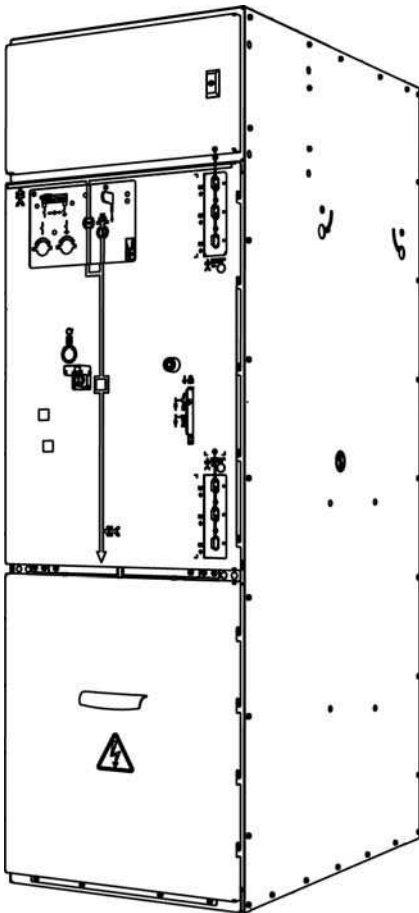


# SIEMENS

## Medium-Voltage Switchgear

Type NXPLUS C Wind Fixed-Mounted Circuit-Breaker Switchgear up to 36 kV,  
Extendable

Single Busbar, Metal-Enclosed, Gas-Insulated



Medium-Voltage  
Switchgear

### **INSTALLATION AND OPERATING INSTRUCTIONS**

Order No.: 802-9074.9

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**Siemens AG**  
**Infrastructure & Cities Sector**  
**Low and Medium Voltage Division**  
**Medium Voltage**

**Since**  
**1992**

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

**Since**  
**1995**

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

**Since**  
**2008**

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

## About these Instructions

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation or operation.

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

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

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

The contents of this instruction manual shall not become part or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.




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# Safety instructions


## 1 Signal terms and definitions

	<p><b>DANGER!</b></p> <p>as used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken.</p> <p>⇒ Observe the safety instructions.</p>
	<p><b>ATTENTION!</b></p> <p>as used in these instructions, this means that damage to property or environment can occur if the relevant precautionary measures are not taken.</p> <p>⇒ Observe the safety instructions.</p>
	<p><b>NOTE!</b></p> <p>as used in these instructions, this points at facilitations of work, particularities for operation or possible maloperation.</p> <p>⇒ Observe the notes.</p>

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

## 2 General instructions

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

	<b>DANGER!</b>
	<p>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:</p> <ul style="list-style-type: none"> <li>⇒ Original Siemens spare parts were not used.</li> <li>⇒ Service engineers performing replacement were not trained and certified by Siemens.</li> <li>⇒ Parts were fitted or adjusted incorrectly.</li> <li>⇒ Settings were not made in accordance with Siemens specifications.</li> <li>⇒ After installation and setting, no final check was performed by a service engineer approved by Siemens, including documentation of the test results.</li> <li>⇒ Maintenance was not done according to the operating instructions of the Siemens products.</li> </ul>

### 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 materials

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

### Personal protective equipment (PPE)

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

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


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

The protective equipment consists of:

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

### 3 Due application

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

	<b>DANGER!</b>
	<p>The perfect and safe operation of this switchgear is conditional on:</p> <ul style="list-style-type: none"> <li>⇒ Observance of operating and installation instructions.</li> <li>⇒ Qualified personnel.</li> <li>⇒ Proper transportation and correct storage of the switchgear.</li> <li>⇒ Correct installation and commissioning.</li> <li>⇒ Diligent operation and maintenance.</li> <li>⇒ Observance of the instructions applicable at site for installation, operation and safety.</li> </ul>

### 4 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

## 5 Features

**Typical uses** Extendable fixed-mounted circuit-breaker switchgear NXPLUS C Wind, single busbar, is used, above all, in wind turbines.

The panels are designed for rated voltages up to 36 kV, rated currents up to 1000 A, and a rated short-time withstand current of 25 kA as a maximum.

**Insulating gas SF<sub>6</sub>** Sulfur hexafluoride SF<sub>6</sub> is used as insulating gas. SF<sub>6</sub> insulates live parts between each other and against the earthed vessel wall. For panels with switch disconnecter, SF<sub>6</sub> serves also for extinguishing the internal arc.

The switchgear is delivered ex works with SF<sub>6</sub> filling, ready for service. The SF<sub>6</sub> filling is provided to last the total service life of the switchgear.

No gas work is required for installation on site and later extensions.

Filling quantity as per rating plate.

- Technology**
- Factory-assembled, type-tested and metal-enclosed switchgear for indoor installation
  - Stainless-steel vessel welded gas-tight
  - Switchgear vessel, gas-insulated
  - Single-pole insulated: cable connection and busbar
  - Installation and extension without SF<sub>6</sub> gas work
  - Screened busbar system, insulated with silicone rubber
  - Three-position switch-disconnector with load-break and make-proof earthing function
  - Cable connection from front with cable plugs
  - Maintenance-free

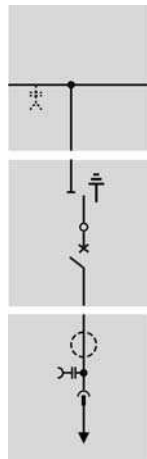
- Personal safety**
- Safe-to-touch due to metal enclosure of live parts
  - Clear mimic diagram with mechanical position indicators
  - Logical mechanical interlocking
  - Capacitive voltage detecting system to verify safe isolation from supply
  - Earthing of feeders by means of the earthing function of the three-position disconnecter in the disconnecter panel, earthing of feeders by means of the earthing function of the three-position disconnecter in the ring-main panel and make-proof earthing through the three-position disconnecter and the circuit-breaker in the circuit-breaker panel
  - Resistance to internal arcing

- Security of operation and availability**
- Hermetically sealed primary enclosure independent of environmental effects such as pollution, humidity and small animals
  - Welded switchgear vessel, sealed for life
  - Operating mechanisms of switching devices accessible outside the switchgear vessel
  - Maloperation is practically excluded due to interlocks and logical arrangement of operating elements.
  - Ready-for-service indicator self-monitoring, easy to read, independent of temperature and environmental pressure variations, with contactless measured-value acquisition and with signaling contacts (option) 1NO + 1NC for telecommunication
  - Minimum fire load
  - Switchgear vessel designed as "sealed pressure system" according to IEC 62 271-200, i.e. the insulating gas filling requires no maintenance

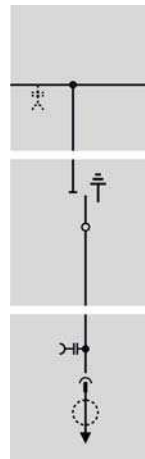


<b>Cost-efficiency</b>	<p>Extremely low "life-cycle costs" and maximum availability thanks to:</p> <ul style="list-style-type: none"><li>• Maintenance-free design (for the service life)</li><li>• Climatic independence</li><li>• Minimum space requirements</li><li>• Long service life</li></ul>
<b>Seismic withstand capability (option)</b>	<p>NXPLUS C Wind switchgear can be upgraded for regions at risk from earthquakes. For upgrading, earthquake qualification testing has been carried out in accordance with the following standards:</p> <ul style="list-style-type: none"><li>• IEC 60068-3-3 "Guidance – seismic test methods for equipment"</li><li>• IEC 60068-2-57 "Test Ff: Vibration – Time-history method"</li><li>• IEC 60068-2-59 "Test Fe: Vibration – Sine-beat method"</li><li>• IEEE 693-2005 "Recommended Practice for Seismic Design of Substations".</li></ul> <p>For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:</p> <ul style="list-style-type: none"><li>• Uniform Building Code 1997 (UBC) – Zone 4</li><li>• California Building Code 1998 (CBC) – Zone 4</li><li>• IEEE 693-2005 – High required response spectrum.</li></ul>

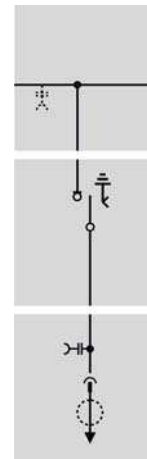
## 6 Panel types



Circuit-breaker panel



Disconnecter panel



Ring-main panel



Vacuum circuit-breaker



Three-position disconnecter



Capacitive voltage detecting system



Current transformer



Three-position switch-disconnector



Cable (not included in the scope of supply)

----- These components can be connected partially or optionally

## 7 Examples for panel versions

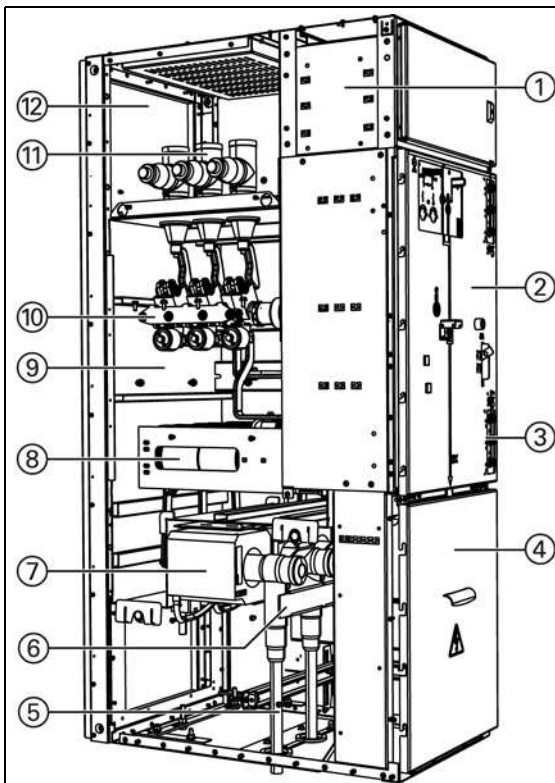


Fig. 1: Circuit-breaker panel (630 A)

- ① Low-voltage compartment
- ② Operating front
- ③ Capacitive voltage detecting system (busbar: top-right, cable feeder: bottom-right)
- ④ Cable compartment cover
- ⑤ Cable with cable plug for outside-cone plug-in system
- ⑥ Arcing plate
- ⑦ Ring-core current transformer (option)
- ⑧ Circuit-breaker with vacuum interrupters
- ⑨ Switchgear vessel, hermetically welded, filled with SF<sub>6</sub> gas, with bursting disc
- ⑩ Three-position disconnector
- ⑪ Busbar system
- ⑫ Pressure relief duct

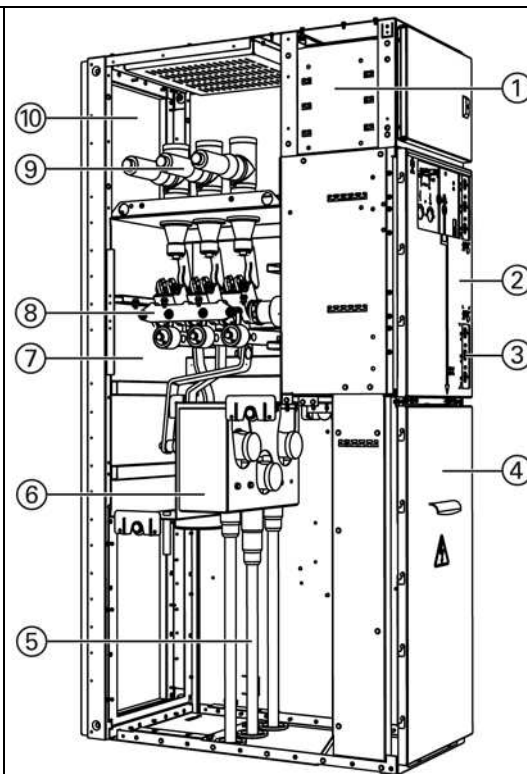


Fig. 2: Disconnector panel (630 A / 1000 A)

- ① Low-voltage compartment
- ② Operating front
- ③ Capacitive voltage detecting system (busbar: top-right, cable feeder: bottom-right)
- ④ Cable compartment cover
- ⑤ Cable with cable plug for outside-cone plug-in system
- ⑥ Arcing plate
- ⑦ Switchgear vessel, hermetically welded, filled with SF<sub>6</sub> gas, with bursting disc
- ⑧ Three-position disconnector
- ⑨ Busbar system
- ⑩ Pressure relief duct

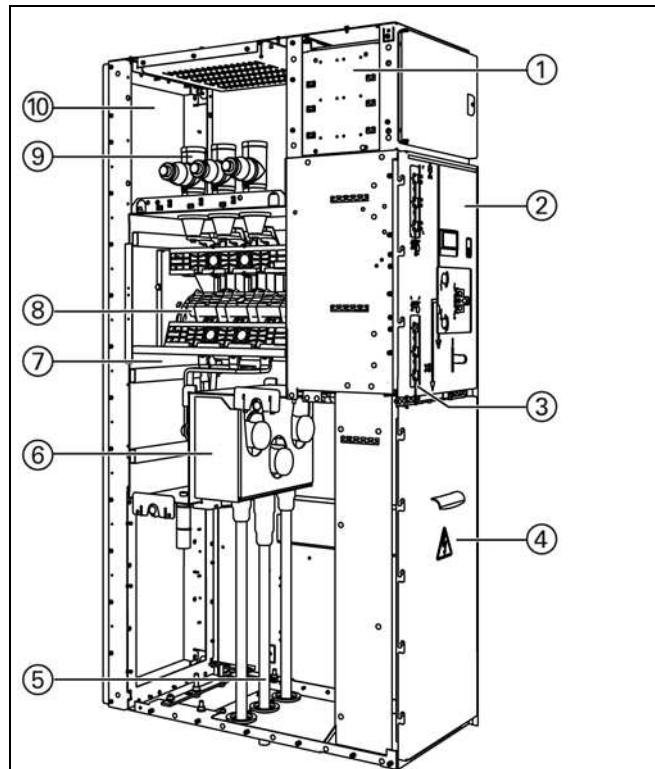


Fig. 3: Ring-main panel (630 A)

- ① Low-voltage compartment
- ② Operating front
- ③ Capacitive voltage detecting system (busbar: top-right, cable feeder: bottom-right)
- ④ Cable compartment cover
- ⑤ Cable with cable plug for outside-cone plug-in system
- ⑥ Arcing plate
- ⑦ Switchgear vessel, hermetically welded, filled with SF<sub>6</sub> gas, with bursting disc
- ⑧ Three-position switch-disconnector
- ⑨ Busbar system
- ⑩ Pressure relief duct

## 8 Components

### 8.1 Circuit-breaker

**Design** The Siemens vacuum circuit-breaker (VCB) 3AH55 is a three-pole indoor circuit-breaker for a rated voltage of 36 kV.

The circuit-breaker consists of the following components:

- Operating mechanism with stored-energy spring mechanism and control elements
- Three circuit-breaker poles with vacuum interrupters
- Partition plate
- Operating rods for contact operation, mounted in the vessel front (partition plate) in a movable way and without seals by means of welded-in metal bellows.

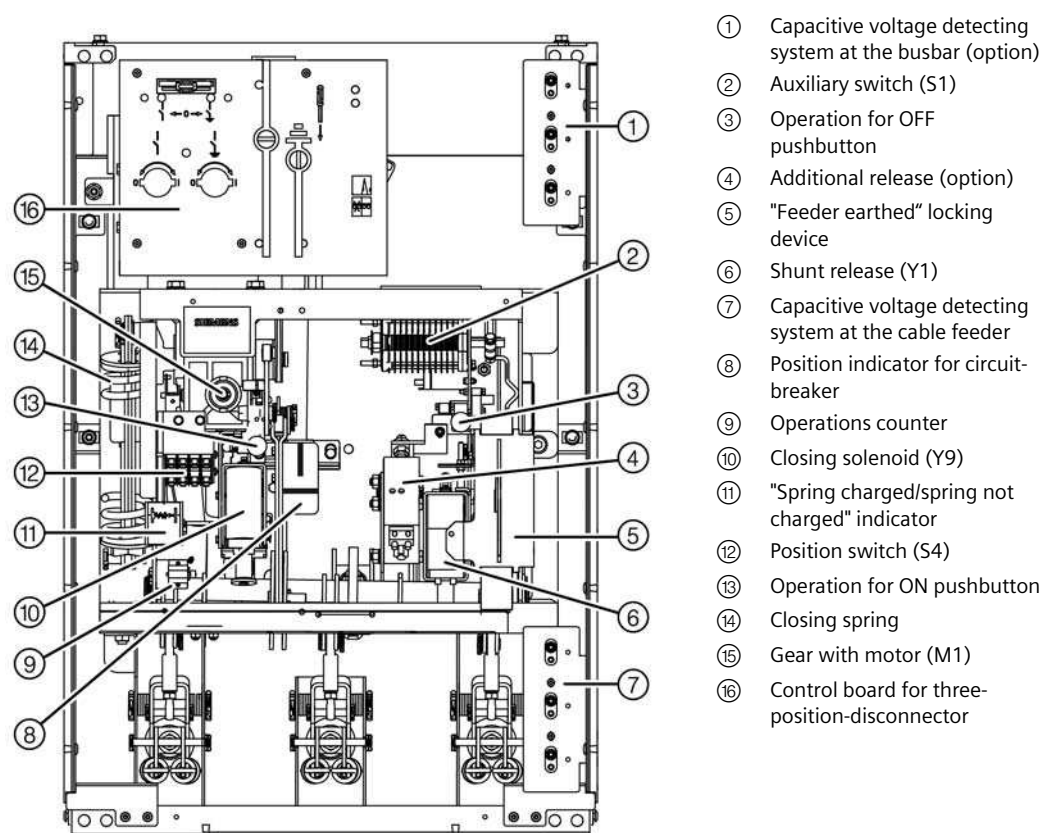


Fig. 4: Circuit-breaker operating mechanism, shown with stored-energy spring mechanism

The operating mechanism box accommodates all electrical and mechanical components required for closing and opening the circuit-breaker.

3AH55 circuit-breakers need no opening spring, as the energy for opening is stored in the contact pressure springs during the closing process.

The operating mechanism box is closed with a removable cover. The cover contains openings for the control elements and indicators.

Circuit-breakers with motor operating stored-energy mechanism are closed with the ON pushbutton. In case of manual operating spring mechanism, the circuit-breaker is automatically closed after the closing spring is charged. The movement transmission to the circuit-breaker poles is performed by metal bellows. In the case of a motor operating stored-energy mechanism, the closing spring is charged again immediately after a closing.

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

The operations counter shows the number of closing processes.

**Vacuum interrupters**

The vacuum interrupter is fixed at the interrupter support. The fixed contact is directly connected to the housing. The moving contact is firmly connected to the connection bolt and is centrally aligned in the guide. A metal bellows forms the vacuum-tight connection to the interrupter housing.

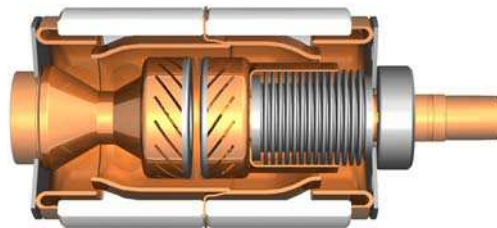


Fig. 5: Vacuum interrupter

**Equipment**

The basic version of the vacuum circuit-breaker with manual spring-operated mechanism is equipped as follows:

- Operating mechanism
- Shunt release (Y1)
- Low-voltage plug connector with 10-pole wiring (Q0)
- Auxiliary switch 4NO + 4NC or 3NO + 4NC freely available (S1)
- Circuit-breaker tripping signal, cutout switches (S6, S7)
- Operations counter
- Feeder locking device

**Additional equipment**

- Motor operating mechanism (M1) with mechanical and electrical anti-pumping device
- Position switch for "closing spring charged" indication (S41, S42)
- Closing solenoid (Y9) (option)
- 2nd shunt release (Y2)
- Undervoltage release (Y7)
- C.t.-operated release (Y4)
- Low-energy c.t.-operated release (Y6)
- Interlocking between feeder locking device and three-position disconnecter (circuit-breaker only lockable in earthed position)
- Interlocking between feeder locking device, three-position disconnecter and cable compartment cover (circuit-breaker only lockable in earthed position, cable compartment cover only removable in earthed position)
- Interlocking between feeder locking device, three-position disconnecter and cable compartment cover (circuit-breaker only lockable in earthed position, cable compartment cover only removable in earthed position) and additional key-operated interlock

**Possible release combinations**

Release		Release combination				
		1	2	3	4	5
1st shunt release	Type 3AY1510	X	X	X	X	X
2st shunt release	Type 3AX1101	-	X	-	-	X
3st shunt release	Type 3AX1101	-	-	-	-	-
C.t.-operated release	Type 3AX1102; 0.5 A or	-	-	X	-	X
	Type 3AX1104, 0.1 Ws					
Undervoltage release	Type 3AX1103	-	-	-	X	-

X: 1 unit of each release, a maximum of 3 releases can be combined

## 8.2 Three-position disconnecter

The three-position disconnecter combines the functions:

- DISCONNECTING
- EARTHING
- READY-TO-EARTH

Application:

- Circuit-breaker panel 630 A and 1000 A
- Disconnector panel 630 A and 1000 A

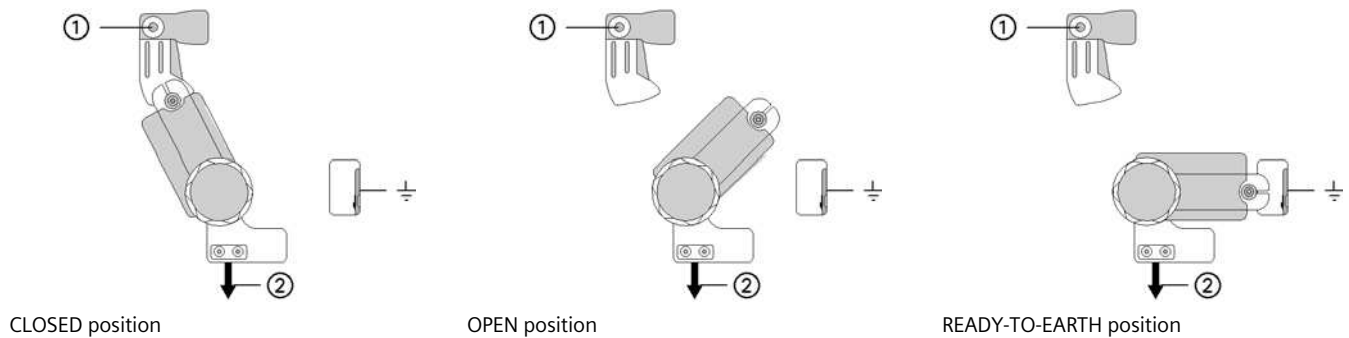
- Features**
- Operation via rotary bushings welded into the front of the switchgear vessel

**Equipment** The basic version of the three-position disconnecter is equipped as follows:

- Auxiliary switch, freely available
  - in EARTHING function with 3NO + 3NC
  - in DISCONNECTING function with 3NO + 3NC
- In the circuit-breaker panel: Mechanical interlocking to the circuit-breaker

- Additional equipment**
- Motor operating mechanism
  - Electromechanical interlock

### Switch positions of the three-position disconnecter



① Busbar connection

② Cable connection or circuit-breaker

### 8.3 Operating mechanisms for the three-position disconnecter

In NXPLUS C Wind switchgear, the three-position disconnecter is used in a disconnecter panel or in combination with circuit-breakers in a circuit-breaker panel.

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

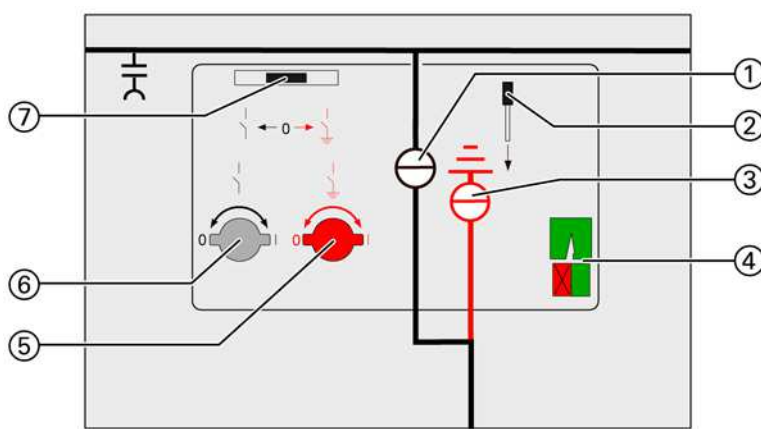
#### Equipment Auxiliary switch

Each operating mechanism is equipped with an auxiliary switch for the position indication.

#### Operating mechanism for three-position disconnecter

Application:

- Circuit-breaker panel 630 A and 800 A
- Disconnecter panel 630 A and 1000 A



- ① Position indicator for three-position disconnecter (DISCONNECTING function)
- ② Interrogation lever (only within circuit-breaker panel)
- ③ Position indicator for three-position disconnecter (EARTHING/READY-TO-EARTH function)
- ④ Ready-for-service indicator
- ⑤ Actuating opening for earthing switch (EARTHING/READY-TO-EARTH function)
- ⑥ Actuating opening for disconnecter (DISCONNECTING function)
- ⑦ Control gate for opening the actuating openings (can only be operated in the circuit-breaker panel if the interrogation lever ② is pushed downwards)



## 8.4 Three-position switch-disconnector

- Features**
- The three-position switch-disconnector is designed for a rated voltage of up to 36 kV.
  - Switching functions as general-purpose switch-disconnector (class E3)

The three-position switch disconnector incorporates the functions of a switch-disconnector and a make-proof earthing switch with the switch positions

- CLOSE
- OPEN
- EARTHED

**Application**

- Ring-main panel

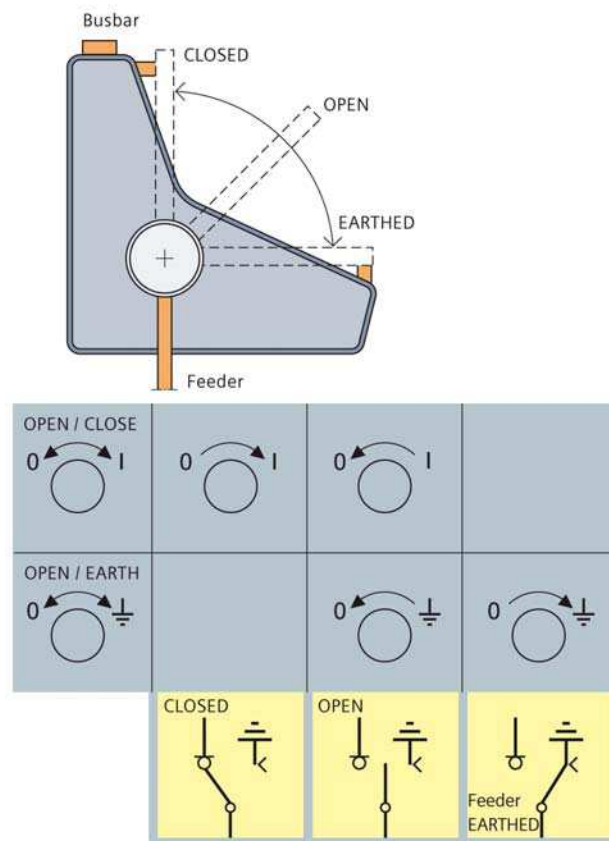


Fig. 6: Operation of three-position switch

**Mode of operation** The operating shaft forms one unit together with the three contact blades. Due to the arrangement of the fixed contacts (earth - busbar), it is not necessary to interlock the CLOSE and EARTHING functions.

**Closing operation** During the closing operation, the operating shaft with the moving contact blades changes from the OPEN to the CLOSED position.

The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.

**Opening operation** During the opening operation, the arc is caused to rotate by the arc-suppression system, thus preventing the development of a fixed root. This very effective arc extinction provides short arcing times. The isolating distance in gas established after opening fulfils the conditions for isolating distances according to IEC/EN 62271-102 / VDE 0671-102, IEC/EN 62271-103 / VDE 0671-103 and IEC/EN 62271-1 / VDE 0671-1.

**Earthing operation** The "EARTHING" operation is implemented by the turning movement of the operating lever (rotation, if required) from the "OPEN" to the "EARTHED" position.

### 8.5 Operating mechanisms of three-position switch-disconnectors

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

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

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

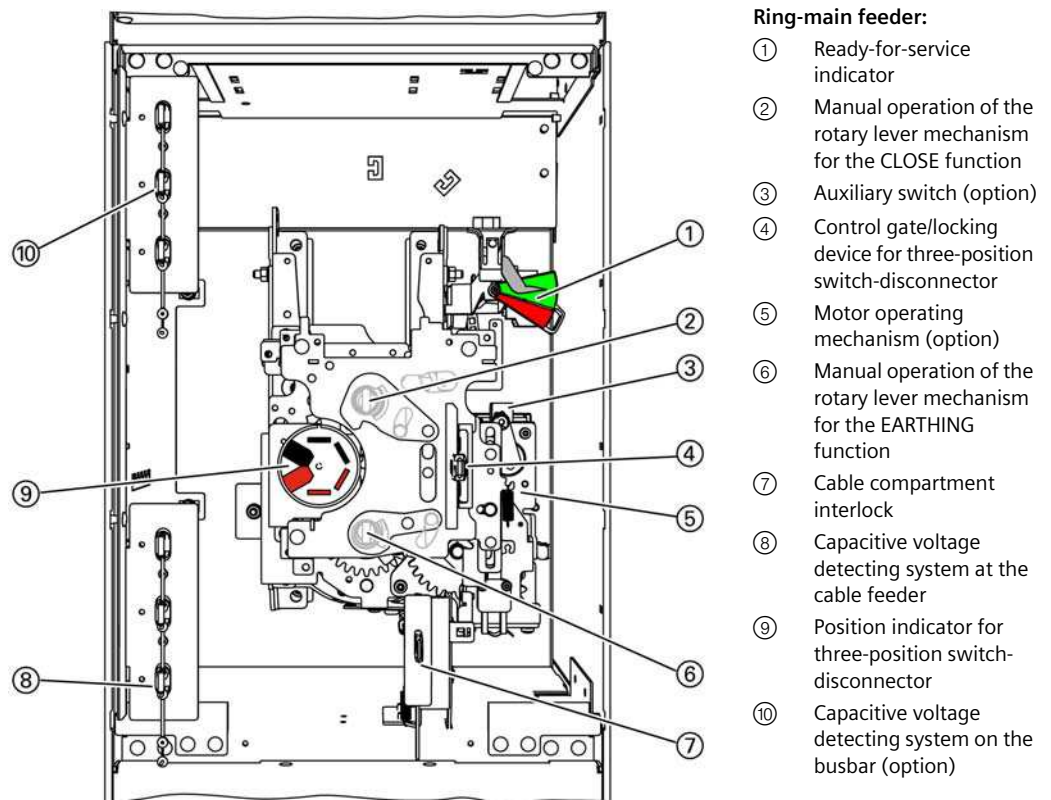


Fig. 7: Front operating mechanism in ring-main feeder

**Options for all operating mechanisms**

- Motor operating mechanism
  - Remote operation (standard) applied to terminal
  - Local operation by momentary-contact rotary control switch in the low-voltage compartment (option)
  - Manual operation possible by operating lever
- Wiring
  - Auxiliary switches and motor operating mechanisms are wired to terminal strips in the low-voltage compartment.

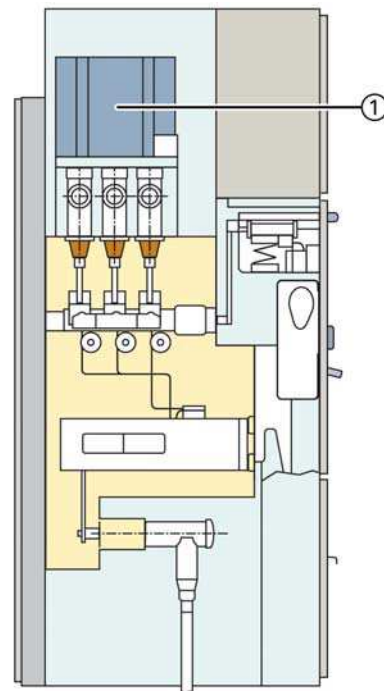
**Option for ring-main feeder**

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

## 8.6 Voltage transformers

- Features**
- According to VDE 0414-9-3 and IEC 61869-3
  - Cast-resin insulated
  - Inductive type
  - Touchable due to metal enclosure
  - Safe-to-touch due to metal cover
  - Pluggable
  - Arranged outside the primary enclosure (switchgear vessel)

- Mounting location**
- On the busbar



① Busbar voltage transformer

- Voltage transformer types**
- Busbar voltage transformer
    - Pluggable in the cross pieces of the busbar using adapters
    - No separate metering panel required
    - Repeat test at 80% of the rated short-duration power-frequency withstand voltage possible with mounted voltage transformer

### Electrical data

Primary data for type 4MT2 36 kV For operating voltages from 30 to 35 kV, rated voltage factor $U_n/8h = 1.9$ ; $U_n/\text{continuous} = 1.2$				
Rated voltage [kV]	Rated short-duration power-frequency withstand voltage [kV]	Rated lightning impulse withstand voltage [kV]	Standard	Operating voltage [kV]
36	70	170	IEC	30/ $\sqrt{3}$ ; 33/ $\sqrt{3}$ ; 34.5/ $\sqrt{3}$ ; 35/ $\sqrt{3}$

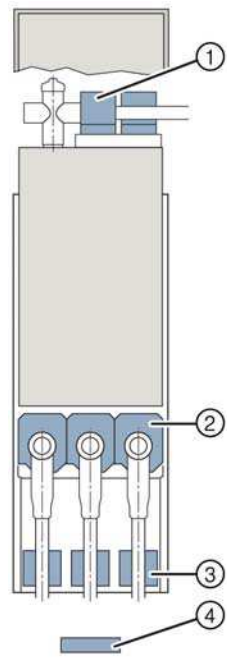
Secondary data								
Type	Operating voltage [V]	Auxiliary winding	Thermal limit current (measuring winding) [A]	Rated long-time current 8 h [A]	Rating at accuracy class [VA]			
					0.2	0.5	1	3
4MT2	100/ $\sqrt{3}$ ;	100/ $\sqrt{3}$ ;	5 A	6	IEC			
	110/ $\sqrt{3}$ ;	110/ $\sqrt{3}$ ;			5, 10, 15, 20, 25	10, 15, 20, 25, 30, 45	10, 15, 20, 25, 30, 45, 50, 60, 75	10, 15, 20, 25, 30, 45, 50, 60, 75
	120/ $\sqrt{3}$	120/ $\sqrt{3}$						

## 8.7 Current transformers

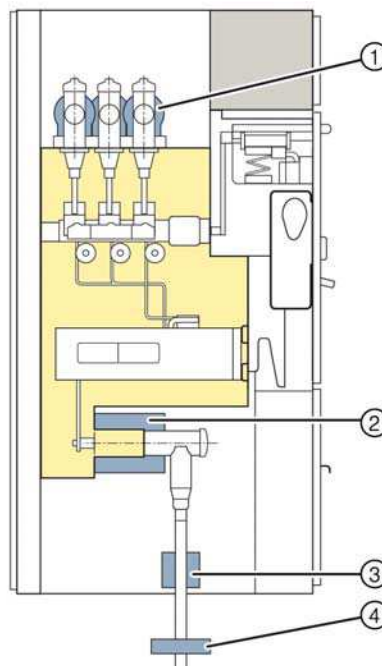
- Features**
- According to VDE 0414-9-2 and IEC 61869-2
  - Designed as ring-core current transformers, single-pole:
    - Ring core as carrier of secondary winding
    - Main circuit corresponds to primary winding
  - Free of dielectrically stressed cast-resin parts (due to design)
  - Arranged outside the primary enclosure (switchgear vessel) due to single-pole design of cable connection
  - Inductive type
  - Certifiable
  - Climate-independent
  - Insulation class E
  - Secondary connection by means of a terminal strip in the low-voltage compartment of the panel

- Mounting locations**
- Around the busbar
  - At the panel connection
  - Around the cable

Front view:



Side view:



- ① Busbar current transformer
- ② Feeder current transformer
- ③ Cable-type current transformer
- ④ Zero-sequence current transformer

**Current transformer types**

- Busbar current transformer
  - Inside diameter of transformer 56 mm
  - Max. usable height 170 mm
- Feeder current transformer (only circuit-breaker panels)
  - Inside diameter of transformer 106 mm
  - Max. usable height 205 mm
- Cable-type current transformer for shielded cables
  - Inside diameter of transformer 55 mm
  - Max. usable height 170 mm
- Zero-sequence current transformer underneath the panels (included in the scope of supply); on-site installation

## Electrical data

Current transformer type	4MC	4MC7032 (core height 80 mm)	WIC	
Operating voltage	max. 0.8 kV	max. 0.8 kV	max. 0.8 kV	
Rated short-duration power- frequency withstand voltage (winding test)	3 kV	3 kV	3 kV	
Rated frequency	50/60 Hz	50/60 Hz	50/60 Hz	
Rated continuous thermal current	max. 1.2 x rated current (primary)	max. 1.2 x rated current (primary)	max. 1.2 x rated current (primary)	
Rated thermal short-time current, max. 1 s	up to 25 kA	up to 25 kA	up to 25 kA	
Rated current	dynamic primary secondary	unlimited 40 A to 600 A 1 A and 5 A	unlimited 40 A to 600 A 1 A and 5 A	unlimited 14.4 A - 57.6 A to 115.2 A - 490.8 A 0.075 A to 0.3 A
Multiratio (secondary)	100 - 50 A to 600 - 300 A	100 - 50 A to 600 - 300 A	-	
Core data according to rated primary current	max. 3 cores	max. 3 cores	max. 2 cores	
Measuring core	Rating Class Overcurrent factor	2.5 VA to 10 VA 0.2 to 1 M10	2.5 VA to 10 VA 0.2 to 1 M10	- - -
Protection core	Rating Class Overcurrent factor	2.5 VA to 30 VA 5 or 10 P10 to P30	2.5 VA to 30 VA 5 or 10 P10 to P30	0.1 VA 5 or 10 P80
Permissible ambient air temperature	max. 60 °C	max. 60 °C	max. 60 °C	
Insulation class	E	E	E	

## 8.8 Busbar system

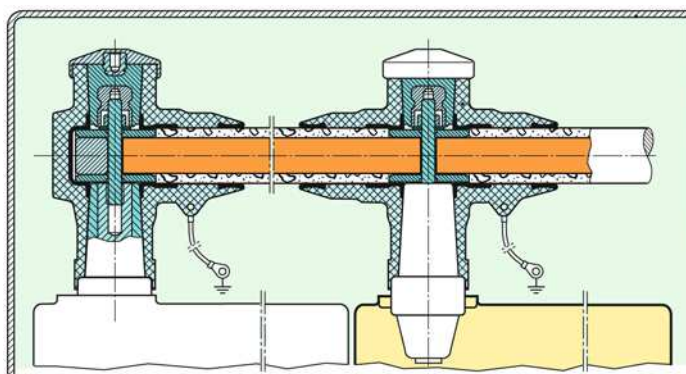


Fig. 8: Busbar system 630 A/1000 A

The busbar is single-pole insulated with silicone rubber. Each phase has an 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, extension or panel replacement is possible within a very short period of time without requiring any gas work.

## 8.9 Cable connection

### Possible combinations of cable connection types (T-plugs, coupling inserts) and surge arresters in NXPLUS C Wind up to 36 kV

For gas-insulated switchgear NXPLUS C Wind, basically only cable plugs shielded by means of an external semi-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 semi-conductive layer) are **not** permissible, as this plug type often produces partial discharges due to the proximity to earthed parts of the switchgear. Partial discharges destroy the cable T-plug, causing an arc between phase and earth.

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

Circuit-breaker panels 630 A / 800 A									
Number of cables per panel and phase	Make	Rated voltage	Conductor cross-section <sup>1)</sup> [mm <sup>2</sup> ]	Insulation	T-plugs/phase bolted	Coupling inserts/ coupling plugs bolted	Surge arresters with coupling inserts		
							Arresters/phase	Coupling unit	
1	Nexans Euromold	36	50 to 240	EPDM	1x M400TB/G	–	1x 400PB-5(10)SA-xxx	–	
		36	50 to 240	EPDM	1x M430TB/G	–	1x 300SA-10-xx	–	
		36	50 to 630	EPDM	1x M484TB/G	–	1x 800SA-10-xx	–	
		36	300 to 630	EPDM	1x M440TB/G	–	1x 400PB-5(10)SA-xxx	–	
	Südkabel	36	70 to 300	Silicone	1x SET 36	–	–	–	
		36	70 to 500	Silicone	1x SEHT 33	–	1x MUT 33	1x KU 33	
	nkt cables	36	25 to 300	Silicone	1x CB 36-630	–	1x CSA36-10	–	
		36	400 to 630	Silicone	1x CB 36-630(1250)	–	1x CSA36-10	–	
	Tyco Electronics Raychem	36	25 to 300	Silicone	1x RSTI-66xx	–	1x RSTI-CC-66SAxxx	–	
		36	25 to 300	Silicone	1x RSTI-68xx	–	–	–	
		36	400 to 630	Silicone	1x RSTI-66Lxx	–	1x RSTI-66SAxxx	1x RSTI-66CP-M16	
		36	400 to 800	Silicone	1x RSTI-69xx	–	–	–	
	2	Nexans Euromold	36	50 to 240	EPDM	2x M400TB/G	1x M400CP	–	–
			36	50 to 240	EPDM	1x M430TB/G	1x M300PBM-630A	1x 300SA-10-xx	–
36			50 to 360	EPDM	1x M484TB/G	1x M804PB/G	–	–	
36			300 to 630	EPDM	2x M440TB/G	1x M400CP	–	–	
Südkabel		36	70 to 500	Silicone	2x SEHT 33	1x KU 33	–	–	
nkt cables		36	25 to 300	Silicone	1x CB 36-630	1x CC36-630	1x CSA36-10	–	
		36	25 to 300	Silicone	2x CB 36-630	1x CP 630C	–	–	
		36	400 to 630	Silicone	2x CB 36-630(1250)	1x CC36-630(1250)	1x CSA36-10	–	
		36	400 to 630	Silicone	2x CB 36-630(1250)	1x CP 630C	–	–	
Tyco Electronics Raychem		36	25 to 300	Silicone	1x RSTI-66xx	1x RSTI-CC-66xx	–	–	
		36	25 to 300	Silicone	1x RSTI-68xx	1x RSTI-CC-68xx	–	–	
		36	400 to 630	Silicone	2x RSTI-66Lxx	1x RSTI-66CP-M16	–	–	
		36	400 to 800	Silicone	1x RSTI-69xx	1x RSTI-CC-69xx	–	–	

<sup>1)</sup> Observe the actual short-circuit and current carrying capacity of the cables and sealing ends.

Disconnecter panel 630 A / 800 A, ring-main panel 630 A								
Number of cables per panel and phase	Make	Rated voltage	Conductor cross-section <sup>1)</sup> [mm <sup>2</sup> ]	Insulation	T-plugs/phase bolted	Coupling inserts/ coupling plugs bolted	Surge arresters with coupling inserts	
							Arresters/phase	Coupling unit
1	Nexans Euromold	36	50 to 240	EPDM	1x M400TB/G	–	1x 400PB 5(10) SA-xxx	–
		36	50 to 240	EPDM	1x M430TB/G	–	1x 300SA-10-xx	–
		36	50 to 630	EPDM	1x M484TB/G	–	1x 800SA-10-xx	–
		36	300 to 630	EPDM	1x M440TB/G	–	1x 400PB 5(10) SA-xxx	–
	Südkabel	36	70 to 500	Silicone	1x SET 36	–	–	–
		36	70 to 500	Silicone	1x SEHT 33	–	1x MUT33	1x KU33
	nkt cables	36	25 to 300	Silicone	1x CB36-630	–	1x CSA36-10	–
		36	400 to 630	Silicone	1x CB36-630(1250)	–	1x CSA36-10	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1x RSTI-66xx	–	1x RSTI-CC-66SAxxx	–
		36	25 to 300	Silicone	1x RSTI-68xx	–	–	–
		36	400 to 630	Silicone	1x RSTI-66Lxx	–	1x RSTI-CC-66SAxxx	1x RSTI-66CP-M16
		36	400 to 800	Silicone	1x RSTI-69xx	–	–	–
2	Nexans Euromold	36	50 to 240	EPDM	2x M400TB/G	1x M400CP	–	–
		36	50 to 240	EPDM	1x M430TB/G	1x M300PB/G	–	–
		36	50 to 630	EPDM	1x M484TB/G	1x M804PB/G	1x 800SA-10-xx	–
		36	300 to 630	EPDM	2x M440TB/G	1x M400CP	–	–
	Südkabel	36	70 to 500	Silicone	2x SEHT 33	1x KU33	–	–
	nkt cables	36	25 to 300	Silicone	1x CB36-630	1x CC36-630	1x CSA36-10	–
		36	25 to 300	Silicone	2x CB36-630	1x CP-630C	1x CSA36-10	–
		36	400 to 630	Silicone	1x CB36-630(1250)	1x CC36-630(1250)	1x CSA36-10	–
		36	400 to 630	Silicone	2x CB36-630(1250)	1x CP-630C	–	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1x RSTI-66xx	1x RSTI-CC-66xx	1x RSTI-CC-66SAxxx	–
		36	25 to 300	Silicone	1x RSTI-68xx	1x RSTI-CC-68xx	–	–
		36	400 to 630	Silicone	2x RSTI-66Lxx	1x RSTI-66CP-M16	1x RSTI-CC-66SAxxx	1x RSTI-66CP-M16
36		400 to 800	Silicone	1x RSTI-69xx	1x RSTI-CC-69xx	–	–	
3	Nexans Euromold	36	50 to 240	EPDM	1x M430TB/G	1x M300PBM-630A	–	–
	nkt cables	36	25 to 300	Silicone	1x CB36-630	2x CC36-630	–	–
		36				2x CP-630C	–	–
		36	400 to 630	Silicone	1x CB 36-630(1250)	2x CC36-630(1250)	–	–
		36	400 to 630	Silicone	2x CB 36-630(1250)	1x CP-630C	–	–
	Tyco Electronics Raychem	36	25 to 300	Silicone	1x RSTI-66xx	2x RSTI-CC-66xx	–	–
		36	25 to 300	Silicone	1x RSTI-68xx	2x RSTI-CC-68xx	–	–
		36	400 to 630	Silicone	3x RSTI-66Lxx	2x RSTI-66CP-M16	–	–
36		400 to 800	Silicone	1x RSTI-69xx	2x RSTI-CC-69xx	–	–	

<sup>1)</sup> Observe the actual short-circuit and current carrying capacity of the cables and sealing ends.


