconnector is in the CLOSED position.

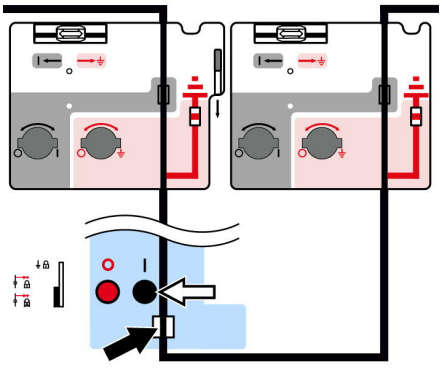
8



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

9



⇨ Close the circuit-breaker to couple the busbars.

✔ The circuit-breaker is in the CLOSED position. The busbar is coupled.

Decoupling the busbars

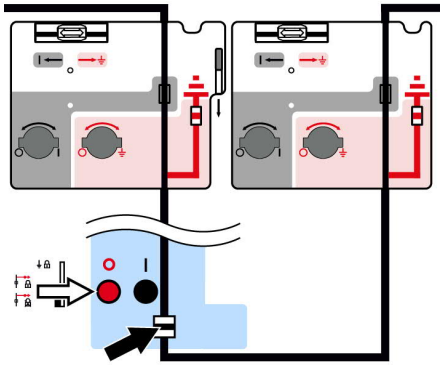
Precondition

- Left-hand three-position disconnector in the CLOSED position.
- Right-hand three-position disconnector in the CLOSED position
- Circuit-breaker in the CLOSED position
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

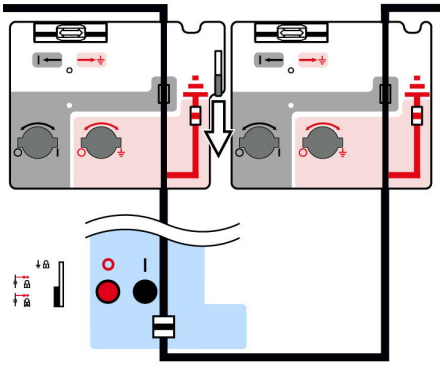
1



⇨ Open the circuit-breaker to decouple the busbars.

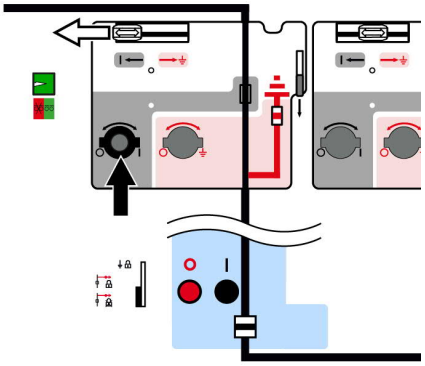
✔ The circuit-breaker is in the OPEN position. The busbar is decoupled.

2



⇨ Push the interrogation lever downwards and hold it.

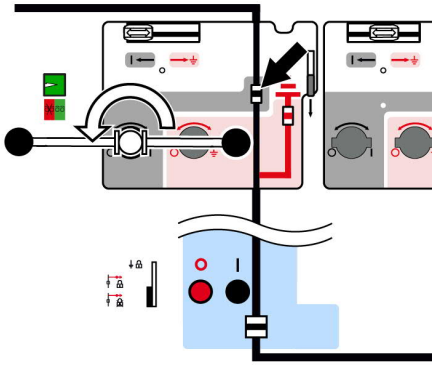
3



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

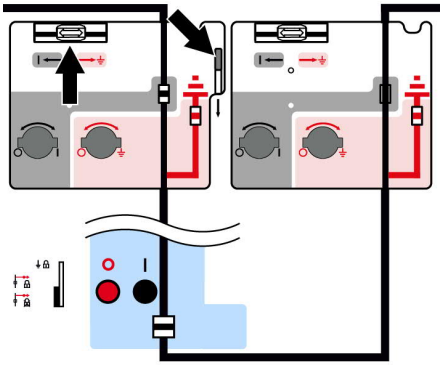
4



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

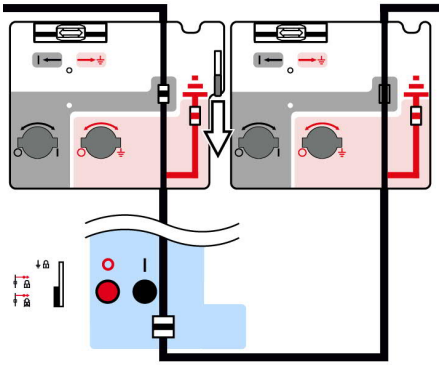
5



⇨ Remove the operating lever.

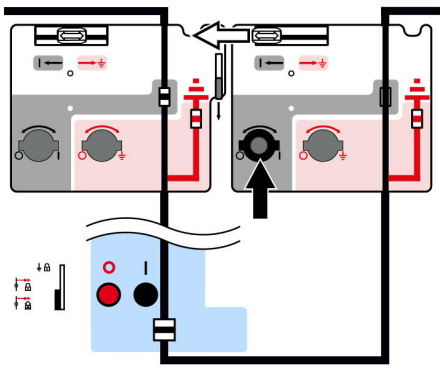
✔ The interrogation lever and the control gate move to their initial position.

5



⇨ Push the interrogation lever downwards again and hold it.

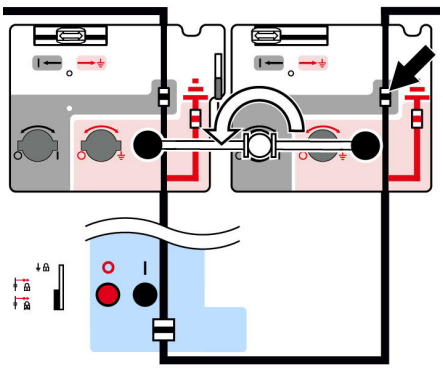
7



⇨ Push the right-hand control gate to the left and hold it.

✔ The actuating opening of the right-hand disconnector is open.

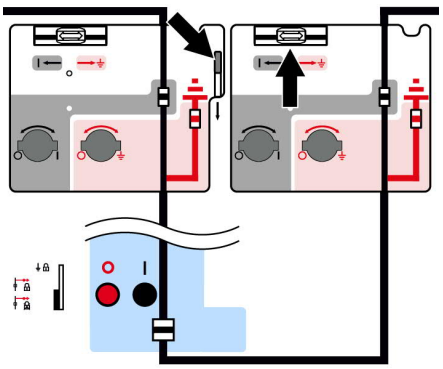
8



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The right-hand disconnector is in the OPEN position.

9



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

Earthing the left-hand busbar system

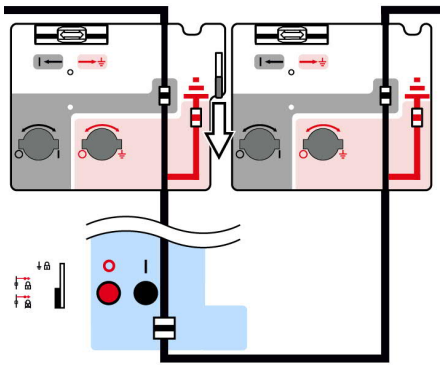
Precondition

- Left-hand three-position disconnector in the OPEN position
- Right-hand three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The left-hand feeder is isolated from supply (see page 207, "Verification of safe isolation from supply").
- "Spring charged" indicator shows "spring charged"

Preparation

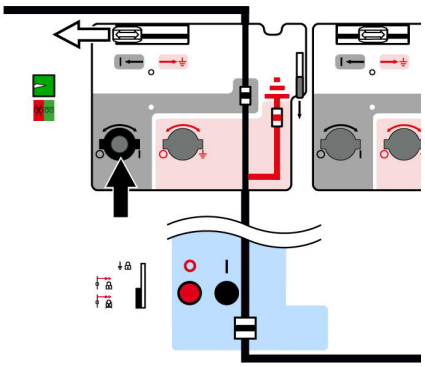
- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Push the interrogation lever downwards and hold it.

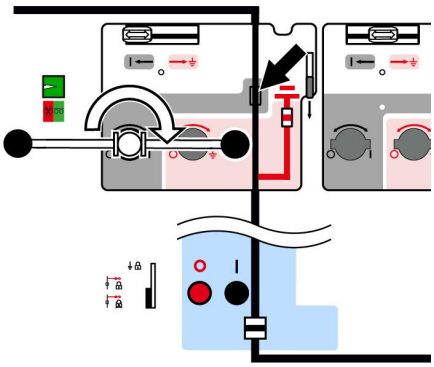
2



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

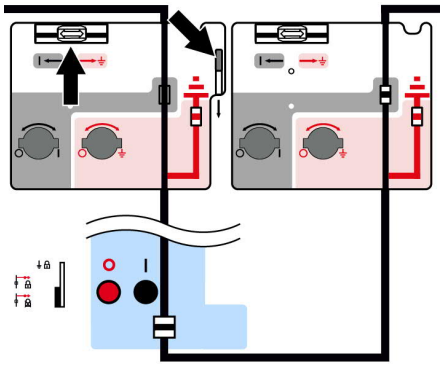
3



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The left-hand disconnector is in CLOSED position.

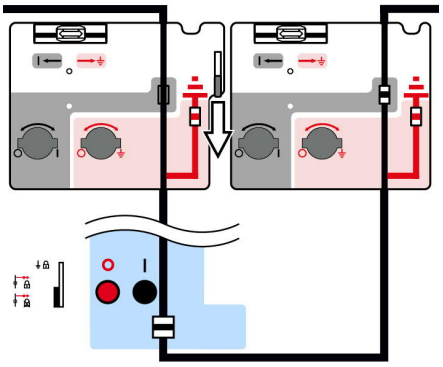
4



⇨ Remove the operating lever.

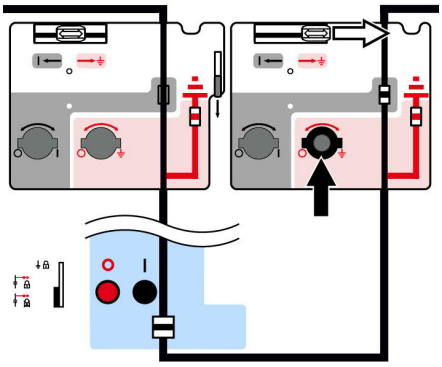
✔ The interrogation lever and the control gate move to their initial position.

5



⇨ Push the interrogation lever downwards again and hold it.

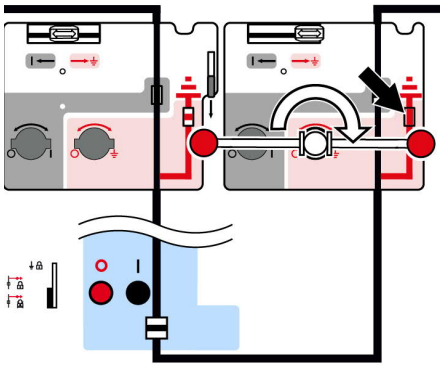
6



⇨ Push the right-hand control gate to the right and hold it.

✔ The actuating opening of the right-hand earthing switch is open.

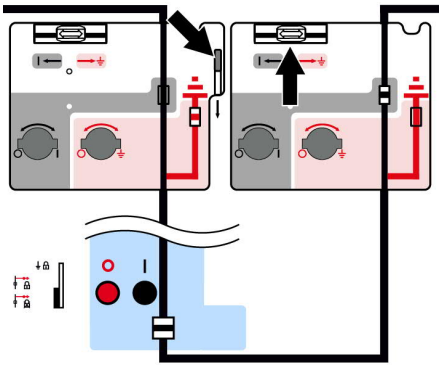
7



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The right-hand disconnector is in the READY-TO-EARTH position.

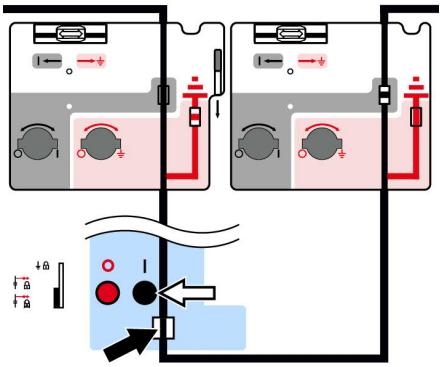
8



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

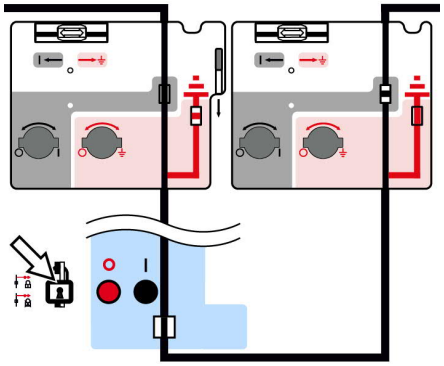
9



⇨ To earth the left-hand busbar system, close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The left-hand busbar system is earthed.

10



⇨ Push the locking device upwards.
Fit a padlock.

De-earthing the left-hand busbar system

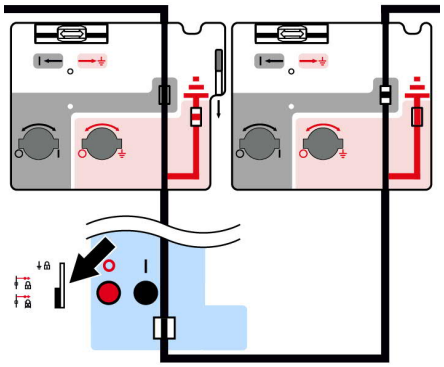
Precondition

- Left-hand three-position disconnector in the CLOSED position.
- Right-hand three-position disconnector in the READY-TO-EARTH position
- Circuit-breaker in the CLOSED position
- The left-hand feeder is isolated from supply (see page 207, "Verification of safe isolation from supply").
- "Spring charged" indicator shows "spring charged"

Preparation

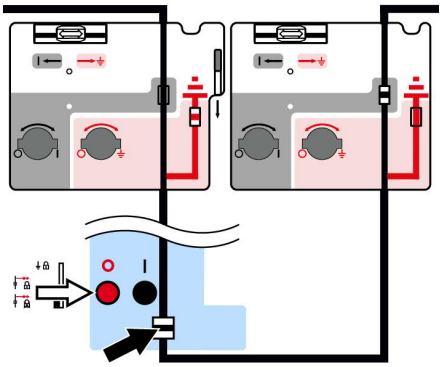
- Check service readiness (see page 190, "Ready-for-service indicator")

1



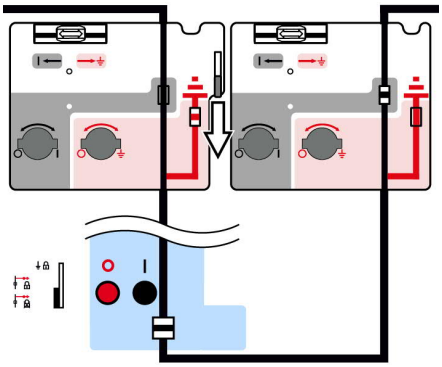
⇨ Remove the padlock.
✔ The locking device goes down.