## Description

**Thermoplastic-insulated cables ≤ 36 kV** according to IEC 60 502-2 and VDE 0276-620

Cable type	Cable sealing end			Comment
	Make	Type	Cross-section [mm <sup>2</sup> ]	
1-core cable, PE and XLPE-insulated N2YSY (Cu) and N2XSX (Cu) or NA2YSY (Al) and NA2XSX (Al)	Nexans Euromold	M400TB/G	50 to 240	EPDM with semi-conductive layer
		M430TB/G	50 to 240	EPDM with semi-conductive layer
		M484TB/G	70 to 630	EPDM with semi-conductive layer
		M440 TB/G	300 to 630	EPDM with semi-conductive layer
	nkt cables	CB 36-630	25 to 300	Silicone with semi-conductive layer (optionally with metal housing)
		CB 36-630(1250)	400 to 630	Silicone with semi-conductive layer (optionally with metal housing)
	Südkabel	SEHDT 33	70 to 500	Silicone with semi-conductive layer (optionally with metal housing)
	Tyco Electronics Raychem	RSTI-66xx	25 to 240	Silicone with semi-conductive layer, with capacitive measuring point
		RSTI-68xx	25 to 240	Silicone with semi-conductive layer, with capacitive measuring point
		RSTI-66Lxx	400 to 630	Silicone with semi-conductive layer, with capacitive measuring point
		RSTI-69xx	400 to 800	Silicone with semi-conductive layer, with capacitive measuring point

- 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 800 mm<sup>2</sup>

- Surge arresters**
- Pluggable on cable T-plug (Nexans Euromold, Tyco Electronics Raychem, nkt cables and Südkabel)
  - Surge arresters recommended
    - if, at the same time, the cable system is directly connected to the overhead line.
    - if, at the same time, the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear.
    - in offshore wind farms.

	<b>NOTE!</b>
	⇒ Cable T-plugs and surge arresters must be from the same manufacturer, see page 22, "Possible combinations of cable connection types (T-plugs, coupling inserts) and surge arresters in NXPLUS C Wind up to 36 kV".

- Check of mounting space** Surge arresters are used only with one cable connected per phase. Some types of surge arresters exceed the permissible dimensions. The following table informs about possible combinations (x):

Surge arrester type	1 cable per phase			2 cables per phase		
	Circuit-breaker panel	Disconnecter panel	Ring-main panel	Circuit-breaker panel	Disconnecter panel	Ring-main panel
Nexans Euromold 400PB-10-SA-45L	X	X	X	–	–	–
Nexans Euromold 300SA-10-xx	X	X	X	X	X	X
Südkabel MUT 33 + KU 33	– *	X	X	–	–	–
nkt cables CSA 36-10	X	X	X	X**	X	X
Tyco Electronics Raychem RSTI-CC-66SAxxx	–*	X	X	–*	X	X
Tyco Electronics Raychem RSTI-66SAxxx	–*	X	X	–*	X	X

\* protrudes into the floor area; possible depending on the local conditions, e.g. with sufficient hole depth

\*\* depending on the plug type (see page 22, "Possible combinations of cable connection types (T-plugs, coupling inserts) and surge arresters in NXPLUS C Wind up to 36 kV")



### 8.10 Ready-for-service indicator

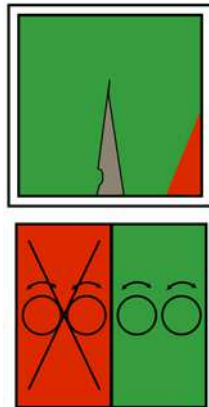


Fig. 9: Ready-for-service indicator on the front plate (disconnecter panel, circuit-breaker panel)

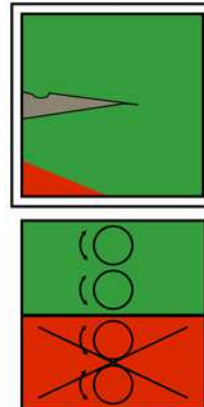


Fig. 10: Ready-for-service indicator on the front plate (ring-main panel)

- Features**
- Self-monitoring, easy to read
  - Independent of temperature and pressure variations
  - Independent of the site altitude
  - Only responds to changes in gas density
  - Option: Alarm switch 1NO + 1NC for remote electrical indication
  - Contactless detection of gas monitoring

#### Mode of operation

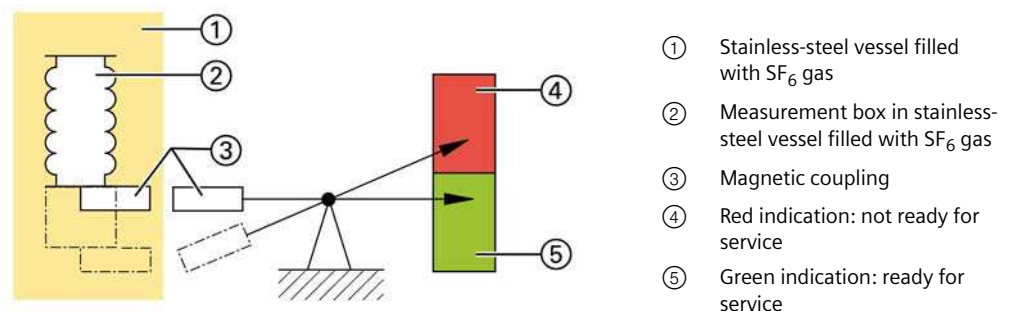


Fig. 11: Gas monitoring principle

For the ready-for-service indicator, a gas-tight measurement box is installed inside the switchgear vessel. A coupling magnet transmits the position of the measurement box to an armature located outside the switchgear vessel. This armature moves the ready-for-service indicator of the switchgear.

Thermal variations of the gas pressure are compensated, as the gas available in the measurement box and in the vessel expands in the same way when it gets warm. A change of the gas density in the switchgear vessel caused by a leak is indicated due to the pressure difference between the switchgear vessel and the measurement box. The gas density is decisive for the insulating capacity.

### 8.11 Interlocks

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

#### Circuit-breaker panel/disconnector panel

Control gate lever in position:		
<b>Left</b>	<b>Center</b>	<b>Right</b>
The three-position switch can be operated	Switching operation not possible	READY-TO-EARTH/EARTHING possible

#### Ring-main panel

Control gate lever in position:		
<b>Up</b>	<b>Center</b>	<b>Down</b>
The three-position switch can be operated	Switching operation not possible	READY-TO-EARTH/EARTHING possible

#### Optional interlocks:

- Mechanical interlocking between feeder locking device and three-position disconnecter (circuit-breaker only lockable in earthed position)
- Mechanical interlocking between feeder locking device, three-position disconnecter and cable compartment cover (circuit-breaker only lockable in earthed position, cable compartment cover only removable in earthed position)
- Mechanical interlocking between feeder locking device, three-position disconnecter and cable compartment cover (circuit-breaker only lockable in earthed position, cable compartment cover only removable in earthed position) with key-operated interlock
- Mechanical interlocking between the three-position switch and the cable compartment cover (cable compartment cover only removable in earthed position)
- Mechanical interlocking between the three-position switch and the cable compartment cover (cable compartment cover only removable in earthed position) with key-operated interlock
- Electromagnetic interlocking of the actuating openings for the three-position switch
- A closing lock-out (option) in the ring-main panel prevents the three-position switch-disconnector from being switched to the CLOSED position if the cable compartment cover is removed.



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

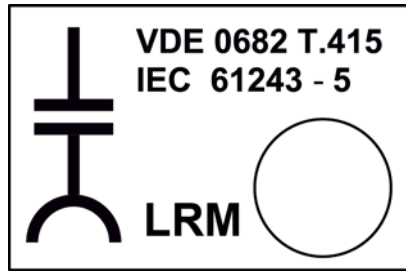


Fig. 14: Documentation to repeat test of interface condition

**VOIS+, VOIS R+**



Fig. 15: Voltage indicator type VOIS+

**Features of VOIS+, VOIS R+**

- Integrated display, without auxiliary power
- With indication "A1" to "A3" (see page 153, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- Maintenance-free, repeat test required
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 54, temperature range -25 °C to +55°C
- With integrated signaling relays (only VOIS R+)
- "M1": Operating voltage present at one phase L1, L2 or L3 as a minimum
- "M2": Operating voltage not present at L1, L2 and L3


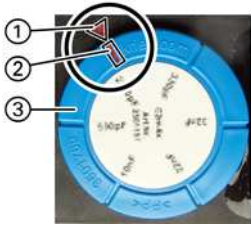
**CAPDIS-Sx+**



Fig. 16: Voltage indicator type CAPDIS -S2+ (option)

### Common features of CAPDIS -S1+/-S2+

- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Test" button
- Adjustable to different operating voltage ranges
- With integrated 3-phase test socket for phase comparison (also suitable for plug-in voltage indicator)
- Degree of protection IP 54, temperature range  $-25\text{ °C}$  to  $+55\text{ °C}$
- With signal-lead test
- With overvoltage monitoring and signaling at 1.2 times operating voltage

	<p><b>DANGER!</b></p> <p>High voltage! Danger! Do only modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ after consultation with the regional Siemens representative!</p>
	<p>⇒ If the setting of the C2 module was modified by mistake, re-establish the factory setting as follows:</p> <ul style="list-style-type: none"> <li>- Pull out the C2 module ③ at the rear side of CAPDIS-S1+/S2+</li> <li>- Plug the C2 module ③ into CAPDIS-S1+/S2+ so that the marked arrow ① on the housing points to the marking ② on the C2 module</li> </ul> <div style="text-align: center;">  </div> <p>Fig. 17: Marking of the factory setting at the C2 module</p>

### Features of CAPDIS-S1+

- Without auxiliary power
- With indication "A1" to "A7" (see page 153, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- Without ready-for-service monitoring
- Without signaling relay (thus without auxiliary contacts)

### Features of CAPDIS-S2+

- With indication "A0" to "A8" (see page 153, "Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+")
- Only by pressing the "Test" pushbutton: "ERROR" indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (external auxiliary power required)
- With integrated signaling relay for signals "M1" to "M4" (auxiliary power required):
  - "M1": Voltage present at phases L1, L2, L3
  - "M2": Voltage not present at L1, L2 and L3 (= active zero indication)
  - "M3": Earth fault or voltage failure, e.g. in one phase
  - "M4": External auxiliary power missing (with operating voltage present or not)

WEGA 1.2



Fig. 18: Voltage indicator type WEGA 1.2

Features of WEGA 1.2

- With indication "A1" to "A5" (see page 155, "Indications WEGA 1.2, WEGA 2.2")
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- Degree of protection IP 54, temperature range –25 °C to +55 °C
- Without integrated signaling relay
- Without auxiliary power

WEGA 2.2



Fig. 19: Voltage indicator type WEGA 2.2

Features of WEGA 2.2

- With indication "A0" to "A6" (see page 155, "Indications WEGA 1.2, WEGA 2.2")
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- Degree of protection IP 54, temperature range –25 °C to +55 °C
- With integrated signaling relay
- Auxiliary power required

### 8.13 Short-circuit/earth-fault indicator (ring-main panel)

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

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

#### Exemplary selection of short-circuit/earth-fault indicators



Fig. 20: Short-circuit indicator ALPHA E, make Horstmann



Fig. 21: Short-circuit indicator SIGMA, make Horstmann)



Fig. 22: Short-circuit indicator IKI-20, make Kries

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

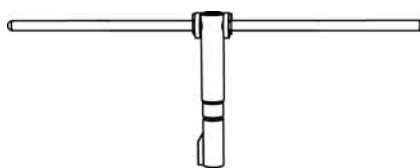
<sup>1)</sup> Power supply for LED indication via built-in long-time lithium cell, alternatively 12–110 V DC or 24–60 V AC

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

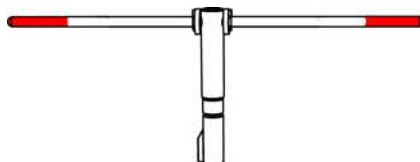
## 8.14 Accessories

### Standard accessories

- Operating and installation instructions
- Operating lever for operating the three-position disconnecter:
  - Operating lever for DISCONNECTING function



- Operating lever for EARTHING/READY-TO-EARTH function (handle painted red)

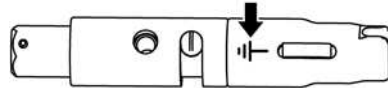


- Adapter for operating the three-position switch-disconnector:
  - Adapter for DISCONNECTING function with DISCONNECTING symbol (see arrow)

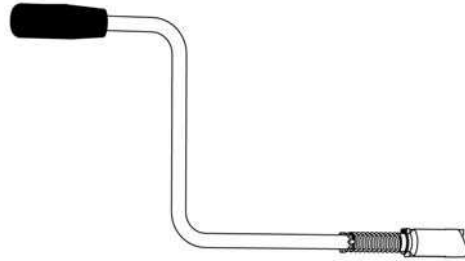




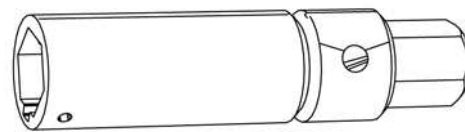
- Adapter for EARTHING function with EARTHING symbol (see arrow)



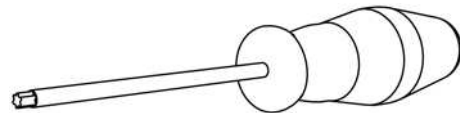
- Hand crank for charging the circuit-breaker closing spring



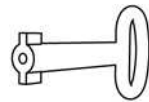
- Adapter for emergency operation (to be used only with motor operating mechanism)



- Torx screwdriver T25 to open the cable compartment cover



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



**Other accessories** According to the order documents/purchase order (selection):

- Cable plugs / adapter systems
- Surge arresters
- LRM voltage indicators
- Test units to check the capacitive interface and the voltage indicators
- Device for the function test of the plug-in indicator



- Phase comparison test units (examples):

**Phase comparison test unit make Pfisterer, type EPV**

As combined test unit (HR and LRM) for

- Voltage detection
- Phase comparison
- Interface testing at the switchgear
- Integrated self-test



**Phase comparison test unit make Kries, type CAP-Phase**

As combined test unit (HR and LRM) for

- Voltage detection
- Repeat test
- Phase comparison
- Phase sequence test
- Self-test
- The unit does not require a battery.



**Phase comparison test unit make Horstmann, type ORION 3.1**

As combined test unit (HR and LRM) for

- Phase comparison
- Interface testing at the switchgear
- Voltage detection
- Integrated self-test
- Indication via LED and acoustic alarm
- Phase sequence indicator



**Phase comparison test unit make Hachmann, type VisualPhase LCD**

As combined test unit (HR and LRM) for

- Voltage detection with measured-value indication
- Interface test
- Low voltage detection
- Documentable repeat test
- Phase comparison with LED signal and measured-value indication
- Phase angle from  $-180^{\circ}$  to  $+180^{\circ}$
- Phase sequence evaluation
- Frequency quality
- Complete self-test



**Service flap (option)** The service flap for fastening the standard accessories is located in the switchgear termination.

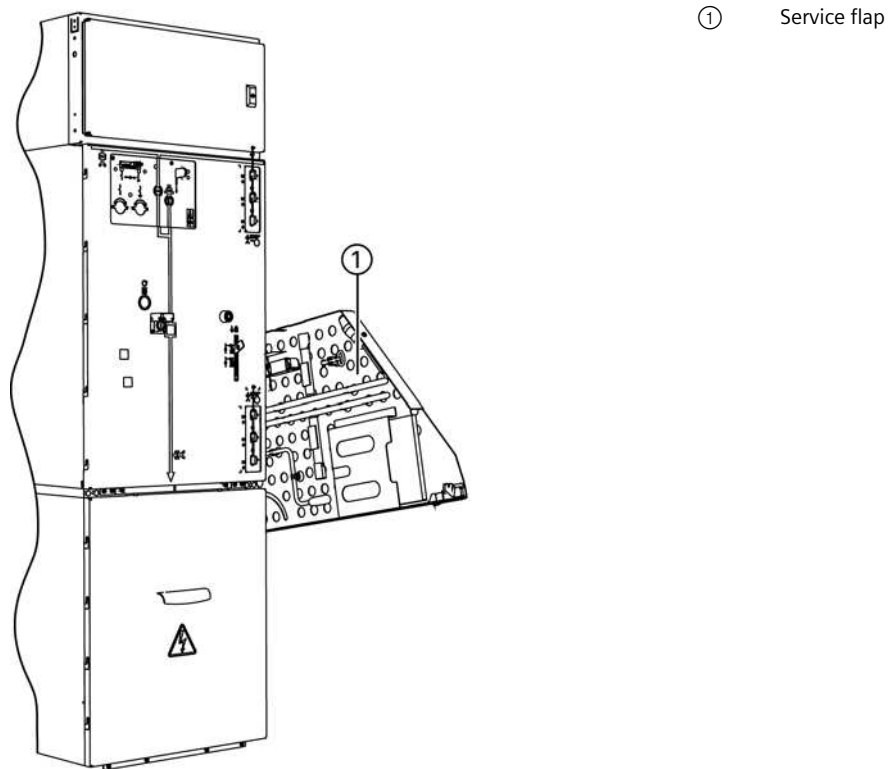





Fig. 23: Service flap with standard accessories

	<p><b>NOTE!</b></p> <p>Changed switchgear width due to service flap</p> <p>⇒ Due to the service flap, the switchgear width is extended by 50 mm.</p>
	<p><b>ATTENTION!</b></p> <p>Risk of injury when closing the service flap! Fingers can be trapped between service flap and switchgear front.</p> <p>⇒ Hold service flap at the provided recess when closing it.</p>
	<p><b>ATTENTION!</b></p> <p>Do not let service flap shut close! Switchgear may be damaged.</p> <p>⇒ Close service flap in a controlled manner.</p>

## 9 Technical data

### 9.1 Complete switchgear

#### General electrical data

Rated voltage	kV	36
Rated short-duration power-frequency withstand voltage		
- phase-to-phase, phase-to-earth, open contact gap	kV	70
- across the isolating distance	kV	80
Rated lightning impulse withstand voltage		
- phase-to-phase, phase-to-earth, open contact gap	kV	170
- across the isolating distance	kV	195
Rated frequency	Hz	50/60 <sup>1)</sup>
Rated short-circuit breaking current	kA	max. 25
Rated short-circuit making current	kA	max. 63/65 <sup>2)</sup>
Rated peak withstand current	kA	max. 63/65 <sup>2)</sup>
Rated short-time withstand current	kA	max. 25 (1 s)
	kA	max. 20 (3 s)
Rated normal current of busbar, max.	A	630/800/1000
Rated normal current for incoming and outgoing feeders	A	630/800/1000
Temperature range	°C	-25 to +55

<sup>1)</sup>for ring-main panel 25 kA (1s) only for 50 Hz

<sup>2)</sup>for ring-main panel max. 63 kA

#### High-voltage test equipment

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

Test voltage [kV]	Power consumption of the incoming feeder panel [mA]	Power consumption of further panels (busbar) [mA]
56*	10	5

\* 80% according to IEC 62271-200

#### Power losses per panel

Rated normal current [A]	Power loss [W] (rated voltage: 36 kV)			
	Circuit-breaker panel	Disconnecter panel 630 A	Disconnecter panel 1000 A	Ring-main panel 630 A
100	7	4	3	5
200	25	15	10	20
400	100	60	40	75
630	250	150	100	180
800	410	-	180	-
1000	-	-	260	-

Phase sequence in the busbar compartment

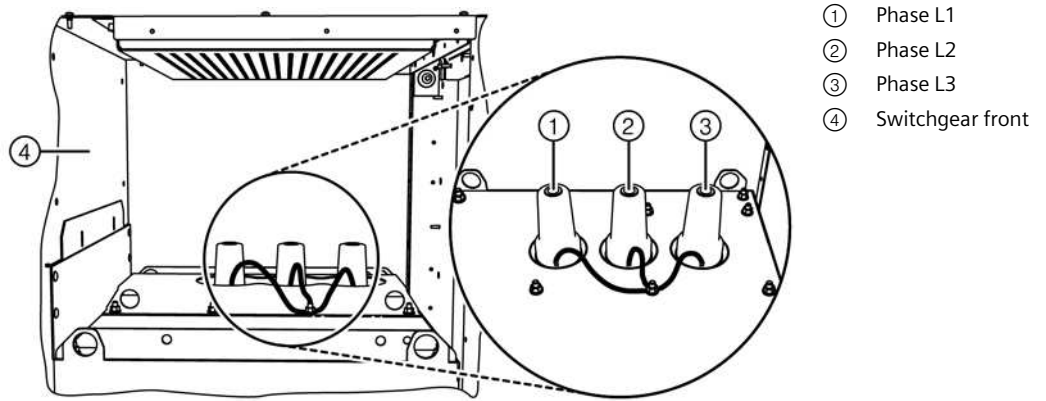


Fig. 24: Phase sequence of bushings in the busbar compartment

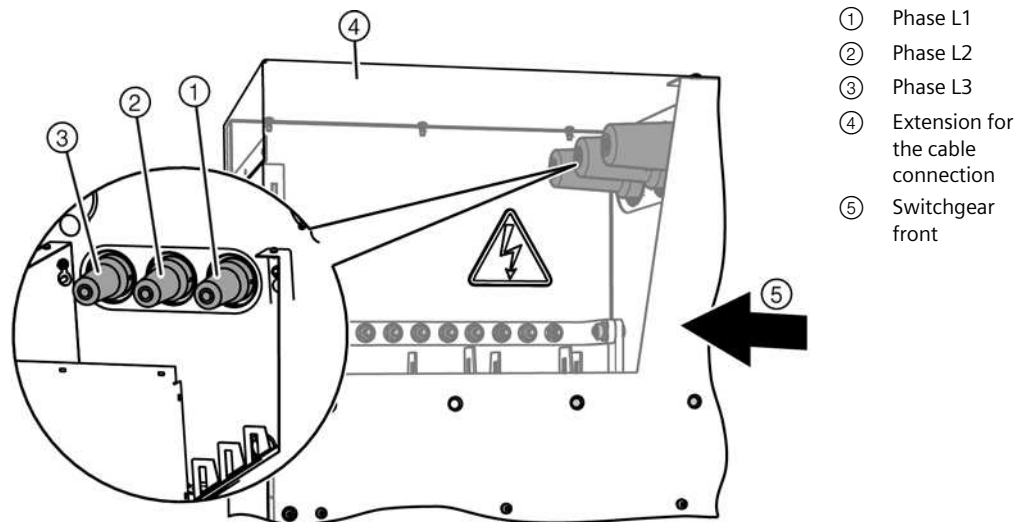


Fig. 25: Phase sequence of bushings at the lateral cable connection (circuit-breaker panel, ring-main panel)

Phase sequence in the cable compartment

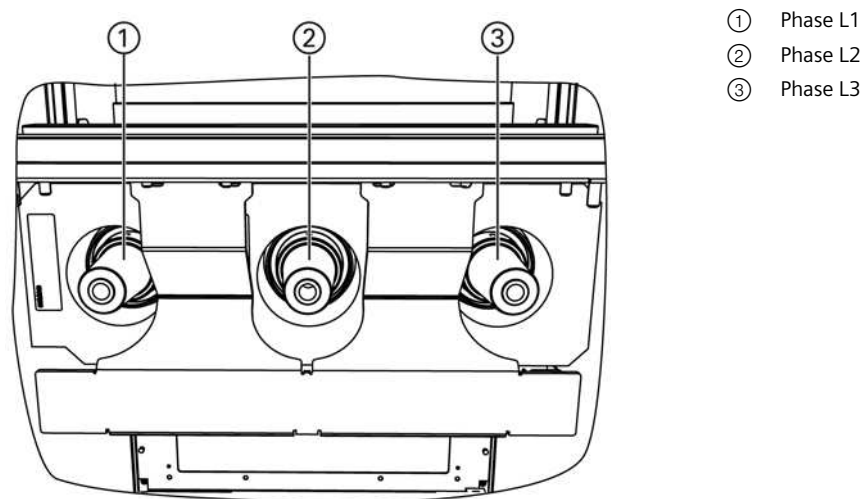
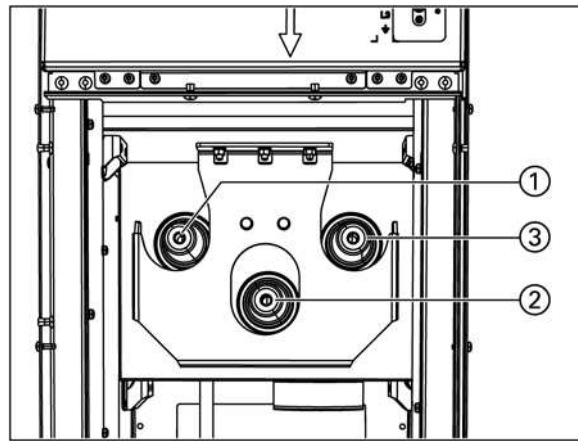


Fig. 26: Phase sequence of bushings in the cable compartment (circuit-breaker panel)



- ① Phase L1
- ② Phase L2
- ③ Phase L3

Fig. 27: Phase sequence of bushings in the cable compartment (disconnecter panel, ring-main panel)

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

## 9.2 Classification of NXPLUS C Wind according to IEC 62 271-200

### Design and construction

Partition class	PM (partition of metal)
Loss of service continuity category <sup>1)</sup>	
- Panels	LSC 2
Accessibility to compartments (enclosure)	
- Busbar compartment	Tool-based
- Switching device compartment	Non-accessible
- Low-voltage compartment	Tool-based
- Cable compartment	Tool-based
	Interlock-controlled and tool-based (option)

<sup>1)</sup> The loss of service continuity category is always referred to the complete switchgear, i.e. the panel with the lowest category determines the loss of service continuity category of the complete switchgear.

### Internal arc classification

Designation of the internal arc classification IAC		
IAC class for <sup>1)</sup>	- Wall-standing arrangement	IAC A FL 20 kA, 1 s IAC A FL 25 kA, 1 s
	- Free-standing arrangement	IAC A FLR 20 kA, 1 s IAC A FLR 25 kA, 1 s
Type of accessibility A		Switchgear in closed electrical service location, access "for authorized personnel only" according to IEC 62 271-200
	- F	Front
	- L	Lateral
	- R	Rear (for free-standing arrangement)
Arc test current		25 kA
Test duration		1 s

<sup>1)</sup> Panels with lateral cable connection have internal arc classification IAC A F

### 9.3 Standards, specifications, guidelines

#### Basic prescriptions and standards

The fixed-mounted circuit-breaker switchgear NXPLUS C Wind for indoor installation complies with the following prescriptions and standards:

		IEC standard	VDE standard	EN standard
Switchgear	NXPLUS C Wind	IEC 62271-1	VDE 0671-1	EN 62271-1
		IEC 62271-200	VDE 0671-200	EN 62271-200
		IEC 62271-304	–	eLC/TS 62271-304
Switching devices	Circuit-breaker	IEC 62271-100	VDE 0671-100	EN 62271-100
	Disconnecter / earthing switch	IEC 62271-102	VDE 0671-102	EN 62271-102
	Switch-disconnector	IEC 62271-103	VDE 0671-103	EN 62271-103
	Voltage detecting systems	IEC 61243-5	VDE 0682-415	EN 61243-5
Degree of protection	IP code	IEC 60529	VDE 0470-1	EN 60529
	IK code	IEC 62262	VDE 0470-100	EN 50102
Insulation		IEC 60071	VDE 0111	EN 60071
Instrument transformers		IEC 61869-1	VDE 0414-9-1	EN 61869-1
	Current transformer	IEC 61869-2	VDE 0414-9-2	EN 61869-2
	Voltage transformer	IEC 61869-3	VDE 0414-9-3	EN 61869-3
Insulating gas SF <sub>6</sub>		IEC 60376	VDE 0373-1	EN 60376
Installation and erection		IEC 61936-1 / HD 637-S1	VDE 0101	EN 61936-1 / HD 637-S1

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

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

#### Electromagnetic compatibility - EMC

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

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

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

#### Protection against solid foreign objects, electric shock and water

The panels of NXPLUS C Wind fulfill the following degrees of protection according to IEC 62 271-200, IEC 60 529 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
- IP4X option for switchgear enclosure of operating front and side walls
- IP65 for parts under high voltage in all switchgear panels
- IP54 for secondary devices in the LV door, according to the definitions for the switchgear enclosure

**Seismic withstand capability (option)**

NXPLUS C Wind switchgear can be upgraded for regions at risk from earthquakes. For upgrading, 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.

**9.4 Rating plates**

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

The rating plate is located:

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

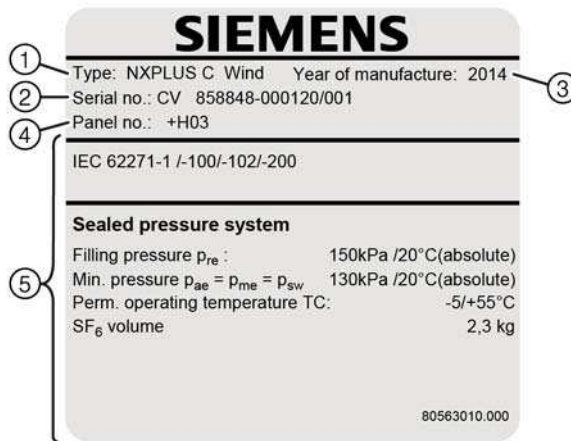


Fig. 28: Rating plate on the switchgear vessel (example)

- ① Switchgear type
- ② Serial number
- ③ Year of manufacture
- ④ Panel number

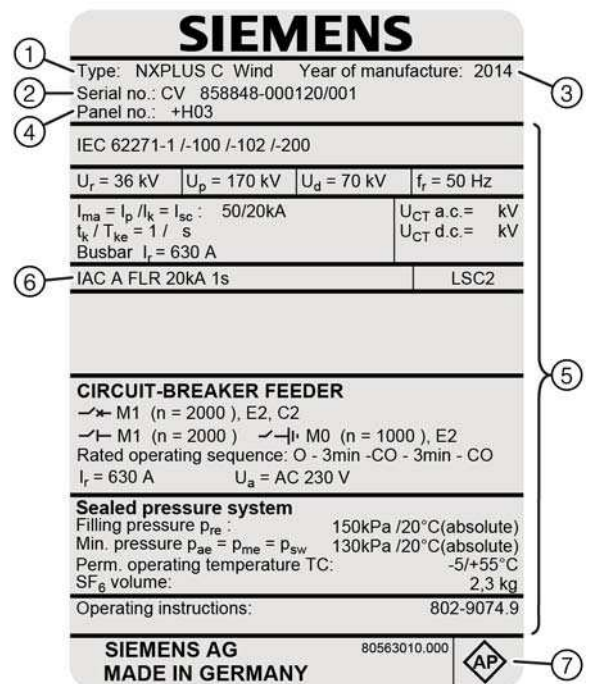


Fig. 29: Rating plate on the switchgear front (example)

- ⑤ Technical data
- ⑥ Internal arc classification
- ⑦ Test mark for the performed acceptance test (German: Abnahme-Prüfung) (pressure test) of the vessel

**IAC classification**

This data (see item ⑥) describes the internal arc classification of the panel according to IEC 62271-200.

The IAC classification is referred to each panel. The data on the rating plate (see item ⑥) describes the areas classified for the corresponding panel (see page 38, "Classification of NXPLUS C Wind according to IEC 62 271-200").



## 9.5 Vacuum circuit-breaker

### Number of operating cycles

Rated normal current	2 000 times
Short-circuit breaking current	20 times

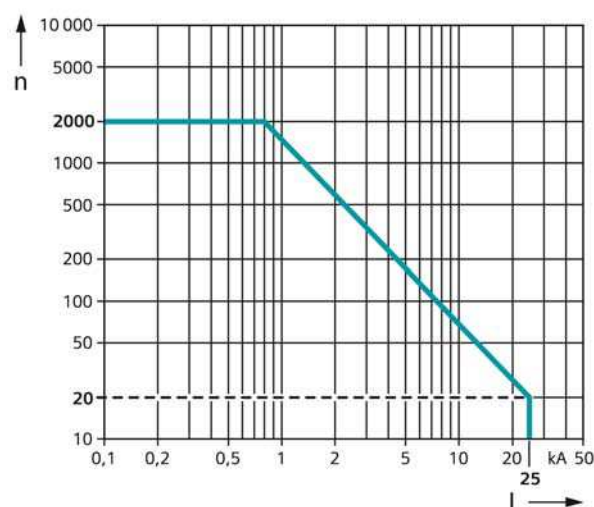


Fig. 30: Permissible number of operating cycles  $n$  as a function of the breaking current  $I$  (r.m.s. value) in kA

### Operating times

Operating times	Component	Item designation	Duration	Unit
Closing time for stored-energy mechanism			< 75	ms
Charging time for electrical operation		(M1)	< 10	s
Opening time	Shunt release	(Y1)	< 65	ms
	Additional release 3AX 11	(Y2), (Y4), (Y6), (Y7)	< 50	ms
Arcing time			< 15	ms
Opening time	Shunt release	(Y1)	< 80	ms
	Additional release 3AX 11	(Y2), (Y4), (Y6), (Y7)	< 65	ms
Dead time			3	min
Close-open contact time	Shunt release	(Y1)	< 75	ms
	Additional release 3AX 11	(Y2), (Y4), (Y6), (Y7)	< 60	ms
Synchronism error between the poles			< 2	ms
Minimum command duration				
CLOSE	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 c.b. tripping signal			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).

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

**Dead time** Interval from the end of the current flow in all poles until the beginning of the current flow in the first pole.

**Operating mechanism** The operating mechanisms of the circuit-breaker 3AH55 for NXPLUS C Wind are **not** appropriate for auto-reclosing.

**Rated operating sequences:**

O - t - CO - t - CO (t = 3 min)

O - t - CO - t' - CO (t = 0.3 sec, t' = 3 min)

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

Manual spring-operated mechanism	The closing spring of the circuit-breaker is charged with the supplied hand crank until the circuit-breaker closes. Then, manual or electrical opening is possible.
Stored-energy mechanism	The motor operating stored-energy mechanism starts directly after applying the supply voltage - with the closing spring not charged - and is automatically deactivated internally after completion of the charging process. After charging, the "spring charged" indication is visible, and a click of the latch can be heard. Then manual or electrical closing is possible and, after that, manual or electrical opening.

For DC operation, the maximum power consumption is approx. 600 W. For AC operation, the maximum power consumption is approx. 750 VA.

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

Rated supply voltage [V]	Recommended rated current for the protection equipment* [A]
24 DC	16
48 DC	10
60 DC	8
DC / AC 110, 50 / 60 Hz	4
DC 220 / AC 230, 50 / 60 Hz	2
*) M.c.b. assembly type 8RL74 or m.c.b. with G-characteristic	

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

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

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		

## Protection table for motor operating mechanism of circuit-breaker

	Rated voltage of operating mechanism	Operating voltage		Power consumption of the motor		Rated current of operating mechanism	Normal current		Smallest possible rated current of the miniature circuit-breaker
		110%	80%						
	U <sub>a</sub> [V]	V <sub>max</sub> [V]	V <sub>min</sub> [V]	P [W]	S [VA]	I <sub>rat_A</sub> [A]	I <sub>max</sub> [A]	I <sub>min</sub> [A]	I <sub>rat_S</sub> [A]
DC	60	66	48	700	-	11.7	14.6	10.6	8
	110	121	88	700	-	6.4	8.0	5.8	6
	125	138	100	700	-	5.6	7.0	5.1	4
	220	242	176	700	-	3.2	4.0	2.9	3
AC	100	110	80	-	1100	11.0	13.8	10.0	8
	110	121	88	-	1100	10.0	12.5	9.1	8
	230	253	184	-	1100	4.8	6.0	4.3	4

**Closing solenoid (Y9)** The closing solenoid 3AY1510 closes the circuit-breaker. After completion of a closing operation, the closing solenoid is de-energized internally. It is available for AC or DC voltage. Power consumption: 140 W or 140 VA.

**Shunt release** Shunt releases are used for automatic or deliberate tripping of circuit-breakers. They are designed for connection to external voltage (DC or AC voltage).

Shunt releases based on two different principles are used:

- The **shunt release (Y1)** 3AY1510 is used as standard in the basic circuit-breaker version. With this design, the circuit-breaker is opened electrically. Power consumption: 140 W or 140 VA.
- The **shunt release (Y2)** 3AX1101 with energy store is fitted if more than one shunt release is required. With this design, the electrical opening command is transferred magnetically and thus, the circuit-breaker is opened. Power consumption: 60 W or 60 VA.


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

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

**C.t.-operated releases (Y4, Y6)** The following c.t.-operated releases are available:

- The **c.t.-operated release (Y4)** 3AX1102 consists of an energy store, an unlatching mechanism and an electromagnetic system. Rated tripping current: 0.5 A/1 A
- The **c.t.-operated release (Y6)** 3AX1104 (low-energy release) is adequate for a tripping pulse of  $\leq 0.1$  Ws in connection with adequate protection systems. It is used if auxiliary voltage is missing, tripping via protection relay.

**Integrated varistors in the circuit-breaker control system for DC operation**

	<b>ATTENTION!</b>
	Switching overvoltages can damage electronic control devices.  ⇒ Do not switch off inductive consumers in DC circuits.

With DC operation, the inductances of the circuit-breaker operating mechanism and the circuit-breaker control system (motor, closing solenoid and release) are equipped with integrated varistors. They limit the overvoltage to approx. 500 V and are available for rated operating voltages from 60 V (DC) up to 220 V (DC).

### 9.6 Three-position disconnecter for circuit-breaker panels and disconnecter panels 630 A / 800 A / 1000 A

Rated voltage	kV	36
Rated current	A	630/800/1000
Rated short-time withstand current	kA (1 s)	25
	kA (3 s)	20
Peak withstand current	kA	63/65

#### Protection table for line protection of "motor operating mechanism" of three-position switch

	Rated voltage of operating mechanism	Operating voltage		Power consumption of motor		Rated current of operating mechanism	Normal current		Smallest possible rated current of the miniature circuit-breaker
		110%	80%	P [W]	S [VA]		I <sub>max</sub> [A]	I <sub>min</sub> [A]	
	U <sub>a</sub> [V]	V <sub>max</sub> [V]	V <sub>min</sub> [V]	P [W]	S [VA]	I <sub>rat_A</sub> [A]	I <sub>max</sub> [A]	I <sub>min</sub> [A]	I <sub>rat_S</sub> [A]
DC	24	26	19	150	–	6.3	7.8	5.7	6
	30	33	24	150	–	5.0	6.3	4.5	6
	32	35	26	150	–	4.7	5.9	4.3	6
	48	53	38	150	–	3.1	3.9	2.8	4
	60	66	48	150	–	2.5	3.1	2.3	3
	110	121	88	150	–	1.4	1.7	1.2	2
	120	132	96	150	–	1.3	1.6	1.1	2
	125	138	100	150	–	1.2	1.5	1.1	2
	127	140	102	150	–	1.2	1.5	1.1	2
	220	242	176	150	–	0.7	0.9	0.6	1
	240	264	192	150	–	0.6	0.8	0.6	1
AC	100	110	80	–	190	1.9	2.4	1.7	2
	110	121	88	–	190	1.7	2.2	1.6	2
	120	132	96	–	190	1.6	2.0	1.4	2
	125	138	100	–	190	1.5	1.9	1.4	2
	230	253	184	–	190	0.8	1.0	0.8	1
	240	264	192	–	190	0.8	1.0	0.7	1

### 9.7 Three-position switch-disconnector

Rated voltage	kV	36
Rated current	A	630
Rated short-time withstand current	kA (1 s)	25
	kA (3 s)	20
Peak withstand current	kA	63

### 9.8 Endurance classes

The switching devices of NXPLUS C Wind switchgear conform to the classes according to IEC 62 271-100, -102 and -103.

#### Circuit-breaker

Function	Class	Standard	Property
BREAKING	M1	IEC 62 271-100	2000 times mechanically without maintenance
	E2 without AR <sup>2)</sup>	IEC 62 271-100	2000 times rated normal current without maintenance
	E2 with AR <sup>2)</sup> (option)		20 times short-circuit breaking current without maintenance
	C2 <sup>1)</sup>	IEC 62 271-100	Very low probability of restrikes

<sup>1)</sup> For rated frequency 50 Hz

<sup>2)</sup> AR = Automatic reclosing

**Three-position  
disconnector**

Function	Class	Standard	Property
DISCONNECTING	M0	IEC 62 271-102	1000 times mechanically without maintenance
READY-TO-EARTH	M0, E0	IEC 62 271-102	1000 times mechanically without maintenance
EARTHING	E2 <sup>1)</sup>	IEC 62 271-200 IEC 62 271-102	5 times rated short-circuit making current $I_{ma}$ without maintenance

<sup>1)</sup> By closing the circuit-breaker


**Three-position switch-  
disconnector****Application in the ring-main panel**

Function	Class	Standard	Property
DISCONNECTING	M0	IEC 62 271-102	1000 times mechanically without maintenance
LOAD BREAKING	M1	IEC 62 271-103	1000 times mechanically without maintenance
	E3	IEC 62 271-103	100 times rated mainly active load-breaking current $I_{load2}$ <sup>2)</sup> without maintenance, 5 times rated short-circuit making current $I_{ma}$ without maintenance
EARTHING	M0	IEC 62 271-102	1000 times mechanically without maintenance
	E2	IEC 62 271-102	5 times rated short-circuit making current $I_{ma}$ without maintenance

<sup>2)</sup> Additionally to  $I_{load2}$ , the class also covers the test currents  $I_{load1}$ ,  $I_{loop}$ ,  $I_{cc2}$ ,  $I_{cc2}$  and  $I_{lc}$ ,  $I_{ef1}$  and  $I_{ef2}$

## 10 End of service life

### SF<sub>6</sub> gas

	<b>NOTE!</b>
	<p>The equipment contains the fluorized greenhouse gas SF<sub>6</sub> registered by the Kyoto Protocol with a global warming potential (GWP) of 23 900. SF<sub>6</sub> has to be reclaimed and must not be released into the atmosphere.</p> <p>⇒ For use and handling of SF<sub>6</sub>, IEC 62271-4 has to be observed: High-voltage switchgear and controlgear - Part 4: Handling procedures for sulphur hexafluoride (SF<sub>6</sub>).</p>

Before recycling the materials, evacuate the SF<sub>6</sub> gas professionally and prepare it for further use.

**Recycling** The switchgear is an environmentally compatible product.

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

After evacuating the SF<sub>6</sub> gas, the switchgear mainly consists of the following materials:

- Galvanized steel (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (conductor bars)
- Silver (contacts)
- Cast-resin based on epoxy resin (bushings)
- Plastic materials (blade housings)
- Silicone rubber

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

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

Batteries have to be recycled professionally.

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

For further information please contact your regional Siemens representative.

# Installation

## 11 Constructional stipulations

### 11.1 Switchgear room

Please observe the following points while preparing the switchgear room:

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

Load-bearing capacity of the floor

Load data and minimum distances		
Constant loads	Vertical single load	4 / 5 kN
Not constant loads	Live load	9 kN/m <sup>2</sup>
Minimum distances	Control aisle	800 mm <sup>1)</sup>
	Wall distance on the left	50 mm <sup>2)</sup>
	Wall distance on the right	50 mm <sup>2)</sup>
	Ceiling height	2400 mm / 2700 mm <sup>3)</sup>
Minimum door opening (upright insertion)	Height	2200 mm <sup>4)</sup>
	Width	600 mm

<sup>1)</sup> Depending on national requirements; for extension/panel replacement, a control aisle of at least 1000 mm is recommended.

<sup>2)</sup> For wall-standing arrangement, a wall distance (on left or right) of at least 500 mm is recommended.

<sup>3)</sup> For switchgear with busbar voltage transformers

<sup>4)</sup> Dimensions for installation/removal in lying position through the door of the wind turbine 600 mm x 830 mm.

**Door opening** The door opening must show the following minimum dimensions:

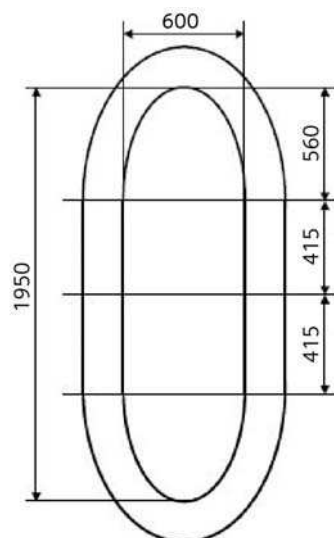



Fig. 31: Minimum dimensions of door opening

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

As floor construction, the following is possible:

**Steel girder layer**

	<p><b>DANGER!</b></p> <p>Risk of injury by falling panel. When shifting, the panel may slip off the frame construction, and fall over.</p>
	<p>⇒ Ensure that the used frame construction corresponds to the requirements on construction and load-bearing capacity. Use longitudinal and cross girders.</p> <p>⇒ When shifting the switchgear, make sure that there is sufficient standing surface for the panel.</p>

Suitable for large and numerous floor openings, and advantageous for later modifications or extensions of the switchgear. The frame construction should feature longitudinal and cross girders to enable later panel replacements without problems. The dimensions result from the constructional data of NXPLUS C Wind (see page 49, "Constructional data of the foundation").

**Reinforced-concrete plate**


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

**Double floor**

Suitable if neither a cable basement nor sufficient cable ducts can be installed; it consists of removable, flame-retardant floor plates mounted on a supporting structure. The supporting floor is about 30 to 80 cm lower depending on the cable routing (bending radius).