2



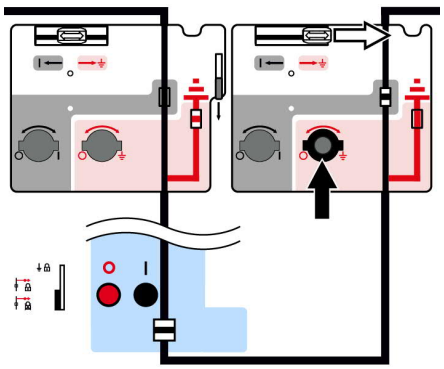
⇨ To de-earth the left-hand busbar system, open the circuit-breaker.
✔ The circuit-breaker is in the OPEN position. The earthing on the left-hand busbar system has been decoupled.

3



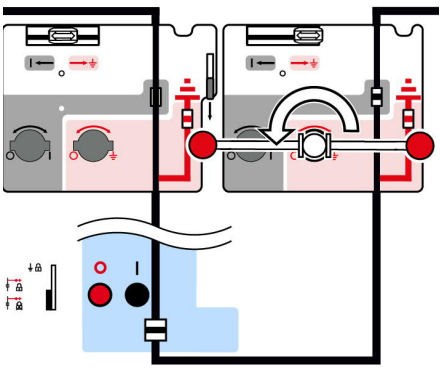
⇨ Push the interrogation lever downwards and hold it.

4



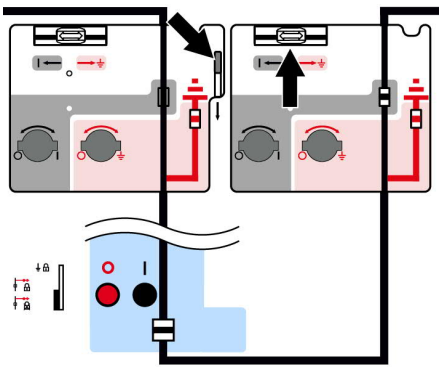
⇨ Push the right-hand control gate to the right and hold it.
✔ The actuating opening of the right-hand earthing switch is open.

5



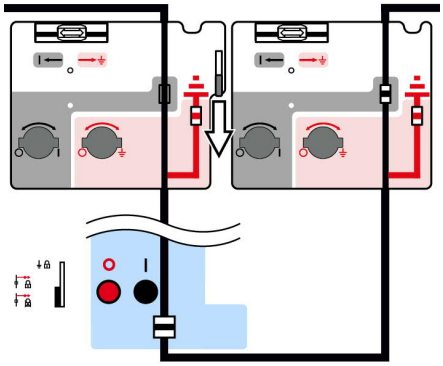
⇨ Insert the operating lever.
Turn it counterclockwise 180°.
✔ The right-hand disconnector is in the OPEN position.

6



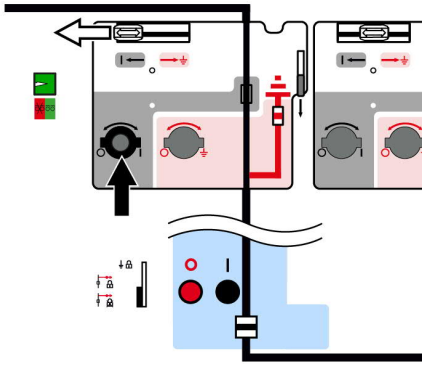
⇨ Remove the operating lever.
✔ The interrogation lever and the control gate move to their initial position.

7



⇨ Push the interrogation lever downwards again and hold it.

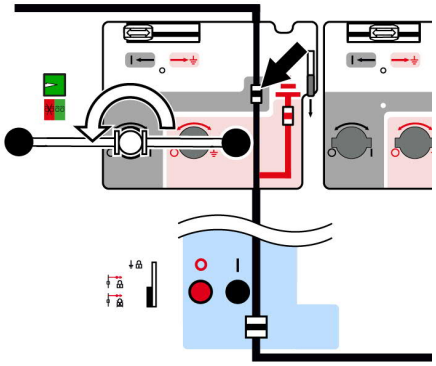
8



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

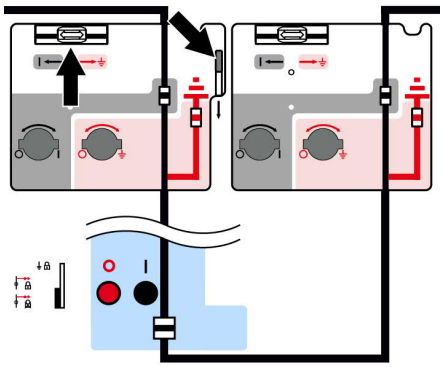
9



⇨ Insert the operating lever.
Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

10



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

Earthing the right-hand busbar system

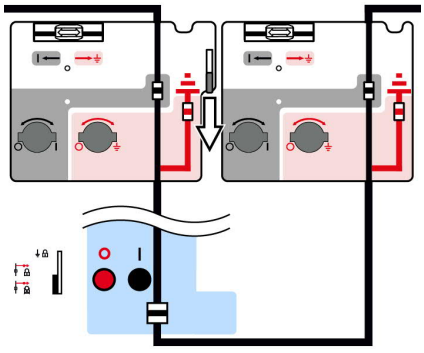
Precondition

- Left-hand three-position disconnector in the OPEN position
- Right-hand three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The right-hand feeder is isolated from supply (see page 207, "Verification of safe isolation from supply").
- "Spring charged" indicator shows "spring charged"

Preparation

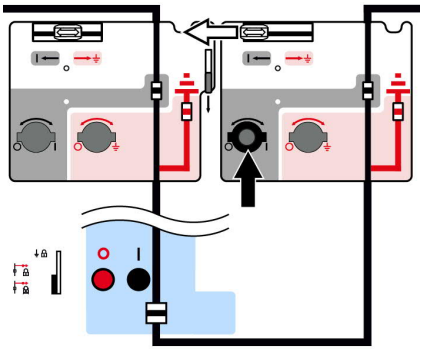
- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Push the interrogation lever downwards and hold it.

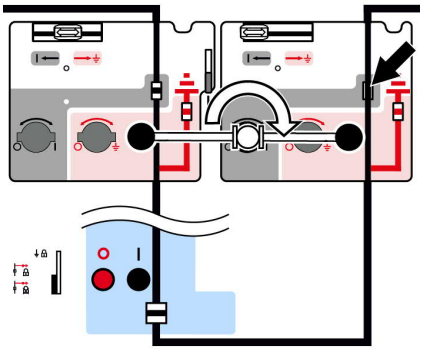
2



⇨ Push the right-hand control gate to the left and hold it.

✔ The actuating opening of the right-hand disconnector is open.

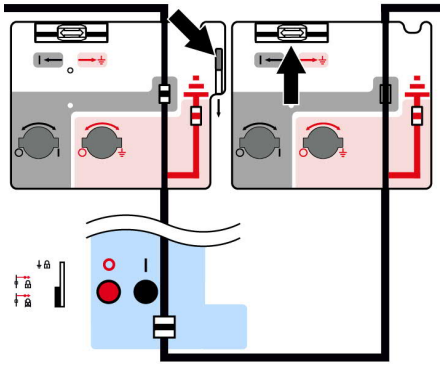
3



⇨ Insert the operating lever.
Turn it clockwise 180°.

✔ The right-hand disconnector is in the CLOSED position.

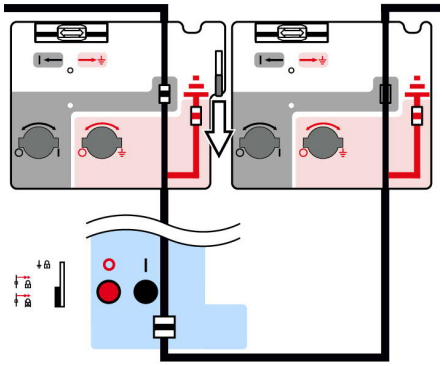
4



⇨ Remove the operating lever.

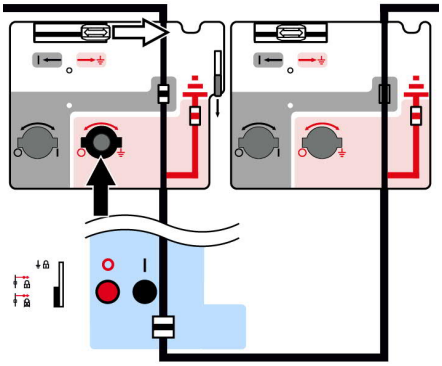
✔ The interrogation lever and the control gate move to their initial position.

5



⇨ Push the interrogation lever downwards again and hold it.

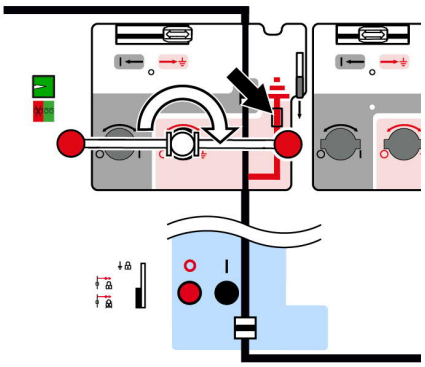
6



⇨ Push the left-hand control gate to the right and hold it.

✔ The actuating opening of the left-hand earthing switch is open.

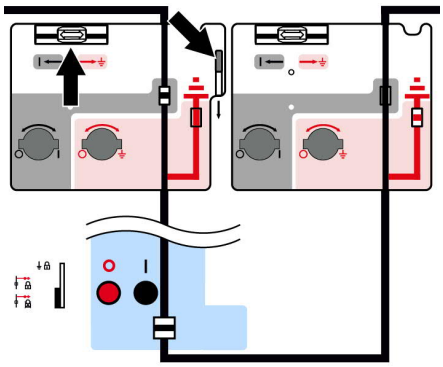
7



⇨ Insert the operating lever.
Turn it clockwise 180°.

✔ The left-hand disconnector is in the READY-TO-EARTH position.

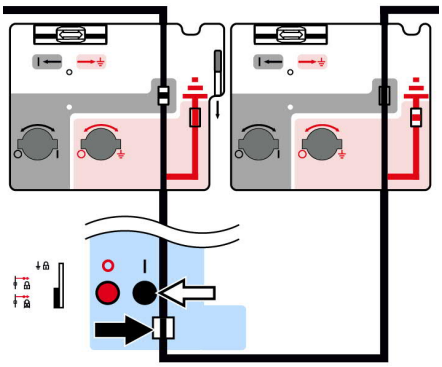
8



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

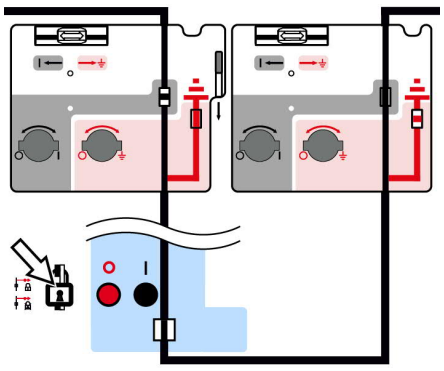
9



⇨ To earth the right-hand busbar system, close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The right-hand busbar system is earthed.

10



⇨ Push the locking device upwards. Fit a padlock.

De-earthing the right-hand busbar system

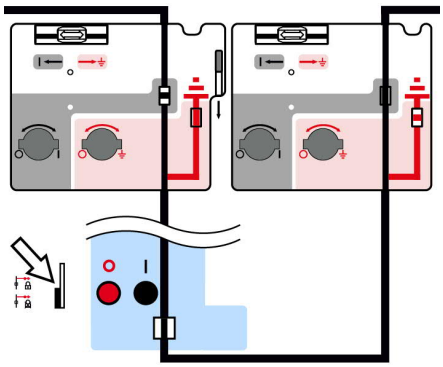
Precondition

- Left-hand three-position disconnector in the READY-TO-EARTH position
- Right-hand three-position disconnector in the CLOSED position
- Circuit-breaker in the CLOSED position
- The right-hand feeder is isolated from supply (see page 207, "Verification of safe isolation from supply").
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

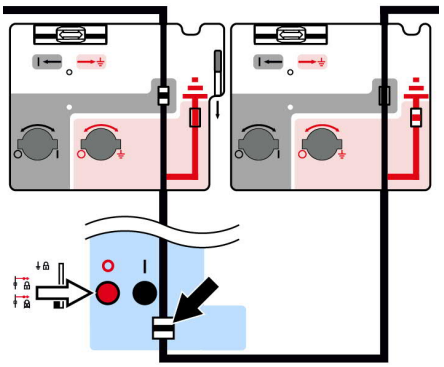
1



⇨ Remove the padlock.

✔ The locking device goes down.

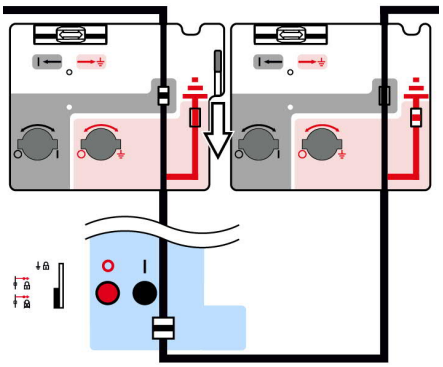
2



⇨ To de-earth the right-hand busbar system, open the circuit-breaker.

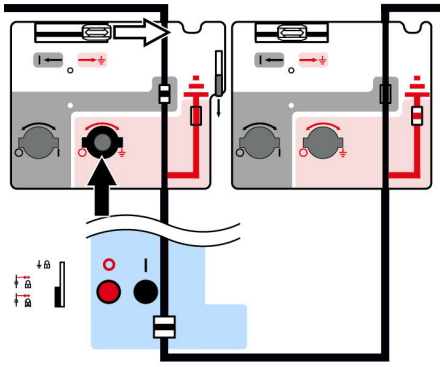
✔ The circuit-breaker is in the OPEN position. The earthing on the right-hand busbar system has been decoupled.

3



⇨ Push the interrogation lever downwards and hold it.

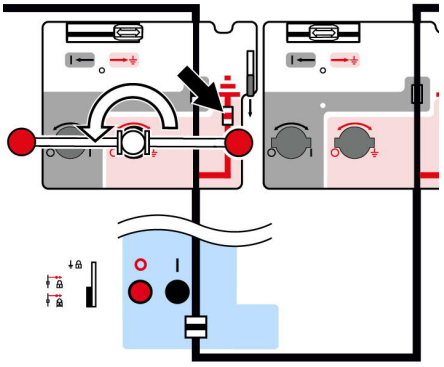
4



⇨ Push the left-hand control gate to the right and hold it.

✔ The actuating opening of the left-hand earthing switch is open.

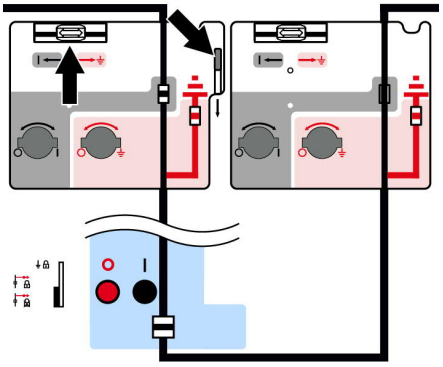
5



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

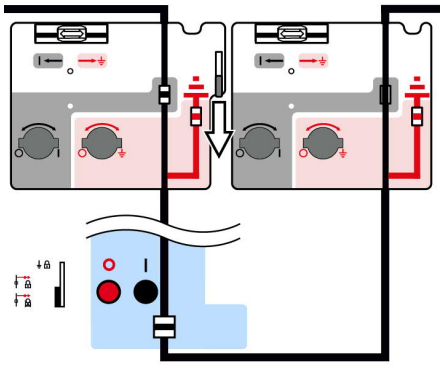
6



⇨ Remove the operating lever.

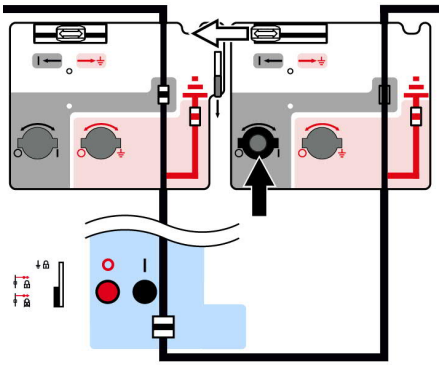
✔ The interrogation lever and the control gate move to their initial position.

7



⇨ Push the interrogation lever downwards again and hold it.

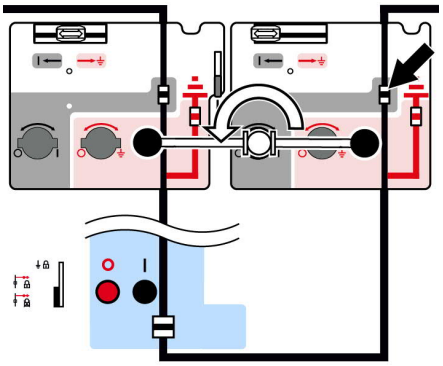
8



⇨ Push the right-hand control gate to the left and hold it.

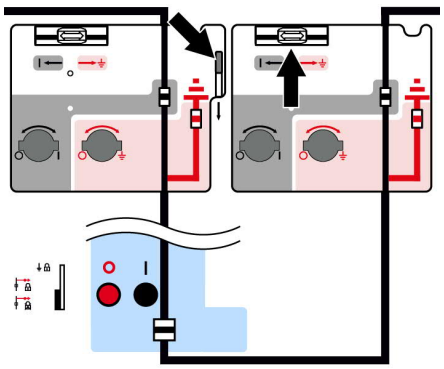
✔ The actuating opening of the right-hand disconnector is open.

9



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The right-hand disconnector is in the OPEN position.

10  ⇨ Remove the operating lever. ✔ The interrogation lever and the control gate move to their initial position.		

30.6 Operating the circuit-breaker panel with busbar earthing switch

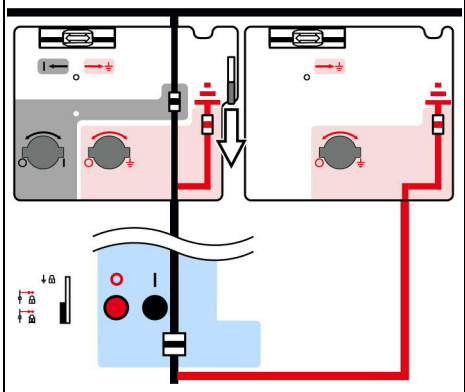
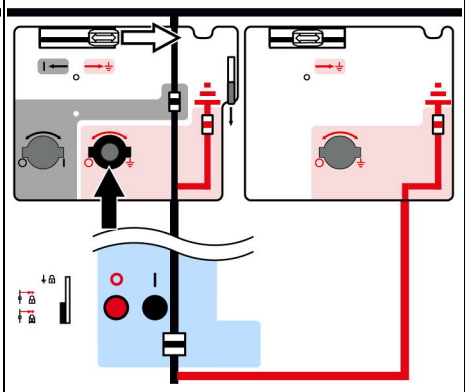
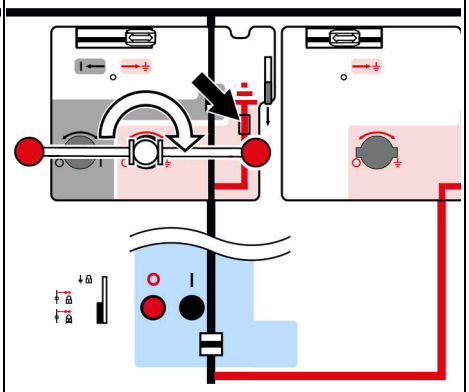
Earthing the busbar system

Precondition8

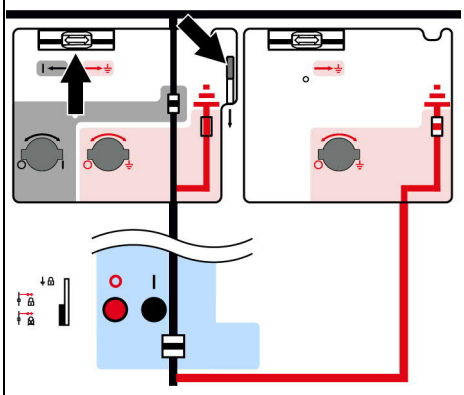
- Left-hand three-position disconnector in the OPEN position
- Right-hand three-position disconnector in the OPEN position
- Circuit-breaker in the OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
 ⇨ Push the interrogation lever downwards and hold it.	 ⇨ Push the left-hand control gate to the right and hold it. ✔ The actuating opening of the left-hand earthing switch is open.	 ⇨ Insert the operating lever. Turn it clockwise 180°. ✔ The left-hand disconnector is in the READY-TO-EARTH position.

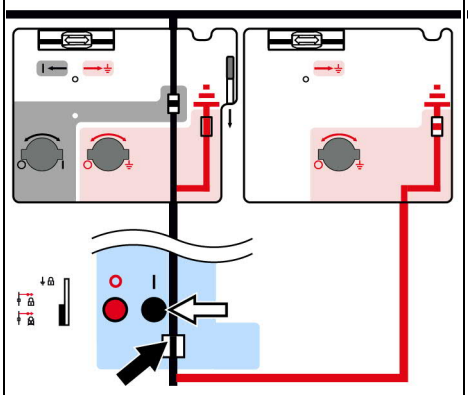
4



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

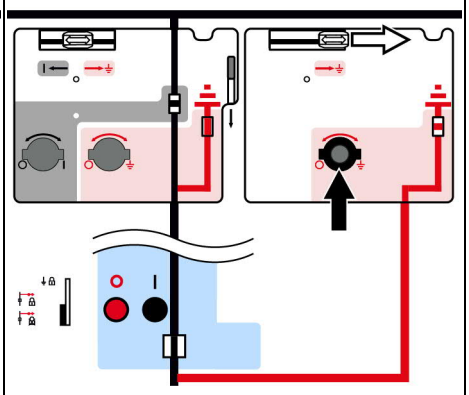
5



⇨ To earth the feeder, close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The feeder is earthed.

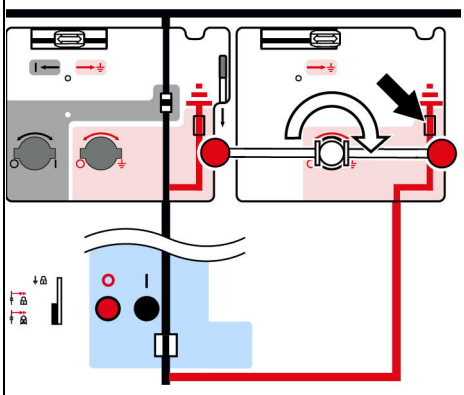
6



⇨ Push the right-hand control gate to the right and hold it.

✔ The actuating opening of the right-hand earthing switch is open.

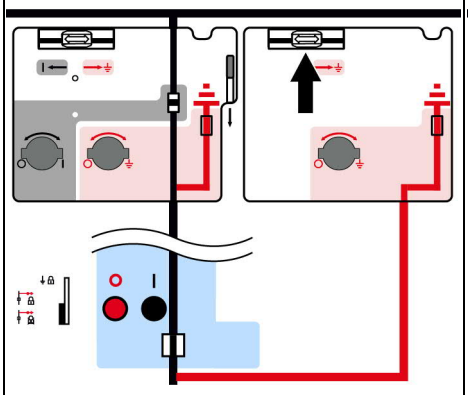
7



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The right-hand disconnector is in the READY-TO-EARTH position.

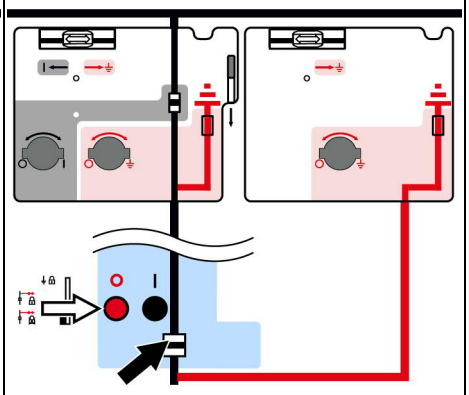
8



⇨ Remove the operating lever.

✔ The control gate moves to its initial position.

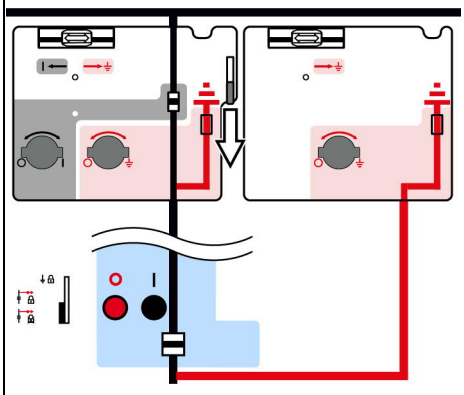
9



⇨ Open the circuit-breaker.

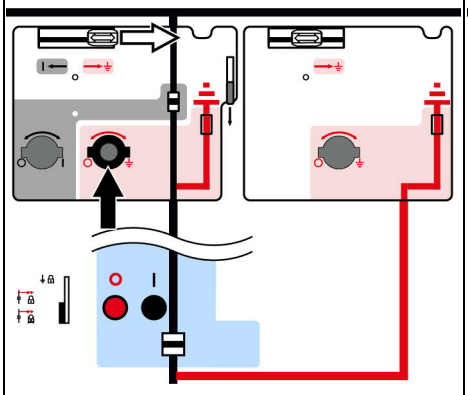
✔ The circuit-breaker is in the OPEN position. The feeder is earthed through the right-hand disconnector.

10



⇨ Push the interrogation lever downwards again and hold it.

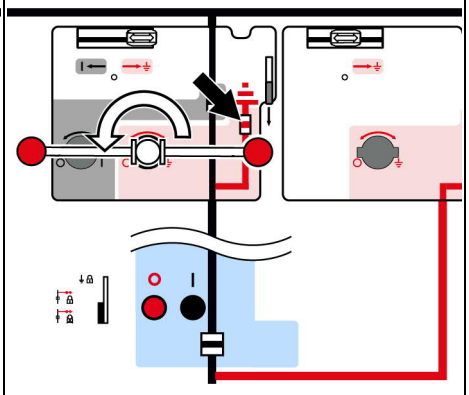
11



⇨ Push the left-hand control gate to the right and hold it.

✔ The actuating opening of the left-hand earthing switch is open.

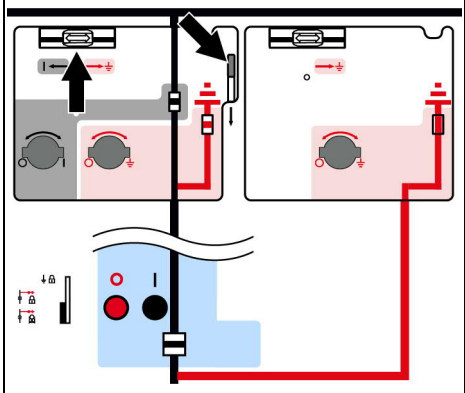
12



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

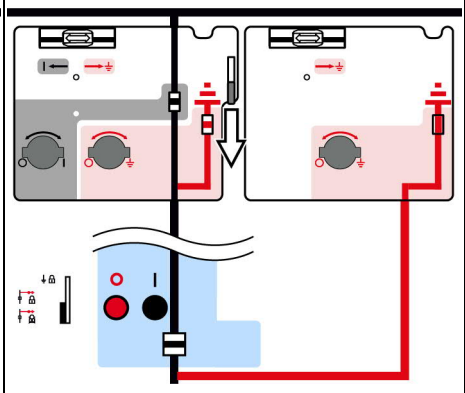
13



⇨ Remove the operating lever.