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

**Cable basement**

	<p><b>ATTENTION!</b></p> <p>The cable basement must be sufficiently large to perform all work involved and to provide a clear arrangement of the cables.</p>
	<p>⇒ The height and depth of the cable basement depends on the bending radii of the cables used.</p>

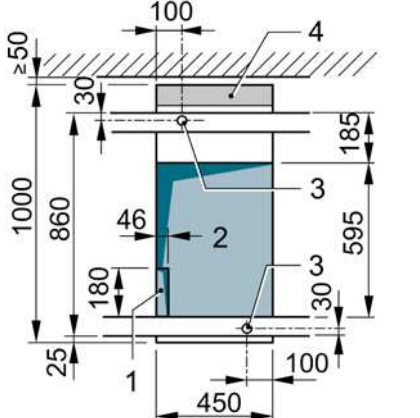
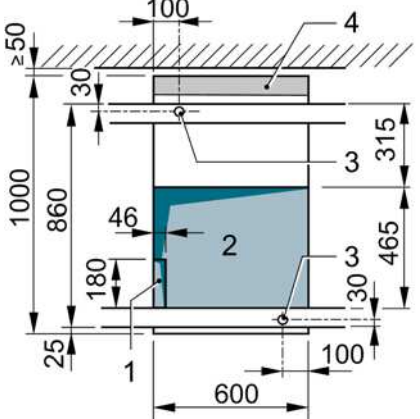
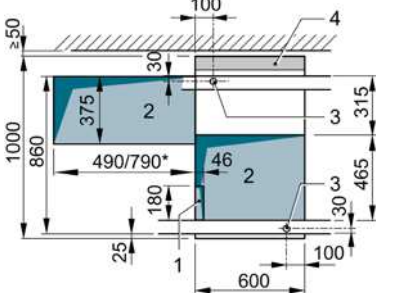
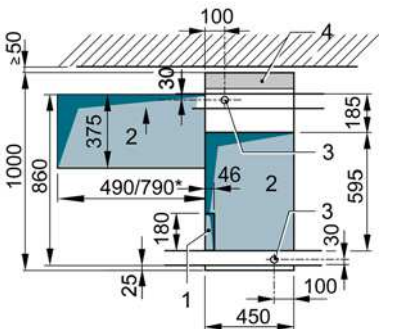
The cable basement must have the following characteristics:

- Dry
- Accessible at any time



### 11.2 Constructional data of the foundation

#### Floor openings and fixing points

Panel type	Panel width	Floor opening and fixing points	
<ul style="list-style-type: none"> <li>• Disconnecter panel</li> <li>• Ring-main panel</li> </ul>	450 mm		<ul style="list-style-type: none"> <li>1 Floor openings for control cables</li> <li>2 Floor opening for high-voltage cables</li> <li>3 Fixing hole for M8/M10</li> <li>4 Pressure relief duct</li> </ul> <p>* depending on number of cable plugs</p>
<ul style="list-style-type: none"> <li>• Circuit-breaker panel</li> </ul>	600 mm		
<ul style="list-style-type: none"> <li>• Circuit-breaker panel with spur panel</li> </ul>	600 mm		
<ul style="list-style-type: none"> <li>• Ring-main panel with spur panel, lateral cable connection (on the busbar)</li> </ul>	450 mm		

**Seismic withstand capability (option)**

NXPLUS C Wind switchgear can be upgraded for operation in regions at risk from earthquakes.

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

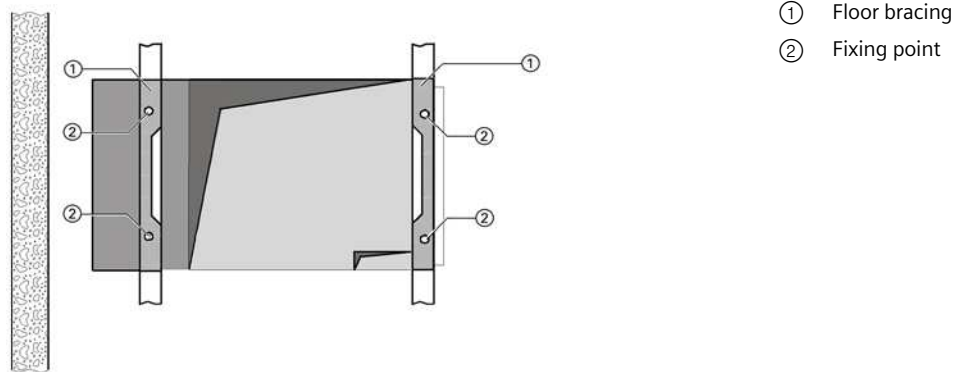


Fig. 32: Aseismic fastening

- ⇒ Lay the front and rear floor bracing on the base frame of the panel.
- ⇒ Bolt the panel and the floor bracings together with the foundation rails using four fixing bolts size M8 or M10. Tightening torque: 60 Nm.

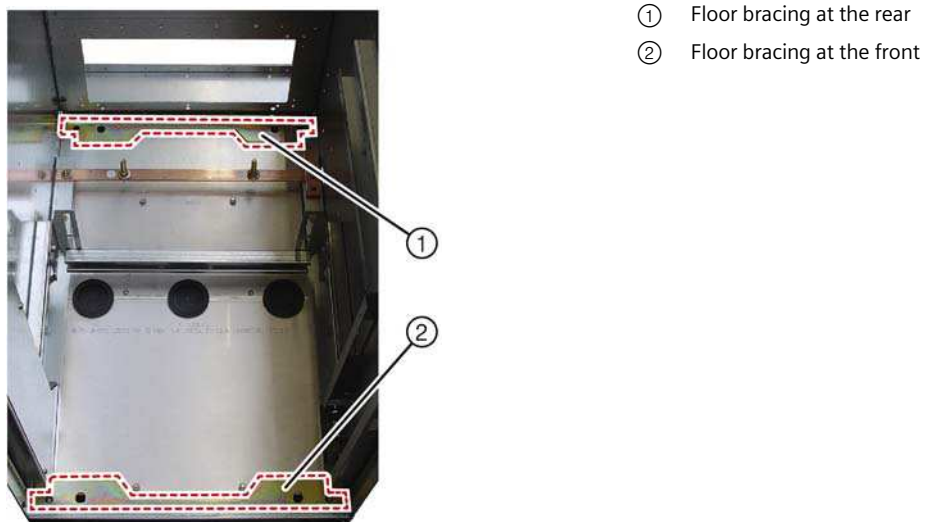



Fig. 33: Aseismic fastening for a panel width of 600 mm (view from the front)

**Core drillings  
(incl. new plug systems)**

	<b>ATTENTION!</b>
	<p>For perfect installation of the cable plugs, the following must be observed:</p> <ul style="list-style-type: none"> <li>⇒ Observe the specifications of the cable manufacturers.</li> <li>⇒ Drilling diameters depend on the cable cross-section!</li> </ul>

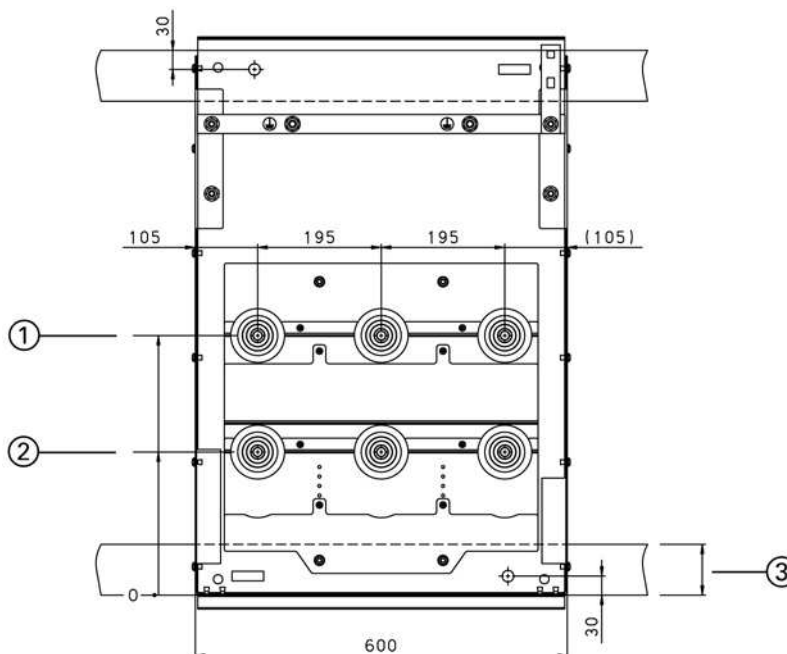


Fig. 34: Core drillings - circuit-breaker panel 630 A

- ① 1st cable
- ② 2nd cable
- ③ Width of base frame support max. 80 mm

**Conductor distances for circuit-breaker panel**

Make	1st cable		2nd cable	
	Plug type	Distance* [mm]	Plug type	Distance* [mm]
Nexans Euromold	M400TB/G	408	M400TB/G	163
	M430TB/G	408	M300PBM-630	303
	M440TB/G	408	M440TB/G	163
Südkabel	SEHDT33	408	SEHDT33	143
nkt cables	CB36-630	408	CC36-630	298
	CB36-630	408	CB36-630	228
	CB36-630 (1250)	408	CC36-630 (1250)	298
	CB36-630 (1250)	408	CB36-630 (1250)	228
Tyco Electronics Raychem	RSTI-66xx	408	RSTI-CC-66xx	293
	RSTI-66Lxx	408	RSTI-66CP-M16	233
	RSTI-68xx	408	RSTI-CC-68xx	308
	RSTI-69xx	408	RSTI-CC-69xx	308

\* Distance from center of cable to front edge of base frame support

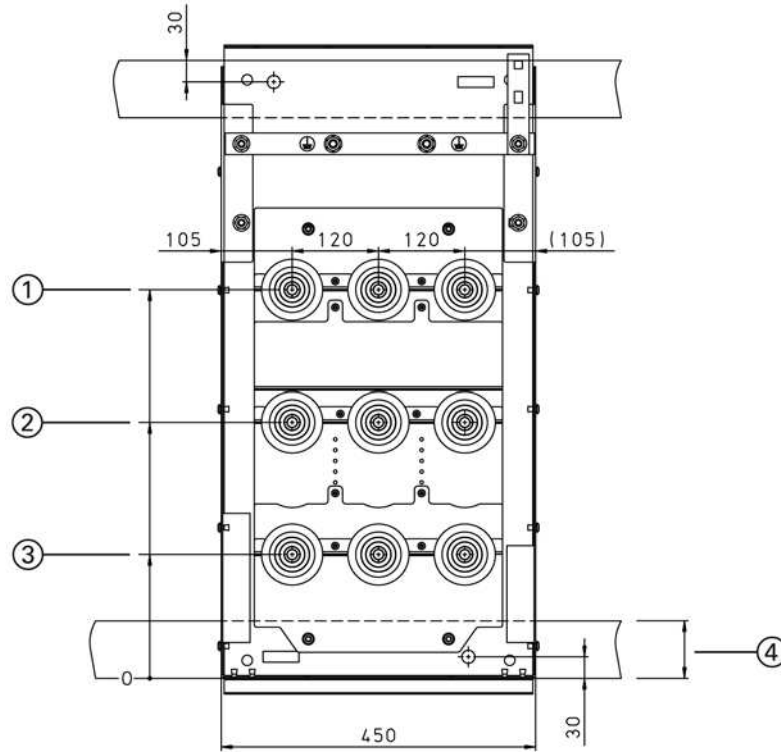


Fig. 35: Core drillings - disconnector panel and ring-main panel

- ① 1st cable
- ② 2nd cable
- ③ 3rd cable
- ④ Width of base frame support max. 80 mm

**Conductor distances for disconnector panel and ring-main panel**

Make	1st cable		2nd cable		3rd cable	
	Plug type	Distance* [mm]	Plug type	Distance* [mm]	Plug type	Distance* [mm]
Nexans Euromold	M400TB/G	540	M400TB/G	295	-	-
	M430TB/G	540	M300PBM-630	435	M300PBM-630	330
	M440TB/G	540	M440TB/G	295	-	-
Südkabel	SEHDT33	540	SEHDT33	275	-	-
nkt cables	CB36-630	540	CC36-630	430	CC36-630	320
	CB36-630	540	CB36-630	360	CB36-630	180
	CB36-630 (1250)	540	CC36-630 (1250)	430	CC36-630 (1250)	320
	CB36-630 (1250)	540	CB36-630 (1250)	360	CB36-630 (1250)	180
Tyco Electronics Raychem	RSTI-66xx	540	RSTI-CC-66xx	425	RSTI-CC-66xx	310
	RSTI-66Lxx	540	RSTI-66CP-M16	365	RSTI-66CP-M16	190
	RSTI-68xx	540	RSTI-CC68xx	440	RSTI-CC	340
	RSTI-69xx	540	RSTI-CC68xx	420	RSTI-CC68xx	300

\* Distance from center of cable to front edge of base frame support

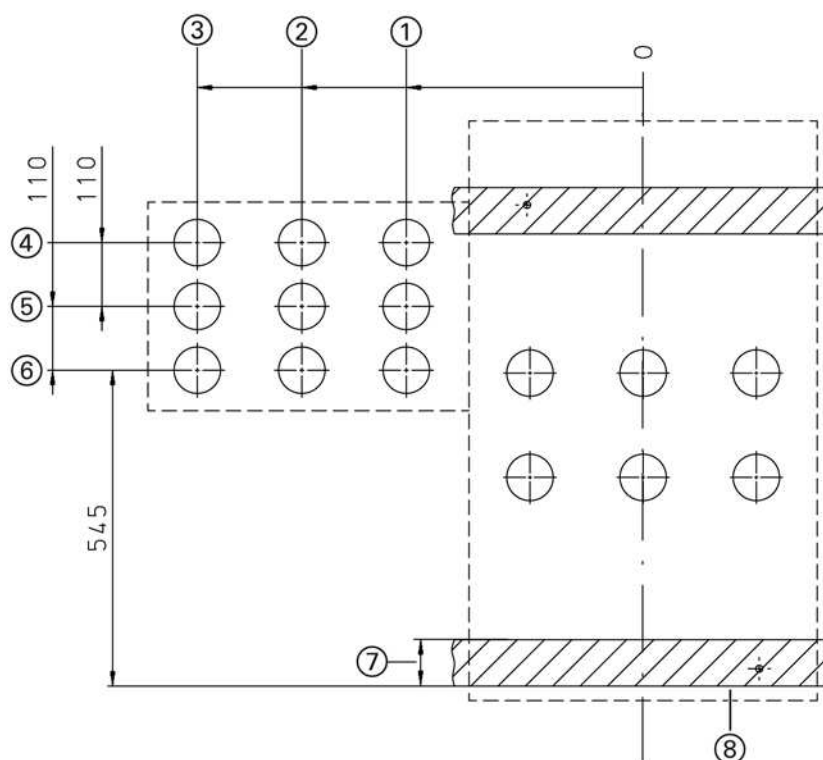


Fig. 36: Core drillings - circuit-breaker panel with lateral cable connection, all dimensions in mm

- |   |           |   |  |
|---|-----------|---|--|
| ① | 1st cable | ⑤ | L2                                     |
| ② | 2nd cable | ⑥ | L1                                     |
| ③ | 3rd cable | ⑦ | Width of base frame support max. 80 mm |
| ④ | L3        | ⑧ | Front side                             |

**Conductor distances for lateral cable connection of circuit-breaker panel**

Make	1st cable		2nd cable		3rd cable	
	Plug type	Distance* [mm]	Plug type	Distance* [mm]	Plug type	Distance* [mm]
Nexans Euromold	M400TB/G	408	M400TB/G	653	M400TB/G	898
	M430TB/G	408	M300PBM-630	513	M300PBM-630	618
	M440TB/G	408	M440TB/G	653	M440TB/G	898
Südkabel	SEHDT33	408	SEHDT33	673	SEHDT33	938
nkt cables	CB36-630	408	CC36-630	518	CC36-630	628
	CB36-630	408	CB36-630	588	CB36-630	768
	CB36-630 (1250)	408	CC36-630 (1250)	518	CC36-630 (1250)	628
	CB36-630 (1250)	408	CB36-630 (1250)	588	CB36-630 (1250)	768
Tyco Electronics	RSTI-66xx	408	RSTI-CC-66xx	523	RSTI-CC-66xx	638
Raychem	RSTI-66Lxx	408	RSTI-66CP-M16	583	RSTI-66CP-M16	758
	RSTI-68xx	408	RSTI-CC68xx	508	RSTI-CC	608
	RSTI-69xx	408	RSTI-CC68xx	528	RSTI-CC68xx	648

\* Distance from center of cable to front edge of base frame support

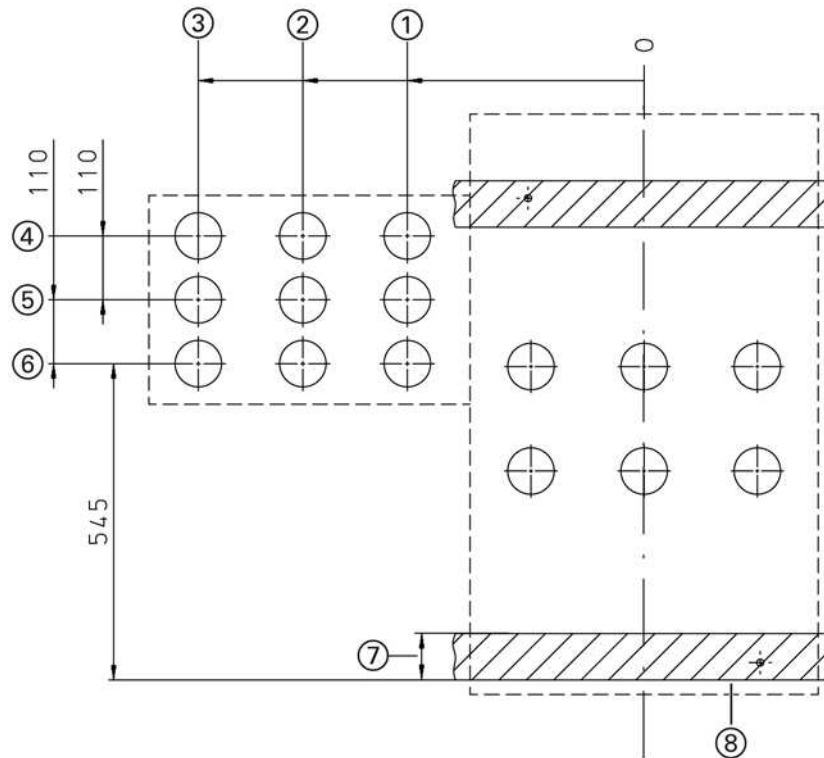


Fig. 37: Core drillings - ring-main panel with lateral cable connection, all dimensions in mm

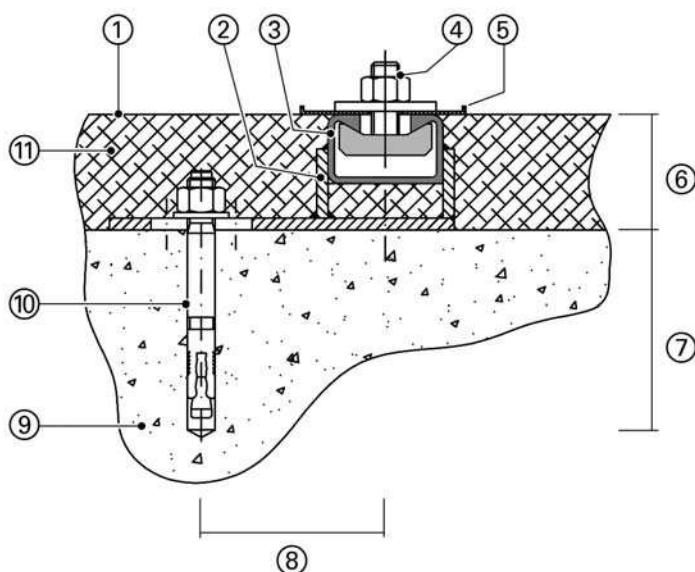
- ① 1st cable
- ② 2nd cable
- ③ 3rd cable
- ④ L3
- ⑤ L2
- ⑥ L1
- ⑦ Width of base frame is max. 80 mm
- ⑧ Front side

**Conductor distances for lateral cable connection of the ring-main panel**

Make	1st cable		2nd cable		3rd cable	
	Plug type	Distance* [mm]	Plug type	Distance* [mm]	Plug type	Distance* [mm]
Nexans Euromold	M400TB/G	333	M400TB/G	578	M400TB/G	823
	M430TB/G	333	M300PBM-630	438	M300PBM-630	543
	M440TB/G	333	M440TB/G	578	M440TB/G	823
Südkabel	SEHDT33	333	SEHDT33	598	SEHDT33	863
nkt cables	CB36-630	333	CC36-630	443	CC36-630	553
	CB36-630	333	CB36-630	513	CB36-630	693
	CB36-630 (1250)	333	CC36-630 (1250)	443	CC36-630 (1250)	553
	CB36-630 (1250)	333	CB36-630 (1250)	913	CB36-630 (1250)	693
Tyco Electronics Raychem	RSTI-66xx	333	RSTI-CC-66xx	448	RSTI-CC-66xx	563
	RSTI-66Lxx	333	RSTI-66CP-M16	508	RSTI-66CP-M16	683
	RSTI-68xx	333	RSTI-CC68xx	433	RSTI-CC	533
	RSTI-69xx	333	RSTI-CC68xx	453	RSTI-CC68xx	573

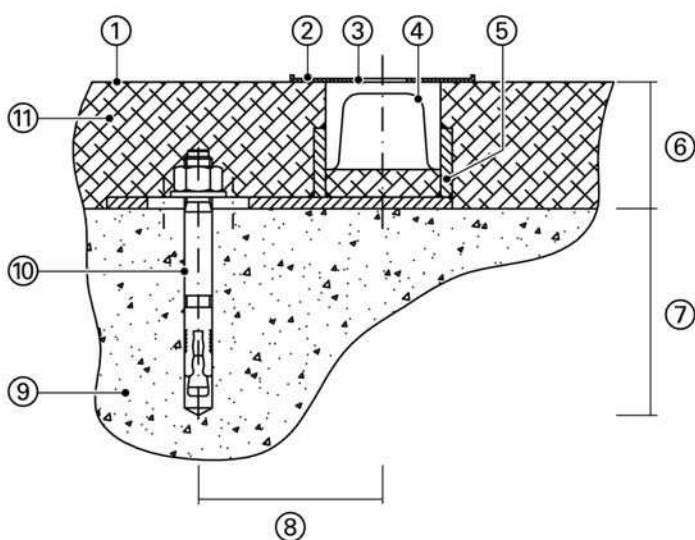
\* Distance from center of cable to front edge of base frame support

Floor fixing versions



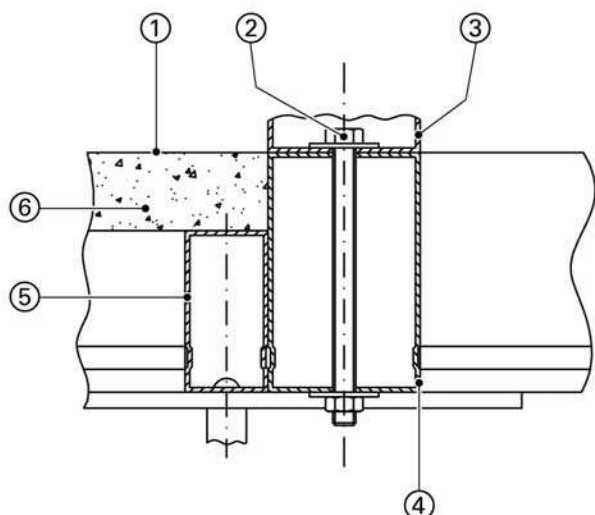
- ① Upper edge of finished floor
- ② Floor fixing plate (holder for profiles at a distance  $\geq 1200$  mm), see page 56, "Fixing plate"
- ③ C-profile CB 50 x 30, EN 10025, S235JR
- ④ • Hook-head bolt M16x35-4.6-A3L, SN 60009  
• Washer R18, DIN 440/ISO 7094, S235JRG2C + L  
• Hexagonal nut M16-8-A4L, DIN 934/EN 4032
- ⑤ Base frame of the switchgear
- ⑥ Min. 50 mm
- ⑦ Min. 90 mm
- ⑧ 80 mm
- ⑨ Raw floor
- ⑩ Expansion dowel with hexagonal bolt and washer, FAN 12/10
- ⑪ Floor finish

Fig. 38: Screwed floor fixing



- ① Upper edge of finished floor
- ② Base frame of the switchgear
- ③ Welding in fixing opening of base frame
- ④ U-profile U50, DIN 1026
- ⑤ Floor fixing plate (holder for profiles at a distance  $\geq 1200$  mm), see page 56, "Fixing plate"
- ⑥ Min. 55 mm
- ⑦ Min. 90 mm
- ⑧ 80 mm
- ⑨ Raw floor
- ⑩ Expansion dowel with hexagonal bolt and washer, FAN 12/10
- ⑪ Floor finish

Fig. 39: Welded floor fixing



- ① Upper edge of double floor
- ② • Hexagonal bolt M10, EN ISO 7093-152  
• Washer 10,5-St-A3L, EN 24014/EN 24017  
• Hexagonal nut M10-8-A4L, EN 4032
- ③ Base frame of the switchgear
- ④ Substructure
- ⑤ Supporting profile (e.g. profile 70 x 40 x 2)
- ⑥ Floor plate (approx. 36 mm thick)

Fig. 40: Fixing on double floor

**Fixing plate**

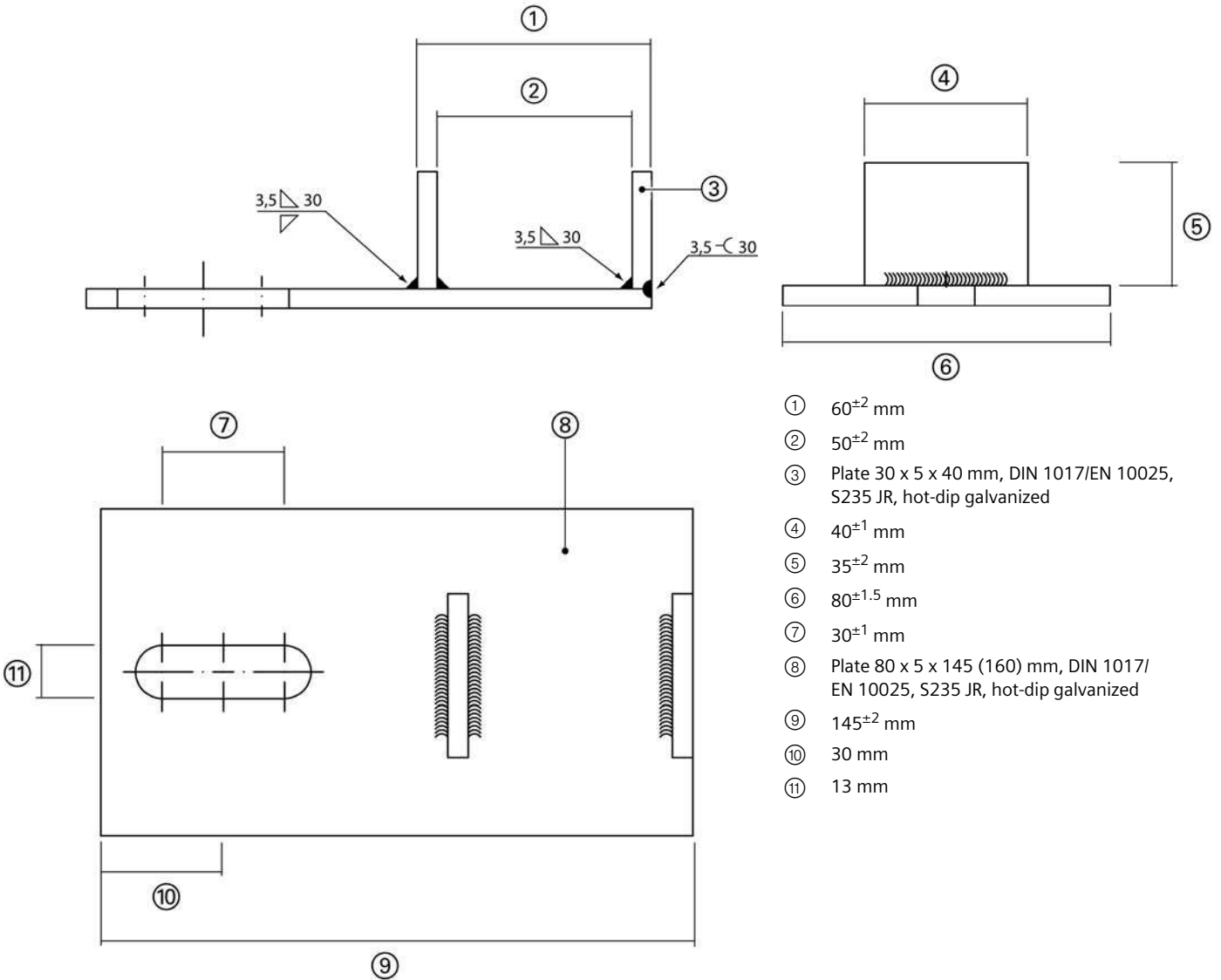



Fig. 41: Floor fixing plate

	<b>NOTE!</b>
	<p>The welded seams are susceptible to corrosion.</p> <p>⇒ Galvanize the welded seams after welding.</p>

**Stipulations for evenness and straightness**

Please observe the following items when preparing the foundation:

- A suitable foundation can be a false floor, a double floor or a reinforced-concrete foundation. The reinforced-concrete floor must be equipped with foundation rails for supporting the panels.
- As for design and construction of the foundation, the relevant standards DIN 43 661 "Fundamentschienen in Innenanlagen der Elektrotechnik" (Foundation rails in electrical indoor installations) and DIN 18 202 "Maßtoleranzen im Hochbau" (Blatt 3) (Measuring tolerances in structural engineering (Sheet 3)) apply.
- Dimensions of the floor opening and the fixing points of the switchgear frame (see page 49, "Floor openings and fixing points" and see page 72, "Fastening the switchgear to the foundation").
- Determine level differences between the installation surfaces of the panels using a measuring sheet, and compensate them with shims (0.5 - 1.0 mm).



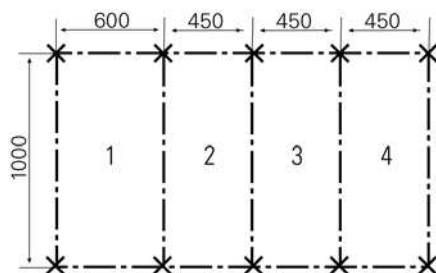


Fig. 42: Measuring sheet for the foundation, all dimensions in mm. Evenness/straightness tolerance according to DIN 43661: 1 mm for 1 m length, 2 mm for the total length.

**Regulations and standards referred to foundation and busbar compartment**

The fixed-mounted switchgear NXPLUS C Wind with circuit-breakers and switches for indoor installation complies with the following prescriptions and standards:

	IEC/EN standard	VDE standard
Switchgear	62 271-1	0671-1
	62 271-200	0671-200
Installation and earthing	61 936-1 / HD 637 -S1	0101
Environmental conditions	60 721-3-3	DIN EN 60 721-3-3

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

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

**11.3 Transport units**

**Dimensions**

Panel width	Panel dimensions Width x Height x Depth [mm]	Transport inside Germany or to European countries Width x Height x Depth [mm]	Transport to overseas (seaworthy crate) Width x Height x Depth [mm]
1 x 450	450 x 1900 x 1000	1100 x 2120 x 1450	1130 x 2650 x 1450
1 x 600	600 x 1900 x 1000	1100 x 2120 x 1450	1130 x 2650 x 1450
1 x 600 und 1 x 450	1050 x 1900 x 1000	1450 x 2120 x 1450	1480 x 2650 x 1450
1 x 600 und 2 x 450	1500 x 1900 x 1000	1764 x 2100 x 1816	1764 x 2700 x 1840

**Transport weights**

Number of panels	Average transport weights depending on the extent to which the switchgear is equipped	
	with packing approx. [kg]	without packing approx. [kg]
1 x 450	500	400
1 x 600	600	500
1 x 600 and 1 x 450	1000	900
1 x 600 and 2 x 450	1400	1300

**Center of gravity** The center of gravity of NXPLUS C Wind (all panels) is located at the following position:

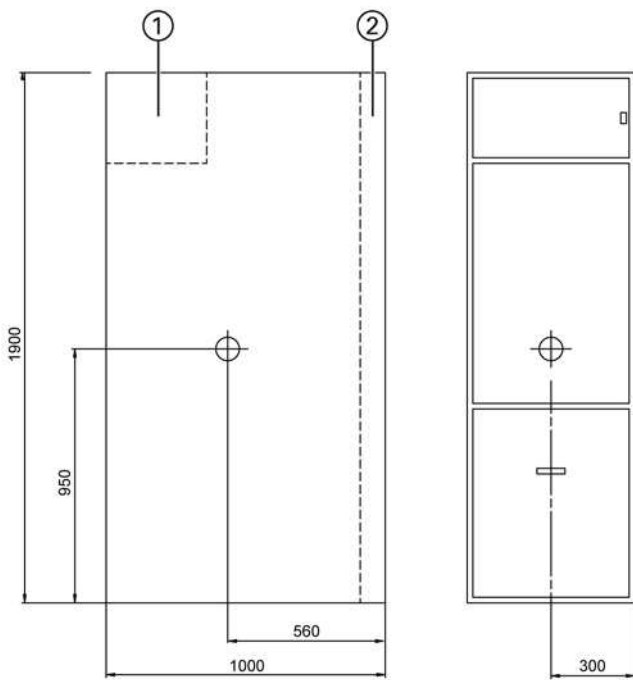


Fig. 43: Position of the center of gravity for 600 mm panel

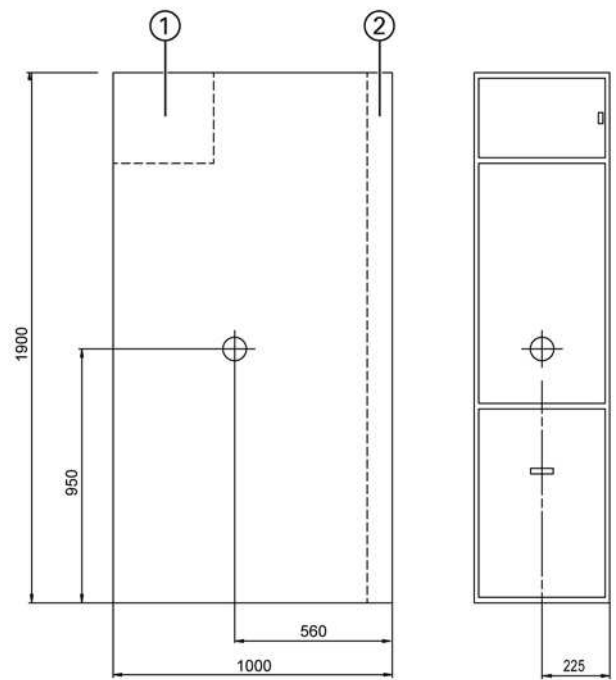


Fig. 44: Position of the center of gravity for 450 mm panel

- ① Low-voltage compartment
- ② Pressure relief duct

The position of the center of gravity is identified with the following symbol:

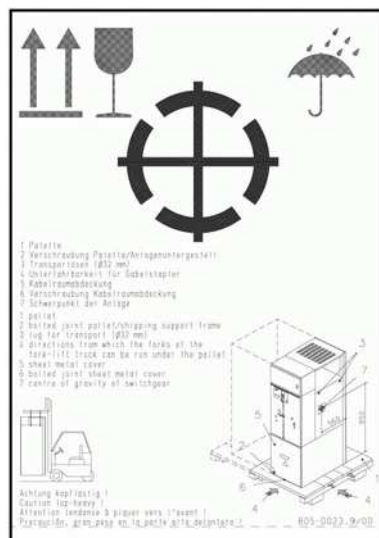


Fig. 45: Symbol for the center of gravity

The symbol is attached on both sides of the panel. Only the end wall (switchgear termination) does not have one.

**Transport regulations**

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




## 12 Before installation

### 12.1 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:

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

### 12.2 Intermediate storage

	<p><b>DANGER!</b></p> <p>Risk of injury and damage to the storage place and the stored goods if the storage space is overloaded.</p> <ul style="list-style-type: none"> <li>⇒ Observe the load-bearing capacity of the floor.</li> <li>⇒ Do not stack the transport units.</li> <li>⇒ Do not overload lighter components by stacking.</li> </ul>
	<p><b>ATTENTION!</b></p> <p>Fire risk. The transport unit is packed in flammable materials.</p> <ul style="list-style-type: none"> <li>⇒ No smoking.</li> <li>⇒ Keep fire extinguishers in a weatherproof place.</li> <li>⇒ Mark the location of the fire extinguisher.</li> </ul>
	<p><b>ATTENTION!</b></p> <p>Supplied desiccant bags lose their effectiveness if they are not stored in the undamaged original packings.</p> <ul style="list-style-type: none"> <li>⇒ Do not damage or remove packing of desiccant bags.</li> <li>⇒ Do not unpack desiccant bags before use.</li> </ul>

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
- Permissible storage temperature of the primary part from -40° C to +70° C or in accordance with the permissible storage temperatures of 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

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

- Floor with adequate load-bearing capacity (weights as per delivery note)
- Even floor to enable stable storage
- Well-ventilated and free of dust as far as possible
- Dry and protected against humidity and vermin (e.g. insects, mice, rats)
- Heatable to at least 2 °C above the outside temperature in order 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, these can be stored up to 6 months in other rooms or outdoors. The storage place must have the following characteristics:

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

## 12.3 Tools/auxiliary means

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

- Hexagonal screwdriver insert (min. length 140 mm) for hexagon socket-head bolt 10 mm DIN 7422
- Torx screwdriver T25
- Torque wrench 20 - 50 Nm
- Ratchet, reconnectable DIN 3122
- Extension DIN 3123 40 - 125
- Socket spanner inserts DIN 3124, socket spanner inserts size 17 and 18, 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 1900 mm, Ø 20 mm for panel groups of up to 3 panels, e.g. certified lifting rods (order number 036-1161.3, to be procured from the regional Siemens representative)
- Additionally, solutions for special transport rods are available on request if there is not enough space at the place of installation to remove the transport rods after transport.

## 12.4 Installation and fixing material

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

## 12.5 Comments on electromagnetic compatibility

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

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

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

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

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

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

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

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

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

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

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


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


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

## 13 Unloading and erecting the switchgear

### 13.1 Packing and transport unit

- Packing** The transport units can be packed as follows:
- On pallets, covered with PE protective foil
  - In a seaworthy crate (switchgear is sealed with desiccant bags in PE foil)
  - Other packings in special cases

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

	<b>NOTE!</b>
	If a special aluminum packing is used, claims can only be asserted when the entire process is performed and documented according to the supplied installation instructions.  ⇒ The installation instructions are delivered with the switchgear accessories. ⇒ Observe the <b>sealing instructions for switchgear with special aluminum packing</b> (order number 036-8003.9).


- Transport unit** Transport units consist of:
- Individual panels or panel groups of up to three panels, if applicable with separate low-voltage compartment
  - Accessories including busbars, if applicable sealing instructions for switchgear with special aluminum packing (order number: 036-8003.9)

### 13.2 Completeness and transport damages

- Checking for completeness**
- ⇒ Check whether the delivery is complete and correct using the delivery note and packing lists.
  - ⇒ Compare the serial number of the switchgear panels on the delivery note with that on the packing and the rating plates of the panels.
  - ⇒ Check whether the accessories are complete.


- Checking for transport damages**
- ⇒ Temporarily open the packing in a weatherproof place to detect hidden damages. Stick the PE foil together again and do not remove it totally until reaching the final mounting position in order to keep the switchgear as clean as possible.
  - ⇒ Check the ready-for-service indicator for SF<sub>6</sub> gas (see page 67, "Checking the ready-for-service indicator").
  - ⇒ Inform the forwarding agent immediately about any defects or transport damages; if required, refuse to accept the delivery.
  - ⇒ As far as possible, document larger defects and transport damages photographically; prepare a damage report and inform your regional Siemens representative immediately.
  - ⇒ Have the transport damages repaired, otherwise you may not start installation.
  - ⇒ Refit the packing.

### 13.3 Unloading transport units

	<b>ATTENTION!</b>
	Non-observance of the following instructions can endanger people or damage the transport units while unloading.
	⇒ Make sure that nobody is standing in the swinging area of lifted switchgear.
	⇒ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the switchpanel walls under load.
	⇒ Observe the dimensions and weights of the transport unit (delivery note).
	⇒ Please ensure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity.
	⇒ Observe the center of gravity of the transport units (see page 36, "Complete switchgear").
	⇒ Do not climb onto the roof of the switchpanels.
	⇒ If the low-voltage compartment is removed, do not step on the mounting plates of the low-voltage compartments.
	⇒ Observe the instructions on the packing.

- ⇒ Attach ropes to the hoisting tackle.
- ⇒ Sling the ropes around the ends of the wooden pallet.
- ⇒ Unload the transport units and set them down as close to the switchgear building as possible in order to avoid unnecessary ways.

### 13.4 Transport to the place of installation (switchgear room)

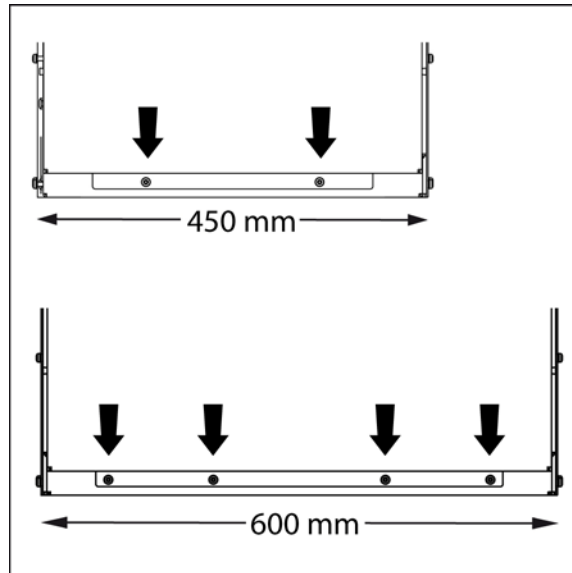
	<b>DANGER!</b>
	Non-observance of the following instructions can endanger people or damage the transport units during further transport.
	⇒ Make sure that nobody is standing in the swinging area of lifted switchgear.
	⇒ Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the switchpanel walls under load.
	⇒ Observe the dimensions and weights of the transport unit (delivery note).
	⇒ Please ensure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity.
	⇒ Observe the center of gravity of the transport units (see page 57, "Transport units").
	⇒ Do not climb onto the roof of the switchpanels.
	⇒ Observe the instructions on the transport units.
	⇒ Transport the transport units in packed condition and leave packed for as long as possible.

- ⇒ Thoroughly clean the switchgear room, since extreme cleanliness is required during 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.
- ⇒ Move the transport units inside the building to the place of installation using a lifting truck, fork-lift truck or 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**

If the panels are equipped with an interlock for the cable compartment cover, the panels must be earthed to remove the cable compartment cover.

- ⇒ Remove PE foil.
- ⇒ Undo the bolted joint of the cable compartment cover at the front. Depending on the panel width, there are two or four self-tapping screws.

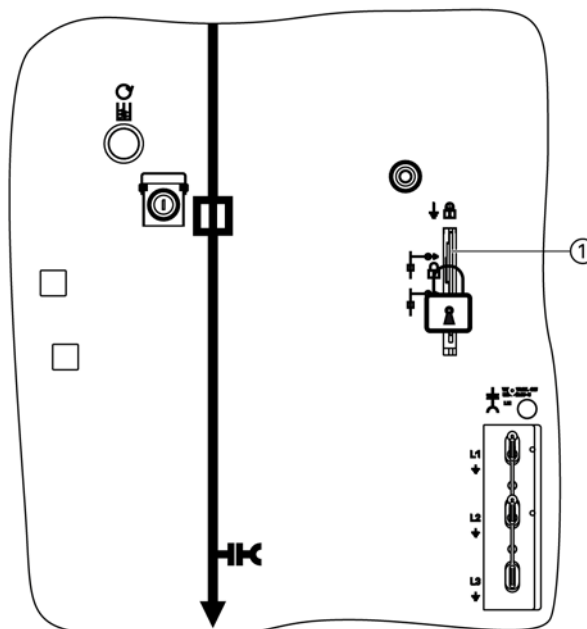


450 mm: Disconnecter panel and ring-main panel

600 mm: Circuit-breaker panel

Fig. 46: Bolted joints of cable compartment cover

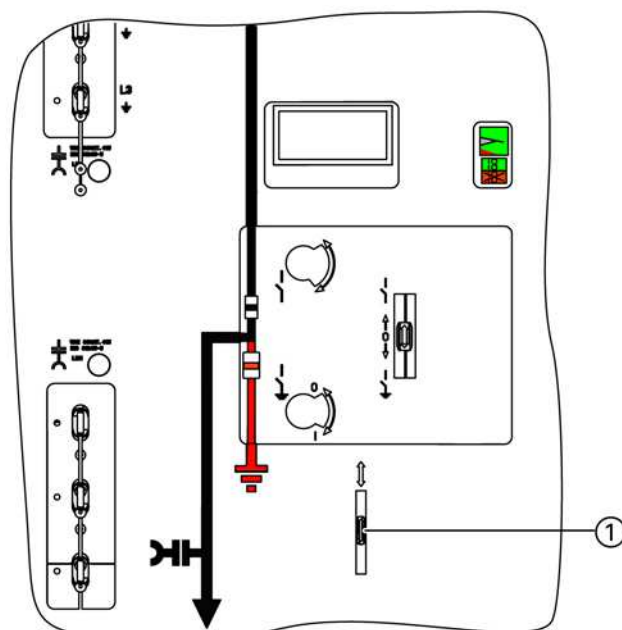
- ⇒ If cable compartment cover is interlocked: Push the locking device lever ① upwards and keep it in this position.



① "Feeder earthed" locking device

Fig. 47: Front plate with mimic diagram on the circuit-breaker panel





① Locking device of cable compartment cover

Fig. 48: Front plate with mimic diagram on the ring-main panel

- ⇒ Lift the cable compartment cover and remove it to the front.
- ⇒ Identify the cable compartment cover with the panel number.
- ⇒ Take the transport bolts in the cable compartment cover out and remove the metal plates placed underneath.

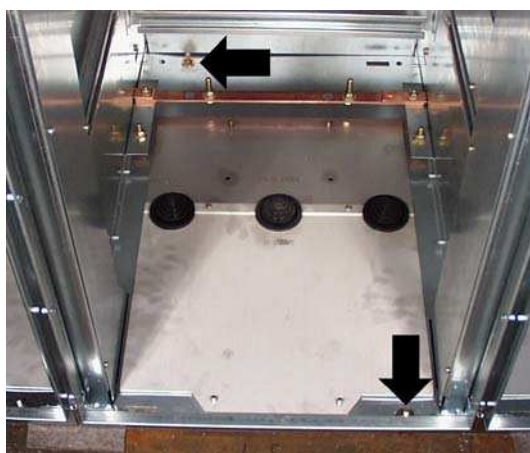



Fig. 49: Cable compartment

- ⇒ Refit the cable compartment cover to keep the panels more rigid for further transport.