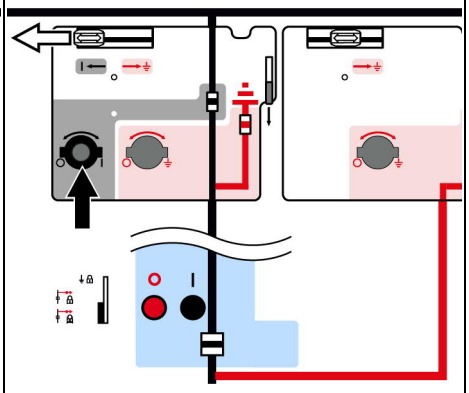
✔ The interrogation lever and the control gate move to their initial position.

14



⇨ Push the interrogation lever downwards again and hold it.

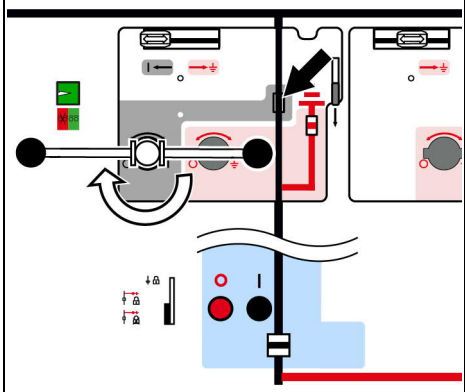
15



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

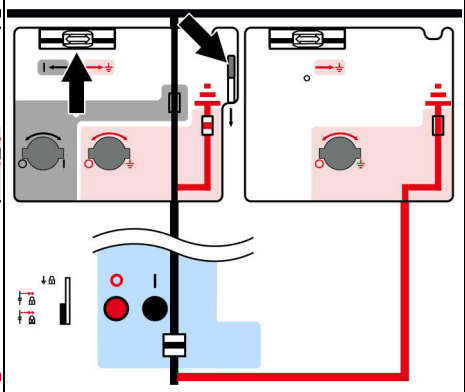
16



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The left-hand disconnector is in CLOSED position.

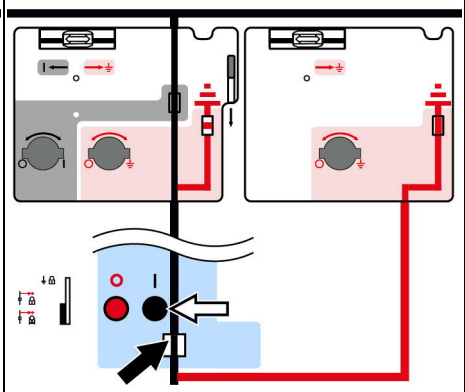
17



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

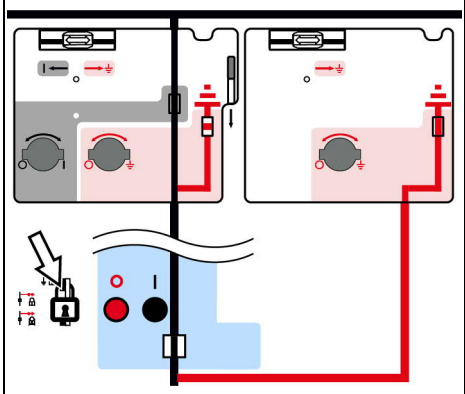
18



⇨ To earth the busbar system, close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The busbar system is earthed.

19



⇨ Push the locking device upwards. Fit a padlock.

De-earthing the busbar system

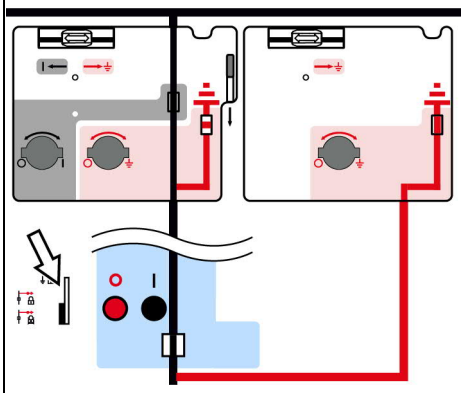
Precondition

- Left-hand three-position disconnector in the CLOSED position.
- Right-hand three-position disconnector in the READY-TO-EARTH position
- Circuit-breaker in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

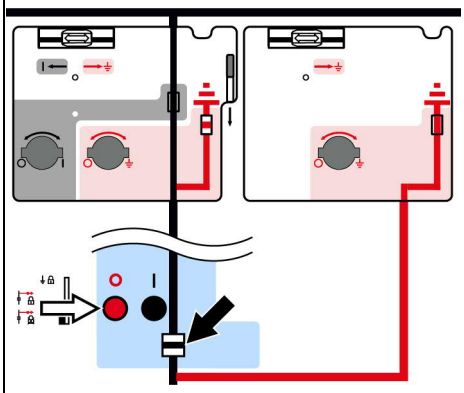
1



⇨ Remove the padlock.

✔ The locking device goes down.

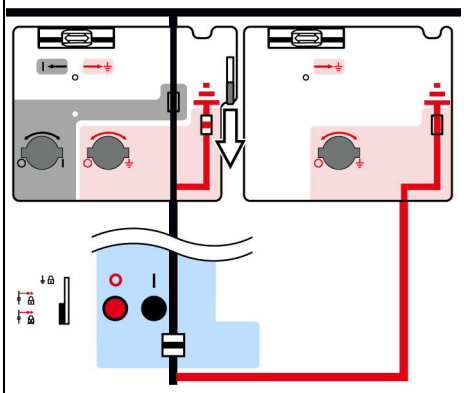
2



⇨ To de-earth the busbar system, open the circuit-breaker.

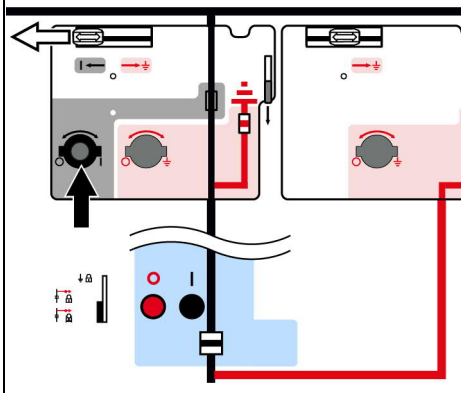
✔ The circuit-breaker is in the OPEN position. The earthing of the busbar system has been decoupled.

3



⇨ Push the interrogation lever downwards and hold it.

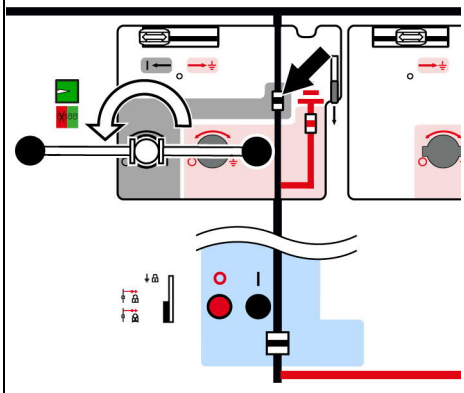
4



⇨ Push the left-hand control gate to the left and hold it.

✔ The actuating opening of the left-hand disconnector is open.

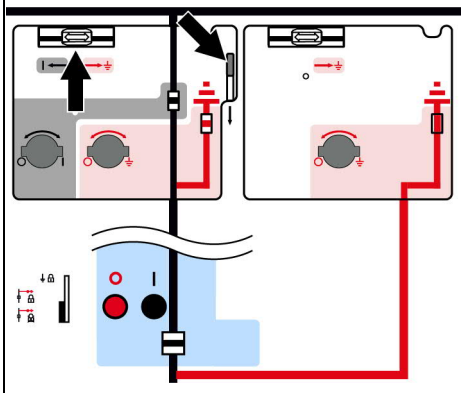
5



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

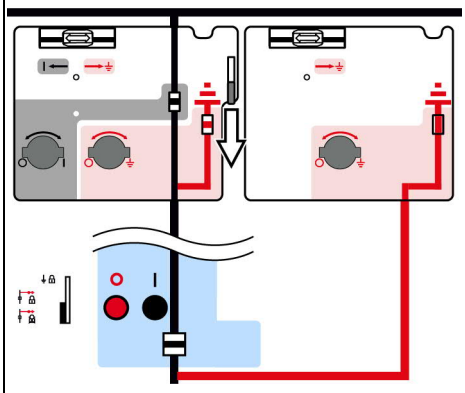
6



⇨ Remove the operating lever.

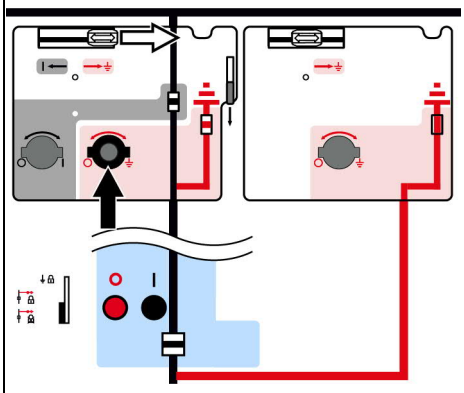
✔ The interrogation lever and the control gate move to their initial position.

7



⇨ Push the interrogation lever downwards again and hold it.

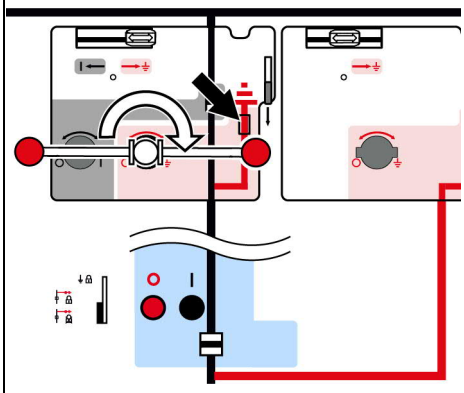
8



⇨ Push the left-hand control gate to the right and hold it.

✔ The actuating opening of the left-hand earthing switch is open.

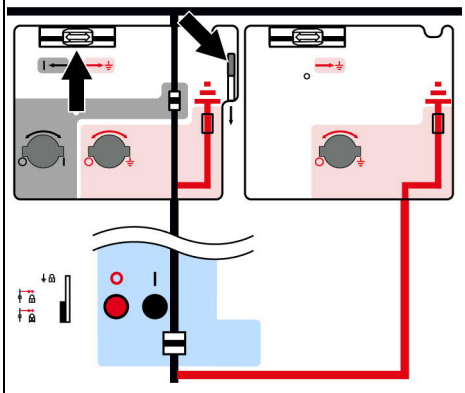
9



⇨ Insert the operating lever. Turn it clockwise 180°.

✔ The left-hand disconnector is in the READY-TO-EARTH position.

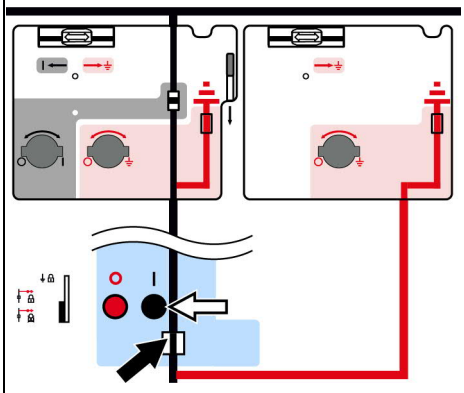
10



⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

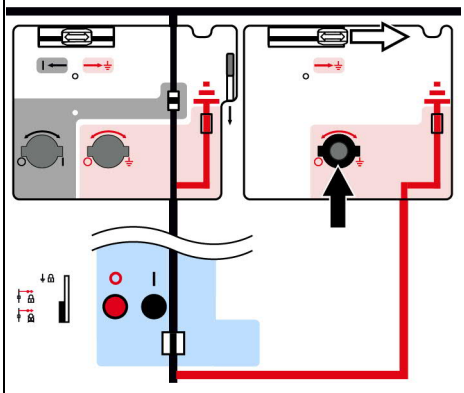
11



⇨ Close the circuit-breaker.

✔ The circuit-breaker is in the CLOSED position. The feeder is earthed through the left-hand disconnector.

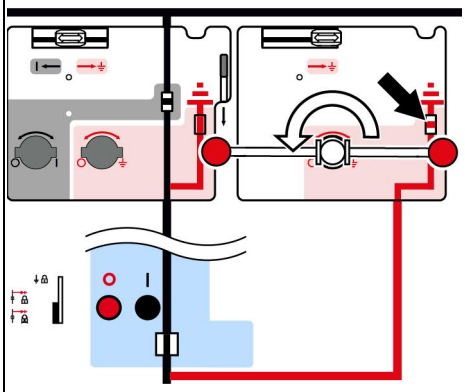
12



⇨ Push the right-hand control gate to the right and hold it.

✔ The actuating opening of the right-hand earthing switch is open.

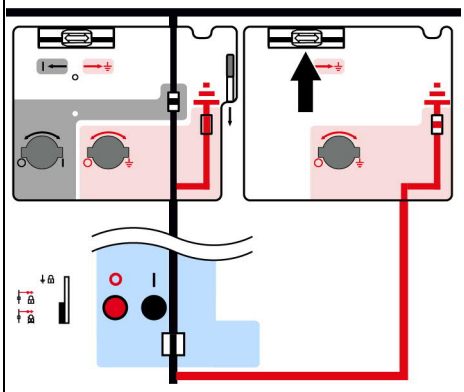
13



⇨ Insert the operating lever. Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

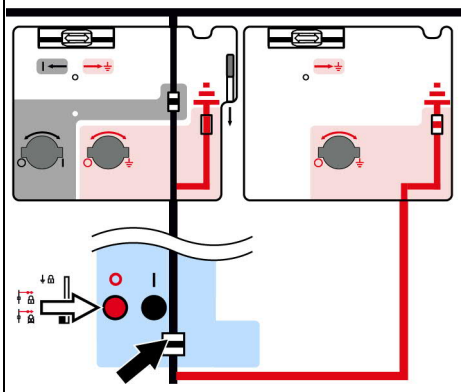
14



⇨ Remove the operating lever.

✔ The control gate moves to its initial position.

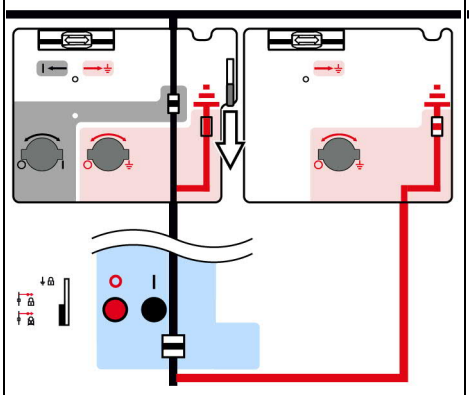
15



⇨ To de-earth the feeder, open the circuit-breaker.