**Further transport without wooden pallets**

	<p><b>ATTENTION!</b></p> <p>The use of unsuitable lifting and transport gear for unloading can endanger people or damage the transport units.</p>
	<p>⇒ Use lifting and transport gear that meets the requirements as regards construction and load-bearing capacity.</p>

⇒ Lift the transport unit with a crane, hydraulic jacks or a fork-lift truck. Before lifting the transport unit with a fork-lift truck, knock the boards marked at the front out of the wooden pallet.

**Lifting the transport unit by means of crane:**

Insert the lifting rods (diameter: 25 mm) into the supports provided at the switchgear vessel.

Available lifting rods (optional):

- Standard lifting rods for individual panels and panel groups of 3 panels
- Extensible lifting rods for panel groups of 2-4 panels

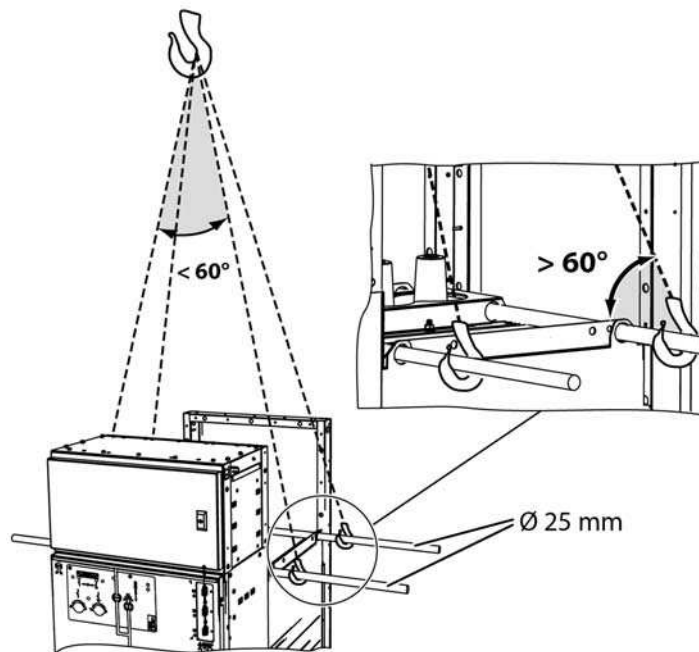



Fig. 50: Craning with lifting rods

- ⇒ 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 mounting position. Apply the roller crowbars only at the corners of the transport units.

	<p><b>ATTENTION!</b></p> <p>Non-observance of the following indications can damage the transport lugs. It may occur that panels cannot be exactly aligned with a transport unit.</p>
	<p>⇒ Maximum permissible angle of lifting equipment <b>at the hook</b> &lt; 60°.</p> <p>⇒ Maximum permissible angle <b>at the panel</b> &gt; 60°.</p> <p>⇒ Minimum permissible length of the <b>pendant parts</b> &gt; 2000 mm.</p>

### Installing the transport units

You may only start installing the transport units when

- all transport damages have been repaired
- the base frame has been levelled (1 mm/m), see DIN 43661
- the SF<sub>6</sub> gas filling in the vessels has been checked (see page 67, "Checking the ready-for-service indicator").
- the accessories and the required material are complete (see page 59, "Before installation").

- ⇒ Place the first (i.e. rearmost) transport unit as exactly as possible on its final location and place the second one close to it, keeping a small distance so that the units can still be aligned before bolting together.
- ⇒ Remove packing and transport materials from the place of installation.
- ⇒ Remove any dirt occurred during transport, as extreme cleanliness is required during installation.
- ✓ Now the transport units are in the correct order for assembly.

### 13.5 Checking the ready-for-service indicator

The panels are filled at a pressure of 1500 hPa. Before starting installation, check the ready-for-service indicator. It is located on the right side of the control board.

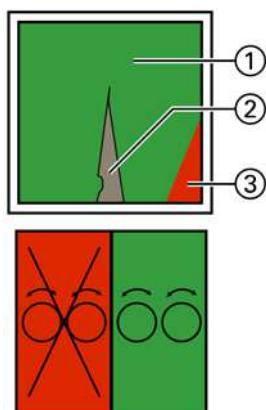


Fig. 51: Ready-for-service indicator for disconnecter panel, circuit-breaker panel

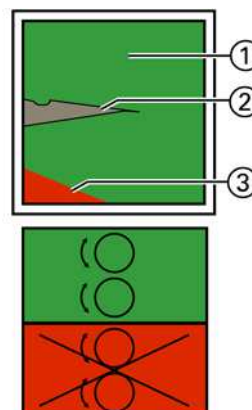


Fig. 52: Ready-for-service indicator for ring-main panel

- ① Green
- ② Pointer
- ③ Red

- ⇒ Read the ready-for-service indicators.
- ✓ If the pointers are in the **green area**, the gas filling is in order.
- ⇒ If the pointer is in the red area: Check the auxiliary switch of the ready-for-service indicator.

### Checking the auxiliary switch of the ready-for-service indicator

During transport, the auxiliary switch of the ready-for-service indicator can latch tight in the red area due to extreme vibrations.

To put the ready-for-service indicator into operation again, the plastic part fixed at the auxiliary switch must be brought to the initial position again by hand.

- ⇒ Remove the front plate of the switchgear. Push the plastic part ① at the auxiliary switch ② downwards with the index finger until the ready-for-service indicator jumps back to the green area. When pushing the plastic part at the auxiliary switch down from the latched position, you must overcome a mechanical resistance. In order to avoid damaging the plastic part, it must be supported with one finger when being pushed down.
- ✓ Then, the pointer must return to the green area automatically. If not, please stop the installation and contact the regional Siemens representative.

**Disconnecter panel, circuit-breaker panel:**

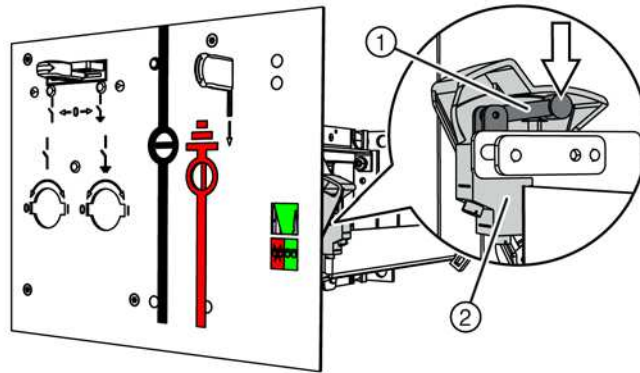


Fig. 53: Plastic part at the auxiliary switch (zoom shows view from the rear)

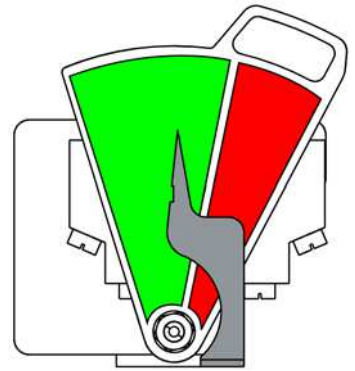


Fig. 54: Correct pointer position after operation

**Ring-main panel:**

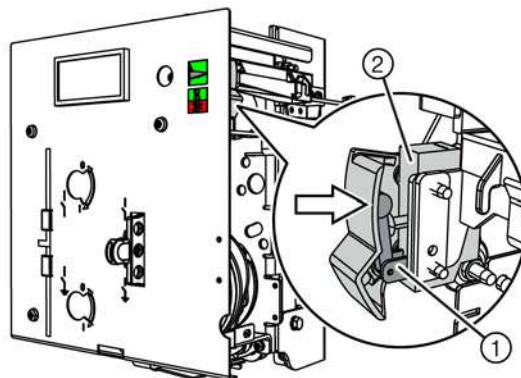


Fig. 55: Plastic part at the auxiliary switch (zoom shows view from the rear)

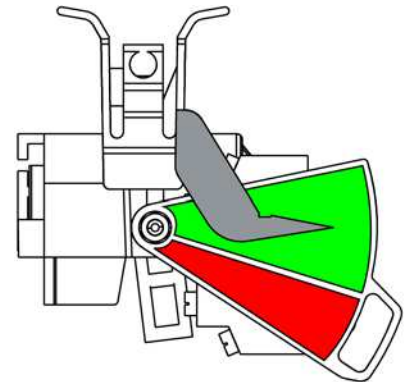




Fig. 56: Correct pointer position after operation

## 14 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 mains, and that it is therefore not live.


	<b>ATTENTION!</b>
	<p>Dirt in the switchgear can cause malfunctions during operation.</p> <p>⇒ Avoid any work that could pollute the switchgear (e.g. sawing, filing, etc.).</p>

### 14.1 Bolting panels together

	<b>NOTE!</b>
	<p>In order to establish a panel joint (busbar panel joint) more easily, pre-assembled low-voltage compartments can be removed for panel connection. Low-voltage compartments on end panels may remain mounted.</p> <p>⇒ Remove low-voltage compartments pre-assembled at the factory.</p>

- Panels, aligning** The first panel is on its mounting position and the others are placed at a small distance.
- ⇒ Align the first panel laterally.
  - ⇒ If necessary, lay shim plates under the panels to align them in vertical and horizontal position.
  - ⇒ Carefully approach the next panel to the one that has already been aligned.
  - ⇒ Align the approached panel by means of the alignment brackets provided at the vessel, and make sure that it is vertical and at the necessary height using shim plates if required.

#### Not mounting the sealing strip in case of wall-standing arrangement

	<b>ATTENTION!</b>
	<p>To take individual panels out of the switchgear assembly, please observe the following for panels that had been provided for free-standing arrangement, but are now installed in wall-standing arrangement:</p> <p>⇒ Do <b>not</b> mount the sealing strip.</p>

**Mounting the sealing strip in case of free-standing arrangement**

⇒ To mount the sealing strip, use the Torx screws from the pressure relief duct. Take the other screws from the supplementary equipment.

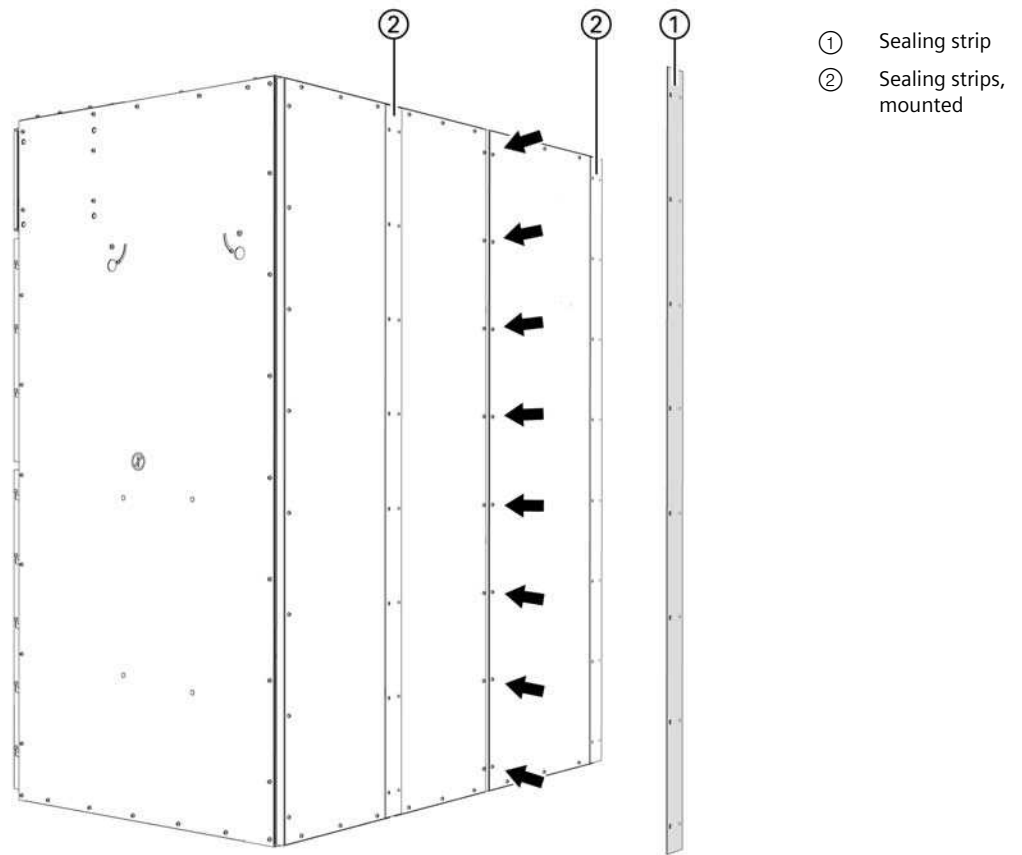



Fig. 57: Mounting sealing strips on rear wall of switchgear

**Joining panels**

	<p><b>ATTENTION!</b></p> <p>If the bolts are tightened too much, the frame may be distorted and the felt strip may become stiff.</p>
	<p>⇒ Tighten the bolts M5x16 only until the felt is pressed slightly together.</p>

- ⇒ Bolt two adjacent panels together at the fixing straps ③ with a panel connecting bolt M8x20 and a nut-and-washer assembly.
- ⇒ Bolt the two panels together at the 4 positions ② with thread-riding screws M5x16 (TORX).
- ⇒ Check whether the bolted panels are in vertical position.

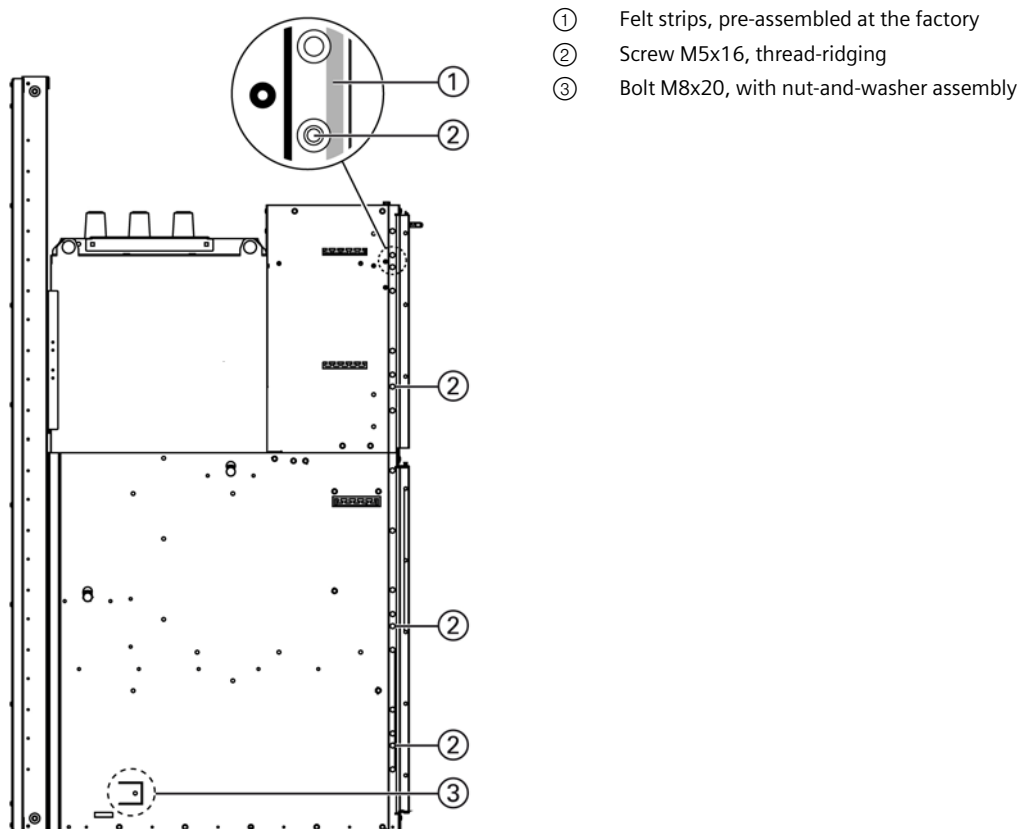


Fig. 58: Bolted joints for panel interconnection

⇒ Mount the panel link ① between the two panels with two bolts M8x45 (saucer-head) and nut-and-washer assemblies ②.

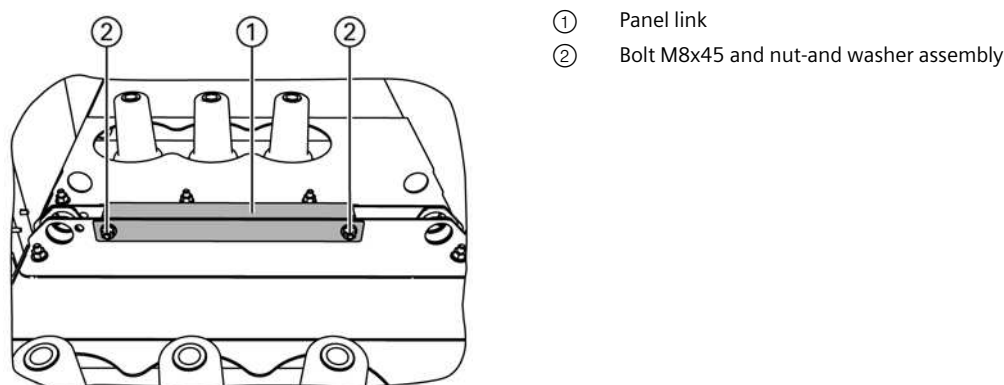



Fig. 59: Panel link, mounted

⇒ Check the reference dimension K1 between the bushings (see page 72, "Assembling the busbars").

⇒ Remove cable compartment covers and operating mechanism covers.

	<p><b>ATTENTION!</b></p> <p>After removal, the cable compartment and operating mechanism covers must be mounted on the same panels again.</p>
	<p>⇒ Write the corresponding panels numbers on all covers after removal.</p>

⇒ Approach all other panels one after the other, align them and bolt the alignment brackets and the frames together.

### 14.2 Fastening the switchgear to the foundation

The panels are bolted to the foundation rails.

The base pieces of the panel frames contain cutouts for fastening the switchgear.

- ⇒ Fasten each panel diagonally to the foundation at two points at least. Use two fixing bolts M8 or M10 as a minimum. Tightening torque: 60 Nm.
- ⇒ For aseismic fastening, connect each panel diagonally to the foundation at 4 points at least. Before doing that, lay the necessary floor bracings into the panel (see page 49, "Floor openings and fixing points"). To do this, use 4 fixing bolts M8 or M10. Tightening torque: 60 Nm.

### 14.3 Assembling the busbars

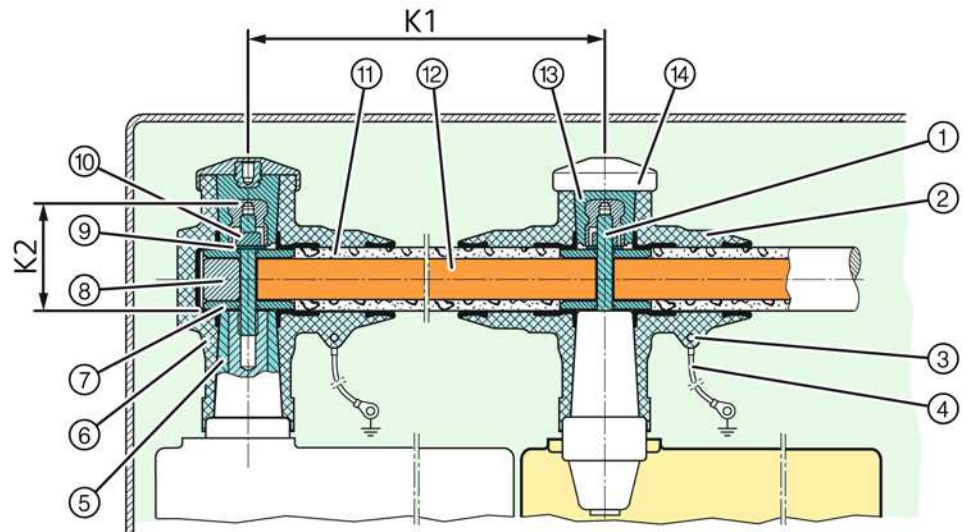


Fig. 60: Busbar joint 630 A/1000 A

- |   |  |
|---|--|
| ① Threaded bolt M12/M16, tightening torque: 10 Nm | ⑧ Fit component  |
| ② Cross adapter                                   | ⑨ Strain washer DIN 6796-12                              |
| ③ Earthing connection                             | ⑩ Hexagonal nut, ISO 4032-M 12, tightening torque: 50 Nm |
| ④ Earthing cable                                  | ⑪ Busbar insulation made of silicone rubber              |
| ⑤ Outside cone                                    | ⑫ Busbar   |
| ⑥ End adapter                                     | ⑬ Screw-type cone, tightening torque: 30 Nm              |
| ⑦ Clamp   | ⑭ Cap  |

Standard reference dimension		
K1	for 600 - 600:	600 +2 mm
	for 600 - 450:	600 +2 mm
	for 450 - 600:	450 +2 mm
	for 450 - 450:	450 +2 mm
K2	Reference dimension	79 +2/-6 mm



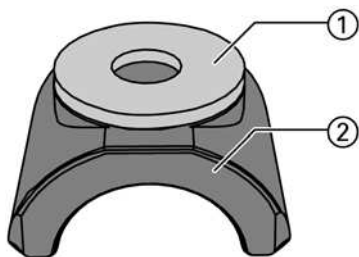


Fig. 61: Mounting position of clamp with strain washer (camber upwards)

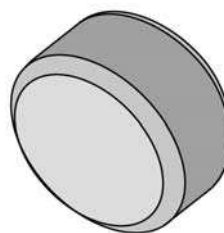


Fig. 62: Fit component ⑤

- ① Strain washer (camber upwards)
- ② Clamp

	<b>ATTENTION!</b>
	<p>Switchgear can be damaged by incorrect handling.</p> <ul style="list-style-type: none"> <li>⇒ The switchgear must be assembled by trained personnel only.</li> <li>⇒ Observe the operating and installation instructions.</li> </ul>

	<b>ATTENTION!</b>
	<p>If the electrical contact is insufficient or the push-on surfaces (high-quality joints) are dirty, the busbars will be damaged during operation.</p> <ul style="list-style-type: none"> <li>⇒ All busbar assembly work must be carried out with particular care. Above all, avoid damaging the contact surfaces.</li> <li>⇒ Observe extreme cleanliness.</li> <li>⇒ No smoking.</li> <li>⇒ Brush oxidized copper surfaces bright and grease them with mounting paste before connection.</li> <li>⇒ Observe tightening torques.</li> </ul>

	<b>ATTENTION!</b>
	<p>The mounting plate of the low-voltage compartment ① can bend under load. This can damage the auxiliary switch of the three-position disconnecter.</p> <ul style="list-style-type: none"> <li>⇒ Do not load the mounting plate ①.</li> <li>⇒ If necessary, use a board with a minimum length of 1100 mm to distribute the load evenly.</li> </ul>

Fig. 63: Panel group, partially mounted

If the switchgear is delivered as a panel group, the busbar is mounted.

If the panels are delivered as individual units, the busbars are always delivered separately with the accessories. To simplify busbar installation, we recommend not to mount the low-voltage compartments before the busbars are assembled.

Do not unpack cross adapters, end adapters and busbars until right before assembly.

Before assembling the busbars, all frames must have been bolted together (see page 69, "Bolting panels together").

**Phase sequence**

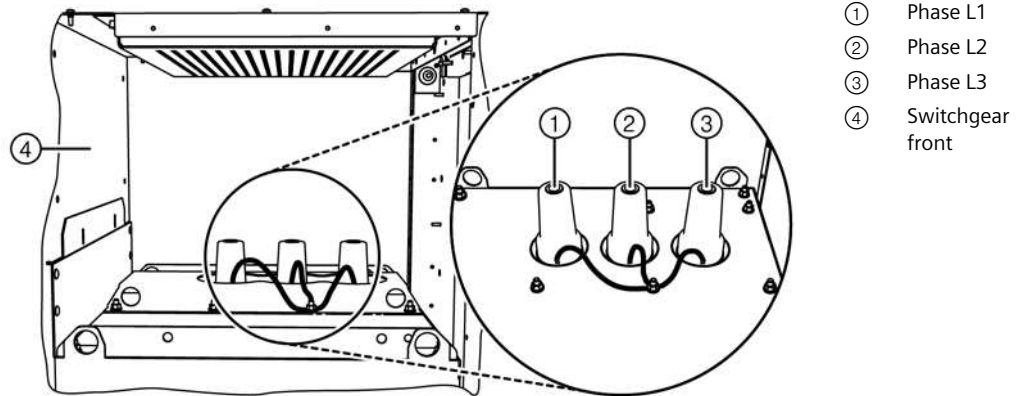
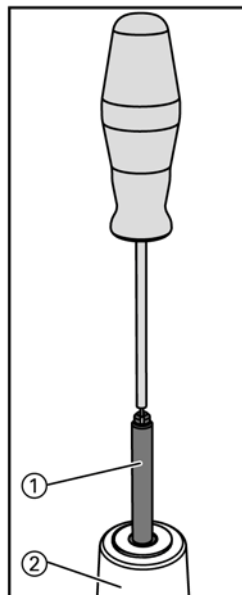


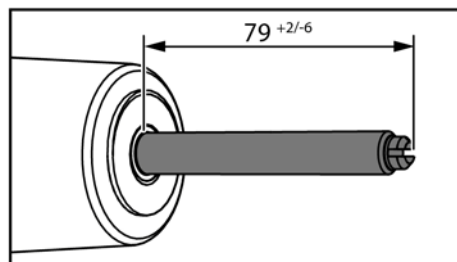
Fig. 64: Phase sequence of bushings in the busbar compartment

**Preparing busbar elements**

- ⇒ Make sure that all busbar elements supplied are complete. Check for perfect condition and cleanliness.
- ⇒ Before connection, brush oxidized copper surfaces (busbar ends and bushings).
- ⇒ Clean dirty busbar elements, cast resin and outside cones of the bushings dry with a lint-free cloth.
- ⇒ Remove dirt in a dry way with a lint-free cloth. If dirt cannot be removed in dry condition, apply a small amount of mounting paste to the lint-free cloth. Use only the mounting paste provided for this purpose.
- ⇒ Grease the brushed copper surfaces evenly and over the whole surface with mounting paste.
- ⇒ Screw threaded bolt M12 / M16 into the bushing with a screwdriver size 10 x 1.6 with approx. 10 Nm (hand-tight).

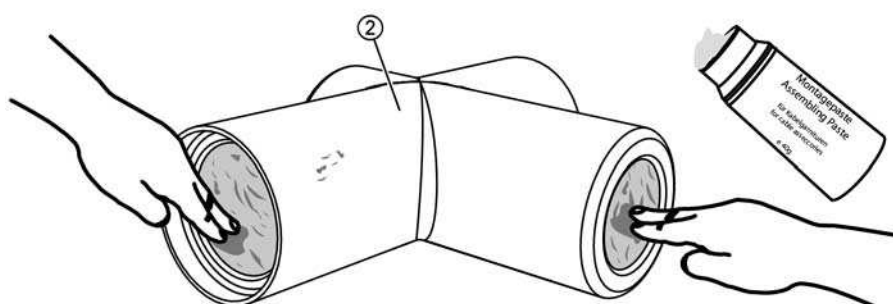


- ⇒ Check reference dimension (79 +2/-6 mm).

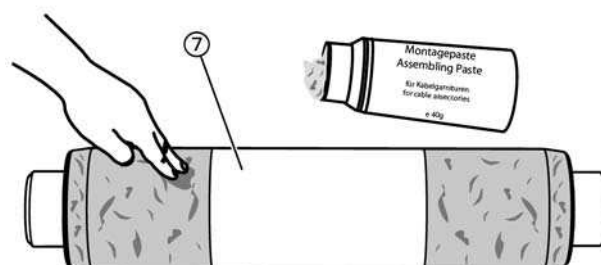


Push-on surfaces must not get dirty during assembly. For this reason, do not grease the surfaces until right before assembly. Avoid damages to the cross and end adapter caused by the threaded bolt while pushing on.

- ⇒ Grease the push-on surfaces (high-quality joints) in the adapters ② with mounting paste. Use the supplied mounting paste only.



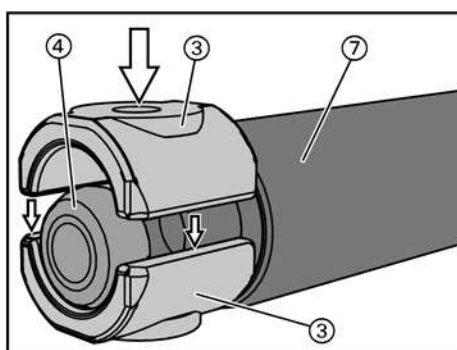
- ⇒ Grease the screw-type cones and the ends of the busbar insulation ⑦ with mounting paste, too. Distribute the paste evenly over the whole surface. Do not grease the stopper until right before assembly.



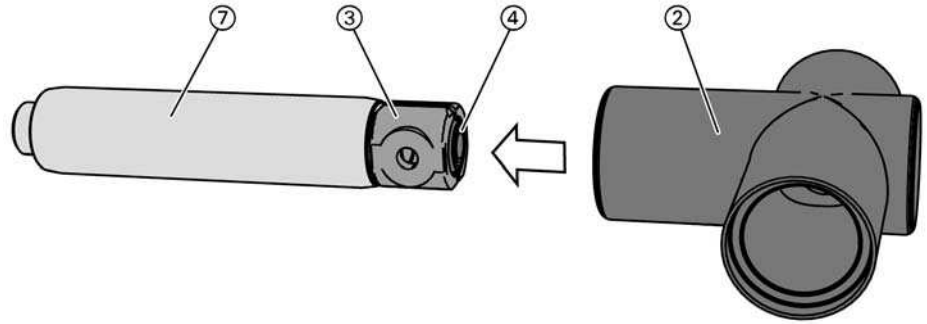
- ⇒ Remove residual mounting paste after assembly.

**Assembling a busbar unit**

- ⇒ Lay the clamps ③ on the ends of the busbar ⑦ and hold them.
- ⇒ In case of end adapters, add a fit component ④ to obtain a symmetrical clamping.



⇒ Push the adapter ② onto the end of the busbar.



⇒ Proceed in the same way with the other end of the busbar.

✓ The busbar unit is completed.

### Mounting the busbar units



#### ATTENTION!

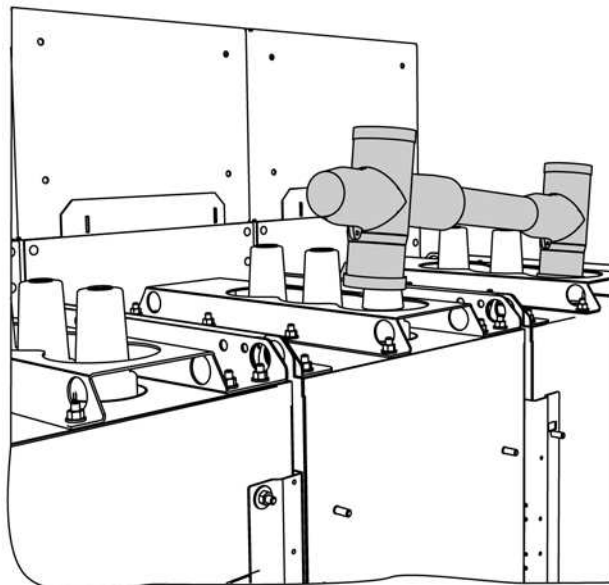
In order to avoid canting or abrasion when pushing the busbar units onto the bushings,

⇒ set down the busbar units carefully and slowly.

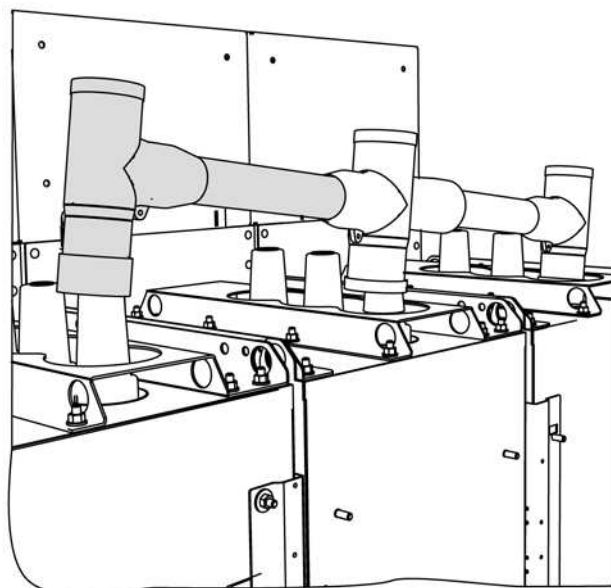
⇒ Grease the bushings with mounting paste.



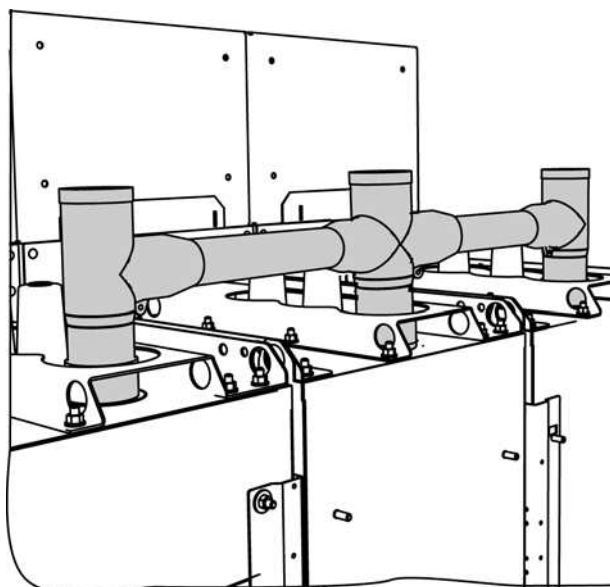
⇒ Plug the busbar unit loosely over the threaded bolts on the bushings of the first two panels.



⇒ Insert another busbar unit in the first busbar unit.

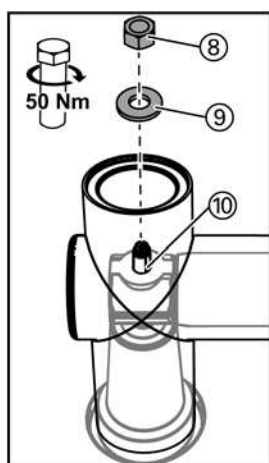


⇒ Press the busbar section onto the bushing.



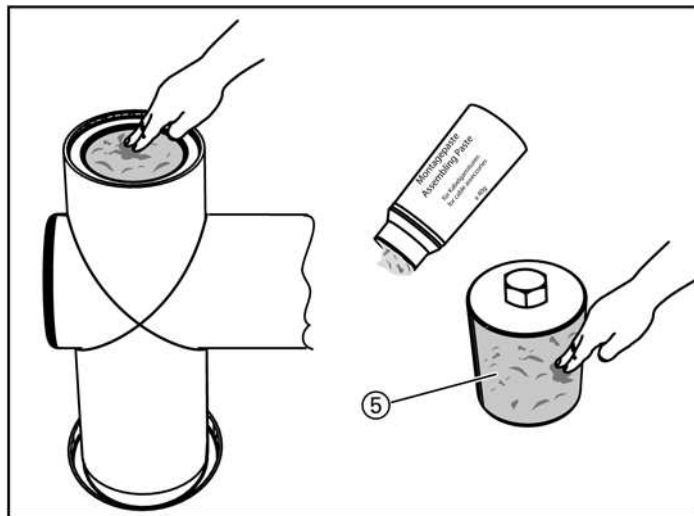
**Fastening the threaded bolt**

⇒ Bolt the threaded bolt ⑩ together with the strain washer (camber upwards) ⑨ and the nut M12 ⑧.



**Fastening the screw insert**

⇒ Grease the screw insert ⑤ and push-on surface (high-quality joint) for the screw insert with mounting paste.

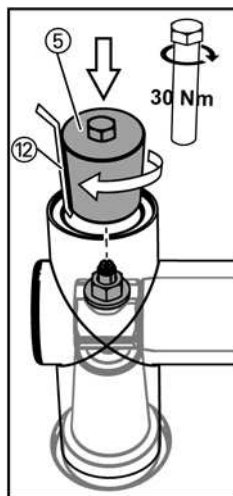


**ATTENTION!**

The busbar insulation may be damaged! Air inclusions can cause flashovers at the insulation.

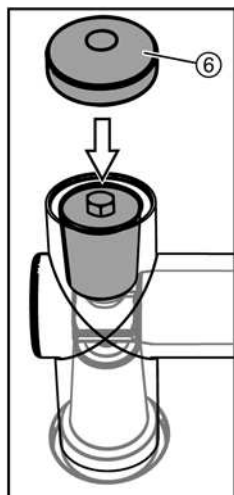
- ⇒ Let excess air out of the screw-type cone with a cable strap while inserting.
- ⇒ After pulling out, verify that cable strap is complete. No pieces of the cable strap may remain between the high-quality joints.

⇒ Insert the screw-type cone ⑤ with a cable strap ⑫ .



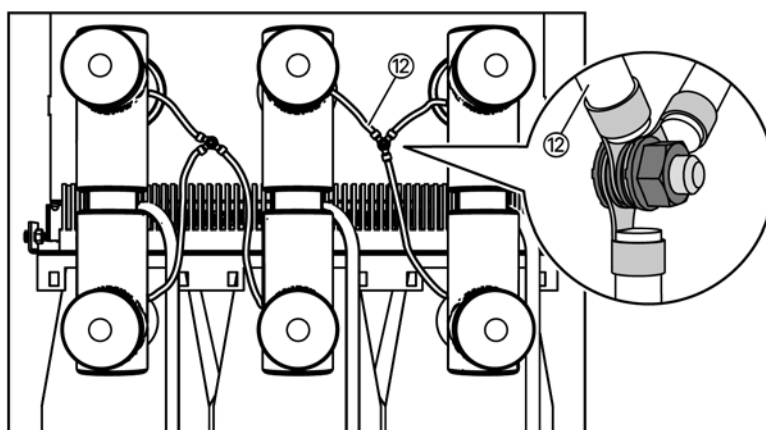
- ⇒ Tighten the screw-type cone.
- ⇒ Pull out the cable strap slowly.
- ⇒ Check whether the cable strap was removed completely.
- ⇒ Turn the screw-type cone back a quarter turn (to distribute the mounting paste).
- ⇒ Tighten the screw insert with 30 Nm.

**Cap** ⇒ Mount the cap ⑥.



**Mounting further screw-type cones** ⇒ Mount all other screw-type cones in the same way.

**Connecting the earthing cables** ⇒ Connect the earthing cables of the adapters ⑫ to the vessel using one of the earthing studs.



- ⇒ Connect all other panels and phases in the same way.
- ⇒ Check earthing of all capacitive taps.
- ⇒ Install the low-voltage compartments and connect them with fixing straps (see page 90, "Installing low-voltage compartments" and see page 91, "Installing the switchgear termination").
- ⇒ Fit the busbar cover.

### 14.4 Installing busbar voltage transformers

The voltage transformers are delivered separately. For installation, the busbars must be mounted (see page 72, "Assembling the busbars") and accessible. For this purpose, the busbar covers must be removed in advance.

If required, the low-voltage compartment, the rear of the pressure relief duct, or the side wall of the switchgear can be removed additionally.

#### Removing the busbar covers

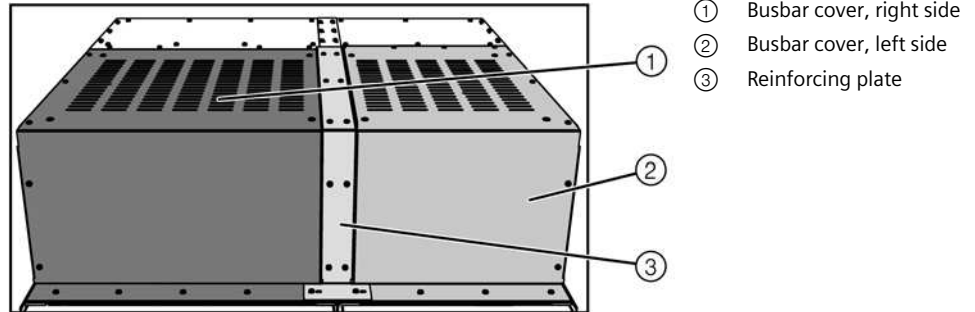
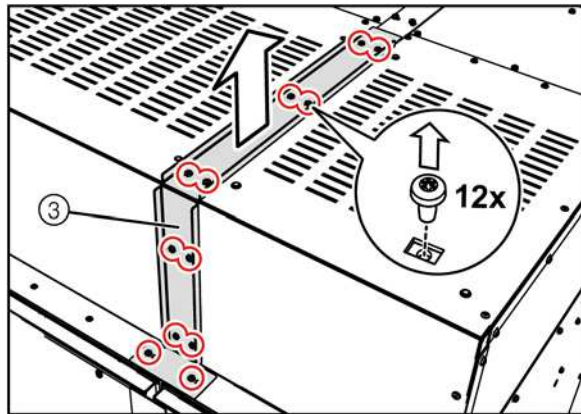


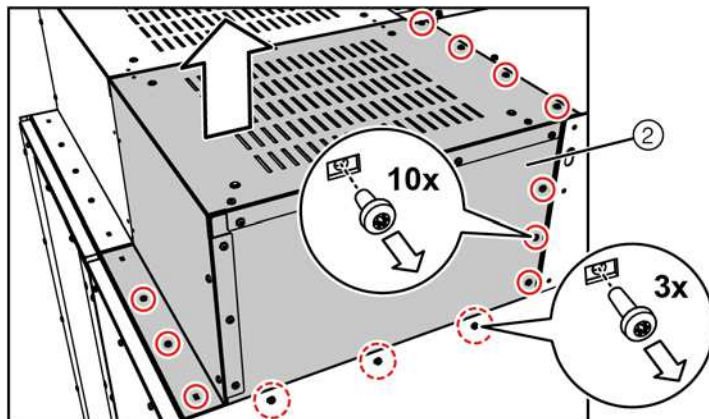
Fig. 65: Busbar covers (view from the rear)

⇒ Remove 12 bolts M5x10 at the reinforcing plate ③ .



⇒ Remove reinforcing plate upwards.

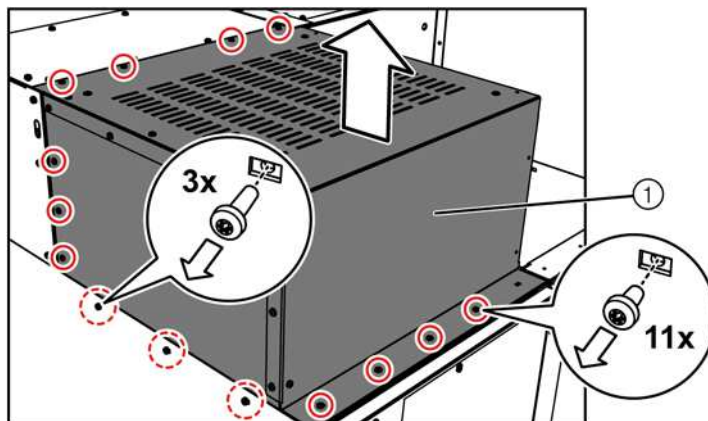
⇒ Remove 10 bolts M5x10 and 3 bolts M5x16 at the left-hand busbar cover ② .



⇒ Remove the left-hand busbar cover upwards.



⇒ Remove 11 bolts M5x10 and 3 bolts M5x16 at the right-hand busbar cover ①.



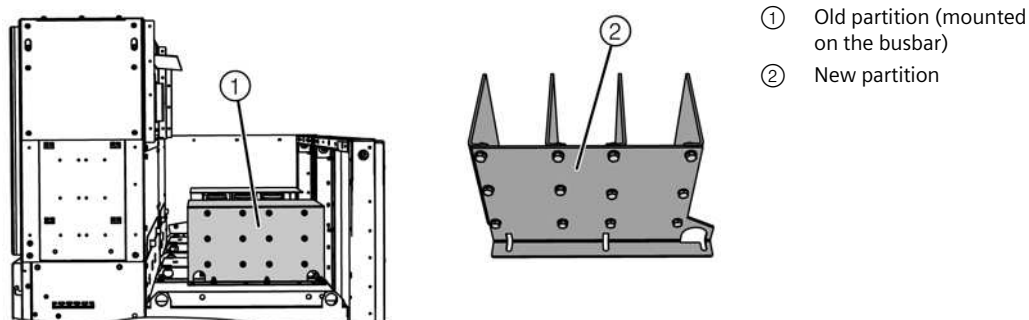
⇒ Remove the right-hand busbar cover upwards.

✓ The busbar covers are removed.

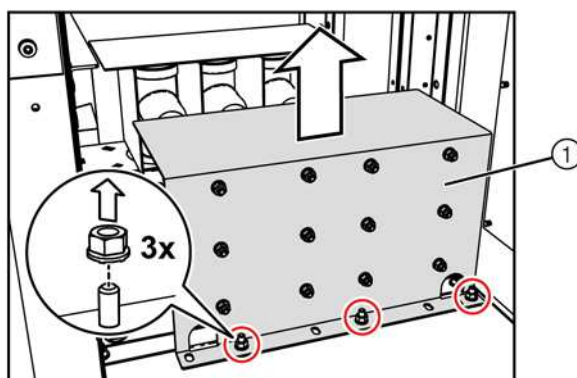
### Mounting new partitions

During installation of the voltage transformers in the right end panel, the busbar partition must be removed and replaced by a new partition.

The new busbar partition ② is delivered together with the voltage transformers.



⇒ Remove the old partition ①. To do this, undo and keep 3 nut-and-washer assemblies M8.



**Mounting the new partition**

⇒ Bolt the new partition together with the threaded bolts on the vessel roof using the 3 previously removed nut-and-washer assemblies M8. Tightening torque: 30 Nm

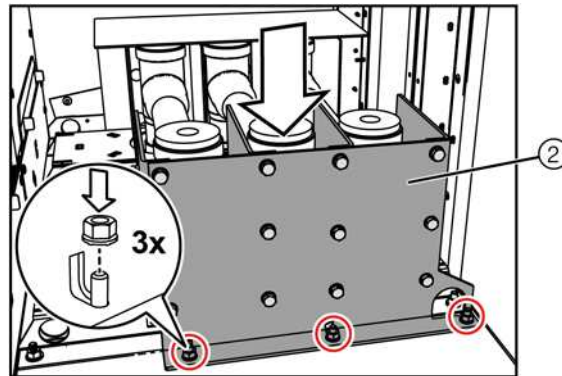
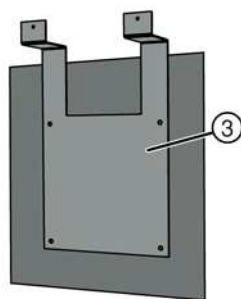


Fig. 66: New partition mounted

**Partition plate of switchgear rear wall**

If the voltage transformers are installed in the right end panel, an additional partition plate must be mounted on the switchgear rear wall.