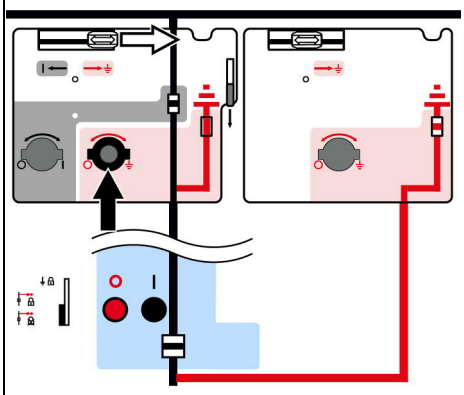
✔ The circuit-breaker is in the OPEN position. The earthing of the feeder has been decoupled.

16



⇨ Push the interrogation lever downwards again and hold it.

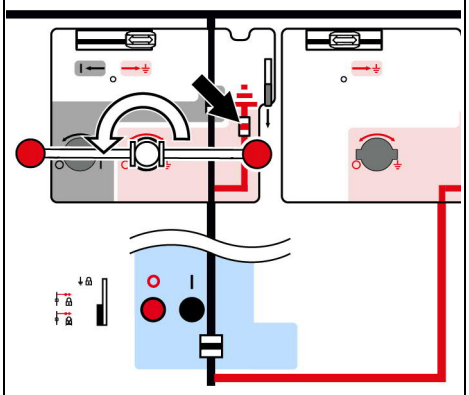
17



⇨ Push the left-hand control gate to the right and hold it.

✔ The actuating opening of the left-hand earthing switch is open.

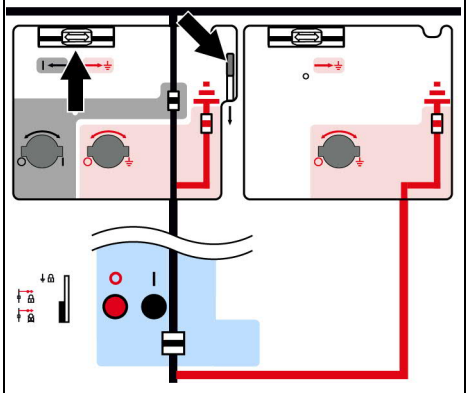
18



⇨ Insert the operating lever.
Turn it counterclockwise 180°.

✔ The left-hand disconnector is in the OPEN position.

19

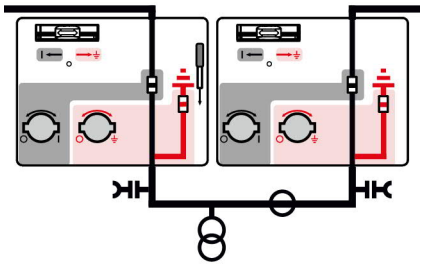
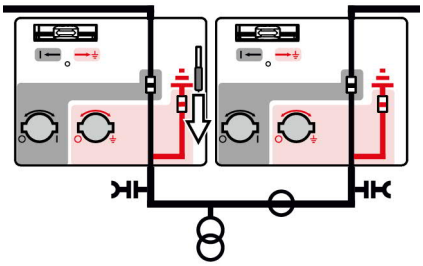
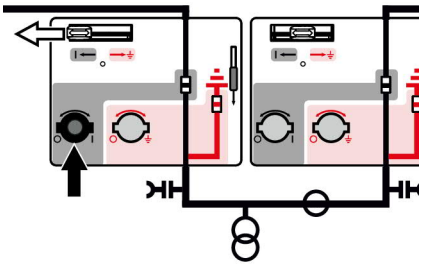
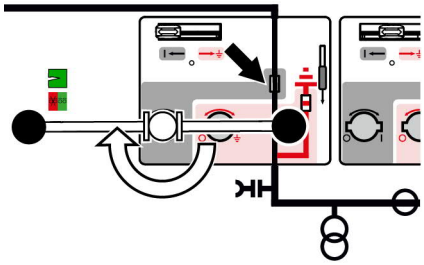
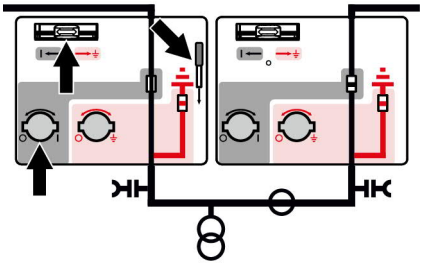
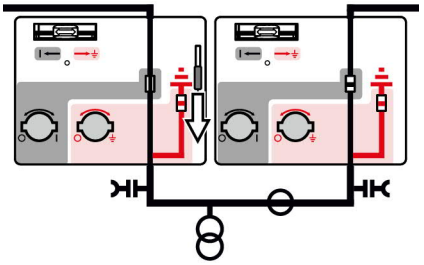
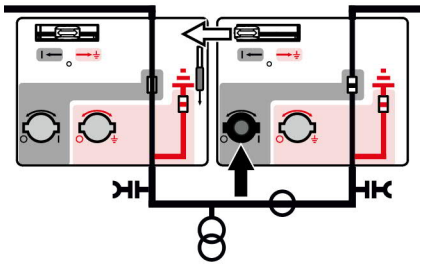
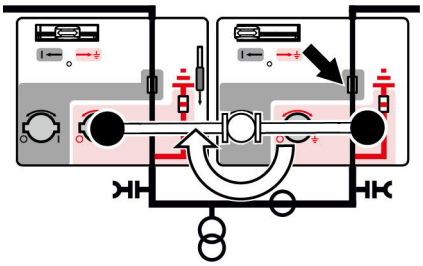
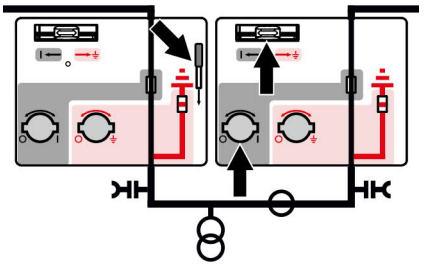


⇨ Remove the operating lever.

✔ The interrogation lever and the control gate move to their initial position.

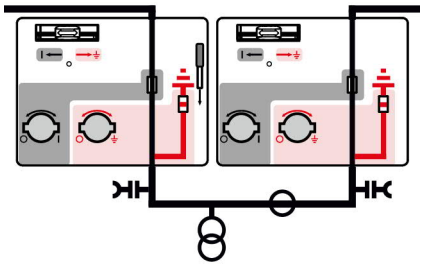
30.7 Switching the air-insulated metering panel with two three-position disconnectors

Coupling the busbars

1  **Preconditions** • Busbars are isolated from supply or earthed. • Left-hand and right-hand three-position disconnector in the OPEN position.	2  ⇨ Push the interrogation lever downwards and hold it.	3  ⇨ Push the left-hand control gate to the left and hold it. The interrogation lever locks in lower position and the actuating opening for the DISCONNECTING function is open.
4  ⇨ Insert the operating lever. Turn it clockwise 180°. The switch position indicator of the three-position disconnector shows the CLOSED position.	5  ⇨ Remove the operating lever. The interrogation lever and the control gate return to their initial position. The actuating opening is closed.	6  ⇨ Push the interrogation lever downwards and hold it.
7  ⇨ Push the right-hand control gate to the left and hold it. The interrogation lever locks in lower position and the actuating opening for the DISCONNECTING function is open.	8  ⇨ Insert the operating lever. Turn it clockwise 180°. The switch position indicator of the three-position disconnector shows the CLOSED position.	9  ⇨ Remove the operating lever. The interrogation lever and the control gate return to their initial position. The actuating opening is closed. The busbars are coupled.

Decoupling the busbars

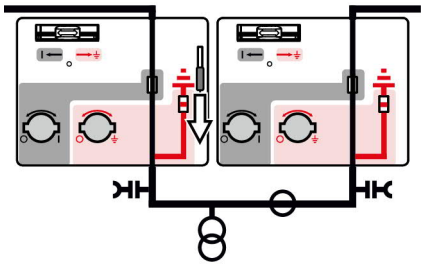
1



Preconditions

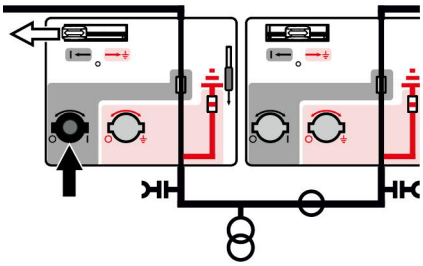
- Busbars are isolated from supply or earthed.
- Left-hand and right-hand three-position disconnector in the CLOSED position.

2



⇨ Push the interrogation lever downwards and hold it.

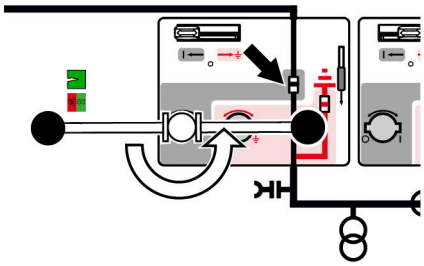
3



⇨ Push the left-hand control gate to the left and hold it.

The interrogation lever locks in lower position and the actuating opening for the DISCONNECTING function is open.

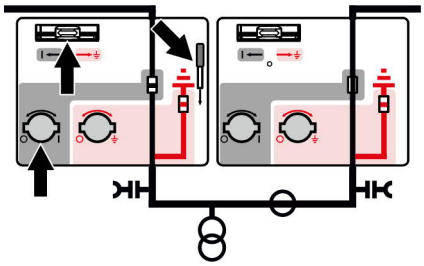
4



⇨ Insert the operating lever.
Turn it counterclockwise 180°.

The switch position indicator of the three-position disconnector shows the OPEN position.

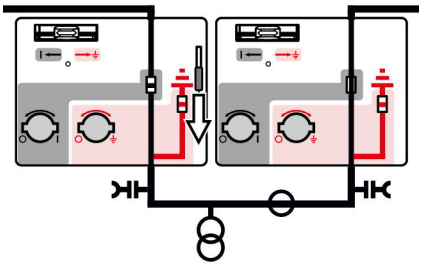
5



⇨ Remove the operating lever.

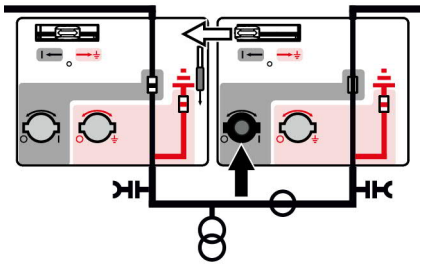
The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

6



⇨ Push the interrogation lever downwards and hold it.

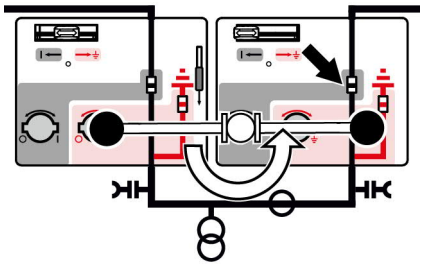
7



⇨ Push the right-hand control gate to the left and hold it.

The interrogation lever locks in lower position and the actuating opening for the DISCONNECTING function is open.

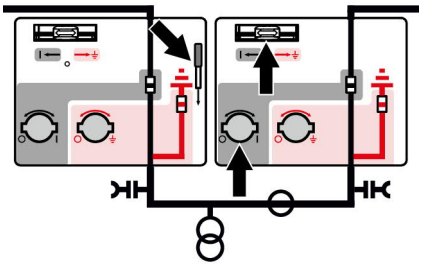
8



⇨ Insert the operating lever.
Turn it counterclockwise 180°.

The switch position indicator of the three-position disconnector shows the OPEN position.

9



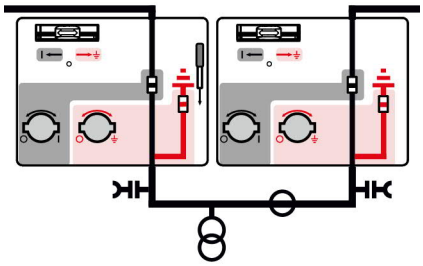
⇨ Remove the operating lever.

The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

The busbars are decoupled.

Earthing the transformer group

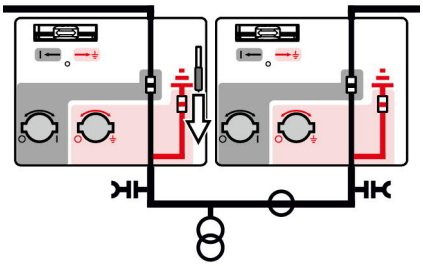
1



Preconditions

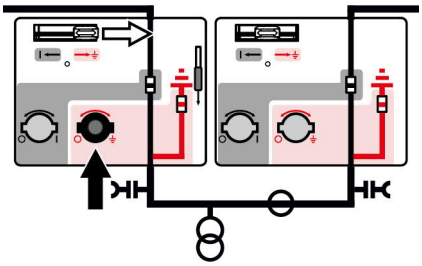
- Busbars are isolated from supply or earthed.
- Left-hand and right-hand three-position disconnector in the OPEN position.

2



⇨ Push the interrogation lever downwards and hold it.

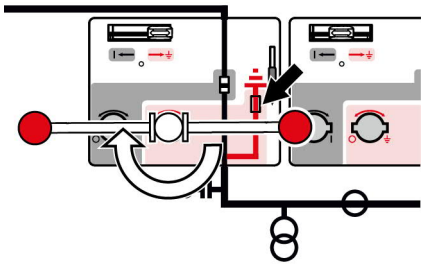
3



⇨ Push the left-hand control gate to the right and hold it.

The interrogation lever locks in the lower position and the actuating opening for the EARTHING function is open.

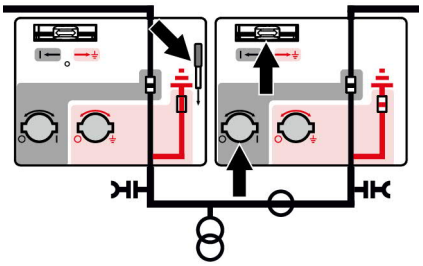
4



⇨ Insert the operating lever. Turn it clockwise 180°.

The switch position indicator of the three-position disconnector shows the EARTHED position.

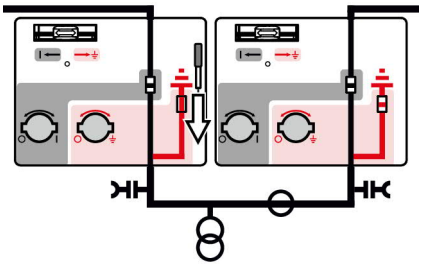
5



⇨ Remove the operating lever.

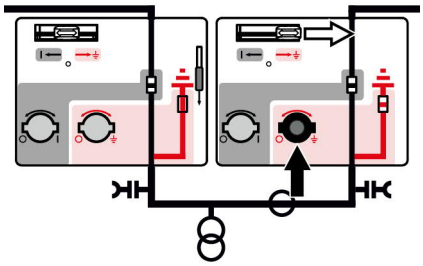
The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

6



⇨ Push the interrogation lever downwards and hold it.

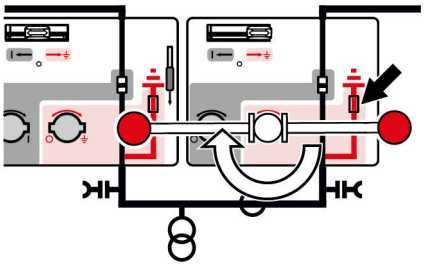
7



⇨ Push the right-hand control gate to the right and hold it.

The interrogation lever locks in the lower position and the actuating opening for the EARTHING function is open.

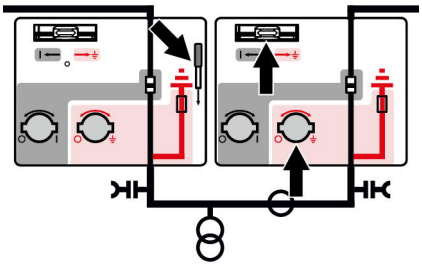
8



⇨ Insert the operating lever. Turn it clockwise 180°.

The switch position indicator of the three-position disconnector shows the EARTHED position.

9



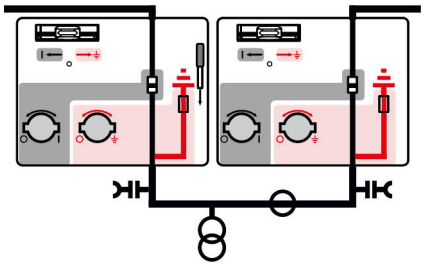
⇨ Remove the operating lever.

The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

The instrument transformer group is earthed.

De-earthing the instrument transformer group

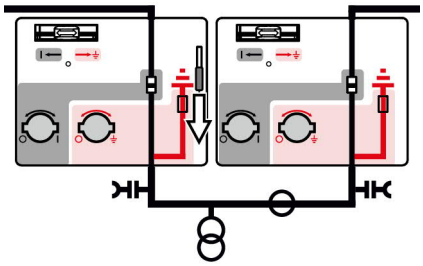
1



Preconditions

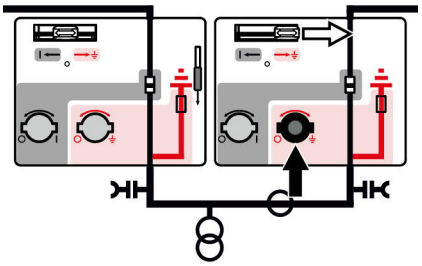
- Busbars are isolated from supply or earthed.
- Left-hand and right-hand three-position disconnector in OPEN position.
- Left-hand and right-hand earthing switch in EARTHED position.

2



⇨ Push the interrogation lever downwards and hold it.

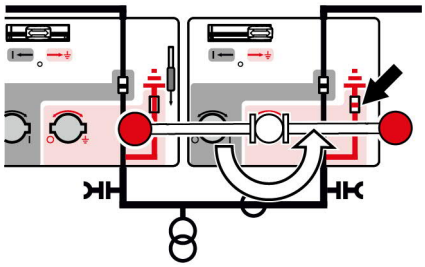
3



⇨ Push the right-hand control gate to the right and hold it.

The interrogation lever locks in lower position and the actuating opening for the EARTHING function is open.

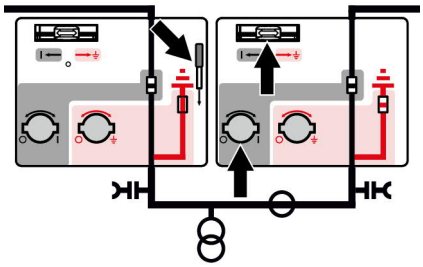
4



⇨ Insert the operating lever.
Turn it 180° counter-clockwise.

The position indicator of the tree-position disconnector shows the OPEN position.

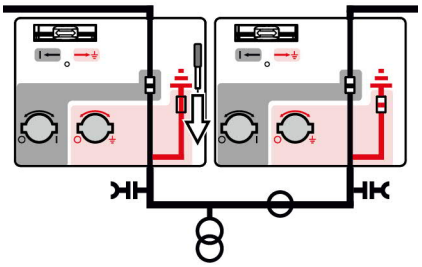
5



⇨ Remove the operating lever.

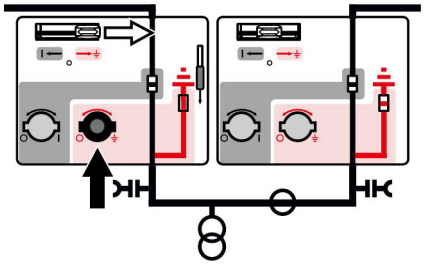
The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

6



⇨ Push the interrogation lever downwards and hold it.

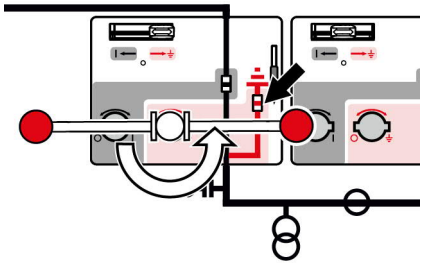
7



⇨ Push the left-hand control gate to the right and hold it.

The interrogation lever locks in lower position and the actuating opening for the EARTHING function is open.

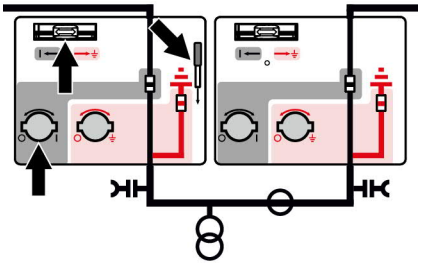
8



⇨ Insert the operating lever.
Turn it 180° counter-clockwise.

The position indicator of the tree-position disconnector shows the OPEN position.

9



⇨ Remove the operating lever.

The interrogation lever and the control gate return to their initial position. The actuating opening is closed.

The instrument transformer group is de-earthed.

30.8 Operating the auxiliary transformer panel and switch-disconnector panel

This chapter describes the manual operation of the following panel types:

- Ring-main panel
- Metering panel (gas-insulated)

The operations are shown using a ring-main panel as an example.

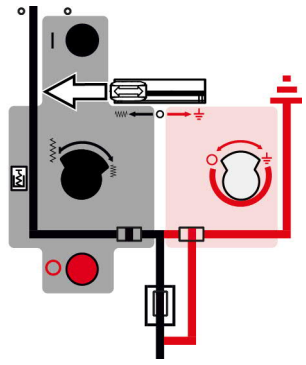
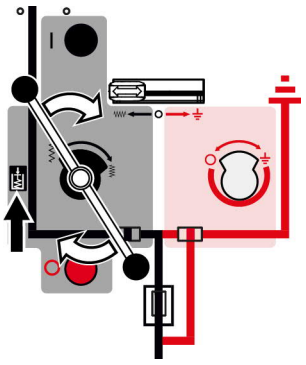
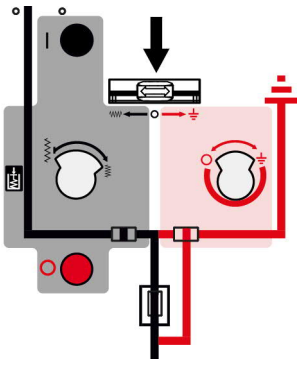
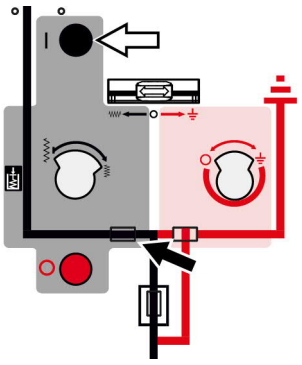
Connecting the feeder to the busbar

Precondition

- Three-position switch-disconnector in OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring not charged".

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3	4
			
⇨ Push the control gate to the left and hold it. ✔ The actuating opening for "spring charging" is free.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The "spring charged" indicator shows "spring charged".	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.	⇨ Close the switch-disconnector to connect the feeder to the busbar. ✔ The switch-disconnector is in the CLOSED position. The feeder is connected to the busbar.

Disconnecting the feeder from the busbar

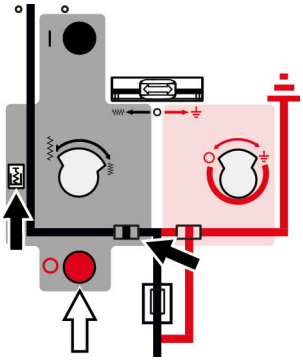
Precondition

- Three-position switch-disconnector in the CLOSED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring charged"

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1



⇨ Open the switch-disconnector to disconnect the feeder from the busbar.

✔ The switch-disconnector is in the OPEN position. "Spring charged" indicator shows "spring not charged". The feeder is disconnected from the busbar.

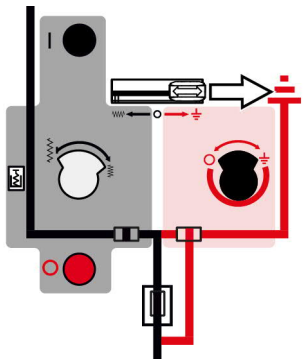
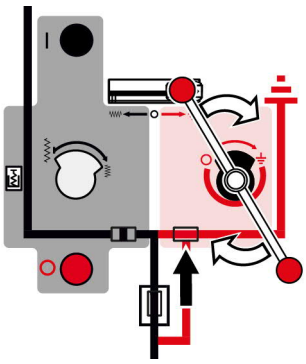
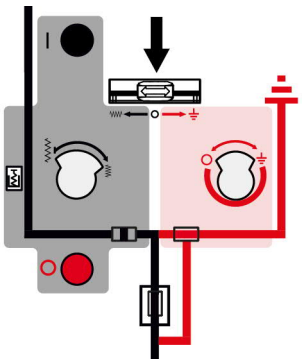
Earthing the feeder

Precondition

- Three-position switch-disconnector in OPEN position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring not charged".

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening of the earthing switch is open.	⇨ Insert the operating lever. Turn clockwise as far as it will go. ✔ The switch-disconnector is in the EARTHED position. The feeder is earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

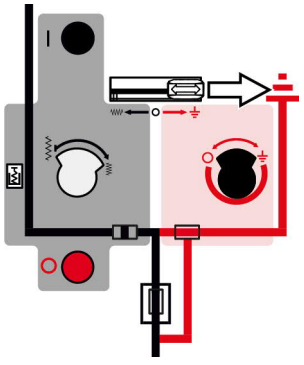
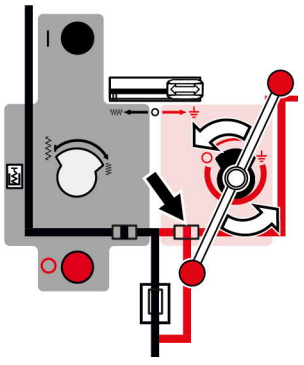
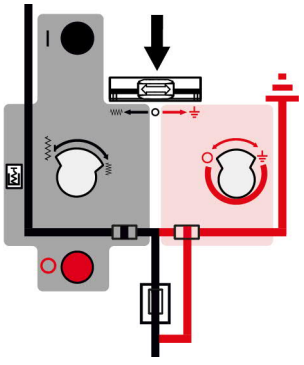
De-earthing the feeder

Precondition

- Three-position switch-disconnector in the EARTHED position
- The feeder is isolated from supply (see page 207, "Verification of safe isolation from supply")
- "Spring charged" indicator shows "spring not charged".

Preparation

- Check service readiness (see page 190, "Ready-for-service indicator")

1	2	3
		
⇨ Push the control gate to the right and hold it. ✔ The actuating opening for the earthing switch is open.	⇨ Insert the operating lever. Turn counterclockwise as far as it will go. ✔ The switch-disconnector is in the OPEN position. The feeder is de-earthed.	⇨ Remove the operating lever. ✔ The control gate moves to its initial position.

31 Cable testing

⚠DANGER

High voltage and explosion hazard
Will cause serious injury and damage the voltage transformer. If the voltage transformer disconnector is closed, the test voltage can destroy the voltage transformer.

⇨ Switch the voltage transformer disconnector to the EARTHED position, and secure it, before testing the cables.

⚠WARNING

Mortal danger due to electric shock!
Due to the high test voltages, faults occurring during the cable test can cause serious injury or death by electric shock.

⇨ During the cable test, keep a safety distance (min. 3 m) from the switchgear.

⇨ Install barriers.

⇨ Switch on warnings.

⇨ When the cable test is completed, earth the test cables.

NOTICE

Damage to the voltage indicators by test voltage!
The voltage indicators can be damaged by the test voltage during the cable test.

⇨ Short-circuit the voltage indicators at the earthing points of the test sockets using short-circuit plugs.

Short-circuit plug, from Kries,
order number 2500029

Short-circuit plug, from Horstmann,
order number 51-9904-001

Preconditions

- Circuit-breaker in the OPEN position.
- Three-position switch in the OPEN position.
- Voltage transformer disconnector in the EARTHED position (see page 215, "Operating the feeder voltage transformer").