③ Partition plate of switchgear rear wall

⇒ Bolt partition plate ③ together with the switchgear rear wall using 2 Torx screws M5x10 and 2 contact washers.

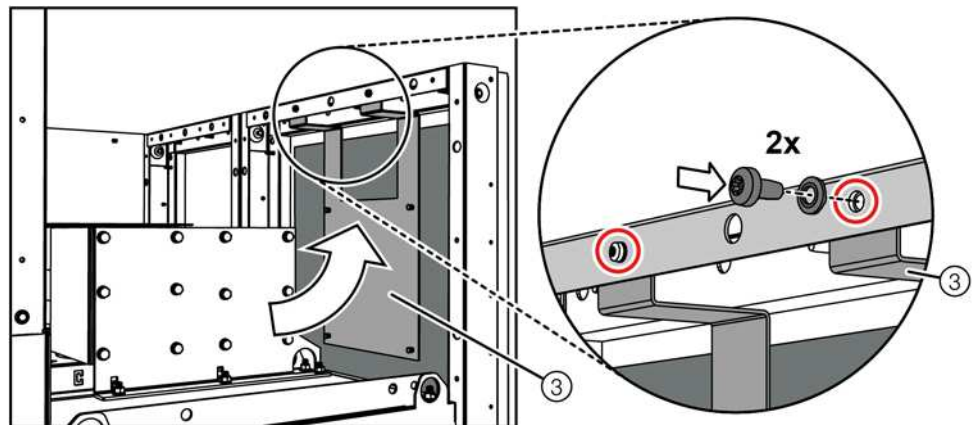


Fig. 67: Bolting the partition plate together with the switchgear rear wall

### Installation of the voltage transformers

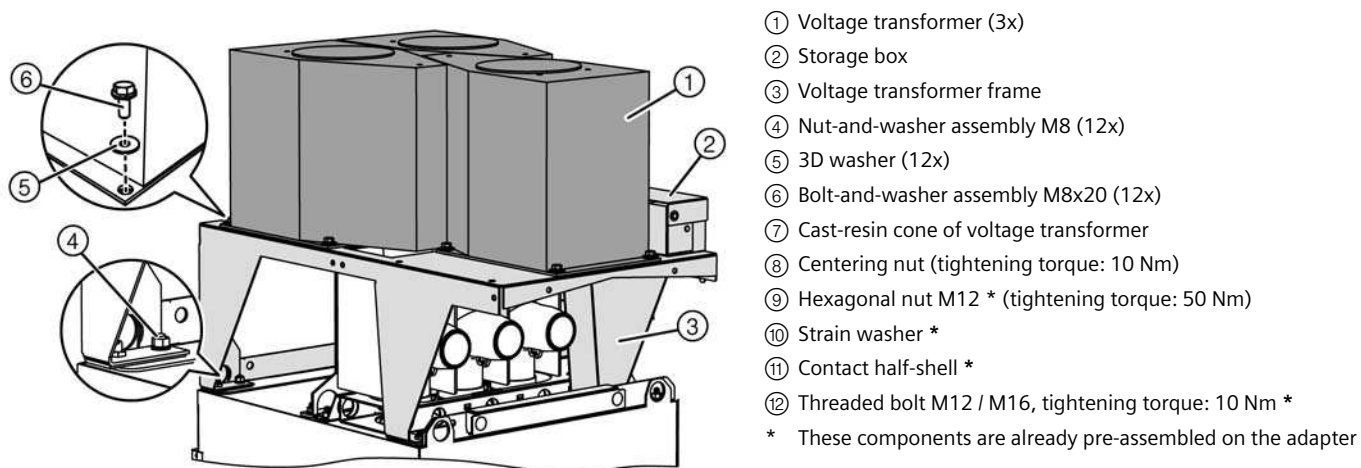


Fig. 68: Mounted voltage transformers (overview)

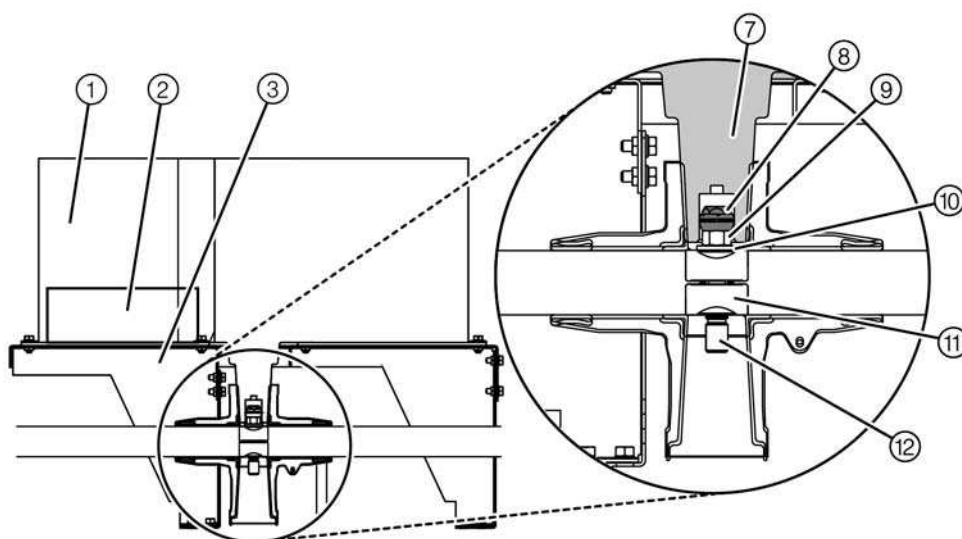

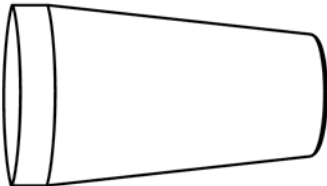



Fig. 69: Voltage transformer mounted on the busbar (sectional view from the front)

	<p><b>ATTENTION!</b></p> <p>The voltage transformer bushings may be damaged during installation.</p>
	<p>⇒ During installation, protect the voltage transformer bushings from damage (lifting, setting down). Do not remove the protective caps of the voltage transformers until right before installation.</p> <div style="text-align: center; margin-top: 20px;">  </div>

	<p><b>ATTENTION!</b></p> <p>For mounting the voltage transformer on the busbar, the cap and the screw-type cone of the end adapters / cross adapters are not required.</p> <p>⇒ During first installation, do not mount the caps and the screw-type cone, but lay them in the storage box. Perform all other operations exactly as described in the installation instructions (see page 72, "Assembling the busbars").</p> <p>⇒ If the busbar assembly has already been completed, remove the caps and the screw-type cone.</p>
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- ⇒ Remove the cap of the end adapter / cross adapter.
- ⇒ Remove the screw-type cone of end adapter / cross adapter.

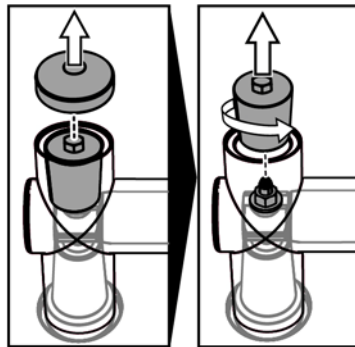


Fig. 70: Removing the cap and the screw-type cone

- ⇒ Bolt the centering nut ⑧ together with the threaded bolt ⑫ in the end adapter / cross adapter. Tightening torque: 10 Nm.

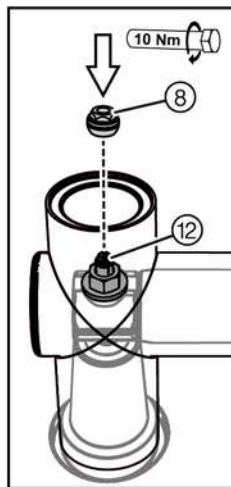


Fig. 71: Bolting the centering nut tight

**Mounting the voltage transformer frame**

- ⇒ Remove the nut-and-washer assemblies at the rear fixing points of the voltage transformer frame.
- ⇒ Set down the voltage transformer frame ③ on the switchgear vessel with the protrusion aligned to the left. Align the voltage transformer frame in such a way that the threaded bolts on the vessel roof fit into the drill holes of the frame feet.

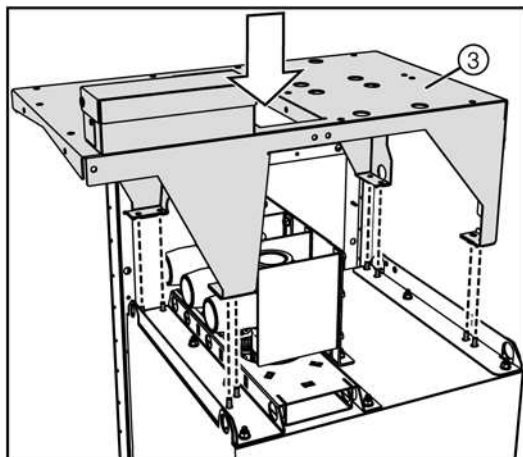


Fig. 72: Setting down the voltage transformer frame

- ⇒ Fasten the voltage transformer frame ③ using 2 nut-and-washer assemblies M8x20 ④ per frame foot.

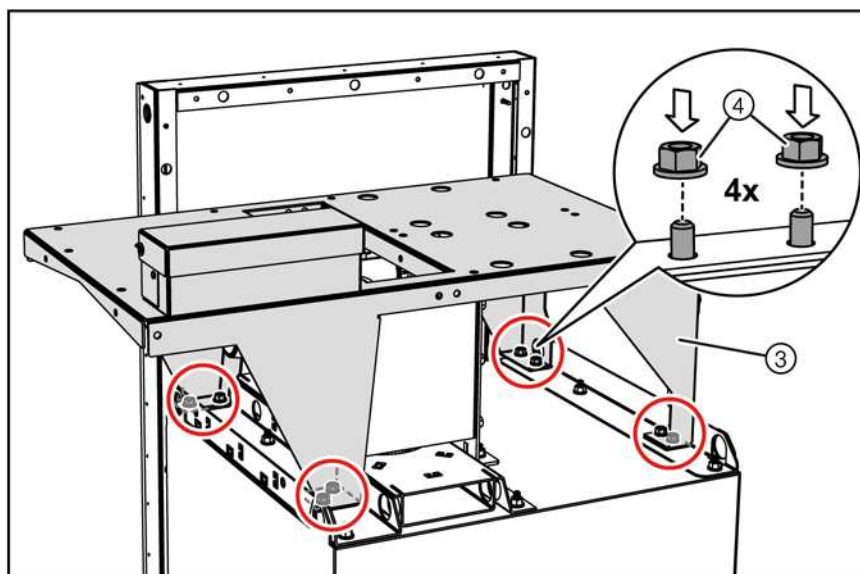




Fig. 73: Mounting the voltage transformer frame

### Installing the voltage transformers

	<p><b>ATTENTION!</b></p> <p>The busbar insulation may be damaged! Air inclusions can cause flashovers at the insulation.</p>
	<ul style="list-style-type: none"> <li>⇒ While installing the voltage transformer, let excess air out of the adapter with a cable strap.</li> <li>⇒ After letting excess air out, pull cable strap out slowly and check for completeness.</li> </ul>

	<p><b>NOTE!</b></p> <p>To remove a defective voltage transformer from the busbar and cover the busbar subsequently in a surge-proof way, observe the following operations:</p>
	<ul style="list-style-type: none"> <li>⇒ Store the screw-type cones left over during installation (3 nos.) in the storage box located at the voltage transformer frame.</li> <li>⇒ Keep the residual mounting paste (tube) in the storage box as well.</li> <li>⇒ Store a cable strap in the storage box.</li> </ul>

- ⇒ Grease high-quality joints of voltage transformer and of end adapter / cross adapter with mounting paste before mounting.
- ⇒ While setting down the voltage transformer, let excess air out of the end adapter / cross adapter with a cable strap ⑭ .
- ⇒ Set down the voltage transformer ① on the voltage transformer frame in such a way that the cast-resin cone of the voltage transformer penetrates into the end adapter / cross adapter, and that the voltage transformer is placed correctly on its bolted joints.

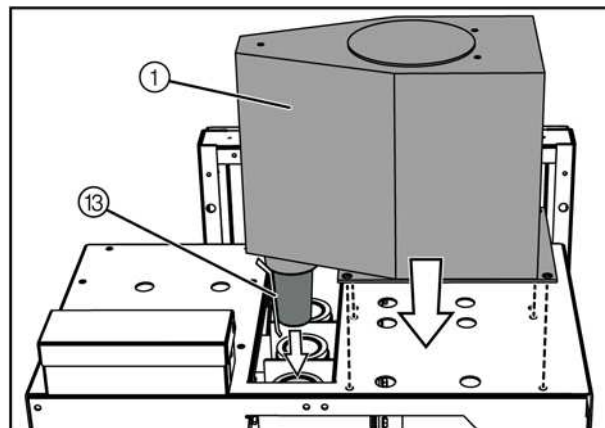


Fig. 74: Setting down the voltage transformer

- ⇒ Pull the cable strap ⑭ slowly out of the end adapter / cross adapter.
- ⇒ Verify intact condition of the cable strap. If parts of the cable strap are missing, remove the voltage transformer again and verify that no residuals of the cable strap remain in the end adapter / cross adapter.

- ⇒ Mount the 3 voltage transformers ① with 4 bolt-and-washer assemblies and 3D washers each. Tightening torque: 20 Nm.

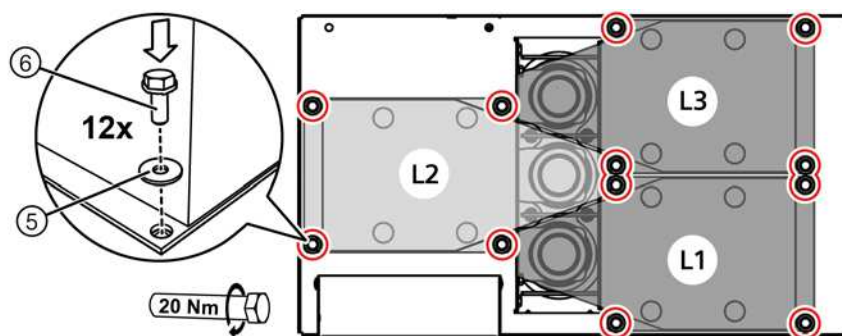


Fig. 75: Bolted joints of voltage transformers

- ⑤ 3D washer
- ⑥ Bolt-and-washer assembly M8

- ⇒ Establish secondary connections to the low-voltage compartment with a plug connector.
- ⇒ Connect the earthing cable of the adapter.

	<b>ATTENTION!</b>
	<p>After removal of the voltage transformers, cover the busbars again in a surge-proof way.</p> <ul style="list-style-type: none"> <li>⇒ To do this, always keep the cap and the screw-type cone in the storage box.</li> </ul>

**Mounting the busbar covers**

- ⇒ Refit the busbar covers; first mount the left-hand ② and right-hand ① busbar covers, then the reinforcing plate ③.

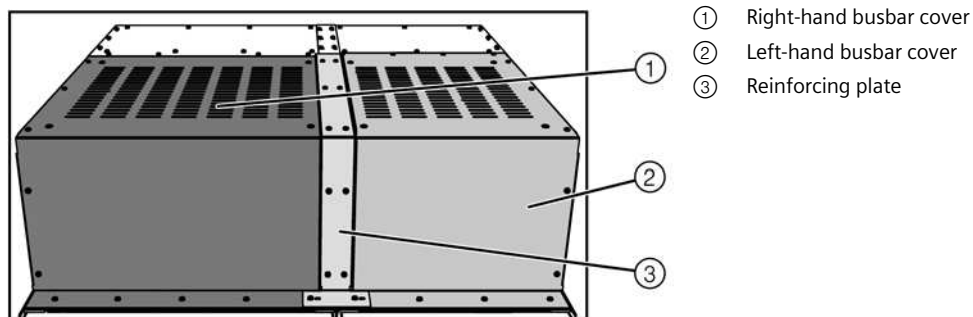


Fig. 76: Busbar cover (view from the rear)

**Checking the voltage transformer connection**

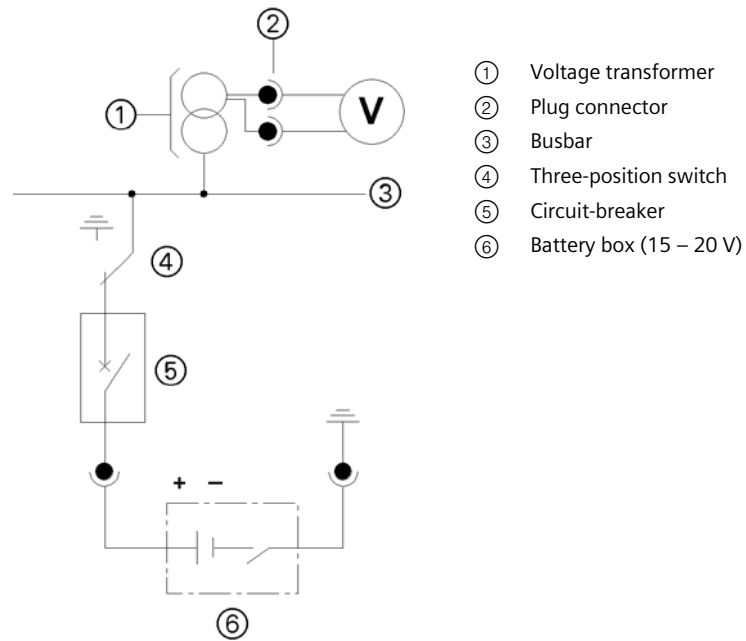


Fig. 77: Circuit diagram for checking the voltage transformer connection

- ⇒ On one panel of the switchgear, switch the circuit-breaker and the three-position switch to CLOSED position.
- ⇒ Connect a voltmeter to the outgoing cable of the voltage transformer and set the mV-range.
- ⇒ Apply 15 to 20 V DC to L1, L2, L3 to earth with the battery and observe the voltmeter.
- ✓ If the pointer moves a little bit, the voltage transformer connection is in good order.

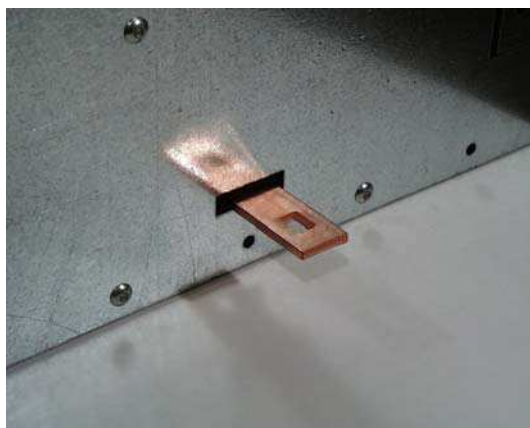
**14.5 Installing the earthing busbar**



Fig. 78: Earth connections



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



- ⇒ Brush oxidized copper surfaces and apply a thin film of mounting paste.
- ⇒ Bolt the link together with the adjacent unit of the earthing busbar using an M 10 bolt. Tightening torque: 50 Nm.
- ⇒ Proceed in the same way with the other joints.

#### 14.6 Switchgear earthing

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

- ⇒ Connect the earthing busbar of the two end panels - at least - (bolt M 12) to the substation earth. In addition, earth approximately every fifth panel.

The diameter of the earthing cable must be at least 70 mm<sup>2</sup>.

- ⇒ Lay the earthing cable through the right-hand wiring duct into the cable basement.

#### Example for an earthing with a 95 mm<sup>2</sup> cable



**14.7 Installing low-voltage compartments**

- ⇒ Put the low-voltage compartment on the frame of the associated switchpanel and push it back until the retaining hooks (2 nos.) slip into the opening and the front of the low-voltage compartment is flush with the panel front.
- ⇒ Bolt the low-voltage compartment to the frame at the front lower edge with two M8 bolts.
- ⇒ Repeat the same operations for the other low-voltage compartments.
- ⇒ Bolt the low-voltage compartments together up at the side edges with one thread-ridging screw size M5 each.
- ⇒ Thread the pre-assembled cables of the three-position switch and the circuit-breaker through the right-side opening at the bottom.
- ⇒ Plug the 10-pole connectors onto the corresponding terminals according to the circuit diagram.
- ⇒ Lay the bus wires in the ducts and plug them on the corresponding terminals according to the circuit diagram.
- ⇒ Wire the current transformer leads to the corresponding terminals according to the circuit diagram.

**14.8 Busbar covers**

- ⇒ Mount the busbar covers and bolt them tight with thread-ridging screws M5x16.

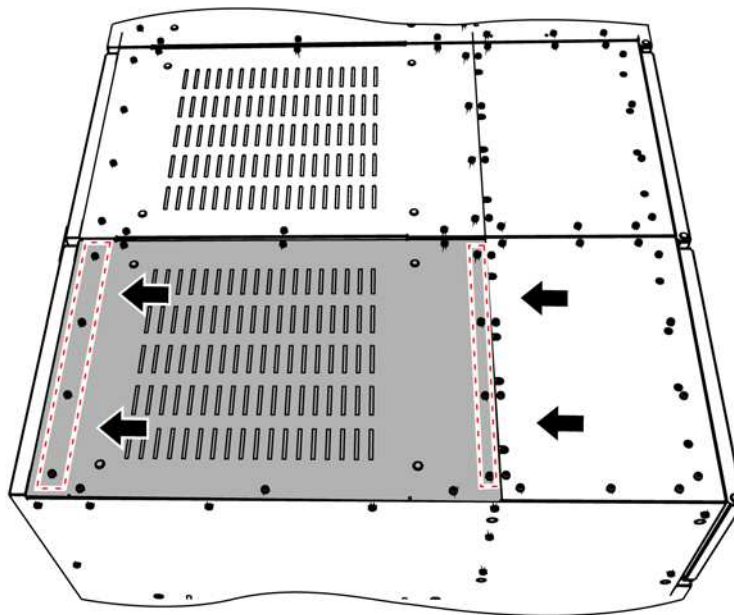



Fig. 79: Bolting the busbar cover, here exemplary for a panel width of 450 mm

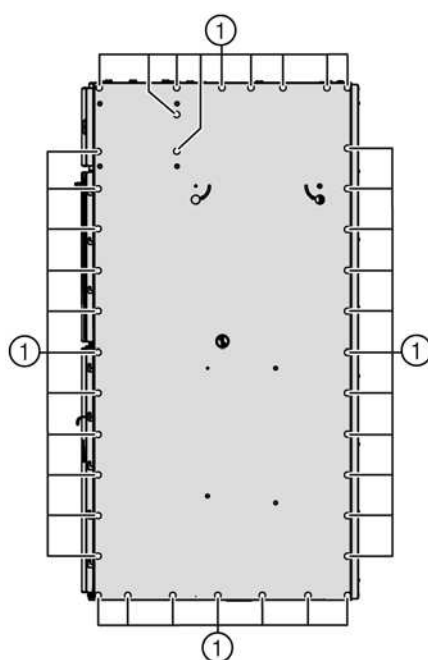
Depending on the panel width, the busbar cover requires the following number of thread-ridging screws M5 x 16 for assembly:

Panel width [mm]	Number of bolted joints
450	8
600	10

## 14.9 Installing the switchgear termination

	<b>NOTE!</b>
	<p>If not ordered otherwise by the customer, the end panel of the NXPLUS C Wind switchgear is delivered with mounted switchgear termination.</p> <p>⇒ The following operations need not be observed then.</p>

⇒ Fasten the switchgear termination of the end panel using 38 thread-ridging screws M5x16.




① Thread-ridging screw M5x16 (38x)

Fig. 80: Fastening the switchgear termination; here, the right end panel for example

## 14.10 Extension with individual panels

Do always observe the Five Safety Rules if you are going to extend an existing switchgear assembly or replace components:

	<b>DANGER!</b>
	<p>High voltage! Danger!</p> <p>⇒ Isolate the switchgear.</p> <p>⇒ Secure against reclosing.</p> <p>⇒ Verify safe isolation from supply.</p> <p>⇒ Earth and short-circuit.</p> <p>⇒ Cover or barrier adjacent live parts.</p>


- ⇒ Remove switchgear termination.
- ⇒ Remove the low-voltage compartment and the busbar cover of the last panel and the one before last.
- ⇒ Approach the extension panel, align it and bolt it together (see page 69, "Bolting panels together").
- ⇒ Fasten the extension panel to the foundation (see page 72, "Fastening the switchgear to the foundation").
- ⇒ On the last two panels, remove the cap and the screw-type cone of the busbar.

## Installation

- ⇒ Undo M 12 nut and take it out.
- ⇒ Remove the strain washer (do not use it again).
- ⇒ Further installation see page 72, "Assembling the busbars".
- ⇒ Replace the end adapters of the former end panel by cross adapters.
- ⇒ Grease new components with mounting paste.
- ⇒ Do not forget to let excess air out.

## 15 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 that it is therefore not live. If you are going to extend an existing switchgear assembly or replace components, please observe the Five Safety Rules:

	<b>DANGER!</b>
	High voltage! Danger!
	⇒ Isolate the switchgear.
	⇒ Secure against reclosing.
	⇒ Verify safe isolation from supply.
	⇒ Earth and short-circuit.
⇒ Cover or barrier adjacent live parts.	

The following panels types are equipped with arcing plates:

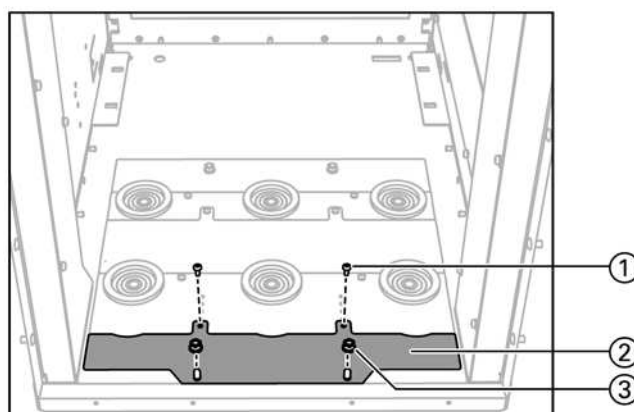
- Circuit-breaker panels
- Disconnecter panels
- Ring-main panels

### 15.1 Installation work at the pressure-resistant floor cover

The pressure-resistant floor cover is pre-assembled at the factory. Before starting with the installation of cable T-plugs, the pressure-resistant floor cover must be removed. The pressure-resistant floor cover is installed in the course of the installation of the cable T-plugs.

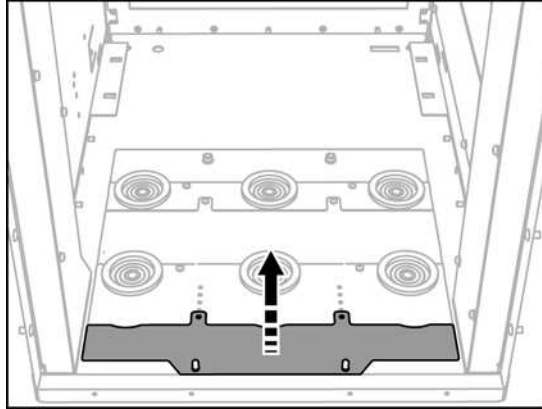
#### Removing the pressure-resistant floor cover

**600 mm panel width** ⇒ Undo 2 nut-and-washer assemblies M8 and 2 bolts M5 of the front floor plate.

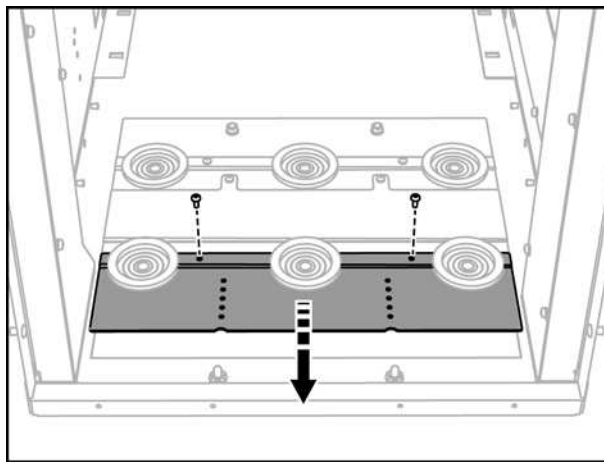


- ① Bolt
- ② Front floor plate
- ③ Nut-and-washer assembly

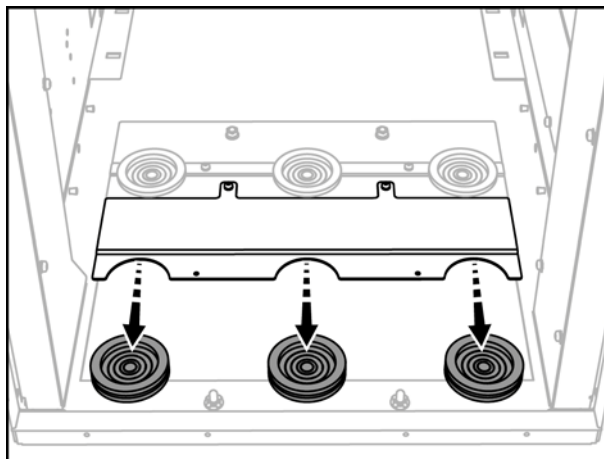
⇒ Take the front floor plate out.



⇒ Undo 2 bolts of another floor plate and remove the floor plate.



⇒ Pull out the rubber sleeves.



⇒ Remove further floor plates.

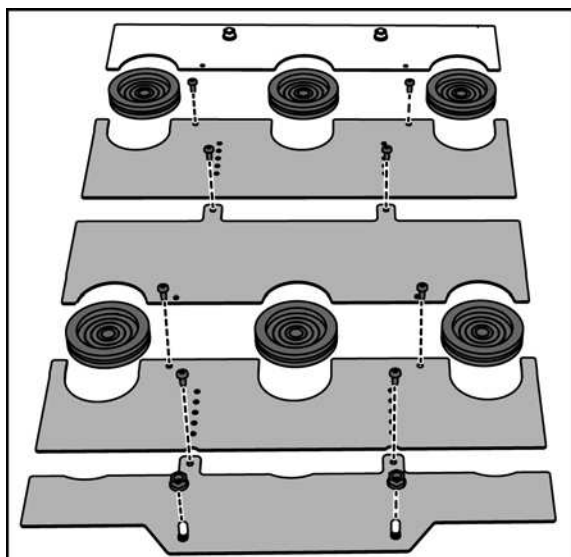
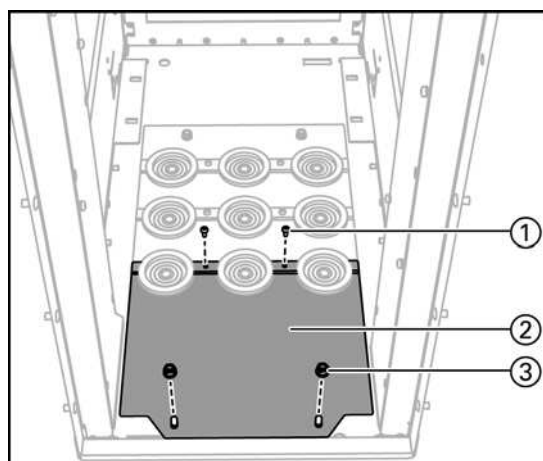


Fig. 81: Components to be removed

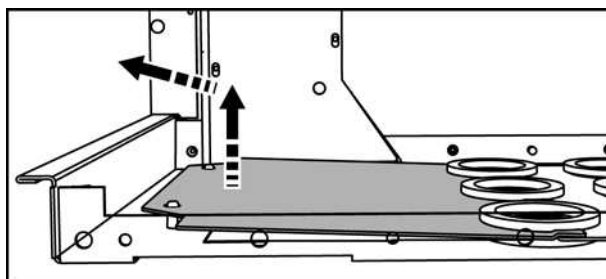
✓ The panel is ready for connecting the cable T-plugs.

**450 mm panel width** ⇒ Undo 2 nut-and-washer assemblies M8 and 2 bolts M5 of the front floor plate.

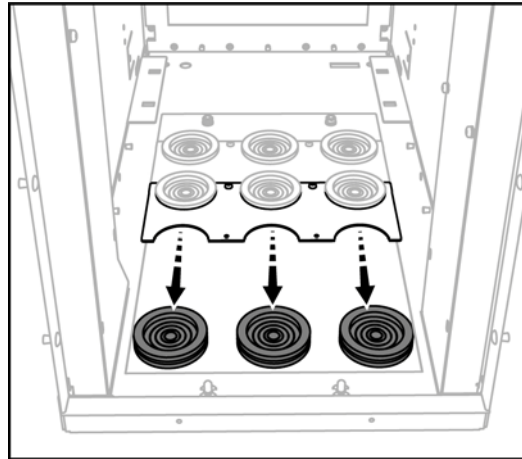


- ① Bolt
- ② Front floor plate
- ③ Nut-and-washer assembly

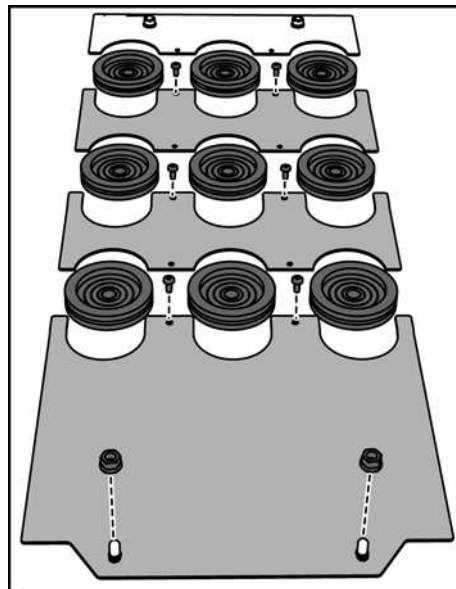
⇒ Lift out the floor plate.



⇒ Pull out the rubber sleeves.


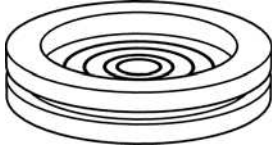


⇒ Remove further floor plates.



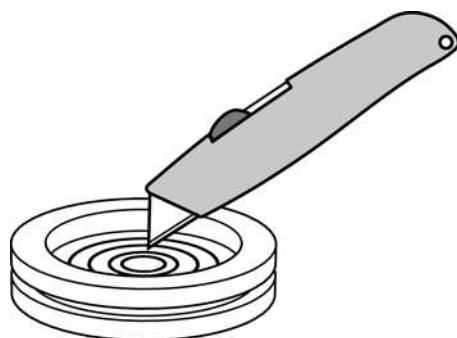
✓ The panel is ready for connecting the cable T-plugs.

### Cutting the rubber sleeves to size

	<p><b>NOTE!</b></p> <p>The rings in the rubber sleeves are not adjusted to the cable diameters, but serve only as rough orientation.</p>  <p>Fig. 82: Rubber sleeve</p>
---	--

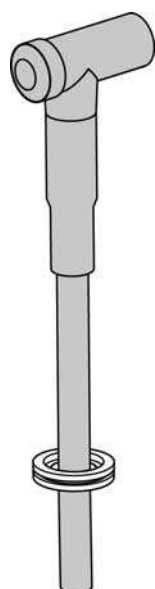


- ⇒ With a knife, cut an opening into the rubber sleeve that fits the diameter of the cable.



**Mounting the pressure-resistant floor cover**

- Mounting the floor plates** ⇒ Push the rubber sleeve onto the cable T-plug.



- ⇒ Connect the cable T-plug (see page 99, "Connecting cable T-plugs").
- ⇒ Insert the rubber sleeve with cable plug into the recess of the floor plate.

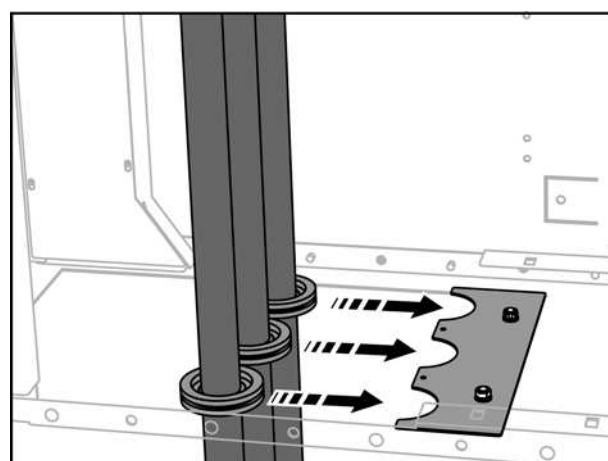


Fig. 83: Example for panel width 450 mm

⇒ Insert the next floor plate in the notch of the rubber sleeve.

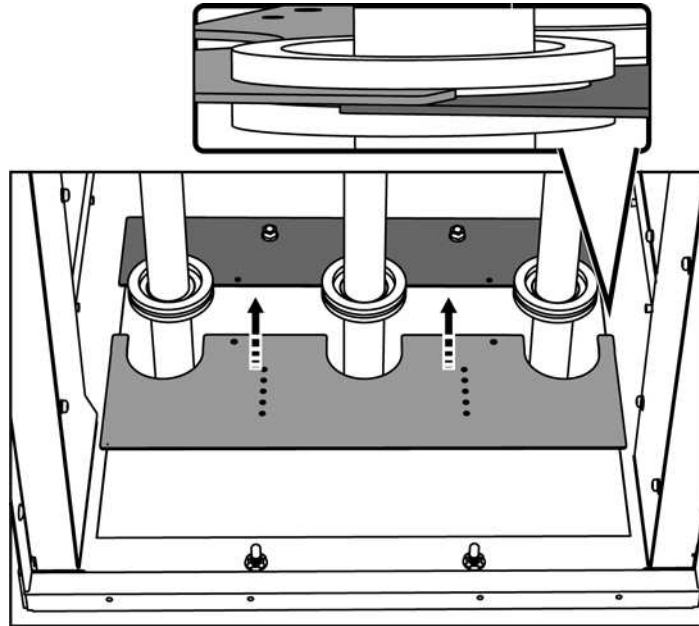


Fig. 84: Example for panel width 600 mm

⇒ Bolt the floor plate tight.

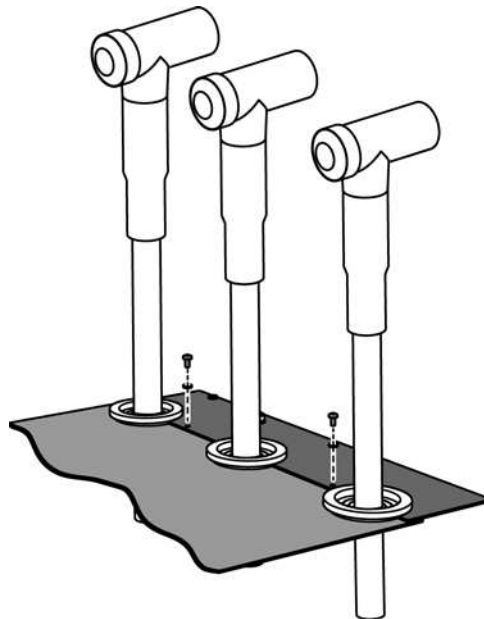



Fig. 85: Example for panel width 450 mm

⇒ Mount further floor plates.

	<b>NOTE!</b>
	For 600 mm panel width, 2 floor plates must be mounted before the next row of cable plugs with rubber sleeves can be mounted.

**Mounting the termination plate**

⇒ Mount the termination plate and set it on the studs.

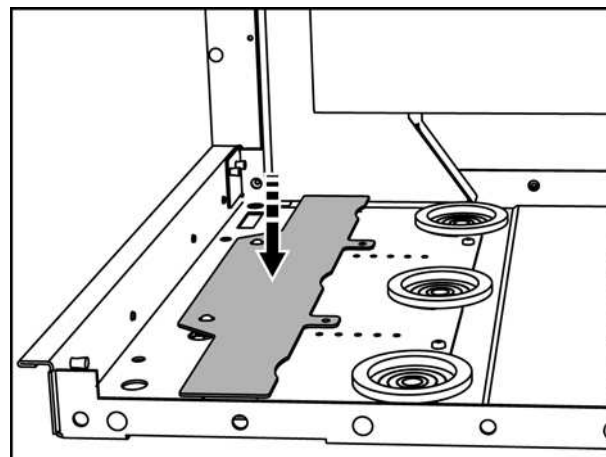
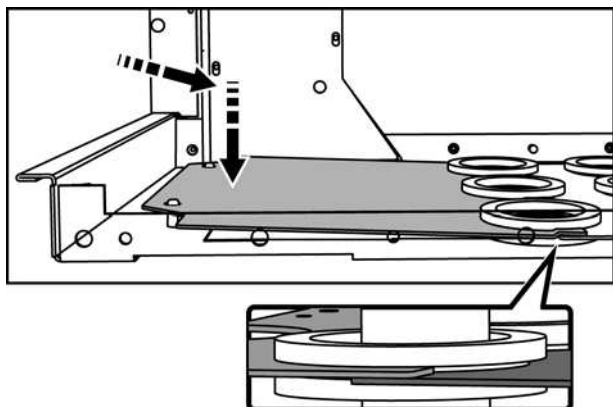


Fig. 86: Example for panel width 450 mm

Fig. 87: Example for panel width 600 mm

- ⇒ Bolt the floor plate and the termination plate together using 2 bolts and 2 nut-and-washer assemblies.
- ✓ The pressure-resistant floor cover is completely assembled.

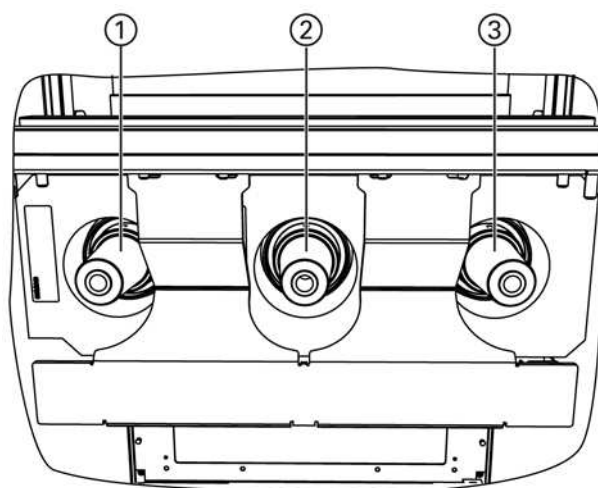
**15.2 Connecting cable T-plugs**

For NXPLUS C Wind switchgear, basically only cable T-plugs shielded by means of an external semi-conductive layer may 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 Wind).

Please select the tightening torque of the bolted joint "cable-T-plug - bushing" according to the specifications of the respective cable T-plug manufacturer.

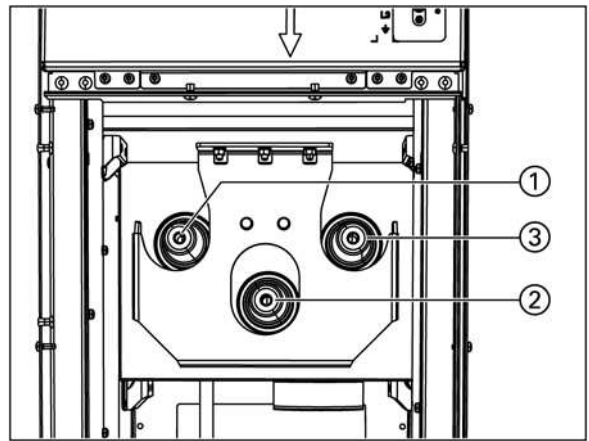
If there are no specifications from the cable T-plug manufacturer's side, please tighten the bolted joint with 50 Nm.

**Phase sequence in the cable compartment**



- ① Phase L1
- ② Phase L2
- ③ Phase L3

Fig. 88: Circuit-breaker panel: Phase sequence of bushings in the cable compartment




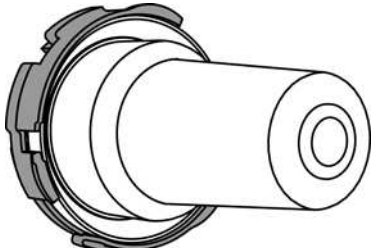
- ① Phase L1
- ② Phase L2
- ③ Phase L3

Fig. 89: Disconnecter panel, ring-main panel: Phase sequence of bushings in the cable compartment

- Preparations**
- ⇒ Earth the feeder.
  - ⇒ Undo the fixing screws of the cable compartment cover.
  - ⇒ Lift the cable compartment cover and remove it to the front.
  - ⇒ Remove the pressure-resistant floor cover (see page 93, "Removing the pressure-resistant floor cover").
  - ⇒ Cut rubber sleeves to size (see page 96, "Cutting the rubber sleeves to size").

**Mounting cable T-plugs on cable ends**

	<p><b>ATTENTION!</b></p> <p>Surfaces of high-quality joints can easily be damaged by incorrect handling.</p> <p>⇒ Observe extreme cleanliness.</p>
	<p><b>ATTENTION!</b></p> <p>Cable plugs can easily be damaged by incorrect handling.</p> <p>⇒ Make sure that the cable T-plugs are mounted on the cable ends by instructed personnel.</p> <p>⇒ Make sure that mounted cable plugs are not bended or twisted.</p>
	<p><b>ATTENTION!</b></p> <p>Do not operate the outside-cone bushings of the cable compartment without cable T-plugs.</p> <p>⇒ If no cables are connected and the panel is to be energized, the outside-cone bushings must be closed in a surge-proof way.</p> <p>⇒ Mount the surge-proof end cap for bushing type "C" (with bolted contact M16), type 8DX1488.</p>


	<p><b>ATTENTION!</b></p> <p>Disassembling the protection ring can cause damages at the connection of the capacitive voltage detecting system.</p>
	<p>⇒ Do not remove the protection ring.</p> <div style="text-align: center;">  </div>

- ⇒ Push the rubber sleeve onto the cable T-plug.
- ⇒ Fit the cable T-plugs on the cable ends according to the manufacturer's instructions.


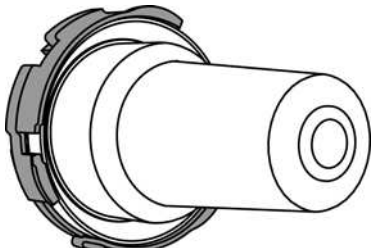
### Mounting cable T-plugs

After installation of the cable T-plugs in the phases L1 to L3, one arcing plate each must be mounted in the cable compartment. The arcing plates are fitted on the mounting plate below the operating mechanism box. Tightening torque for the air guides: 20 Nm.