Test voltages

Rated voltage of the switchgear [kV]	DC test voltage				AC test voltage VLF[1] 0.1 Hz				
	AC		DC		Rectangle [kV]		Sine [kV]		Test duration [min]
	U_{ct} [kV]	Test duration [min]	U_{ct} [kV]	Test duration [min]	Mean value	Maximum value	Mean value	Maximum value	
7.2	11	1	22	15	22	22	15.6	22	60
12	19	1	38	15	38	38	26.8	38	60
15	28	1	52	15	52	52	36.8	52	60
17.5	28	1	52	15	52	52	36.8	52	60
24	38	1	72	15	72	72	51	72	60
36	57	1	72	15	72	72	51	72	60
38	57	1	72	15	72	72	51	72	60

[1] Very low frequency

Test adapter

Suitable test adapters must be available for performing the cable test. The following table offers an overview of the test adapters of the individual cable T-plug manufacturers:

Product	Test adapter	For cable T-plugs
Nexans Euromold	400TR	430TB/G; 300PB/GK430TB/G; K300PB/GM430TB/G; M300PB/G
	800TR	480TB/G; 800PB/G484TB/G; 804PB/G489TB/G; 809PB/GK480TB/G;K800PB/GK484TB/G; K804PB/GK489TB/G; K809PB/GM480TB/G; M800PB/GM484TB/G; M804PB/GM489TB/G; M809PB/GP480TB/G;P800PB/GP484TB/G; P804PB/GP489TB/G; P809PB/G
NKT	PAK 630 M12	CB 24-630; CC 24-630CB 24-1250/2; CC 24-1250/2CB 36-630; CC 36-630
	PAK 630 M16	CB 36-630(1250); CC 36-630(1250)CB 42-1250/3, CC 42-2500/3
Tyco Electronics Raychem	RSTI-68TRRSTI-68TRL	RSTI-58xx; RSTI-CC-58xxRSTI-68xx; RSTI-CC-68xxRSTI-395x; RSTI-CC-395xRSTI-595x; RSTI-CC-595xRSTI-695x; RSTI-CC-695x

Performing the cable test

⇨ Earth the feeder.

⇨ Secure the feeder against reclosing.

⇨ Verify safe isolation from supply (see page 207, "Verification of safe isolation from supply").

⇨ Disconnect the feeder in the opposite substation.

⇨ Secure the feeder in the opposite substation against reclosing.

⇨ Verify safe isolation from supply in the opposite substation.

⇨ Remove the cable compartment cover of the panel under test (see page 185, "Removing and mounting the connection compartment covers").

⇨ If necessary, shut off the voltage transformer at the feeder (see page 215, "Switching off the feeder voltage transformer").

⇨ Remove the screw-type cone of the connected cable T-plug according to the manufacturer's specifications.

⇨ Insert or screw the test adapter into the cable T-plug.

⇨ Connect test lead.

⇨ Short-circuit the voltage presence indicating systems at the earthing connection points of the test sockets using short-circuit plugs.

⇨ De-earth the feeder.

⇨ Perform voltage test. Perform the test according to the recommendations of the cable manufacturers and the operator's specifications.

⇨ To return to the initial situation, proceed in reverse order.

Service information

32 Maintenance

The NXPLUS C switchgear, the circuit-breakers in use and the vacuum contactors do not require maintenance under normal operating conditions.

The switchgear vessel represents a hermetically sealed pressure system according to IEC 62271-200. Maintenance of the insulating gas is not required.

Secondary equipment

Inspection/testing of the secondary equipment such as the capacitive voltage detecting system is done within the scope of national standards and customer-specific regulations.

Replacement of components

Due to the fact that all parts of this switchgear have been optimized to last the normal service life, there is no need to recommend particular spare parts.

33 Checks and maintenance work in case of special operating conditions

If the switchgear is operated outside normal operating conditions, it is recommended that the switchgear be subjected to regular checks.

These special operating conditions can include factors such as severe or frequent condensation, dusty air or the like.

If corrosion or similar problems are found during a check, contact the Siemens Service Hotline (see page 261, "Siemens Service Hotline").

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

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

⚠WARNING

Hazardous voltage
Can cause death, injury or property damage. If the operating mechanism cover is removed, do not touch any live parts.

- ⇨ Switch off the auxiliary voltage.

⚠WARNING

Risk of injury due to high-speed moving parts
Parts behind the front cover can automatically move quickly and cause serious injury.
Do not remove the front cover of the operating mechanism until the following actions have been performed:

- ⇨ To avoid impermissible switching operations, switch off auxiliary voltage, e.g.:
  - Switch off the auxiliary voltage supply of the motor.
  - Trip the MCB.
  - Disconnect the control cables from the low-voltage compartment.
- ⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:
  - Push the manual OFF pushbutton.
  - Push the manual ON pushbutton.
  - Push the manual OFF pushbutton again.
- ⇨ Check if the "spring charged" indicator shows "spring not charged".

Overview of necessary checks

Depending on the type of panel and operating mechanism, the checks listed in the following tables must be performed:

Panels with three-position switch-disconnector

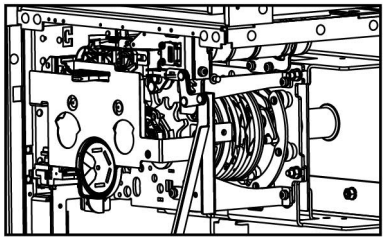
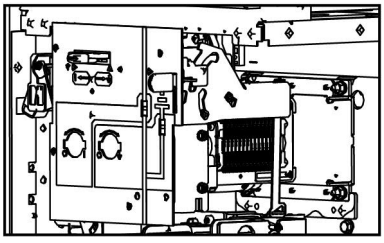
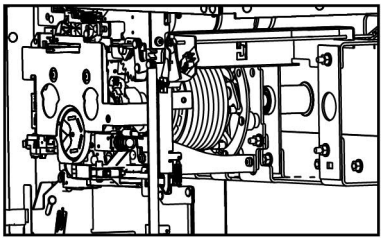
Panel type	Vacuum contactor panel	Metering panel (gas-insulated)	Switch-disconnector panel	Ring-main panel	Auxiliary transformer panel
Check the galvanically plated surfaces for traces of corrosion	X	X	X	X	X
Check the lubrication of sliding surfaces	X	X	X	X	X
Check the firm seating of all terminal connections	X	X	X	X	X
Check the smooth operation of control gate and interrogation lever	X	X	X	X	X
Visual check of spring-operated mechanism	X	X	-	X	-
Visual check of spring-operated/stored-energy mechanism with fuse tripping	-	-	X	-	X
Visual check of vacuum contactor operating mechanism	X	-	-	-	-
Check the functionality and smooth operation of the cable compartment interlock	X	X	X	X	X
Check fuse tripping	X	X	X	-	X
Check the high-voltage compartment for dirt	X	X	X	X	X

Panels with three-position disconnector

Panel type	Disconnector panel	Circuit-breaker panel	Bus sectionalizer panel	Air-insulated metering panel
Check the galvanically plated surfaces for traces of corrosion	X	X	X	X
Check the lubrication of sliding surfaces	X	X	X	X
Check the firm seating of all terminal connections	X	X	X	X
Check the smooth operation of control gate and interrogation lever	X	X	X	X
Visual check of slow motion mechanism	X	X	X	X
Visual check of circuit-breaker operating mechanism	-	X	X	-
Check the functionality and smooth operation of the cable compartment interlock	X	X	X	X
Check the high-voltage compartment for dirt	X	X	X	X

33.1 Checks on three-position switch operating mechanisms

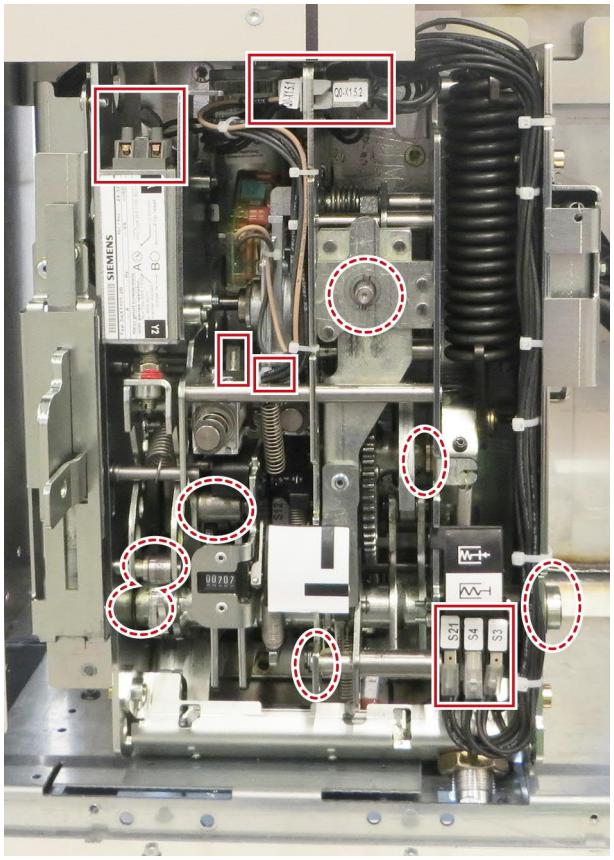
⇨ Check the firm seating of all terminal connections.
⇨ Perform electrical and mechanical functional test.
⇨ Check the lubrication of sliding surfaces.
⇨ Check the galvanically plated surfaces for traces of corrosion.
⇨ Check the smooth operation of the interrogation lever.
⇨ Check the smooth operation of the control gate.

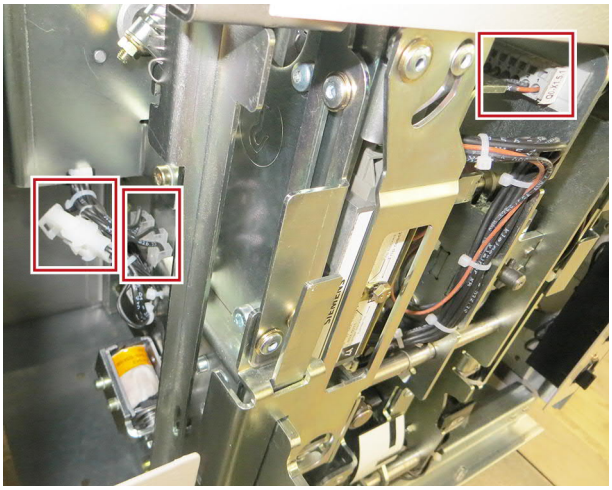
Type of operating mechanism	Spring-operated mechanism	Slow motion mechanism	Spring-operated/stored-energy mechanism
Panel types	• Ring-main panel • Vacuum contactor panel • Metering panel (gas-insulated)	• Circuit-breaker panel • Bus sectionalizer panel • Disconnector panel • Air-insulated metering panel	• Switch-disconnector panel • Auxiliary transformer panel
			

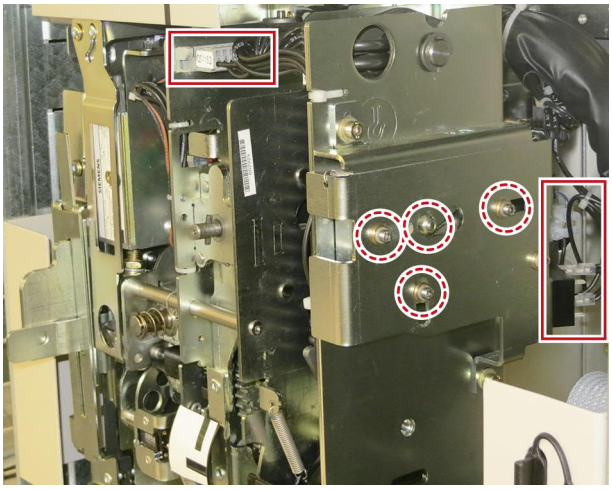
33.2 Visual check of circuit-breaker operating mechanism

- ⇨ Perform electrical and mechanical functional test.
- ⇨ Check the firm seating of all terminal connections (rectangular markings).
- ⇨ Check the lubrication of all sliding surfaces (circular markings).

Circuit-breaker 34E44 and 3AE43







33.3 Visual check of vacuum contactor operating mechanism

NOTICE

Removing the cover of the vacuum contactor operating mechanism
Can damage the operating mechanism.

⇨ Do not remove the cover ① .

⇨ In the event of a functional failure of the vacuum contactor operating mechanism, please contact the Siemens Service Hotline.

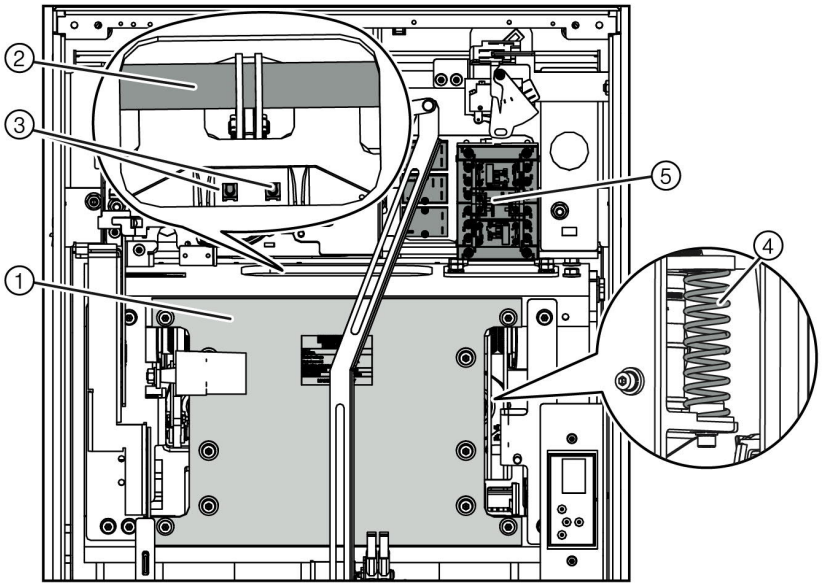


Fig. 159: Vacuum contactor operating mechanism

⇨ Perform electrical functional test.

⇨ Check the intact condition of the shaft ② (cracks, damage, etc.).

⇨ Check the intact condition of the fuse elements ③ .

⇨ Check the intact condition of the springs ④ .

⇨ Check the firm seating of all terminal connections ⑤ .

33.4 Connection compartment interlock check

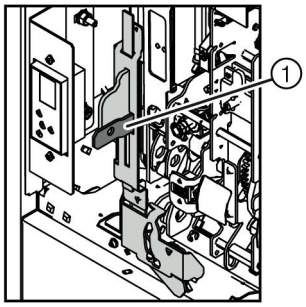
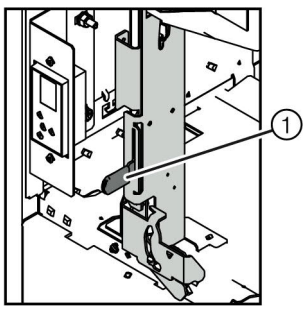
The following connection compartment covers are checked in the same way:

- Cable compartment cover
- Instrument transformer compartment cover
- Transformer compartment cover
- HV HRC fuse compartment cover

⇨ Check functionality and smooth operation of the cable compartment cover ① .