The associated floor plate of the pressure-resistant floor cover must be mounted after installation of a row of cable T-plugs (see page 97, "Mounting the pressure-resistant floor cover").

	<p><b>NOTE!</b></p> <p>The arcing plates in the cable compartment have been pre-assembled at the factory. For cable installation, the arcing plates must be removed.</p>
	<ul style="list-style-type: none"> <li>⇒ After cable installation, position the arcing plates as close as possible to the front in accordance with the cable T-plugs used.</li> <li>⇒ Do <b>not</b> exceed the distance of 10 mm to the cable T-plugs.</li> <li>⇒ After installation, the arcing plates must not touch the cable T-plugs.</li> <li>⇒ While installing the arcing plates, take care not to damage the cable T-plugs.</li> </ul>

A white plastic protection ring may be factory-assembled on the outside-cone bushing type C. This ring serves as a top for the plug, and protects the connection of the capacitive voltage detecting system at the bushing from damages when the cable plugs are mounted.

	<p><b>ATTENTION!</b></p> <p>Disassembling the protection ring can cause damages at the connection of the capacitive voltage detecting system.</p>
	<p>⇒ Do not remove the protection ring.</p> <div style="text-align: center;">  </div>

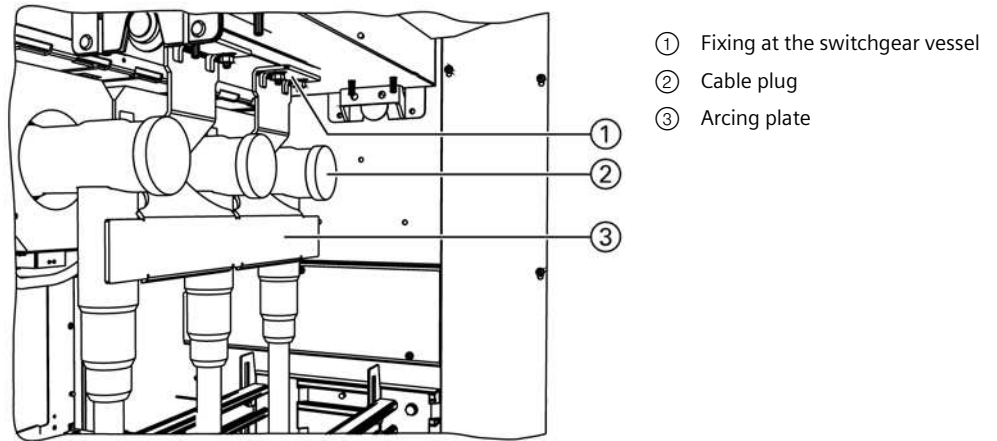


Fig. 90: Circuit-breaker panel: Arcing plate at the cable connection, one cable per phase

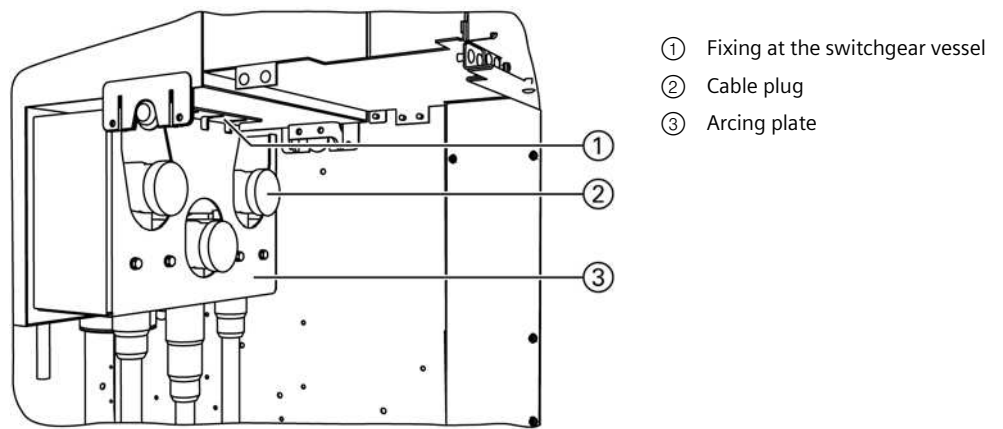
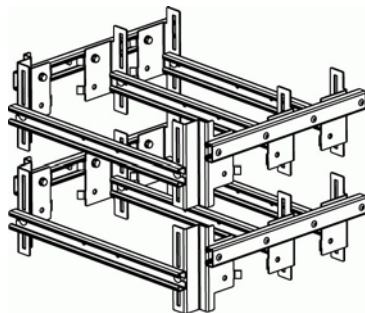


Fig. 91: Disconnector panel and ring-main panel: Arcing plate at the cable connection, one cable per phase

- ⇒ Push the rubber sleeve onto the cable T-plug.
  - ⇒ Mount the cable T-plugs of the phases L1 to L3 one after the other.
  - ⇒ In the cable compartment, fit the arcing plate on the mounting plate. Tightening torque: 20 Nm
  - ⇒ Mount the floor plate of the pressure-resistant floor cover (see page 97, "Mounting the pressure-resistant floor cover").
- Aligning and mounting the cable bracket**
- ⇒ Align the cable bracket and bolt it tight.




- ⇒ Mount the cable clamps. To do this, use cable clamps made of non-magnetizable materials (plastic, aluminum) to fasten the high-voltage cables at the NXPLUS C Wind cable bracket, e.g. plastic clamps make id-Technik (cable clamp K26-38 mm, cable clamp K36-52 mm).

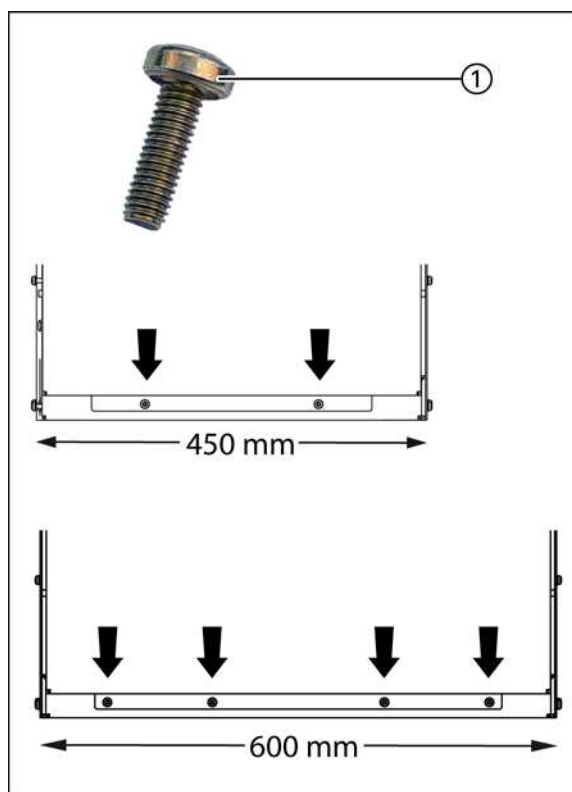
- ⇒ Connect the cable shield and the earthing of the plug housing to the cable bracket.



- ⇒ Hang the cable compartment cover in and fit the two or four fixing screws again.

	<p><b>ATTENTION!</b></p> <p>To guarantee safe earthing of the cable compartment cover, observe the following:</p>
	<ul style="list-style-type: none"> <li>⇒ Do always use the Torx screws M5 with cutting ring supplied to fasten and earth the cable compartment cover.</li> </ul>

- ⇒ Fix the cable compartment cover at the lower edge. Depending on the panel width, two or four Torx screws with cutting ring are required for this. Tightening torque: 7 Nm.




① Torx screw with cutting ring

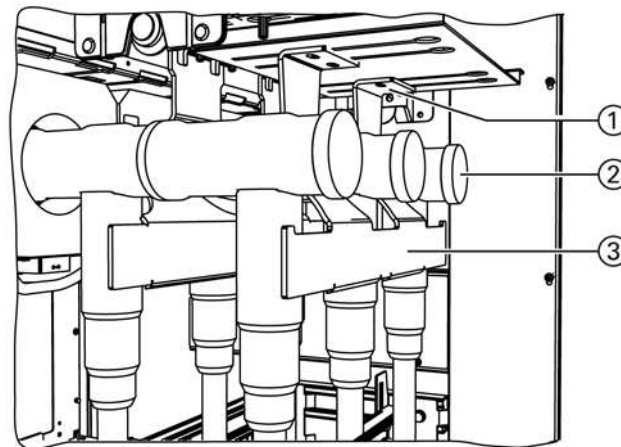
Fig. 92: Earthing the cable compartment cover with Torx screw with cutting ring

**Connecting two or three cables per phase**

Up to 2 cables (plugs) can be connected per phase for 600-mm-wide panels and up to 3 cables (plugs) per phase for 450-mm-wide panels.

After cable installation on the three phases, one arcing plate each must be mounted in the cable compartment. In like manner, the associated floor plate of the pressure-resistant floor cover must be mounted after each installed row of cable T-plugs (see page 97, "Mounting the pressure-resistant floor cover").

	<b>NOTE!</b>
	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 accordance with the cable T-plugs used.
	⇒ Do <b>not</b> exceed the distance of 10 mm to the cable T-plugs.
	⇒ After installation, the arcing plates must not touch the cable T-plugs.
⇒ While installing the arcing plates, take care not to damage the cable T-plugs.	



- ① Fastening at the partition to the operating mechanism compartment
- ② Cable T-plug
- ③ Arcing plate

Fig. 93: Circuit-breaker panel, 600 mm: Arcing plates at the cable connection, two cables per phase

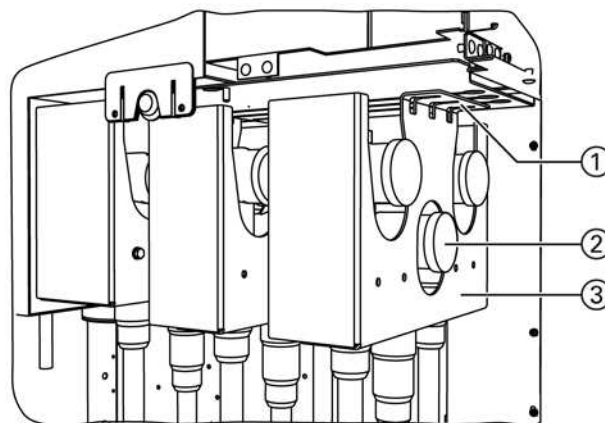


Fig. 94: Disconnector panel and ring-main panel, 450 mm: Arcing plates at the cable connection, three cables per phase

- ⇒ Push rubber sleeves onto cable T-plugs.
- ⇒ Mount first set of cable T-plugs on phases L1 to L3.
- ⇒ Mount the floor plate of the pressure-resistant floor cover (see page 97, "Mounting the pressure-resistant floor cover").



- ⇒ Pre-assemble the coach bolts on the first arcing plate. To do this, turn the fixing nut so far that the bolt heads can still be fitted into the mounting plate later.
- ⇒ Hang the arcing plate into the mounting plate and push into the correct position.
- ⇒ Push rubber sleeves onto cable T-plugs.
- ⇒ Mount second set of cable T-plugs on phases L1 to L3.
- ⇒ Mount the floor plate of the pressure-resistant floor cover (see page 97, "Mounting the pressure-resistant floor cover").
- ⇒ Pre-assemble the coach bolts on the second arcing plate. To do this, turn the fixing nut so far that the bolt heads can still be fitted into the mounting plate later.
- ⇒ Hang the arcing plate into the mounting plate and push into the correct position.
- ⇒ Tighten the fixing nuts of the arcing plate. Tightening torque: 20 Nm.
- ⇒ Push rubber sleeves onto cable T-plugs.
- ⇒ Mount third set of cable T-plugs on phases L1 to L3.
- ⇒ Mount the floor plate of the pressure-resistant floor cover (see page 97, "Mounting the pressure-resistant floor cover").
- ⇒ Mount the third arcing plate in the same way as the second one.

### 15.3 Cable connection with cable-type current transformers

#### Cable-type current transformers in the disconnecter panel / ring-main panel

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

#### Installation position

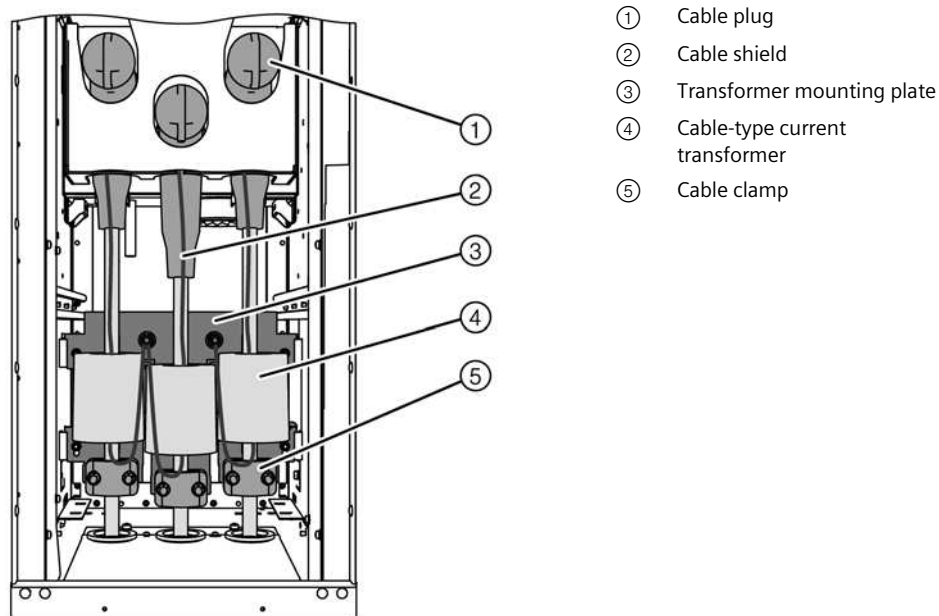


Fig. 95: Installation position of cable-type current transformers in the disconnecter panel / ring-main panel.

Principle of installation

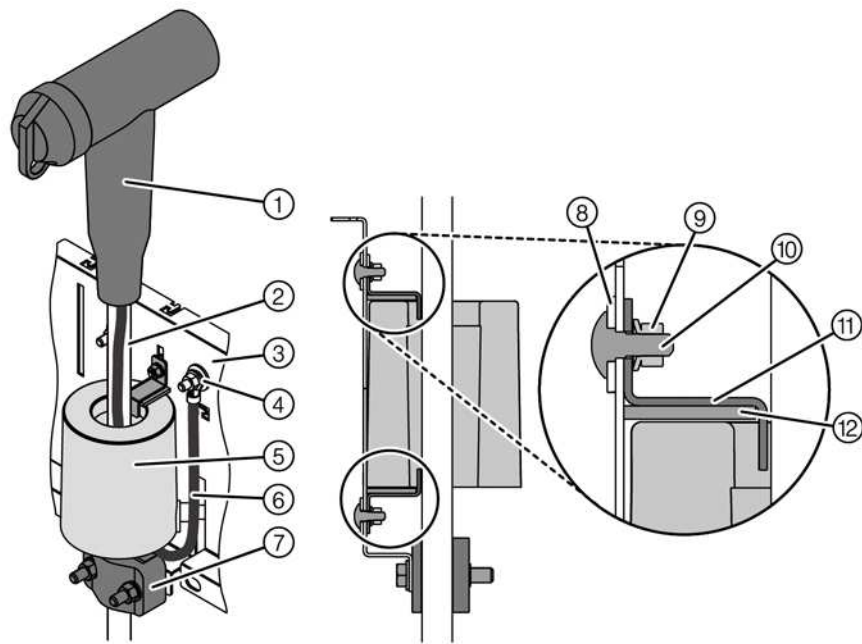


Fig. 96: Cable connection with cable-type current transformers type 4MC7032

- |                                  |                                   |
|----------------------------------|-----------------------------------|
| ① Cable plug                     | ⑦ Cable clamp                     |
| ② High-voltage cable             | ⑧ 3D washer A10.5 (2x)            |
| ③ Transformer mounting plate     | ⑨ Nut-and-washer assembly M8 (2x) |
| ④ Earthing point                 | ⑩ Saucer-head bolt M8x20 (2x)     |
| ⑤ Cable-type current transformer | ⑪ Current transformer holder (2x) |
| ⑥ Cable shield                   | ⑫ Felt strip (2x)                 |

**Installation of cable-type current transformers**

- ⇒ Remove the cable compartment cover.
- ⇒ Take the supplied cable-type current transformers ⑤ out of the cable compartment.
- ⇒ Push the cable-type current transformers ⑤ on the high-voltage cables.
- ⇒ Place the cable-type current transformers ⑤ into the supports ⑪, and bolt tight.
- ⇒ Mount the cable plugs ① according to the manufacturer's instructions.
- ⇒ Position the pre-assembled transformer mounting plate ③ at the cable bracket in such a way that all 3 cable-type current transformers can be mounted.
- ⇒ Bolt the cable-type current transformer ⑤ onto the transformer mounting plate ③ with the 2 supports ⑪, saucer-head bolts ⑩, 3D washers ⑧ and nut-and-washer assemblies ⑨.
- ⇒ Lead the cable shield ⑥ back through the cable-type current transformer ⑤, and bolt tight at the earthing point ④.
- ⇒ Swing the high-voltage cables ② in together with the cable-type current transformers ⑤, and connect the cable plugs ① to the cable feeder (see page 99, "Connecting cable T-plugs").
- ⇒ Mount the cable compartment cover.

### Cable-type current transformers in the circuit-breaker panel

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

#### Installation position

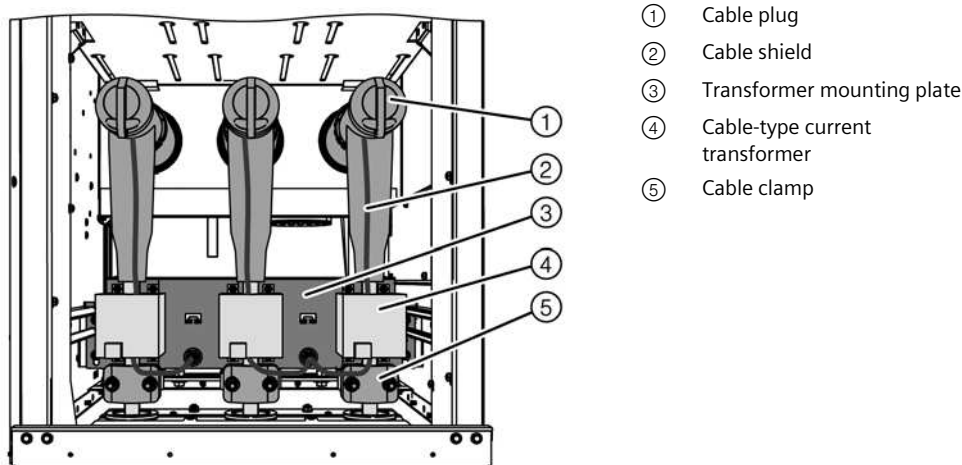


Fig. 97: Installation position of cable-type current transformers in the circuit-breaker panel

#### Principle of installation

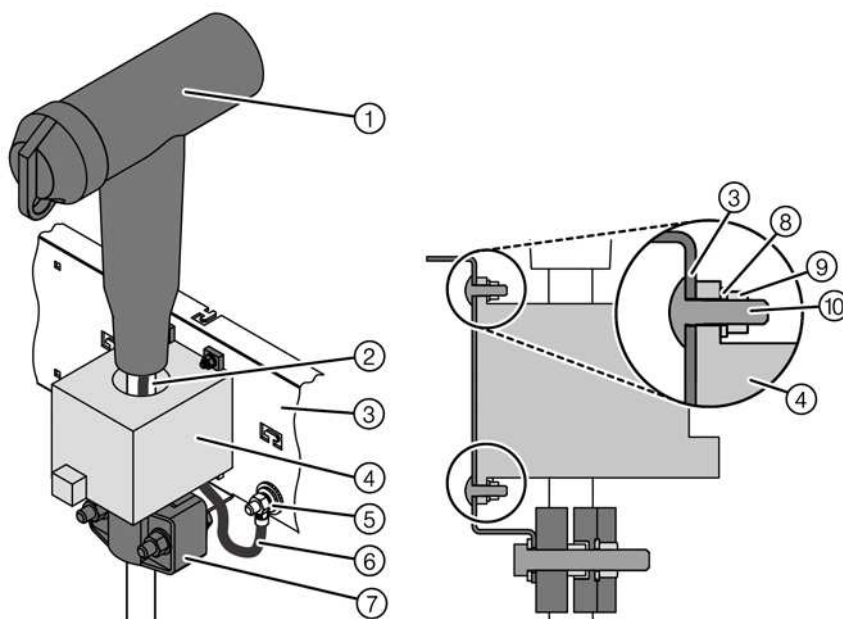


Fig. 98: Cable connection with cable-type current transformers type WIC1-WE2AS1

- |                                  |                               |
|----------------------------------|-------------------------------|
| ① Cable plug                     | ⑥ Cable shield                |
| ② High-voltage cable             | ⑦ Cable clamp                 |
| ③ Transformer mounting plate     | ⑧ Plain washer A6.4 (4x)      |
| ④ Cable-type current transformer | ⑨ Hexagonal nut M6 (4x)       |
| ⑤ Earthing point                 | ⑩ Saucer-head bolt M6x20 (4x) |


#### Installation of cable-type current transformers

- ⇒ Undo the cable compartment cover.
- ⇒ Take the supplied cable-type current transformers ④ out of the cable compartment.
- ⇒ Push the cable-type current transformers ④ on the high-voltage cables.
- ⇒ Mount the cable plugs ① according to the manufacturer's instructions.
- ⇒ Position the pre-assembled transformer mounting plate ③ at the cable bracket in such a way that all 3 cable-type current transformers can be mounted.

- ⇒ Bolt the cable-type current transformers ⑤ onto the transformer mounting plate ③ using 4 saucer-head bolts ⑩ , washers ⑧ and hexagonal nuts ⑨ each.
- ⇒ Lead the cable shield ⑥ back through the cable-type current transformer ④ , and bolt tight at the earthing point ⑤ .
- ⇒ Swing the high-voltage cables ② in together with the cable-type current transformers ④ , and connect the cable plugs ① to the cable feeder (see page 99, "Connecting cable T-plugs").
- ⇒ Mount the cable compartment cover.

**15.4 Connecting 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 in NXPLUS C Wind up to 36 kV").

	<b>NOTE!</b>
	<p>For certain surge arrester types in the circuit-breaker panel, the surge arresters protrude through the floor cover into the cable basement (see page 22, "Cable connection").</p> <p>⇒ Provide additional core drillings for the surge arresters.</p>

The surge arresters are supplied with the supplementary equipment. Depending on their version, they are pre-assembled with a support.

If a power-frequency voltage test is planned at site after installation (see page 126, "Performing the power- frequency voltage test"), do not fit the surge arresters and cables yet.

- ⇒ Mount the surge arresters according to the manufacturer's assembly instructions.
- ⇒ Ensure earth connection of the surge arrester according to the manufacturer's assembly instructions.



Fig. 99: Mounted surge arrester (example)

### 15.5 Connecting auxiliary circuits

The circuit-breaker switchgear NXPLUS C Wind is delivered with operating and control equipment as ordered.

The operating and control equipment 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.

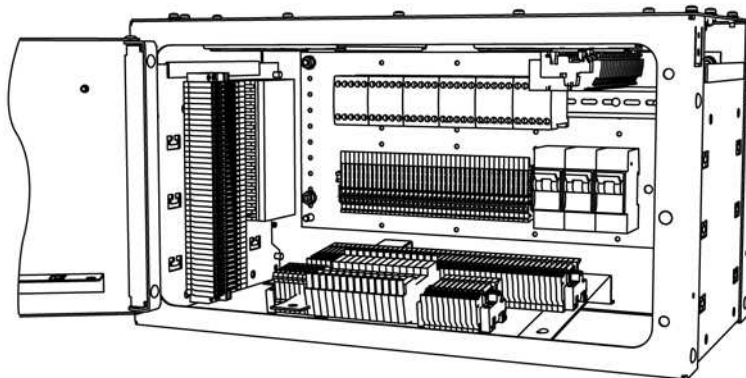


Fig. 100: Auxiliary circuits in the 600 mm low-voltage compartment

Lay, fix and connect the external cables in accordance with the national standards and specifications (conductor, shielding, earthing).

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, their cables are lead through the right-side cable duct.

⇒ Lay the external cables in the left-hand wiring duct and fix them with cable straps.



### Laying the current transformer leads and wires for the capacitive voltage detecting system in the right-hand wiring duct

⇒ Lay overlong current transformer leads in meanders.

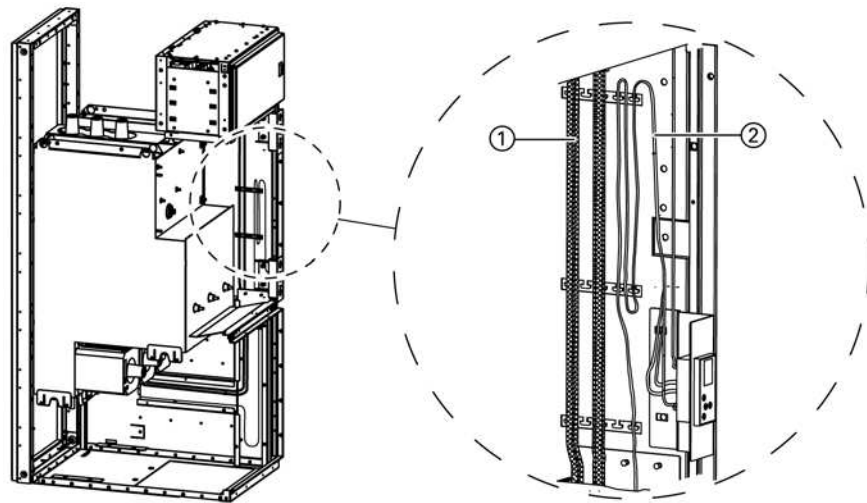


Fig. 101: Current transformer leads laid in meanders in the right-hand wiring duct

- ① Current transformer lead
- ② Wire for capacitive voltage detecting system

⇒ Laying wire groups keeping the maximum possible distance between them and tight on the earthed plate.

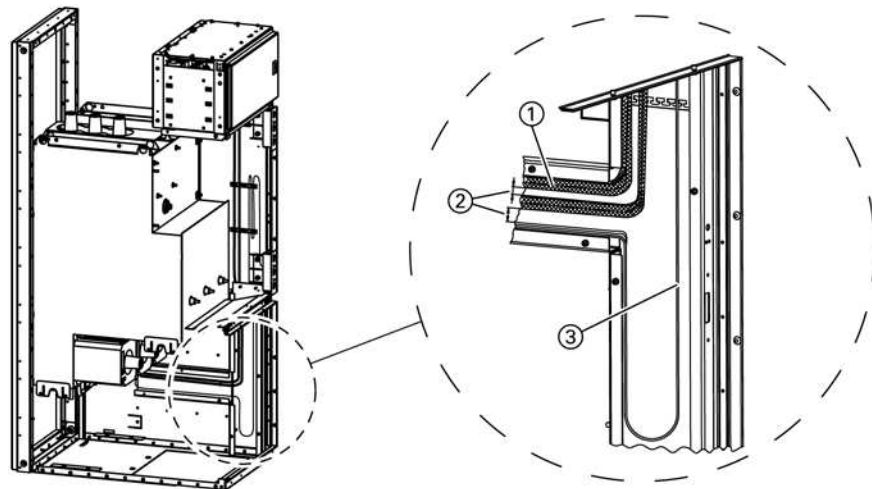


Fig. 102: Wire groups laid in the right-hand wiring duct keeping the maximum possible distance between them

- ① Current transformer lead
- ② Laying wire groups keeping the maximum possible distance between them
- ③ Wire for capacitive voltage detecting system

### Laying secondary customer cables in the left-hand wiring duct

- ⇒ Lay overlong current transformer leads in meanders.
- ⇒ Cross the cables at a right angle.

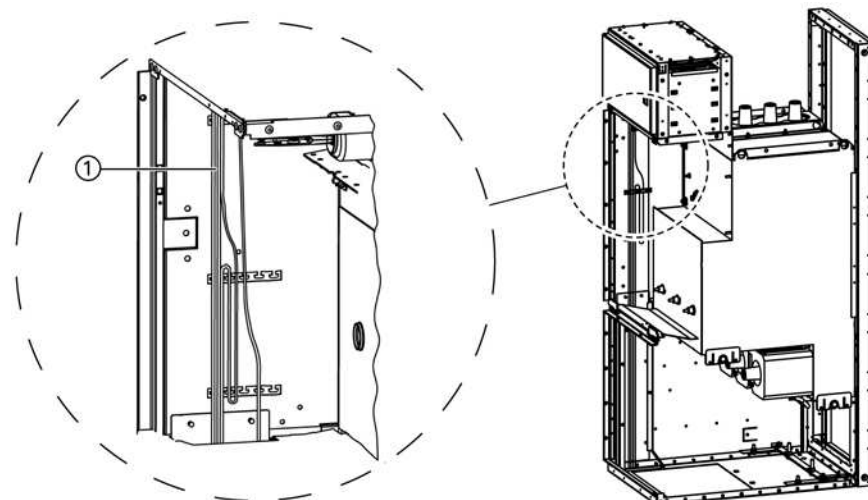


Fig. 103: Customer cables laid in meanders in the left-hand wiring duct

- ① Customer cable

- ⇒ Lay wire groups keeping the maximum possible distance between them, and tight on the earthed plate.
- ⇒ For EMC-compatible laying, the cables have been divided into functional groups: e.g. group 1 (signal wires), group 2 (control wires), etc.

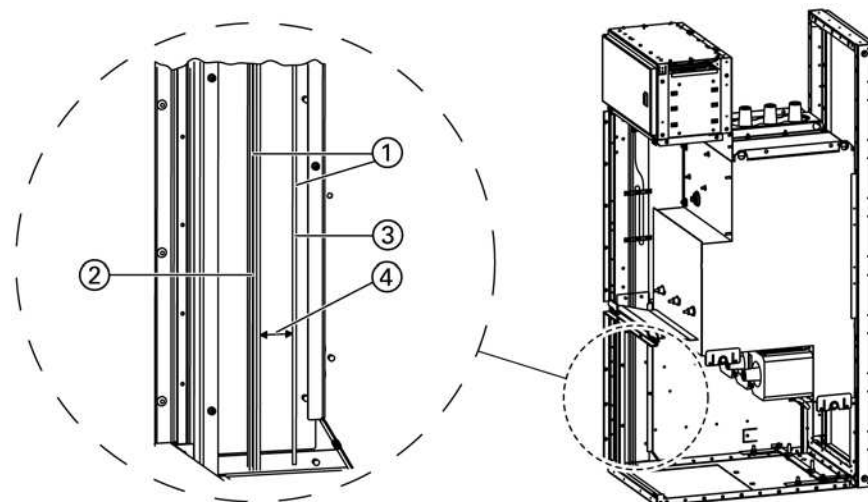


Fig. 104: Wire groups laid in the left-hand wiring duct keeping the maximum possible distance between them


- ① Customer cable
- ② Group 1
- ③ Group 2
- ④ Laying wire groups keeping the maximum possible distance between them

The bus wires as well as the cables for the circuit-breaker and the three-position switch are pluggable. The terminals are arranged in the low-voltage compartment.

- ⇒ Lay the cables for the three-position switch and, if required, for the current transformers in the low-voltage compartment.
- ⇒ Plug pre-assembled bus wires onto the bus wire terminals. Observe the coding of the 10-pole plugs.
- ⇒ Plug the cables for the circuit-breaker and the three-position switch on the associated terminals.
- ⇒ Connect wires for current transformer, if necessary.

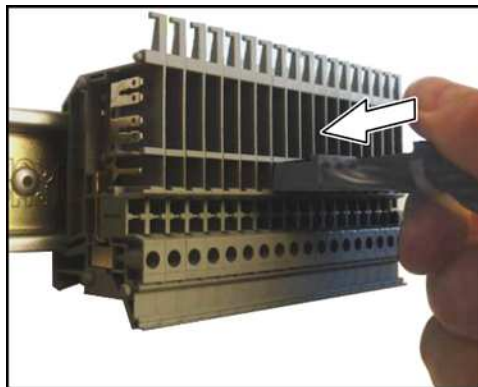
**Connecting the STG plug with the VBSTB4 modular terminal**

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

	<p><b>NOTE!</b></p> <p>The information stated herein refer to the user instructions of PHOENIX CONTACT. The user is obliged to inform himself about the latest state of the instructions for installation or removal of the STG plugs, and to observe the manufacturer's instructions.</p> <p>⇒ Manufacturer's site: <a href="https://www.phoenixcontact.com">https://www.phoenixcontact.com</a></p>
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**Mounting the STG plug**

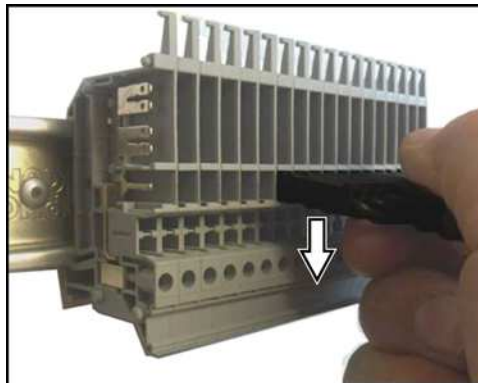
- ⇒ Hold the STG plug horizontally over the plug shaft of the VBSTB4 modular terminal.
- ⇒ Push the STG plug horizontally into the modular terminal until the STG plug latches in.



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

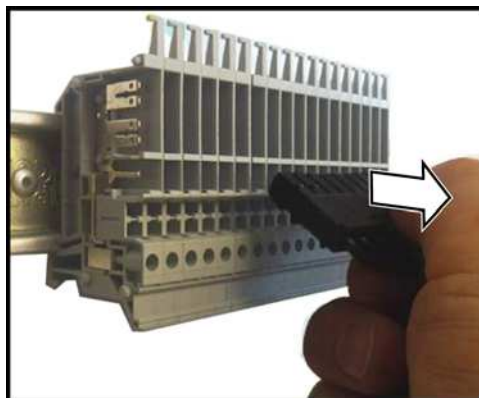
**Removing the STG plug**

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





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




✓ The STG plug is removed.

## 16 Installation of designs with degree of protection IP31D (low-voltage compartment)

### 16.1 IP31D - protection against vertically falling water drops

#### Mounting the protection against vertically falling water drops

	<b>ATTENTION!</b>
	<p>To be able to mount the protection against vertically falling water drops, observe the following:</p> <p>⇒ The switchgear termination and the busbar cover must be assembled.</p>

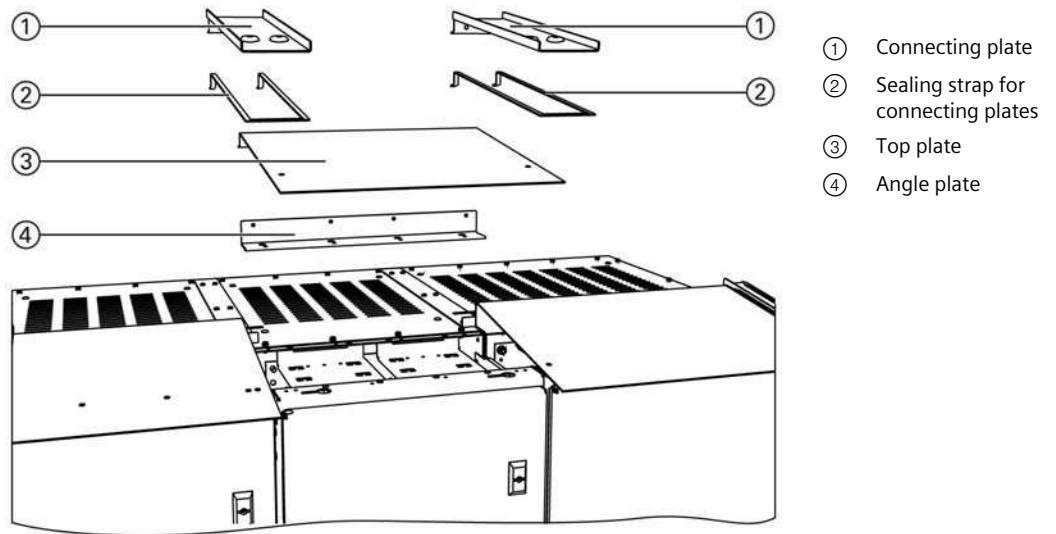


Fig. 105: Setup of a protection against vertically falling water drops (example with small low-voltage compartment) - view from the front

⇒ Stick sealing strap on rear side of angle plate.

While sticking, take care that the sealing strap is in line with the angle plate on the left and on the right.

⇒ Mount the angle plate on the low-voltage compartment using thread-ridging screws M5x16.

Panel width [mm]	Number of bolted joints
450	4
600	5

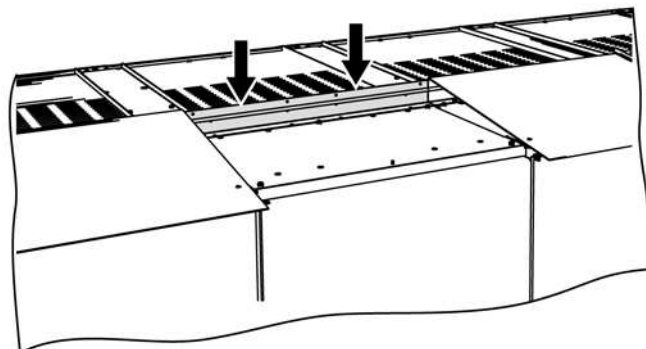


Fig. 106: Mounting the angle plate (example with small low-voltage compartment) - view from the front

⇒ Align and fasten the top plate on the low-voltage compartment.

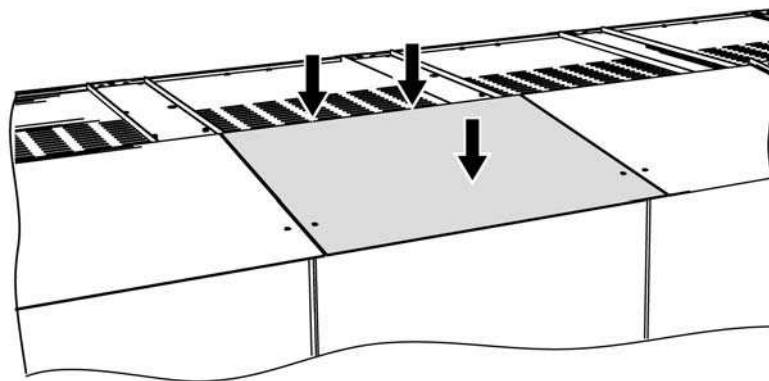
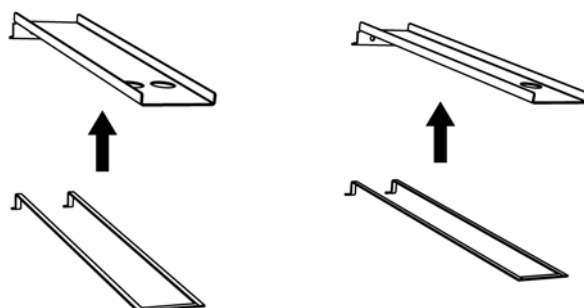


Fig. 107: Bolting the top plate tight (example with small low-voltage compartment) - view from the rear

⇒ Stick sealing strap on connecting plates.



⇒ Bolt the connecting plates together with the top plates and the angle plates respectively on the left and on the right.

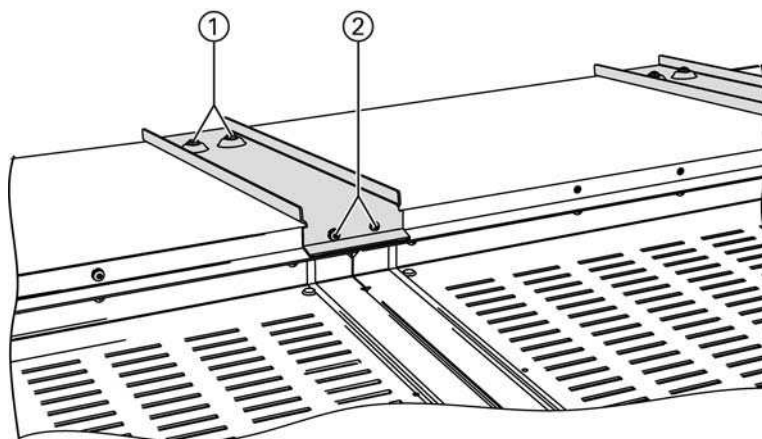


Fig. 108: Bolting the connecting plates tight (example with small low-voltage compartment) - view from the rear

- ① M5x30, thread-ridging
- ② M5x16, thread-ridging

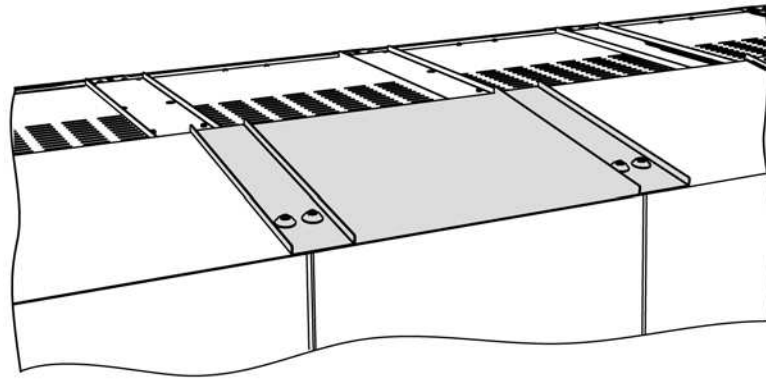


Fig. 109: Completed protection against vertically falling water drops (example with small low-voltage compartment) - view from the front

**Mounting the protection against vertically falling water drops on the end panel**

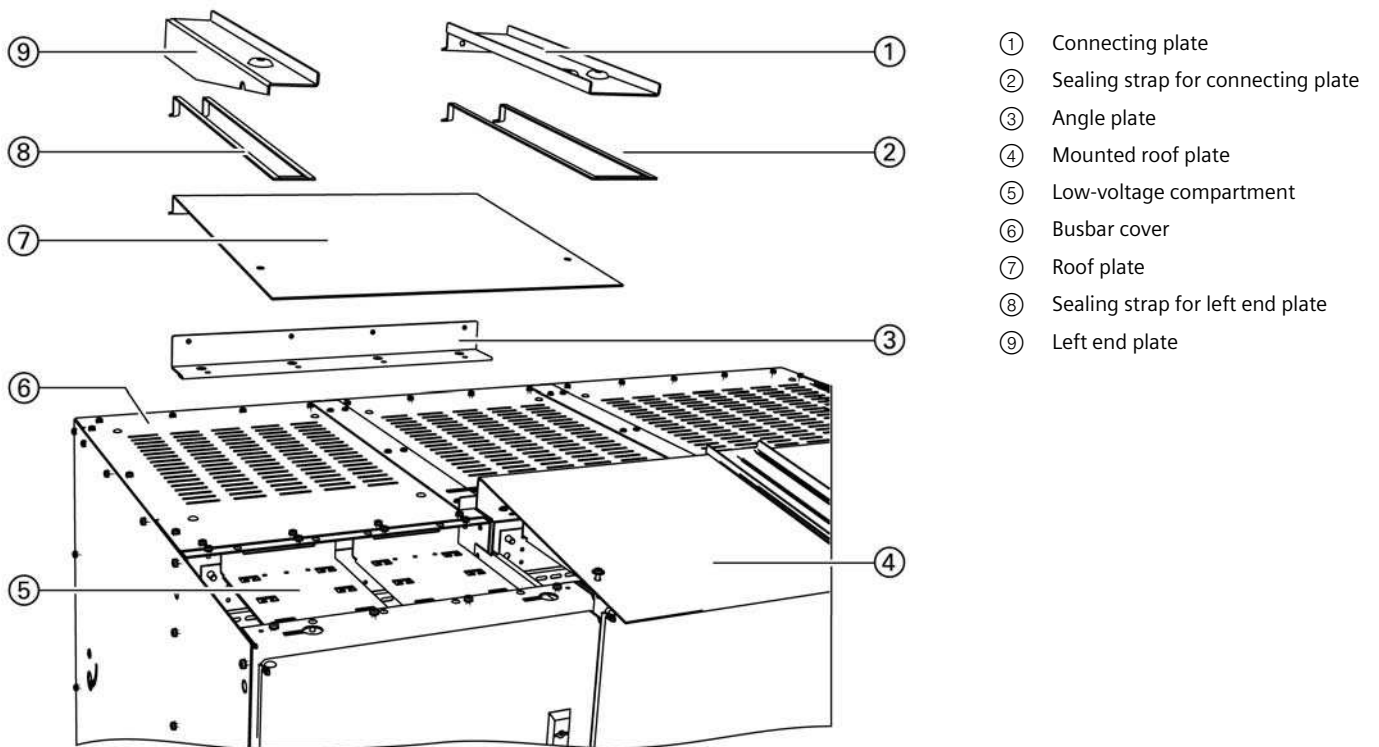



Fig. 110: Protection against vertically falling water drops on the left-end panel (example with small low-voltage compartment) - view from the front

**Mounting the protection against vertically falling water drops on a high low-voltage compartment**

	<p><b>ATTENTION!</b></p> <p>Please observe the following instructions to mount the protection against vertically falling water drops on a high low-voltage compartment if the low-voltage compartments are not pre-assembled:</p>
	<ul style="list-style-type: none"> <li>⇒ Stick a sealing strap in line with the upper edge of the busbar cover and on the rear wall of the low-voltage compartment.</li> <li>⇒ Stick a sealing strap between the panels on the rear wall of the low-voltage compartment, in line with the partition plate.</li> </ul>

- ⇒ If the high low-voltage compartments are already pre-assembled, the operations to be performed are the same as those for installation of the protection against vertically falling water drops on small low-voltage compartments.

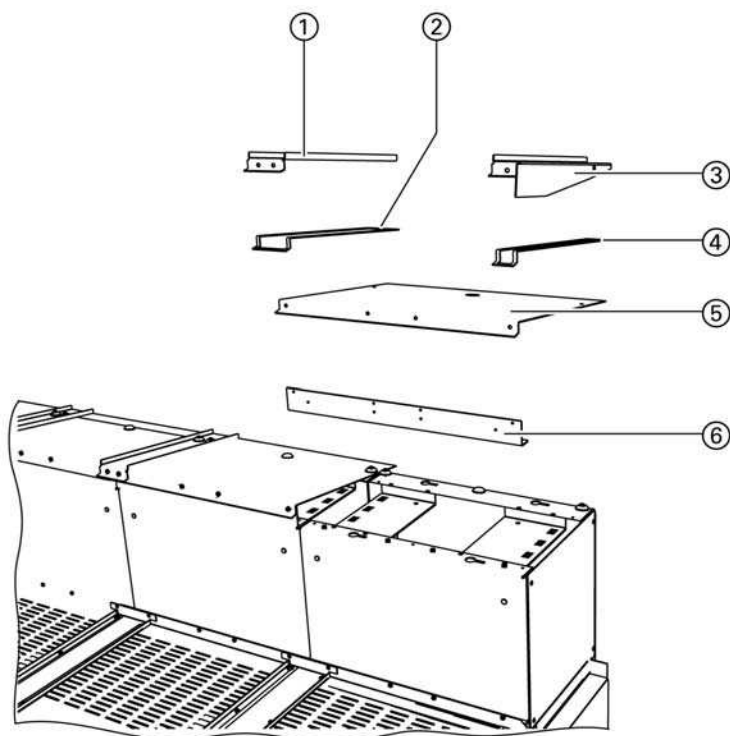


Fig. 111: Protection against vertically falling water drops on the left-end panel (example with high low-voltage compartment) - view from the rear

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| ① Connecting plate                   | ④ Sealing strap for left end plate |
| ② Sealing strap for connecting plate | ⑤ Top plate                        |
| ③ Left end plate                     | ⑥ Angle plate                      |

- ⇒ If the low-voltage compartments are not pre-assembled, provide sealing straps at the following positions:
- Between the individual panels.
  - On the rear wall of the low-voltage compartment, in line with the busbar cover.

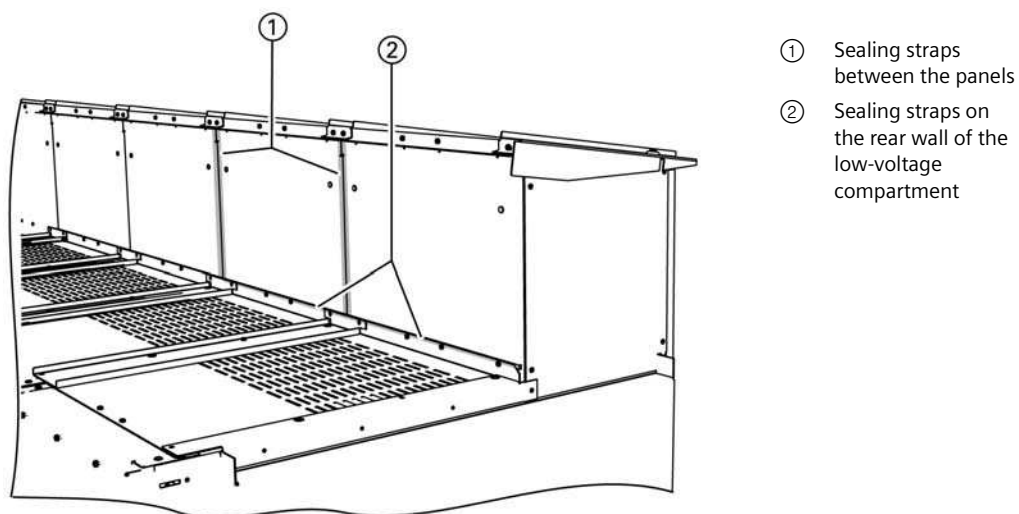




Fig. 112: Sticking sealing straps on high low-voltage compartments (example with high low-voltage compartment) - view from the rear


## 17 Commissioning

	<b>DANGER!</b>
	<p>High voltage! Danger!</p> <ul style="list-style-type: none"> <li>⇒ Isolate the switchgear.</li> <li>⇒ Secure against reclosing.</li> <li>⇒ Verify safe isolation from supply.</li> <li>⇒ Earth and short-circuit.</li> <li>⇒ Cover or barrier adjacent live parts.</li> </ul>

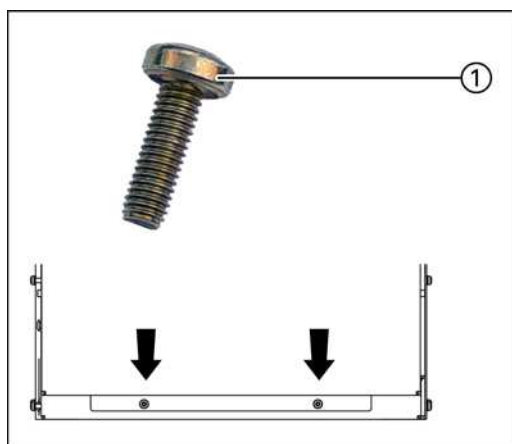
	<b>DANGER!</b>
	<p>Mechanical components may move quickly - even remotely controlled.</p> <ul style="list-style-type: none"> <li>⇒ Do not remove covers.</li> <li>⇒ Do not reach into openings.</li> </ul>

### 17.1 Final work

- Rating plate / type plate** ⇒ Check the data on the rating plate and the auxiliary voltage of the control and end devices as against the requirements.
- Ready-for-service indicator, checking** ⇒ Check ready-for-service indicator (see page 67, "Checking the ready-for-service indicator").
- Checking switchgear fixing** ⇒ Check switchgear fixing.
- Checking bolted joints**
  - ⇒ Check the earthing connections.
  - ⇒ Check the bolted joints of the low-voltage equipment at random.
  - ⇒ Check all parts of the switchgear that have been disassembled and assembled again at site during installation or that have been installed subsequently, in order to verify correct assembly and completeness.
- Closing the circuit-breaker front cover** ⇒ Hang the front cover in.

	<b>ATTENTION!</b>
	<p>Earthing of the front cover is only guaranteed if the cover is bolted together with the switchgear frame. Do always use the Torx screws with cutting ring supplied, in order to achieve a safe earthing of the front cover.</p> <ul style="list-style-type: none"> <li>⇒ Before commissioning, bolt the front cover together with the switchgear frame.</li> </ul>

- ⇒ Bolt the front cover at the lower edge tight with two Torx screws M5 with cutting ring. Tightening torque: 7 Nm.




① Torx screw with cutting ring

Fig. 113: Earthing the front cover using Torx screw with cutting ring

**Closing the cable compartment cover**

- ⇒ Mount and bolt together cable compartment cover competently, see page 99, "Connecting cable T-plugs".

	<b>ATTENTION!</b>
	<p>Earthing of the cable compartment cover is only guaranteed if the cover is bolted together with the switchgear frame. Do always use the self-tapping screws supplied to achieve a safe earthing of the cable compartment cover.</p> <ul style="list-style-type: none"> <li>⇒ Before commissioning, bolt the cable compartment cover together with the switchgear frame.</li> </ul>

**Checking auxiliary cable connections**

- ⇒ Check correct wiring according to the circuit diagrams.
- ⇒ Check clamping and plug-in connections at random (perfect contact, labels, etc.).

**Checking high-voltage connections**

- ⇒ Check earthing of cable terminations on all connected high-voltage cables.
- ⇒ If required, test cables (see page 166, "Cable testing").

**Feeder without cables**

- ⇒ Switch the switching device to EARTHED position and lock it, or cover the bushings with surge-proof caps.

**Tyding up and visual inspection**

- ⇒ Remove any attached instruction labels and documents that are not required anymore for operation.
- ⇒ Remove any tools, materials etc. that are not required anymore from the area of switchgear.
- ⇒ Remove any dirt from the area of the switchgear (cleaning agent ARAL 4005 or HAKU 1025 and lint-free rag/brush).
- ⇒ Fit all covers.
- ⇒ Put the caps on the test sockets of 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.


### 17.2 Checking the accessories


- ⇒ Make sure that the following accessories are ready to hand:
  - Operating instructions
  - One operating lever for the three-position disconnecter, for the DISCONNECTING function
  - One operating lever for the EARTHING/READY-TO-EARTH function (painted red)
  - Hand crank for charging the circuit-breaker closing spring (with freewheel)
  - Adapter for emergency operation (option only for three-position disconnecter with motor operating mechanism)
  - Double-bit key with a diameter of 3 mm
  - Circuit diagrams
  - Torx screwdriver T25
  - 1 adapter for the three-position disconnecter, for the DISCONNECTING function
  - 1 adapter for the three-position disconnecter, for the EARTHING/READY-TO-EARTH function (painted red)

### 17.3 Instructing operating personnel

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

### 17.4 Function test / Test operation

	<b>DANGER!</b>
	<p>Putting defective switchgear into operation can endanger the life of people and damage the switchgear.</p> <ul style="list-style-type: none"> <li>⇒ Never put switchgear into operation if you notice during test operation that a part of it does not work as described in here.</li> <li>⇒ Perform test operations with auxiliary voltage only!</li> </ul>

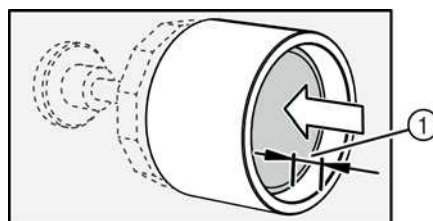
	<b>DANGER!</b>
	<p>Risk of injury by sudden rotation of hand crank. If you use a hand crank <b>without a freewheel</b> to charge the spring, the hand crank will rotate when the control voltage is switched on again (motor starts up) and can lead to injury.</p> <ul style="list-style-type: none"> <li>⇒ Use special hand crank <b>with freewheel</b> from the accessories!</li> </ul>

- Mechanical function test**
- ⇒ Switch the three-position switch and the circuit-breaker several times to CLOSED and OPEN position. Observe the correct indication of the associated switch position indicators.
  - ⇒ Check mechanical interlocks and covers to verify easy operation.

**Readjusting the freewheel of circuit-breaker pushbutton**

After the mechanical function test, the freewheel of the OPEN and CLOSE pushbuttons of the circuit-breaker can be readjusted. The factory-set freewheel is approx. 5 - 7 mm.

- ⇒ Measure the freewheel of the two pushbuttons (e.g. by means of a tape measure or vernier caliper).

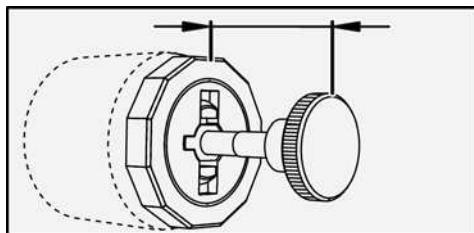


① Freewheel (approx. 7 – 5 mm)

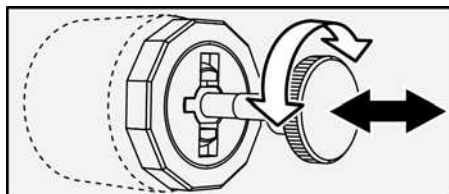
- ⇒ Remove the front plate of the circuit-breaker panel.



- ⇒ Measure the distance of the knurled bolt to the plastic nut.



- ⇒ Hold the housing of the pushbutton at the front.
- ⇒ Adjust the freewheel to the requested dimension by turning the knurled bolt (recommendation: wear gloves, so that the bolt can be turned more easily).



- ⇒ Refit the front plate.

**Emergency release of the solenoid interlocking**

If the switchgear is equipped with a solenoid interlocking, the control gate is blocked if there is no auxiliary voltage available. In case of emergency, this interlock of the circuit-breaker panel and disconnecter panel can be bypassed as follows:

	<p><b>DANGER!</b></p> <p>If the interlocking provided by the control gate is eliminated, switching operations are possible that can cause an arc fault which will endanger the life of the people present and damage the switchgear.</p>
	<ul style="list-style-type: none"> <li>⇒ Do only eliminate the interlocking of the control gate to push the control gate to the center position.</li> <li>⇒ Do not perform switching operations.</li> <li>⇒ Use a screwdriver that fits the hole diameter of the solenoid openings.</li> </ul>

**Tripping the emergency release in the circuit-breaker/disconnector panel:**

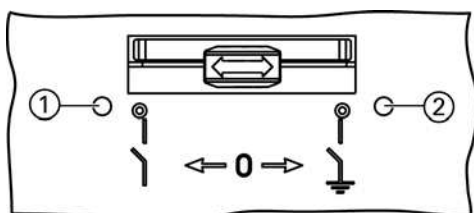



Fig. 114: Solenoid openings in the circuit-breaker/disconnector panel

**To push the control gate from center position to right position:** Remove left-hand dummy plug ①. Insert the screwdriver through the left-hand opening and push the solenoid back. Push the control gate to the right. The left-hand solenoid is released again, blocking further movements.

- ⇒ **To push the control gate from center position to left position:** Remove right-hand dummy plug ②. Insert the screwdriver through the right-hand opening and push the solenoid back. Push the control gate to the left. The right-hand solenoid is released again, blocking further movements.

- ⇒ **To push the control gate from the right or left position to the center position again:** Remove the stopper (according to the position of the control gate), and push the solenoid back with the screwdriver. Push the control gate to the center position. The solenoid is released again, blocking further movements.
- ⇒ After work completion, pull the screwdriver out and refit the dummy plug.

**Tripping the emergency release in the ring-main panel:**

	<b>ATTENTION!</b>
	<p>The solenoid openings in the ring-main panel are covered with the front plate.</p> <p>⇒ Remove the front plate in the ring-main panel.</p>

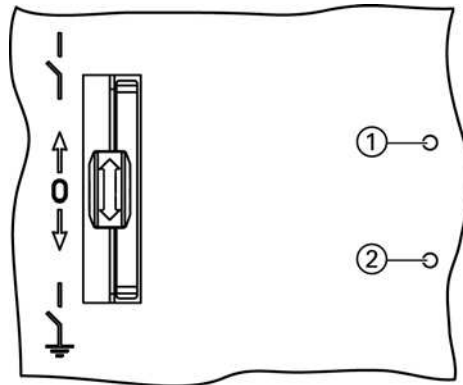


Fig. 115: Solenoid openings in the ring-main panel

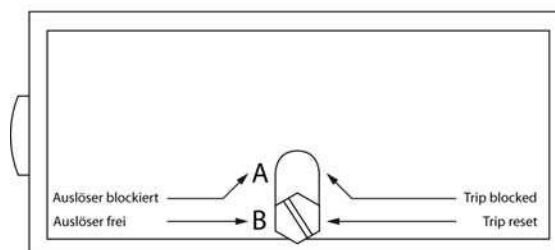
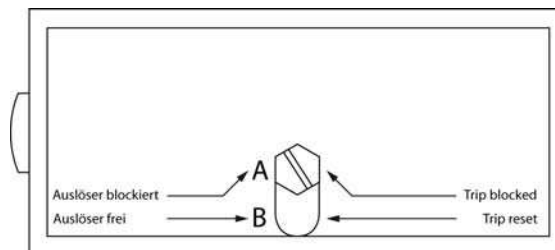
- To push the control gate from center position to upper position:** Insert the screwdriver through the upper opening ① and push the solenoid back. Push the control gate upwards. The upper solenoid is released again, blocking further movements.
- ⇒ **To push the control gate from center position to lower position:** Insert the screwdriver through the lower opening ② and push the solenoid back. Push the control gate downwards. The lower solenoid is released again, blocking further movements.
- ⇒ **To push the control gate from the upper or lower position to the center position again:** Insert the screwdriver (according to the position of the control gate), and push the solenoid back. Push the control gate to the center position. The solenoid is released again, blocking further movements.
- ⇒ After work completion, pull the screwdriver out and refit the front plate.

**Activating undervoltage release**

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

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

- ⇒ Remove the circuit-breaker front cover.
- ⇒ Shift the retaining screw of the striker from position A to position B to activate the undervoltage release.



- ⇒ Close the operating mechanism box and refit the cover.
- ✓ The circuit-breaker operating mechanism is now ready for operation with undervoltage release.

**Electrical function test**

Test operation helps you to verify the perfect operation of the switchgear without high voltage before commissioning.

**ATTENTION!**

Before test operation, make sure that the three-position switch is switched to the basic position, i.e. the position indicators show the OPEN position for the DISCONNECTING and EARTHING functions.

- ⇒ Do absolutely switch the three-position switch to the basic position by hand.

- ⇒ Switch on all auxiliary and control voltages and verify correct polarity.
- ✓ The motor of the circuit-breaker operating mechanism starts up, charges the closing spring and closes the circuit-breaker in case of spring-operated mechanisms.
- ⇒ Test 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 whether the switch positions of the three-position switch are displayed correctly.
- ⇒ Switch the three-position switch and the circuit-breaker several times to CLOSED and OPEN position at the panel and from remote. At the same time, check whether the switch positions are displayed correctly at the panel and, if applicable, in the control room, and if the auxiliary switches and position switches operate correctly.
- ⇒ After operating the three-position switch, check whether the operating levers can be pushed onto the operating shafts. If not, please contact the regional Siemens representative.
- ⇒ Check the function of the closing solenoid by electrical operation.
- ⇒ Check the function of the shunt releases, c.t.-operated releases and undervoltage releases by electrical operation.

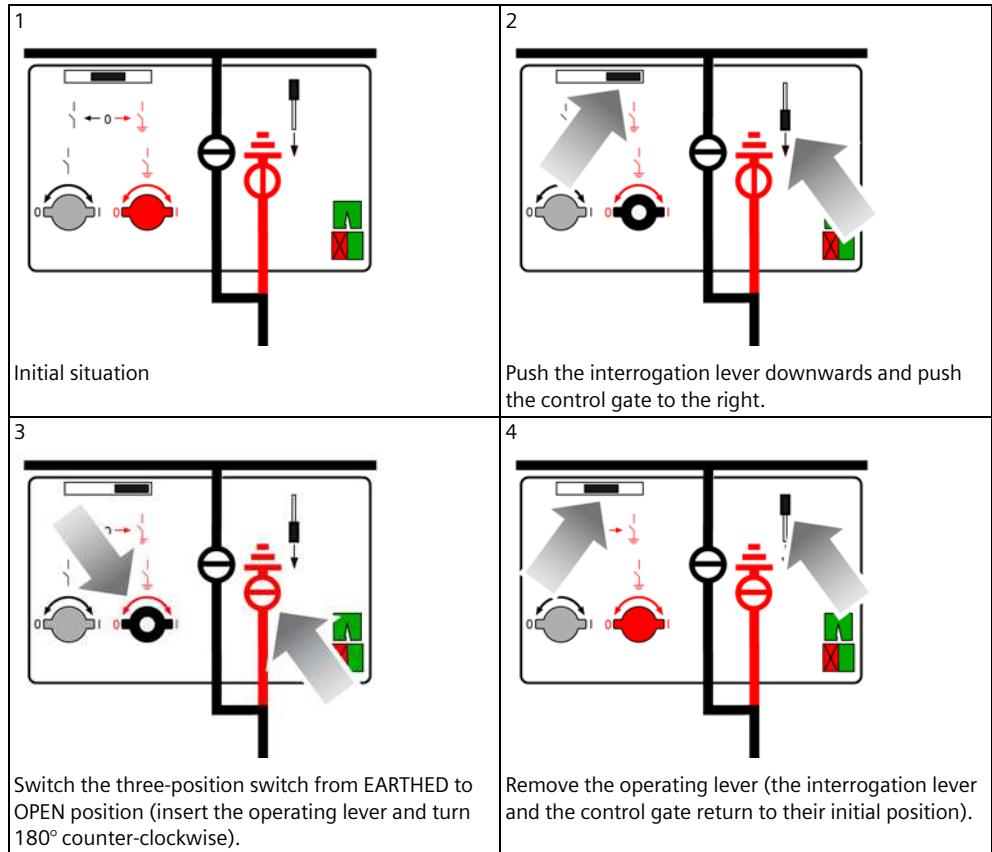
**Faults during test operation**

- The three-position switch does not move to the desired position during the first electrical operation. (Example: The three-position switch moves to the EARTHING CLOSED position instead of the DISCONNECTING CLOSED position)
- The control system of the three-position switch has detected the incorrect execution of the command and is in faulty mode. In this condition, no further switching operations are possible.

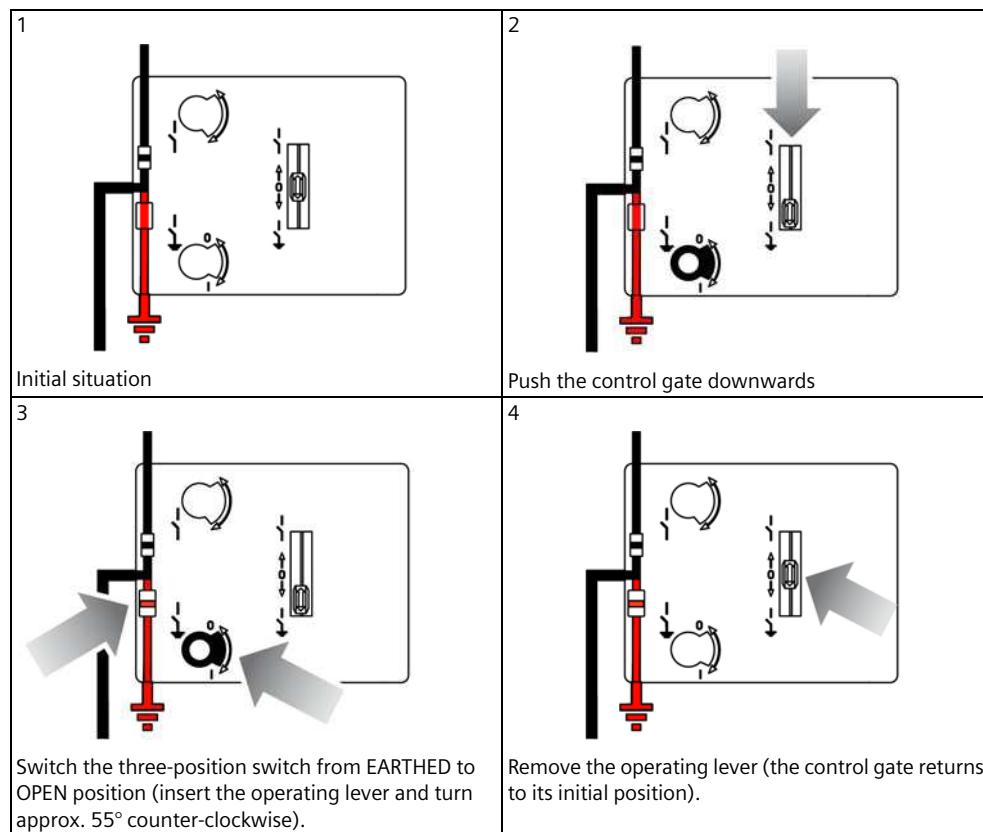
**Fault clearing**


- ⇒ Check the polarity of the auxiliary voltage and the motor connection.
- ⇒ Switch the operating mechanism **manually** back to the basic position.
- ⇒ Reset fault mode (2 possibilities):
  - Switch the auxiliary voltage off and on
  - Operate the reset button (covered opening on the device front)
- ✓ The position indicator for the DISCONNECTING and EARTHING functions shows OPEN.
- ✓ The three-position switch can be put into operation again.
- ⇒ Perform test operation of the three-position switch.

**Three-position disconnecter**



### Three-position switch-disconnector



	<p><b>ATTENTION!</b></p>
	<p>If there are any faults that cannot be cleared at site:</p> <ul style="list-style-type: none"> <li>⇒ Do not put the switchgear into operation.</li> <li>Inform the regional Siemens representative.</li> </ul>

**Completing test operation** ⇒ Switch all switching devices to OPEN position.

### 17.5 Performing the power- frequency voltage test

If required, a test with rated short-duration power-frequency withstand voltage can be performed on site. The busbar voltage transformers are designed for a repeat test at 80%  $U_D$  and 50 Hz according to IEC 62271-200.

At the factory, the individual feeders are routine-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 166, "Cable testing".


	<p><b>ATTENTION!</b></p> <p>The voltage indicators CAPDIS-S1+ and CAPDIS-S2+, LRM, VOIS+, VOIS R+, WEGA 1.2 and WEGA 2.2 may be damaged if test voltage is applied.</p> <p>⇒ Short-circuit the voltage indicators with the earthing points of the test sockets.</p>
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Fig. 116: Short-circuit plug, make Kries, order number 2500029



Fig. 117: Short-circuit plug, make Horstmann, order number 51-9904-001

#### Preparing the power-frequency voltage test

- ⇒ Switch the circuit-breaker and the three-position switch of the incoming feeder to CLOSED position to perform the power-frequency voltage test.
- ⇒ Switch all other three-position switches to EARTHED position.
- ⇒ If required, remove high voltage cables from the panel to be tested.
- ⇒ Apply the power-frequency test voltage in a surge-proof way at the cable connection bushing via test cables.
- ⇒ Short-circuit the capacitive voltage detecting system.
- ✓ Now you can carry out the test.

#### Performing the power-frequency voltage test

- ⇒ Earth adjacent phases.
- ⇒ Test phases L1, L2 and L3 consecutively for 60 seconds with the rated short-duration power-frequency voltage.

#### Completing the power-frequency voltage test

- ⇒ Undo short-circuit on the capacitive voltage detecting system.
- ⇒ Remove the test cable.
- ⇒ Undo earthing of the adjacent phases.
- ⇒ If required, connect high-voltage cables again.

### 17.6 Primary injection test

If requested by the customer's specifications, 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 EARTHED position and the circuit-breaker to 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 via one or three phases.

After applying the test current, the secondary measuring devices and tripping systems can be tested.

### 17.7 Applying operating voltage (high voltage)

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Observe the Five Safety Rules of Electrical Engineering.</li> <li>⇒ Observe the specifications for prevention of accidents.</li> <li>⇒ Observe the operating and working instructions of the switchgear owner.</li> </ul>

The operating personnel must have been trained, the installation work checked and test operation must have been carried out successfully without malfunctions.

- ⇒ Close all covers.
- ⇒ Open all circuit-breakers.
- ⇒ On all panels, switch the three-position switch to OPEN position. If there is a feeder without connected cables, earth this feeder. Additionally, all bushings must be protected in a surge-proof way.
- ⇒ Ensure that all consumers connected to all outgoing feeders are switched off.
- ⇒ Ensure that all current transformers not in operation are short-circuited.
- ✓ Operational voltage (high voltage) can be applied and the switchgear can be put into operation as described hereafter:


#### Applying voltage to the busbar

- ⇒ Switch on incoming feeders in the respective opposite substation.
- ⇒ Connect one incoming feeder to the busbar, observing no-load operation of the three-position switch.
- ✓ Now the busbar of the switchgear is live.

If the busbar is to be interconnected with further incoming feeders, a phase comparison with the already energized incoming feeder must be performed before energizing the new incoming feeder.

#### Verifying correct terminal-phase connections

Verify correct terminal-phase connections of the next incoming feeder and switch on the incoming feeder:

	<b>DANGER!</b>
	<p>Short-circuit in case of different phase sequence of the incoming feeders.</p> <ul style="list-style-type: none"> <li>⇒ Make sure that all incoming feeders have the same phase sequence.</li> <li>⇒ To check the phase sequence, use only phase comparison test units which are adequate for the LRM interface (capacitive test sockets).</li> </ul>

- ⇒ Switch on tested incoming feeder.

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

Verify correct terminal-phase connections at the interfaces (capacitive test sockets on right side of control board) of the panel to be tested and an energized panel using a phase comparison test unit.


- ⇒ Plug the measuring cables of the phase comparison test unit into the test sockets of the capacitive voltage detecting system "L1" of the two panels.
- ⇒ Read the indication.
- ⇒ Same procedure with the test sockets of the capacitive voltage detecting system of the two other phases ("L2" and "L3").
- ✓ If the test unit shows a coincidence in any case, the phase sequence of the tested feeder is correct.

### **Connecting consumer feeders**

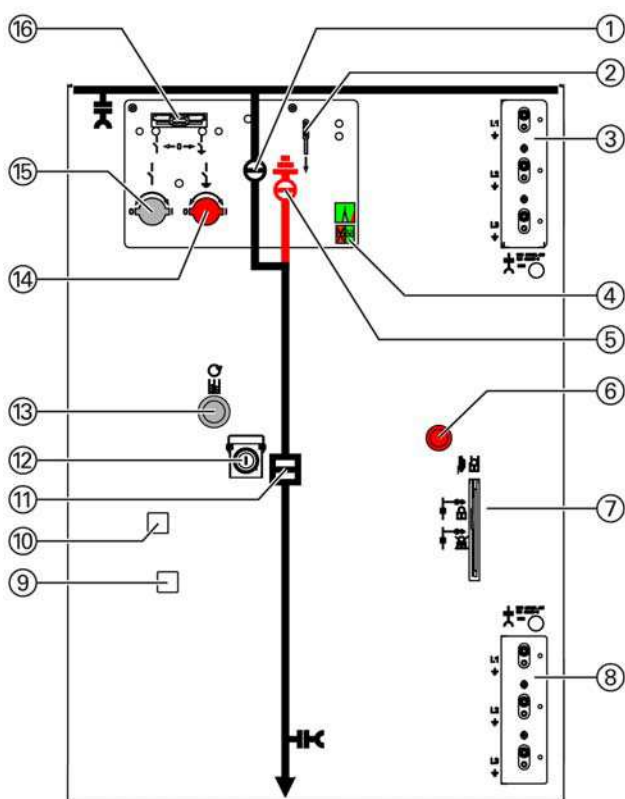
- ⇒ One after the other, switch on all outgoing feeders with connected consumers.
- ✓ Now all feeders are connected. The switchgear is completely in operation.



# Operation

	<p><b>DANGER!</b></p> <p>The internal arc classification of the switchgear according to IEC 62271-200 has only been proved by tests for the switchgear sides with internal arc classification and with closed high-voltage compartments.</p>
	<p>⇒ Determine the IAC internal arc classification of the switchgear by means of the data on the rating plate (see page 40, "Rating plates").</p> <p>⇒ Regulations for access to switchgear areas without internal arc classification according to IEC 62271-200 must be defined by the switchgear owner.</p>

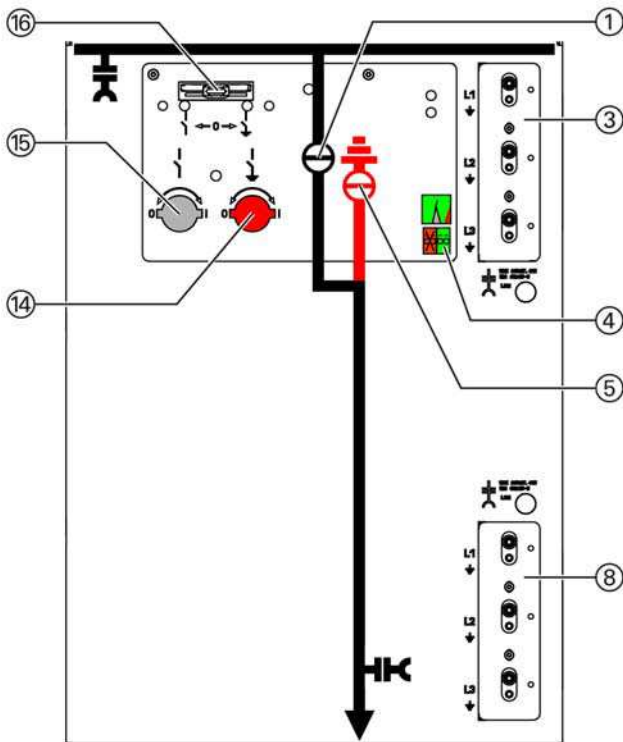
## 18 Indicators and control elements



- ① Position indicator for three-position disconnecter (DISCONNECTING function)
- ② Interrogation lever
- ③ Capacitive voltage detecting system on the busbar (option)
- ④ Ready-for-service indicator
- ⑤ Position indicator for three-position disconnecter (EARTHING/READY-TO-EARTH function)
- ⑥ OFF pushbutton for circuit-breaker
- ⑦ "Feeder earthed" locking device
- ⑧ Capacitive voltage detecting system on the cable feeder
- ⑨ Operations counter for circuit-breaker
- ⑩ Indicator for circuit-breaker "spring charged"
- ⑪ Position indicator for circuit-breaker
- ⑫ ON pushbutton for circuit-breaker
- ⑬ Manual charging for circuit-breaker
- ⑭ Actuating opening for earthing switch (EARTHING/READY-TO-EARTH function)
- ⑮ Actuating opening for disconnecter (DISCONNECTING function)
- ⑯ Control gate for opening the actuating openings (can only be operated if the interrogation lever ② is pushed downwards)

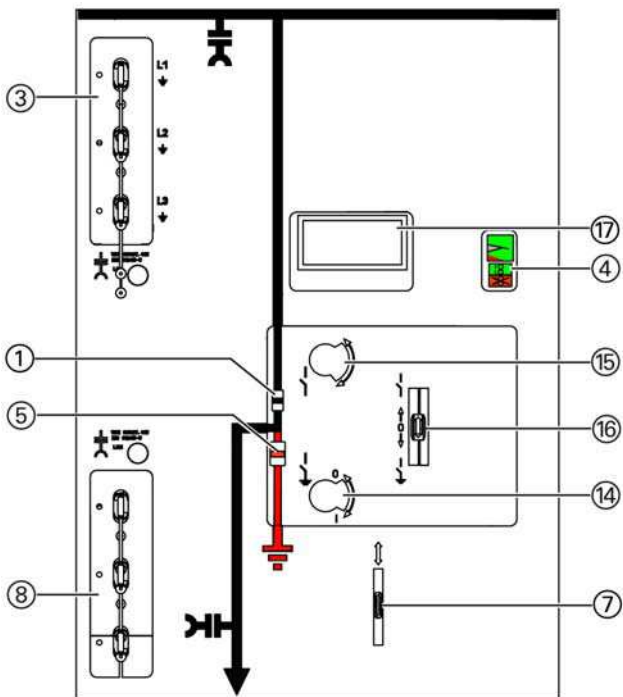
Fig. 118: Control board of the 600 mm circuit-breaker panel

## Operation



- ① Position indicator for three-position disconnector (DISCONNECTING function)
- ③ Capacitive voltage detecting system on the busbar (option)
- ④ Ready-for-service indicator
- ⑤ Position indicator for three-position disconnector (EARTHING/READY-TO-EARTH function)
- ⑧ Capacitive voltage detecting system on the cable feeder
- ⑭ Actuating opening for earthing switch (EARTHING/READY-TO-EARTH function)
- ⑮ Actuating opening for disconnector (DISCONNECTING function)
- ⑯ Control gate for opening the actuating openings









Fig. 119: Control board for disconnector panel 450 mm




- ① Position indicator for three-position switch-disconnector (DISCONNECTING function)
- ③ Capacitive voltage detecting system on the busbar (option)
- ④ Ready-for-service indicator
- ⑤ Position indicator for three-position switch-disconnector (EARTHING/READY-TO-EARTH function)
- ⑦ Cable compartment interlock
- ⑧ Capacitive voltage detecting system on the cable feeder
- ⑭ Actuating opening for earthing switch (EARTHING/READY-TO-EARTH function)
- ⑮ Actuating opening for disconnector (DISCONNECTING function)
- ⑯ Control gate for opening the actuating openings
- ⑰ Short-circuit/earth-fault indicator (option)

Fig. 120: Control board for ring-main panel 450 mm

Indications and their meaning

<p>Disconnecter</p>	 <p>CLOSED</p>	 <p>Contacts are not in defined end position</p>	 <p>OPEN</p>
<p>Earthing switch</p>	 <p>READY-TO-EARTH</p>	 <p>Contacts are not in defined end position</p>	 <p>OPEN</p>
<p>Circuit-breaker</p>	 <p>CLOSED</p>	<p>(not available)</p>	 <p>OPEN</p>

<p>Closing spring</p>	 <p>charged</p>	 <p>not charged</p>
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## 19 Checking the ready-for-service indicator

Perfect operation of the switchgear is only guaranteed if the ready-for-service indicators are in the **green area**.

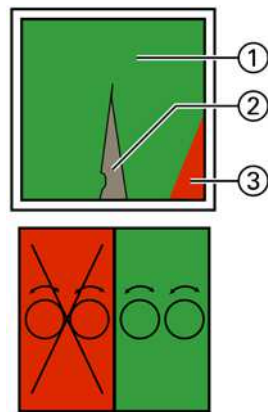


Fig. 121: Ready-for-service indicator for disconnecter panel, circuit-breaker panel

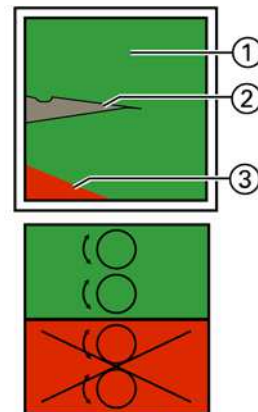




Fig. 122: Ready-for-service indicator for ring-main panel


### Circuit-breaker panels

	<b>ATTENTION!</b>
	<p>If the ready-for-service indicator is in the red area:</p> <ul style="list-style-type: none"> <li>⇒ Contact the regional Siemens representative immediately.</li> <li>⇒ Shut down the circuit-breaker panel if required.</li> </ul>


### Disconnecter panels

	<b>ATTENTION!</b>
	<p>The three-position disconnecter may only be used for breaking currents &lt;math&gt;&lt;0.5\text{ A}&lt;/math&gt;. If the ready-for-service indicator is in the red area:</p> <ul style="list-style-type: none"> <li>⇒ Do not switch.</li> <li>⇒ Contact the regional Siemens representative immediately.</li> </ul>

### Ring-main panel

	<b>ATTENTION!</b>
	<p>If the three-position switch is operated although the switchgear is not ready for service, this can cause an arc fault that will damage the switchgear. If the ready-for-service indicator is in the red area:</p> <ul style="list-style-type: none"> <li>⇒ Do not switch.</li> <li>⇒ Contact the regional Siemens representative immediately.</li> </ul>

## 20 Operating the circuit-breaker

	<b>ATTENTION!</b>
	<p>Operating the circuit-breaker locking device with the three-position disconnecter in CLOSED position can damage the switchgear.</p> <p>⇒ Operate the circuit-breaker locking device only with the three-position disconnecter in READY-TO-EARTH position, and lock it with a padlock. The shackle of the padlock <b>must</b> have a diameter of 6 mm or larger.</p>

### 20.1 Closing the circuit-breaker

If there is no block active from the mechanical interlock, you can close the circuit-breaker electrically or mechanically. Depending on the selected type of operating mechanism, the circuit-breaker is automatically closed with an ON pushbutton or by charging the closing spring.

#### Closing the circuit-breaker

- ⇒ Operate the ON pushbutton in the mechanical control board or charge the closing spring in spring-operated mechanisms. For motor operating mechanisms the circuit-breaker can also be closed on the electrical control board.
- ✓ The circuit-breaker is closed.

### 20.2 Opening the circuit-breaker

You can open the circuit-breaker electrically or mechanically.

If the control voltage fails, you have to open the circuit-breaker manually.

If the feeder is earthed through the three-position disconnecter and the circuit-breaker, and if the "feeder locking device" is fitted, all electrical OFF signals 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 control board  
or
- ⇒ open via electrical operation.
- ✓ The circuit-breaker is open.

### 20.3 Test operation

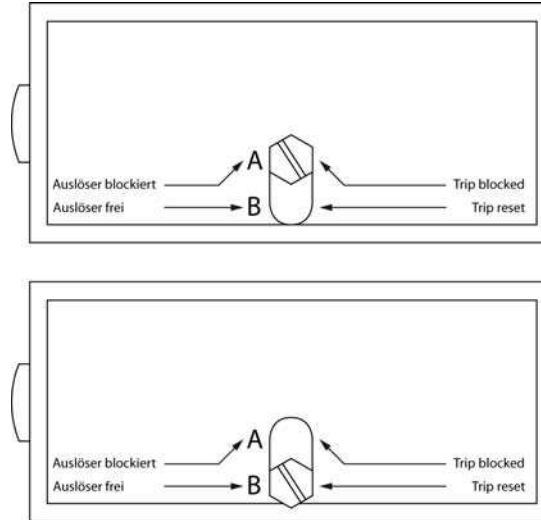
Perform the following actions to guarantee that the circuit-breaker is ready for operation:

- ⇒ Charge the closing spring (see page 135, "Charging the closing spring manually with the hand crank").
- ⇒ For circuit-breaker operating mechanisms with stored-energy mechanism, 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:

	<b>ATTENTION!</b>
	<p>If the retaining screw of the striker is not shifted back from position A to position B after the test operation without auxiliary voltage, the undervoltage release will not function.</p> <p>⇒ After the test operation without auxiliary voltage, shift the retaining screw of the striker back from position A to position B.</p>

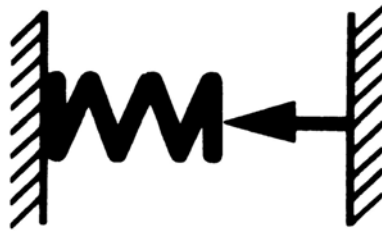
⇒ Shift the retaining screw of the striker from position A to B to activate the undervoltage release.



**20.4 Test operation with auxiliary voltage (motor operating mechanism)**

**Circuit-breaker with stored-energy mechanism**

- ⇒ Switch on the supply voltage.
- ✓ The motor operating mechanism starts up and charges the closing spring.
- ⇒ Check whether the "closing spring charged" indication appears.




- ⇒ 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.

**Circuit-breaker with spring-operated mechanism**

- ⇒ Switch on the supply voltage.
- ✓ The motor operating mechanism starts up, charges the closing spring and opens automatically.
- ⇒ Check whether the position indication "circuit-breaker CLOSED" appears.
- ⇒ Open the circuit-breaker.
- ⇒ Check whether the position indication "circuit-breaker OPEN" appears.

### 20.5 Charging the closing spring manually with the hand crank

The hand crank has a freewheel, so that there is no risk of injury if the control voltage returns and the motor (option) starts up with the crank inserted.

	<b>DANGER!</b>
	<p>Risk of injury by sudden rotation of hand crank with motor operating mechanism. If you use a hand crank <b>without a freewheel</b> to charge the spring, the hand crank will rotate when the control voltage is switched on again (motor starts up) and can lead to injury.</p> <p>⇒ Use special hand crank <b>with freewheel</b> from the accessories.</p>

- ⇒ Remove cover from cutout "Manual charging for circuit-breaker".
- ⇒ Insert hand crank there.
- ⇒ Turn hand crank clockwise approx. 30 times.
- ✓ For motor operating stored-energy mechanism: "Closing spring charged" indication in inspection window.
- ✓ For spring-operated mechanism: Circuit-breaker can be clearly heard to close.
- ⇒ Remove hand crank.
- ⇒ Close cutout with cover.

## 21 Operating the three-position disconnecter


This section describes the switching operations:

- DISCONNECTING and READY-TO-EARTH with the three-position disconnecter in the circuit-breaker panel
- DISCONNECTING and EARTHING with the three-position disconnecter in the disconnecter panel

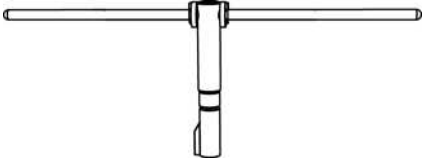
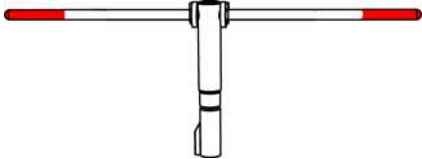
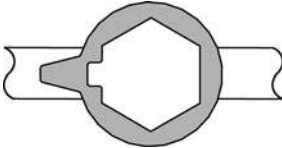
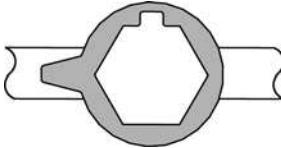
The manual switching operations DISCONNECTING or EARTHING/READY-TO-EARTH must be pre-selected. Pre-selection is only possible if the associated switching operation is permissible.

The operating levers for the three-position disconnecter are coded and identified by color:

- Operating lever for DISCONNECTING operation
- Operating lever for switching EARTHING/READY-TO-EARTH operation: Red painting (handle painted red)


	<b>NOTE!</b>
	<p>The interrogation lever is only available at the circuit-breaker panel (600 mm wide). Except for this difference, the operation of the three-position disconnecter is identical in both panel types. The operation is always described and shown with interrogation lever.</p> <p>⇒ Observe the specific panel type during operation.</p>


### 21.1 Operating levers for three-position disconnecter

	
<p>Fig. 123: Operating lever for DISCONNECTING function</p>	<p>Fig. 124: Operating lever for EARTHING/READY-TO-EARTH function (handle painted red)</p>
	
<p>Fig. 125: Socket nut for operating lever, DISCONNECTING function</p>	<p>Fig. 126: Socket nut for operating lever, EARTHING/READY-TO-EARTH function</p>




## 21.2 Closing the three-position disconnecter


	<b>ATTENTION!</b>
	<p>Before operating the three-position disconnecter:</p> <p>⇒ Make sure that the circuit-breaker is in OPEN position.</p>

	<b>DANGER!</b>
	<p><b>For ring-main panels:</b> If the switch-disconnector or the earthing switch are operated although the switchgear is not ready for service (see page 132, "Checking the ready-for-service indicator"), this can cause an arc fault that will damage the switchgear and endanger the life of the people present.</p> <p>⇒ If the ready-for-service indicator is in the red area, <b>do not switch</b>.</p>

- ⇒ Push the interrogation lever downwards.
- ⇒ Push the control gate to the left.
- ✓ The opening for the DISCONNECTING operation is free.
- ⇒ Insert the operating lever for the DISCONNECTING operation and turn 180° clockwise.
- ✓ The three-position disconnecter is closed.
- ⇒ Remove the operating lever for the DISCONNECTING operation.
- ✓ The interrogation lever and the control gate return to their initial position.


## 21.3 Opening the three-position disconnecter


	<b>ATTENTION!</b>
	<p>Before operating the three-position disconnecter:</p> <p>⇒ Make sure that the circuit-breaker is in OPEN position.</p>


	<b>DANGER!</b>
	<p><b>For ring-main panels:</b> If the switch-disconnector or the earthing switch are operated although the switchgear is not ready for service (132, "Checking the ready-for-service indicator"), this can cause an arc fault that will damage the switchgear and endanger the life of the people present.</p> <p>⇒ If the ready-for-service indicator is in the red area, <b>do not switch</b>.</p>

- ⇒ Push the interrogation lever downwards.
- ⇒ Push the control gate to the left.
- ✓ The opening for the DISCONNECTING operation is free.
- ⇒ Insert the operating lever for the DISCONNECTING operation and turn 180° counter-clockwise.
- ✓ The three-position disconnecter is open.
- ⇒ Remove the operating lever for the DISCONNECTING operation.
- ✓ The interrogation lever and the control gate return to their initial position.