Lift the lever of the cable compartment interlock, and release it. The lever must move down again automatically.

Connection compartment interlock

Panels with circuit-breaker	All other panels
	

33.5 Fuse tripping check

⚠DANGER

Life-endangering voltage
Will cause death, injury or considerable property damage.

Always observe the Five Safety Rules:

⇨ Isolate.

⇨ Secure against reclosing.

⇨ Verify safe isolation from supply.

⇨ Earth and short-circuit.

⇨ Cover or barrier adjacent live parts.

⚠WARNING

Hazardous voltage
Can cause death, injury or property damage. If the operating mechanism cover is removed, do not touch any live parts.

⇨ Switch off the auxiliary voltage.

⚠WARNING

Risk of injury due to high-speed moving parts
Parts behind the front cover can automatically move quickly and cause serious injury.
Do not remove the front cover of the operating mechanism until the following actions have been performed:

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

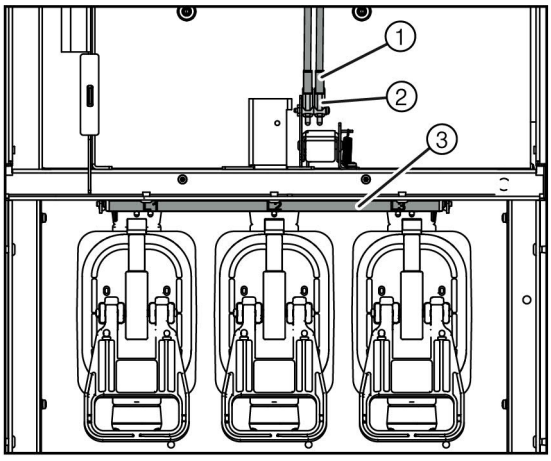
⇨ To discharge the spring energy store in the operating mechanism, execute the following instructions:
- Push the manual OFF pushbutton.
- Push the manual ON pushbutton.
- Push the manual OFF pushbutton again.

⇨ Check if the "spring charged" indicator shows "spring not charged".

The fuse tripping check differs for spring-operated mechanisms and spring-operated/stored-energy mechanisms

Spring-operated mechanism

Refers to panel types:
- Vacuum contactor panel
- Metering panel (gas-insulated)



① Terminal connections
② Auxiliary switches
③ Tripping rocker

⇨ Check the firm seating of all terminal connections ① .

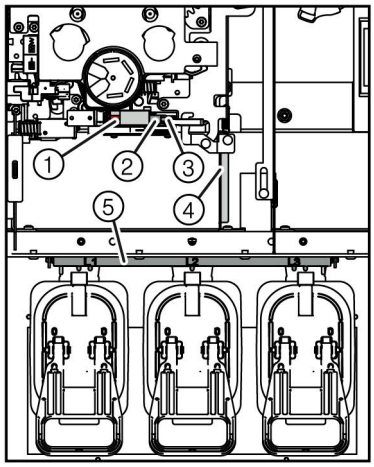
⇨ Check the smooth operation of tripping rocker ③ . Push the tripping rocker upwards.

⇨ Check whether the auxiliary switch ② (option) reacts when the tripping rocker is lifted (clicking noise). A signal to the telecontrol room occurs if applicable.

Spring-operated/stored-energy mechanism

Refers to panel types:

- Auxiliary transformer panel
- Switch-disconnector panel



① "Fuse tripped" indicator
② Auxiliary switches
③ Terminal connections
④ Pull rod
⑤ Tripping rocker

⇨ Check the firm seating of all terminal connections ③ .

⇨ Check the smooth operation of tripping rocker ⑤ . Move the tripping rocker upwards.

⇨ Hook in the fuse compartment cover.

⇨ Switch the switch-disconnector to the CLOSED position.

⇨ Check whether the auxiliary switch ② (option) reacts when the pull rod ④ is lifted.

✔ The spring-operated/stored-energy mechanism trips. The "Fuse tripped" indicator ① displays as tripped. The switch-disconnector shows the OPEN position.

⇨ In order to restore service readiness, switch the switch-disconnector to the EARTH position.

33.6 Cleaning, greasing and lubricating the operating mechanisms

☞INFORMATION
Use only permitted lubricants and cleaning agents. For suppliers and manufacturer information of lubricants, see page 257, "Permissible lubricants". Cleaning agents: Mild, conventional household cleaner for general degreasing work and cleaning work (solvent-free)

⇨ Clean the external parts of the switchgear and switching devices at regular intervals with a lint-free wiping cloth.

⇨ If necessary, renew the anti-corrosion protection greasing.

⇨ If necessary, lubricate the bearings.

NOTICE
Contact by cleaning agents Can cause property damage. Joints and bearings that cannot be removed may be damaged by cleaning agents. ⇨ Do not use cleaning agents to clean joints and bearings that cannot be removed.

Three-position switch operating mechanism

Use the following aids for the spring-operated mechanism, the spring-operated/stored-energy mechanism and the slow motion mechanism of the three-position switch:

- For bearings, sliding surfaces: Molykote (R) MKL-N Grease

Circuit-breaker operating mechanism

Use the following aids for the circuit-breaker operating mechanism:

- For bearings, sliding surfaces: Isoflex Topas L 32, Klüber
- For bearings that are inaccessible for grease: Tellus Oil 32
- For bearings of the auxiliary switches: Tellus Oil 32

For suppliers and manufacturer information of lubricants, see page 257, "Permissible lubricants".

Vacuum contactor operating mechanism

It is not required to clean, grease or lubricate the operating mechanism of the vacuum contactor.

33.7 Test operation of the operating mechanisms

Preconditions:

- All maintenance work has been performed without incident
- All covers are installed

If one of the operating mechanism does not operate correctly, please contact the regional Siemens representative.

⇨ Operate the operating mechanism of the three-position switch several times mechanically by hand for testing.

⇨ Operate the operating mechanism of the circuit-breaker several times mechanically by hand for testing.

⇨ Operate the operating mechanism of the vacuum contactor electrically 5 times for testing.

34 Permissible lubricants

Lubricants	Manufacturer
Molykote (R) MKL-N Grease	Dow Corning GmbH Rheingaustr. 34 D-65201 Wiesbaden
Isoflex Topas L 32	Klüber - Lubrication KG Geisenhauer Str. 7 Postfach 70 10 47 D-81310 Munich
Tellus Oil 32	Shell Direct GmbH Suhrenkamp 71 D-22335 Hamburg

The following lubricants can be obtained from a regional Siemens representative:

Weight	Lubricants	Order No.
180 g	Isoflex Topas L 32	3AX1133-3H
1 kg	Isoflex Topas L 32	3AX1133-3E
1 kg	Tellus Oil 32	3AX1133-2D
1 kg	Molykote (R) MKL-N Grease	5000000082

35 Extending the switchgear or replacing panels and components

The individual parts, such as measuring instruments, current transformers, etc., can be replaced. Contact a regional Siemens representative for extending the switchgear and replacing components. The busbar design allows for extending the switchgear or replacing a panel without gas work.

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

- Type and serial number of the switchgear and circuit-breaker (see rating plates).
- The 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.

Annex

36 MCU-MH (Motor Control Unit - Module Housing)

36.1 Extract from the Technical Description

The following sections are an extract from the Technical Description of the electrical motor control unit MCU-MH.

The complete Technical Description is available under the order number 953-0071.9.

36.2 Application

The MCU-MH controls the following motor operating mechanisms for three-position switches in medium-voltage load-break switchgear and circuit-breaker switchgear:

- Spring-operated mechanism
- Spring-operated/stored-energy mechanism
- Slow motion mechanism

The MCU-MH is installed in the module housing on standard DIN rails.

Application

The MCU-MH is equipped with a universal wide voltage range. It can optionally be connected to different auxiliary and motor voltages. The auxiliary and motor voltages can be combined and do not necessarily have to be identical.

36.3 Design, function

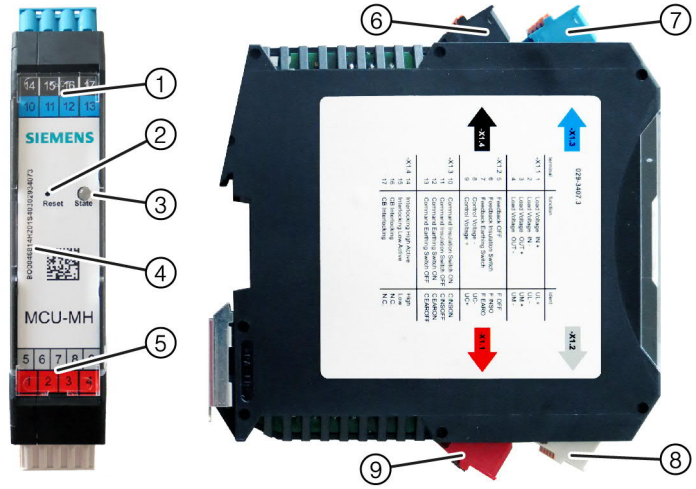


Fig. 160: MCU-MH in the module housing

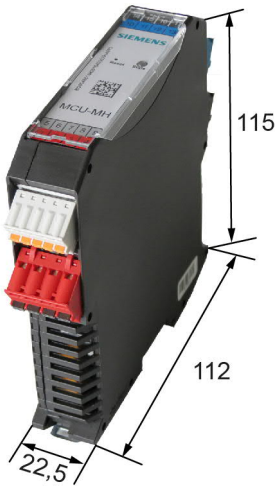


Fig. 161: Dimensions of MCU-MH (data in mm)

① Identification of terminals of upper plugs
② Reset pushbutton
③ LED status indicator
④ Serial number in clear text
⑤ Identification of terminals of lower plugs
⑥ Upper module plug -X1.4
⑦ Upper module plug -X1.3
⑧ Lower module plug -X1.2
⑨ Lower module plug -X1.1

36.4 Technical data

Binary inputs Command input, feedback and interlocking is done through a total of 9 binary inputs (BI).

Binary input	Description	Type	Electrical function	Function
1	Command inputs	Active	High active	Disconnector in the CLOSED position[1]
2				Disconnector in the OPEN[1] position
3				Earthing switch in the CLOSED[1] position
4				Earthing switch in the OPEN[1] position
5	Interlocking inputs	Passive	High active	Total of all interlocking conditions, release of control unit with applied high signal
6		Passive	Low active	Other interlock / 2-pole switching of the disconnector and earthing switch function
7	Feedback inputs	Passive	High active	Disconnector and earthing switch in the OPEN[1] position
8				Disconnector in the CLOSED[1] position
9				Earthing switch in the CLOSED[1] position

[1] Depending on the panel type and the necessary motor direction of rotation, the assignment of the motor direction of rotation can vary.

NOTICE

Functional failure due to insufficient voltage quality
The functioning of MCU-MH may be impaired.

⇨ The voltage quality of the voltages used for auxiliary and load circuits must correspond to applicable standards.

⇨ If an AC control or AC load voltage is used, which is generated directly from single-phase inverters, earth $U_{N2\sim}$.

NOTICE

Functional failure due to incorrect circuit of the command inputs
The functioning of MCU-MH may be impaired.

⇨ For activation of the command inputs for disconnector CLOSED, disconnector OPEN, earthing switch OPEN and earthing switch CLOSED, do not use any external switching contacts that are equipped with capacitors > 4.7 nF connected in parallel with the contact.

NOTICE

Damage to MCU-MH due to test voltages
If the specified limits (1 kV, 1 s) are exceeded during dielectric tests according to the standard IEC 62271-200, the MCU-MH may be damaged by too high test voltages.

⇨ Before performing the dielectric test, remove the connecting plugs at the MCU-MH.

36.5 Fault signals

Output of fault signals Fault signals at the unit are displayed via a red flashing LED status indicator.

Possible causes for a fault signal:

- An incorrect sense of rotation of the motor was detected while moving the operating mechanism from disconnector OPEN / earthing switch OPEN position to disconnector CLOSED / earthing switch CLOSED position.
- There is an internal MCU-MH fault (watchdog).
- The feedback monitoring time (runtime monitoring of the operating mechanism) for protecting the drive motor and the mechanical system was exceeded.
- A command for moving the operating mechanism is applied to the active command inputs (disconnector CLOSED / disconnector OPEN / earthing switch CLOSED / earthing switch OPEN) for more than 5 minutes, although existing interlocking conditions prevent the execution of this command.
- A command is applied to one of the active command inputs (disconnector CLOSED / disconnector OPEN / earthing switch CLOSED / earthing switch OPEN) for more than 5 minutes, although the associated switching operation was completed successfully.

Clearing the fault mode

Options for clearing the fault mode after the cause for the fault mode was eliminated:

- Through the reset button at the device (operation of the reset button: insert a thin, pointed object through the opening at the front side.)
- By removing and re-applying the control voltage

36.6 Terminal assignment of motor control unit

Terminal	Designation
-X1.1:1	Load voltage + (for AC supply L ~)
-X1.1:2	Load voltage - (for AC supply N ~)
-X1.1:3	Output for motor voltage +
-X1.1:4	Output for motor voltage -
-X1.2:5	BI 7: OPEN feedback from auxiliary switch
-X1.2:6	BI 8: Disconnector feedback from auxiliary switch
-X1.2:7	BI 9: Earthing switch feedback from auxiliary switch
-X1.2:8	Control voltage - (for AC supply N ~)
-X1.2:9	Control voltage + (for AC supply L ~)
-X1.3:10	BI 1: Disconnector CLOSED (active BI)[1]
-X1.3:11	BI 2: Disconnector OPEN (active BI)[1]
-X1.3:12	BI 3: Earthing switch CLOSED (active BI)[1]
-X1.3:13	BI 4: Earthing switch OPEN (active BI)[1]
-X1.4:14	BI 5: Interlocking high (passive BI)
-X1.4:15	BI 6: Interlocking low (passive BI)
-X1.4:16	Floating contact, reverse interlocking to circuit-breaker (NC contact)
-X1.4:17	Floating contact, reverse interlocking to circuit-breaker (NC contact)

[1] Depending on the panel type and the necessary motor direction of rotation, the assignment of the motor direction of rotation can vary.

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