### 21.4 Earthing/ready-to-earth with the three-position switch


	<b>ATTENTION!</b>
	<p>Before operating the three-position disconnecter:</p> <ul style="list-style-type: none"> <li>⇒ Make sure that the circuit-breaker is in OPEN position.</li> <li>⇒ Make sure that the feeder is isolated from supply.</li> </ul>


	<b>DANGER!</b>
	<p><b>For ring-main panels:</b> If the switch-disconnector or the earthing switch are operated although the switchgear is not ready for service (132, "Checking the ready-for-service indicator"), this can cause an arc fault that will damage the switchgear and endanger the life of the people present.</p> <ul style="list-style-type: none"> <li>⇒ If the ready-for-service indicator is in the red area, <b>do not switch</b>.</li> </ul>

	<b>DANGER!</b>
	<p>Danger, high voltage! The earthing process in circuit-breaker panels is not completed until the circuit-breaker is closed.</p> <ul style="list-style-type: none"> <li>⇒ Switch the three-position disconnecter to READY-TO-EARTH function.</li> <li>⇒ Close the circuit-breaker.</li> </ul>

- ⇒ Push the interrogation lever downwards.
- ⇒ Push the control gate to the right.
- ✓ The opening for the EARTHING/READY-TO-EARTH operation is free.
- ⇒ Insert the operating lever for the EARTHING/READY-TO-EARTH operation (red) and turn 180° clockwise.
- ✓ The three-position disconnecter is closed.
- ⇒ Remove the operating lever again for the EARTHING/READY-TO-EARTH operation.
- ✓ The interrogation lever and the control gate return to their initial position.
- ⇒ In circuit-breaker panels, close and lock the circuit-breaker.

### 21.5 De-earthing with the three-position switch

	<b>ATTENTION!</b>
	<p>Before operating the three-position disconnecter:</p> <ul style="list-style-type: none"> <li>⇒ Make sure that the circuit-breaker is in OPEN position.</li> </ul>

	<b>DANGER!</b>
	<p><b>For ring-main panels:</b> If the switch-disconnector or the earthing switch are operated although the switchgear is not ready for service (132, "Checking the ready-for-service indicator"), this can cause an arc fault that will damage the switchgear and endanger the life of the people present.</p> <ul style="list-style-type: none"> <li>⇒ If the ready-for-service indicator is in the red area, <b>do not switch</b>.</li> </ul>

- ⇒ In circuit-breaker panels: Unlock the locking device at the circuit-breaker and open the circuit-breaker.

- ⇒ Push the interrogation lever downwards.
- ⇒ Push the control gate to the right.
- ✓ The opening for the EARTHING/READY-TO-EARTH operation is free.
- ⇒ Insert the operating lever for the EARTHING/READY-TO-EARTH operation (red) and turn 180° counter-clockwise.
- ✓ The three-position disconnecter is open.
- ⇒ Remove the operating lever for the EARTHING/READY-TO-EARTH operation.
- ✓ The interrogation lever and the control gate return to their initial position.

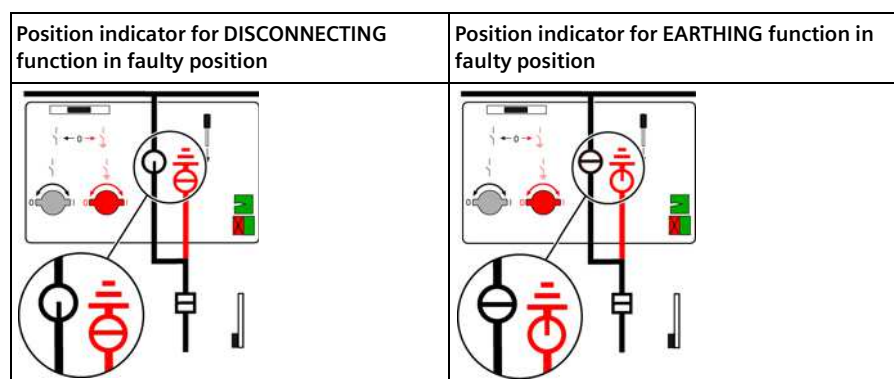
### 21.6 Operating the three-position disconnecter with motor operating mechanism

The switching operations DISCONNECTING, EARTHING and READY-TO-EARTH of the three-position disconnecter can be performed by means of a motor operating mechanism (option).

Three-position disconnecters with motor operating mechanism can also be controlled from remote according to their design.

### 21.7 Emergency operation of the three-position disconnecter

If the motor voltage of the three-position disconnecter with motor operating mechanism fails, and the three-position disconnecter is in none of the two end positions, you must operate the three-position disconnecter manually.



To do this, the adapter for emergency operation has to be pushed on the standard operating lever.

#### Adapter for emergency operation

- ⇒ Push emergency operation adapter on operating lever for three-position switch.

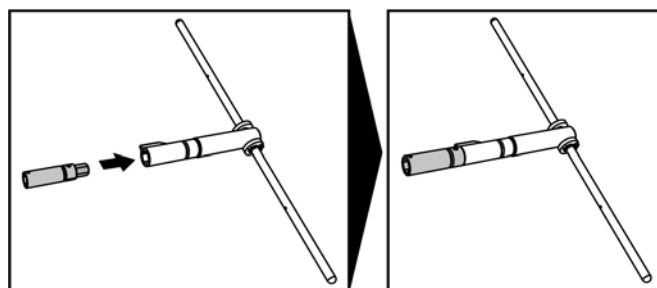



Fig. 127: Pushing on the adapter for emergency operation

	<b>ATTENTION!</b>
	<p>If the operating lever with pushed-on adapter is incorrectly used, the indicator or even the operating mechanism of the three-position switch can be damaged.</p> <p>⇒ The operating lever with pushed-on adapter is not aligned according to the noses of the standard operating lever, but according to the adapter slots.</p>

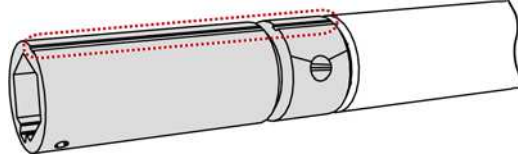


Fig. 128: Marking (long slot) on operating lever with pushed-on adapter

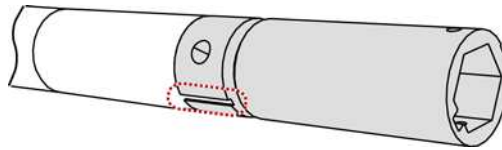



Fig. 129: Marking (short slot) on operating lever with pushed-on adapter

The noses of the operating lever are not significant for evaluating the position of the operating mechanism.

**End positions of the three-position disconnecter while switching with the operating lever with pushed-on adapter**

	<b>ATTENTION!</b>
	<p>The operating lever does not have a stop. Switching with the operating lever with pushed-on adapter beyond the end position of the three-position disconnecter will damage the three-position disconnecter.</p> <p>⇒ Do always observe the markings on the adapter of the operating lever.</p>

Insert the operating lever with pushed-on adapter in such a way that the inner slot of the adapter fits on the pin of the operating shaft.

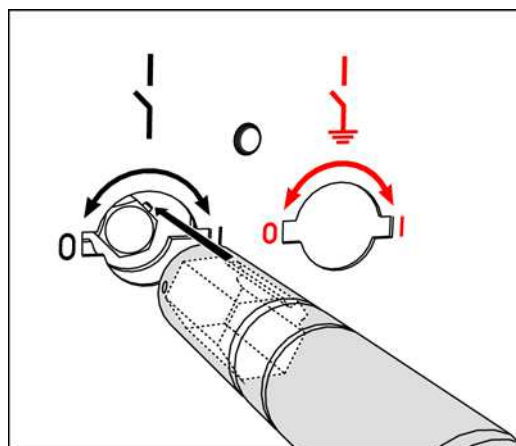
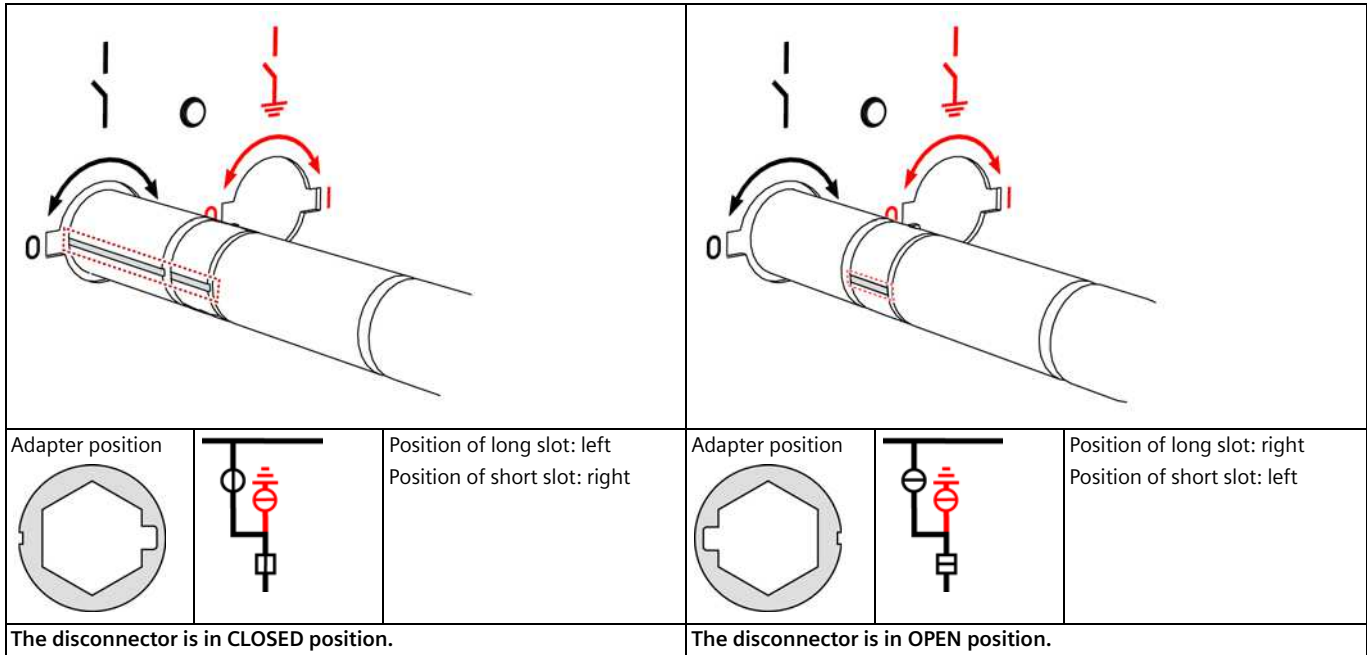
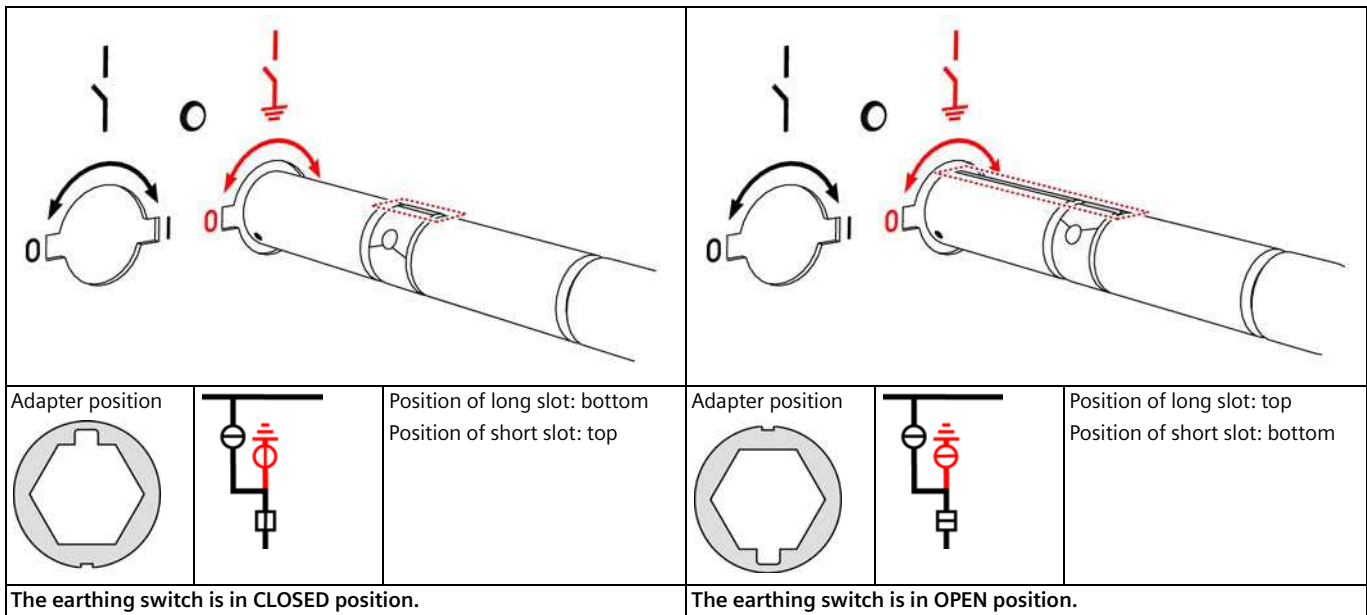


Fig. 130: Inserting the operating lever with pushed-on adapter


End positions of DISCONNECTOR




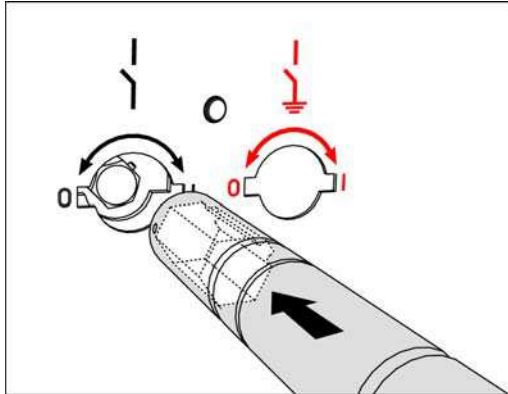

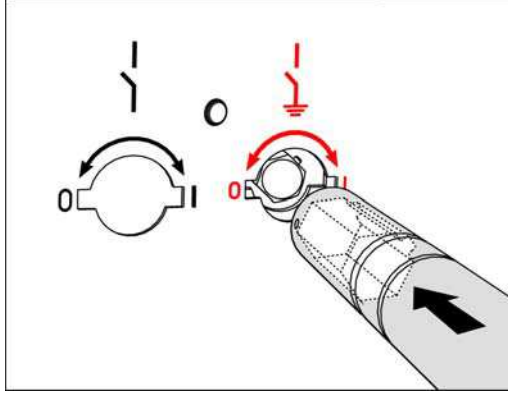
End positions of EARTHING SWITCH



**Performing emergency operation according to fault indication**

	<p><b>ATTENTION!</b></p>
	<p>The operating lever of the three-position disconnecter with pushed-on adapter for the emergency operation must be used according to the fault indications.</p> <p>⇒ Please do absolutely observe the fault indications.</p>

Always insert the operating lever with pushed-on adapter in the opening related to the fault indication.

Fault indication	Operation
	
	

**Emergency operation of the DISCONNECTING function**

If the switch does not reach its end position, e.g., due to a failure of the auxiliary voltage during disconnecter operation, push the operating lever with pushed-on adapter onto the hexagonal shaft for the DISCONNECTING function in such a way that the pin of the hexagonal shaft fits in the inner slot of the operating adapter.

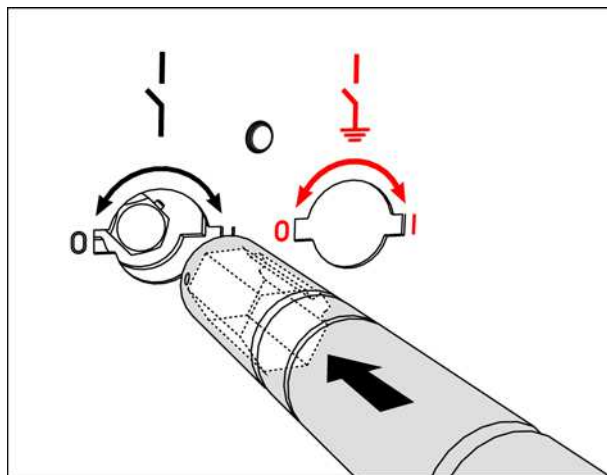


Fig. 131: Inserting the operating lever with pushed-on adapter (DISCONNECTING function)

<p>Initial situation</p>	<p>Push the interrogation lever downwards and push the control gate to the left.</p>	<p>Open the disconnecter (insert the operating lever with pushed-on adapter and turn counter-clockwise until the slots at the adapter are horizontal to the actuating opening).</p>
<p>Remove the operating lever with pushed-on adapter. The interrogation lever and the control gate return to their initial position.</p>	<p>End position Remove the adapter from the operating lever and lay it back into the service flap.</p>	

**Emergency operation of the EARTHING function**

If the switch does not reach its end position, e.g., due to a failure of the auxiliary voltage during earthing switch operation, push the operating lever with pushed-on adapter onto the hexagonal shaft for the EARTHING function in such a way that the pin of the hexagonal shaft fits in the inner slot of the operating adapter.

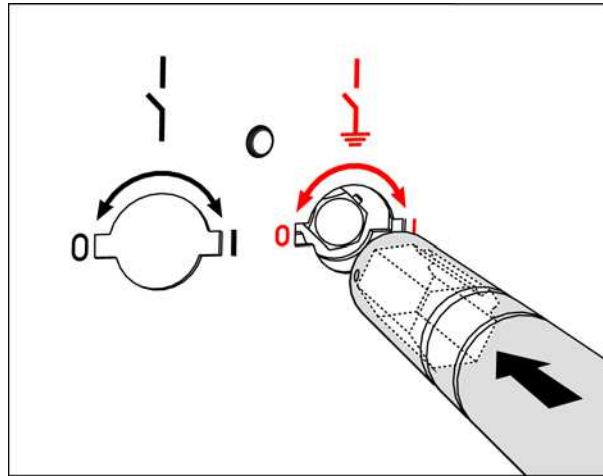


Fig. 132: Inserting the operating lever with pushed-on adapter (EARTHING function)


<p>Initial situation</p>	<p>Push the interrogation lever downwards and push the control gate to the left.</p>	<p>Open the earthing switch (insert the operating lever with pushed-on adapter and turn counter-clockwise until the slots at the adapter are vertical to the actuating opening).</p>
<p>Remove the emergency operating lever. The interrogation lever and the control gate return to their initial position.</p>	<p>End position Remove the adapter from the operating lever and lay it back into the service flap (option).</p>	

**Switching operations after emergency operation**

Perform further manual switching operations only with the associated operating levers for the DISCONNECTING or EARTHING functions.



## 22 Operating the three-position switch-disconnector

	<b>DANGER!</b>
	Non-observance of the following instructions can endanger people or damage the switchgear.
	<ul style="list-style-type: none"> <li>⇒ The sequence of the following instructions must followed by all means.</li> <li>⇒ All instructions must be executed.</li> </ul>

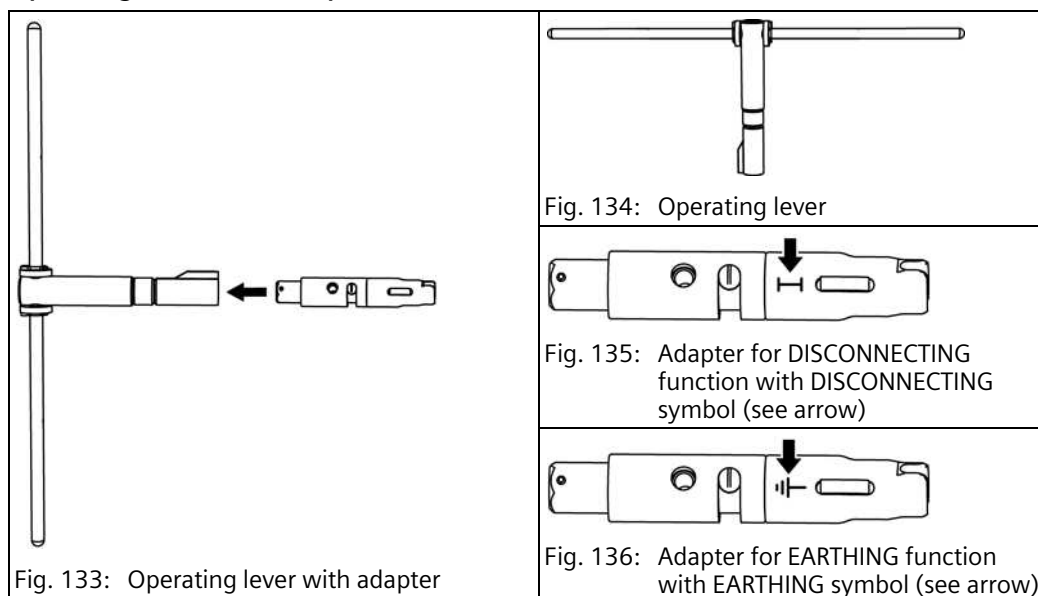
The DISCONNECTING operation must be pre-selected manually. Pre-selection is only possible if the associated switching operation is permissible.

### 22.1 Operating lever for three-position switch-disconnector (with adapter)

For operating the three-position switch-disconnector, one of the two adapters is plugged onto the operating lever for the DISCONNECTING function of the three-position disconnector.

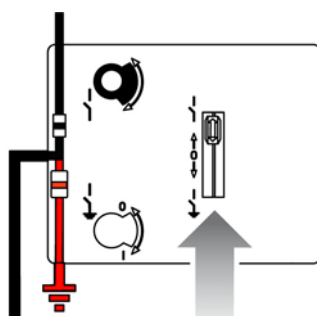
The function of the two adapters is marked respective symbols.

#### Operating lever for three-position switch-disconnector

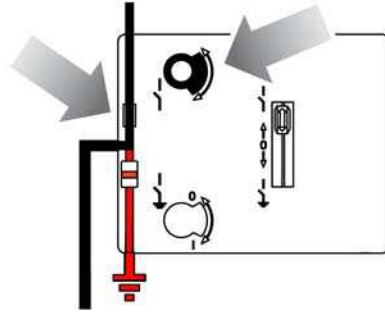


### 22.2 Closing the three-position switch-disconnector

- ⇒ Check the ready-for-service indicator.
- ⇒ Remove the padlock (optional).
- ⇒ To release the switching gate, push the control gate upwards and hold.

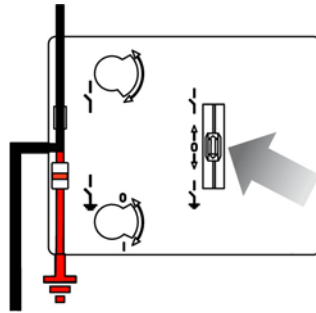


⇒ Insert the operating lever and move straight to CLOSED position.



✓ The switchgear is energized.

⇒ Remove the operating lever. The control gate moves to the center position automatically.



⇒ Refit the padlock at desired position.

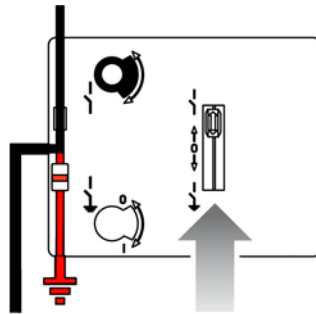
✓ The locking device of the switching gate can be padlocked in all three switch positions.

### 22.3 Opening the three-position switch-disconnector

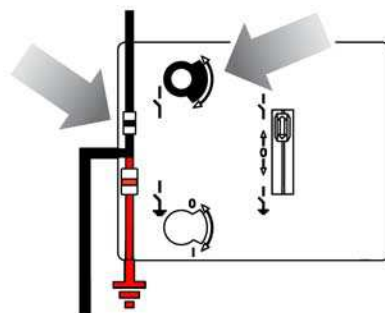
⇒ Check the ready-for-service indicator.

⇒ Remove the padlock (optional).

⇒ To release the switching gate, push the control gate upwards and hold.

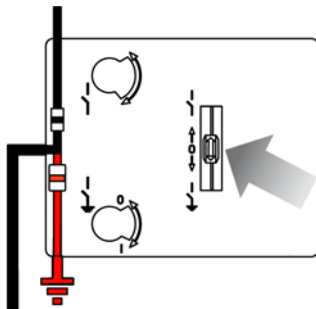


⇒ Insert the operating lever and move straight to OPEN position.



✓ The switchgear is de-energized.

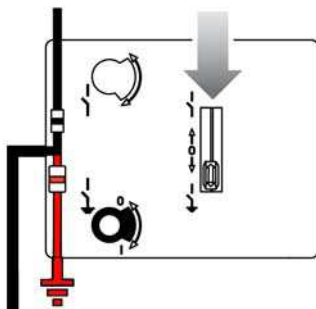
- ⇒ Remove the operating lever. The control gate moves to the center position automatically.



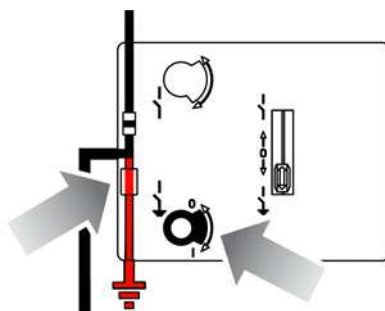
- ⇒ Refit the padlock at desired position.
- ✓ The locking device of the switching gate can be padlocked in all three switch positions.

#### 22.4 Earthing the three-position switch-disconnector

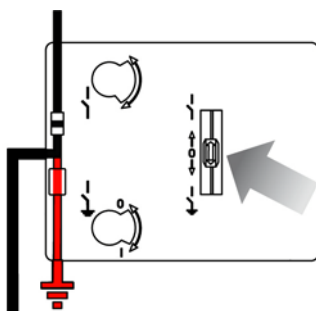
- ⇒ Check the ready-for-service indicator.
- ⇒ Remove the padlock (optional).
- ⇒ To release the switching gate, push the control gate downwards and hold.




- ⇒ Insert the operating lever and move straight to EARTHED position.



- ✓ The switchgear is earthed.
- ⇒ Remove the operating lever. The control gate moves to the center position automatically.



	<p><b>DANGER!</b></p>
	<p>Danger!</p> <p>⇒ In order to prevent switching operations and accidental de-earthing or de-earthing caused by unauthorized persons: Always secure the control gate with a padlock. This also applies to earthing with motor operating mechanism.</p>

⇒ Fit a padlock as follows:

- **For manual earthing:** Fit the padlock at the control gate in center position.

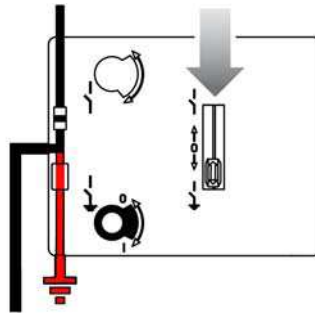
**Earthing switch with motor operating mechanism:** Push the control gate upwards and fit the padlock to interrupt the motor control.

### 22.5 De-earthing with three-position disconnecter

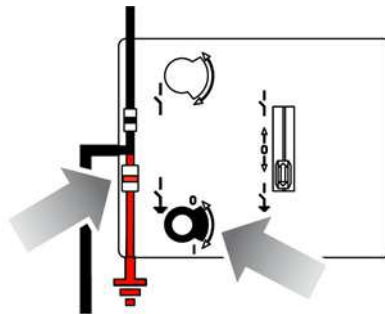
⇒ Check the ready-for-service indicator.

⇒ Remove the padlock.

⇒ To release the switching gate, push the control gate downwards and hold.

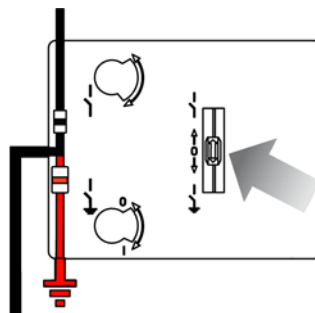


⇒ Insert the operating lever and move straight to OPEN position.



✓ The switchgear is de-energized.

⇒ Remove the operating lever. The control gate moves to the center position automatically.




⇒ Refit the padlock at desired position.

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

## 22.6 Operating three-position switch-disconnector with motor operating mechanism

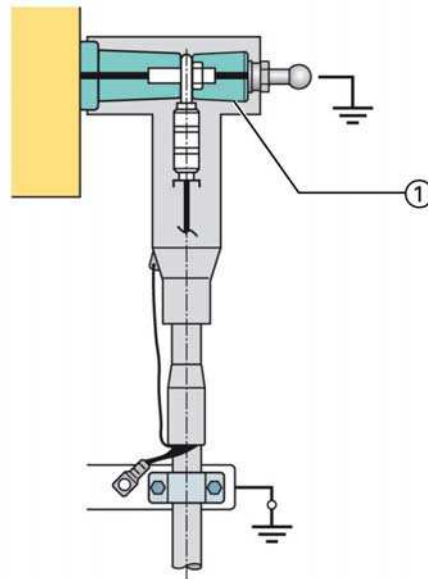
The switching operations DISCONNECTING and EARTHING of the three-position switch-disconnector can be performed by means of a motor operating mechanism (option) - also from remote.

	<b>NOTE!</b>
	⇒ De-earthing is only possible manually on site.

## 23 Work-in-progress earthing

### Visible earthing without removing the cable

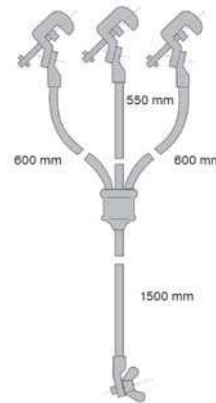
- ⇒ Earth the switchgear panel.
- ⇒ Plug the adapter for work-in-progress earthing onto the cable T-plug of the connected cable.



① Adapter for work-in-progress earthing

- ⇒ Earthing accessories by different manufacturers (e.g. Horstmann, Pfister) can be connected to the spherical bolts of the adapter for work-in-progress earthing. Diameter of the spherical bolts can be 20 mm and/or 25 mm.

### Example for arthing accessories:



- ⇒ Connect earthing accessories with the connecting point M 12 of the pulled-out earthing bar.




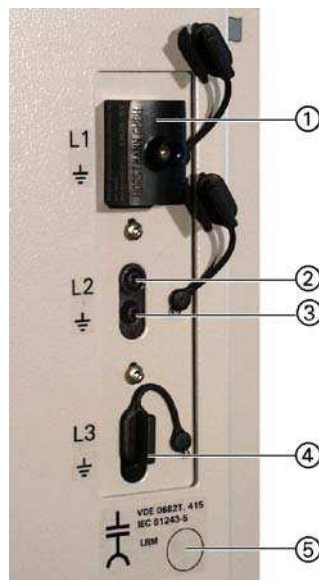
① Connecting point M 12 for earthing accessories

Supplier	Adapter for work-in-progress earthing	Diameter of spherical bolt	for cable T-plug				
Nexans Euromold	300GP-B-KB-20	20 mm	M430TB/G M300PBM				
	300GP-B-KB-25	25 mm	M430TB/G M300PBM				
	400GP-B-KB-20	20 mm	M400TB/G M440TB/G				
	400GP-B-KB-25	25 mm	M400TB/G M440TB/G				
	800GP-B-KB-20	20 mm	M484TB/G M804TB/M				
	800GP-B-KB-25	25 mm	M484TB/G M804TB/M				
nkt cables	E 20	20 mm	CB36-630 CC36-630 CB36-630(1250) CB36-630(1250)				
			25 mm	CB36-630 CC36-360 CB36-360(1250) CC36-360 (1250)			
				ER 23	20 mm	SET 36 SEHDT 33	
			Tyco Electronics Raychem	RSTI-56EA20	20 mm	RSTI-66xx RSTI-CC66xx RSTI-66Lxx	
		RSTI-56EA25				25 mm	RSTI-66xx RSTI-CC66xx RSTI-66Lxx
							RSTI-68EA20
RSTI-68EA25	25 mm			RSTI-68xx RSTI-CC-68xx RSTI-69xx RSTI-CC-69xx			

## 24 Verification of safe isolation from supply

### 24.1 LRM plug-in sockets

	<p><b>DANGER!</b></p>
	<p>High voltage! Danger! Verify safe isolation from supply without any doubt!</p> <ul style="list-style-type: none"> <li>⇒ Possible sources of failure:                     <ul style="list-style-type: none"> <li>- Defective voltage indicator (or device for function testing of the coupling section)</li> <li>- Maloperation of the voltage indicator (or device for function testing of the coupling section)</li> </ul> </li> <li>⇒ Test the perfect function of the voltage indicator and the coupling section in accordance with national standards:                     <ul style="list-style-type: none"> <li>- On a live panel</li> <li>- With a test unit according to IEC 61243-5/EN 61243-5</li> <li>- On all phases</li> </ul> </li> <li>⇒ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)</li> <li>⇒ 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.</li> <li>⇒ Do not use short-circuiting jumpers as separate plugs. The function of the surge arrester installed is not guaranteed anymore if short-circuiting jumpers are used (see page 27, "Voltage detecting systems").</li> </ul>






- ① Voltage indicator type LRM
- ② Capacitive test socket L2
- ③ Earth socket
- ④ Cover for test sockets
- ⑤ Documentation to repeat test of interface condition


Fig. 137: Verification of safe isolation from supply (LRM plug-in sockets)

- ⇒ Remove covers from plug-in sockets (capacitive test sockets L1, L2, L3).
- ⇒ Plug voltage indicator in all three phases L1, L2, L3 of the plug-in sockets.
- ✓ If the indicator does **not** flash or light up in any of the three phases, the phases are not live.
- ⇒ Replace the covers on the plug-in sockets.



Indication	LRM system	
	Indication flashes	Phase not isolated from supply
	Indication lights up	Phase not isolated from supply
	Indication does not light up or flash	Phase isolated from supply

### 24.2 Indications VOIS, VOIS R+, CAPDIS -S1+/-S2+

	<b>DANGER!</b>
	<p>High voltage! Danger! Verify safe isolation from supply without any doubt!</p> <p>⇒ Possible sources of failure:</p> <ul style="list-style-type: none"> <li>- Defective voltage indicator (or device for function testing of the coupling section)</li> <li>- Maloperation of the voltage indicator (or device for function testing of the coupling section)</li> </ul> <p>⇒ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)</p>


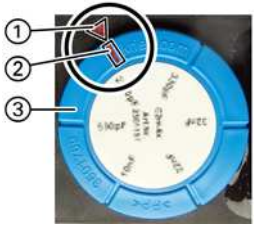
	<b>DANGER!</b>
	<p>High voltage! Danger! Do only modify the factory setting of the C2 module in the voltage detecting system CAPDIS-S1+/S2+ after consultation with the regional Siemens representative!</p> <p>⇒ If the setting of the C2 module was modified by mistake, re-establish the factory setting as follows:</p> <ul style="list-style-type: none"> <li>- Pull out the C2 module ③ at the rear side of CAPDIS-S1+/S2+</li> <li>- Plug the C2 module ③ into CAPDIS-S1+/S2+ so that the marked arrow ① on the housing points to the marking ② on the C2 module</li> </ul> <div style="text-align: center;">  </div> <p>Fig. 138: Marking of the factory setting at the C2 module</p>



Fig. 139: CAPDIS-S2+: Cover closed

Fig. 140: CAPDIS-S2+: Cover opened

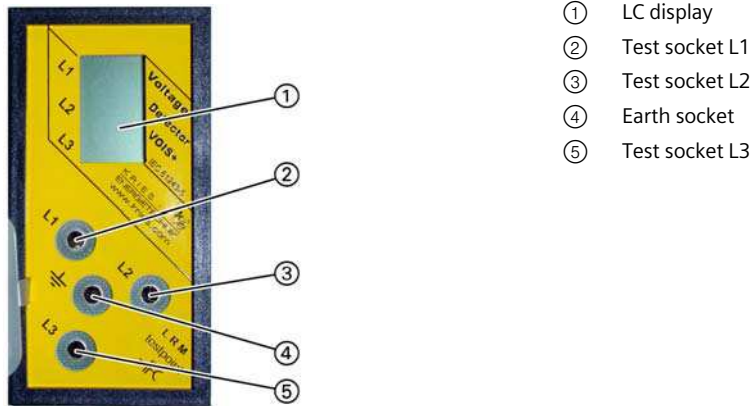



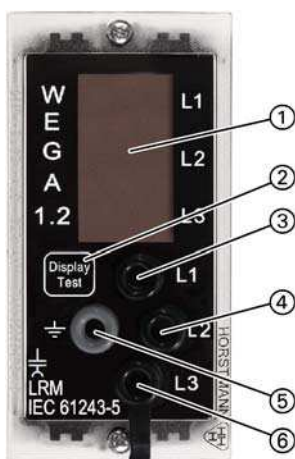
Fig. 141: VOIS+: Cover opened

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

Indication	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+			
	L1	L2	L3	L1	L2	L3	L1	L2	L3	
A0							000			Operating voltage not present (CAPDIS-S2+)
A1	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	Operating voltage present
A2										<ul style="list-style-type: none"> <li>Operating voltage not present</li> <li>Auxiliary power not present (CAPDIS-S2+)</li> </ul>
A3		⚡	⚡		⚡	⚡		⚡	⚡	Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4					⚡	⚡	⚡	⚡	⚡	Voltage ( <b>not</b> operating voltage) present
A5				⚡	⚡	⚡	⚡	⚡	⚡	Indication: "Test" passed (lights up shortly)
A6				⚡	⚡	⚡	⚡	⚡	⚡	Indication: "Test" not passed (lights up shortly)
A7				⚡	⚡	⚡	⚡	⚡	⚡	Overvoltage present (lights up permanently)
A8							⚡	⚡	⚡	Indication: "ERROR" e.g. in case of missing auxiliary voltage

24.3 Indications WEGA 1.2, WEGA 2.2

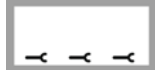

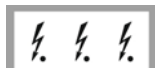
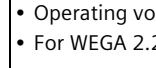
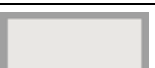
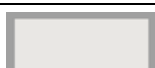
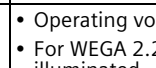

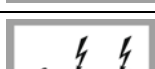
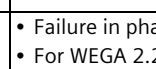


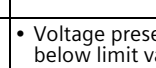


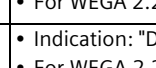
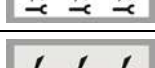
	<b>DANGER!</b>
	<p>High voltage! Danger! Verify safe isolation from supply without any doubt!</p> <p>⇒ Possible sources of failure:</p> <ul style="list-style-type: none"> <li>- Defective voltage indicator (or device for function testing of the coupling section)</li> <li>- Maloperation of the voltage indicator (or device for function testing of the coupling section)</li> </ul> <p>⇒ Use only voltage indicators or devices according to EN 61 243-5 / IEC 61 243-5 / VDE 0682-415 to test the function of the coupling section. (The interface conditions have not changed as against the old standard VDE 0681 Part 7; the corresponding indicators can still be used.)</p>




- ① LC display (illuminated for WEGA 2.2)
- ② "Display Test" button
- ③ Test socket L1
- ④ Test socket L2
- ⑤ Earth socket
- ⑥ Test socket L3

Fig. 142: Operating elements WEGA 1.2/2.2

Indications WEGA 1.2, WEGA 2.2

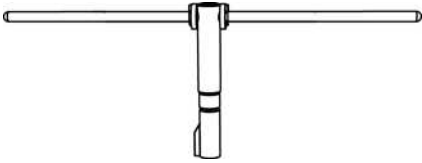
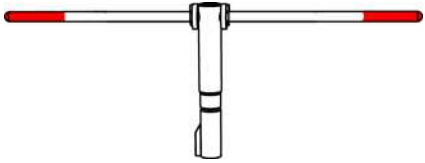
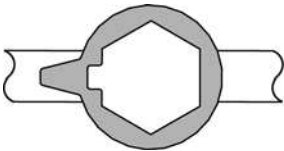
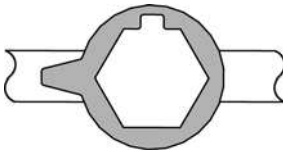
Indication	WEGA 1.2			WEGA 2.2			
	L1	L2	L3	L1	L2	L3	
A0					For WEGA 2.2: Operating voltage not present, auxiliary power present, LCD illuminated		
A1				<ul style="list-style-type: none"> <li>• Operating voltage present</li> <li>• For WEGA 2.2: Auxiliary power present, LCD illuminated</li> </ul>			
A2				<ul style="list-style-type: none"> <li>• Operating voltage not present</li> <li>• For WEGA 2.2: Auxiliary power not present, LCD not illuminated</li> </ul>			
A3				<ul style="list-style-type: none"> <li>• Failure in phase L1, operating voltage at L2 and L3</li> <li>• For WEGA 2.2: Auxiliary power present, LCD illuminated</li> </ul>			
A4				<ul style="list-style-type: none"> <li>• Voltage present, current monitoring of coupling section below limit value</li> <li>• For WEGA 2.2: Auxiliary power present, LCD illuminated</li> </ul>			
A5				<ul style="list-style-type: none"> <li>• Indication: "Display Test" passed</li> <li>• For WEGA 2.2: Auxiliary power present, LCD illuminated</li> </ul>			
A6					For WEGA 2.2: LCD for missing auxiliary voltage is not illuminated		

## 25 Short instructions

	<b>DANGER!</b>
	<p>Danger in case of maloperation! The following short instructions give an overview of the operating procedures.</p> <p>⇒ Perform the switching operations as described (see page 133, "Operating the circuit-breaker") and observe the warnings given there.</p>

The operating levers for the three-position switches with/without adapter are coded and identified by color:

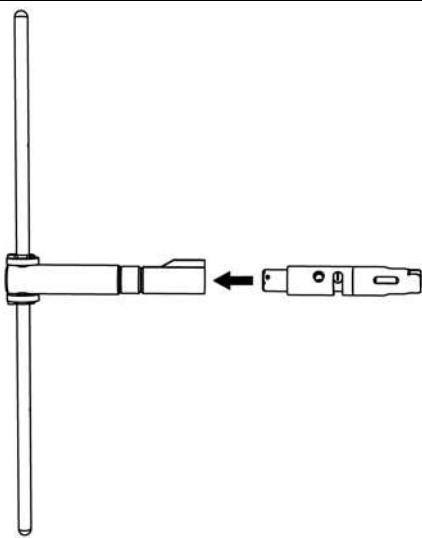
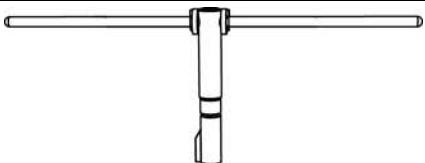


### Operating levers for three-position disconnecter

	
Fig. 143: Operating lever for DISCONNECTING function	Fig. 144: Operating lever for EARTHING/READY-TO-EARTH function (handle painted red)
	
Fig. 145: Socket of operating lever, DISCONNECTING	Fig. 146: Socket of operating lever, EARTHING/READY TO EARTH

To operate the three-position switch-disconnector, one of the two adapters is pushed onto the operating lever for the DISCONNECTING function of the three-position disconnecter.

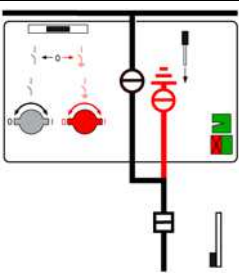
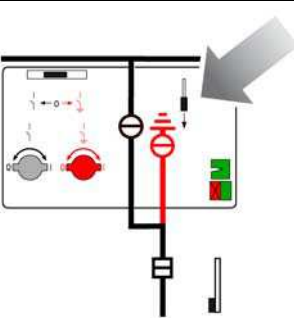
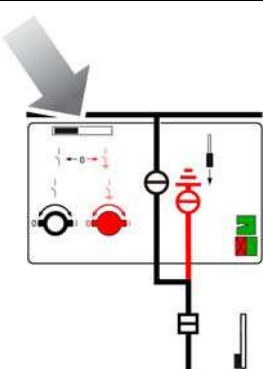
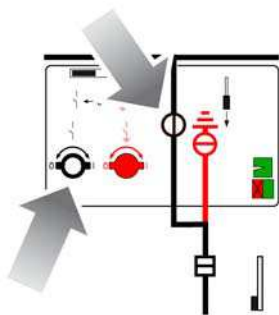
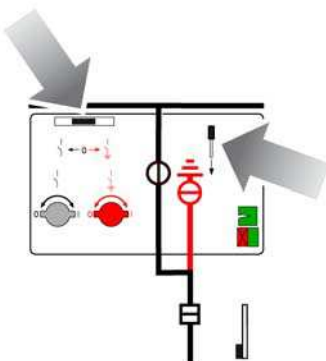
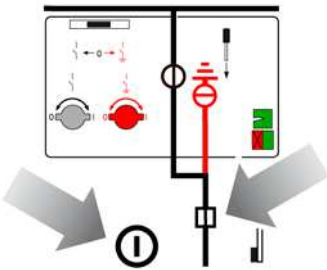
The function of the two adapters is marked respective symbols.

### Operating lever for three-position switch-disconnector

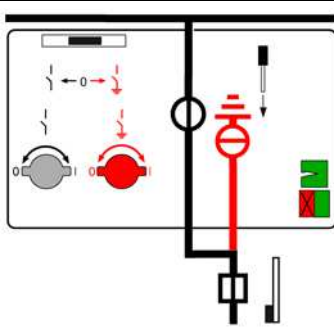
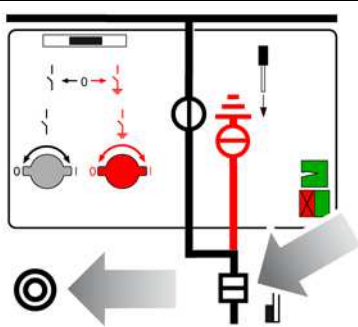
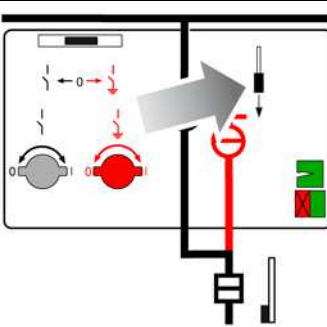
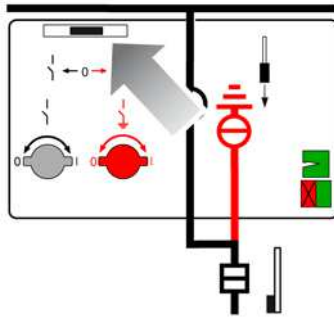
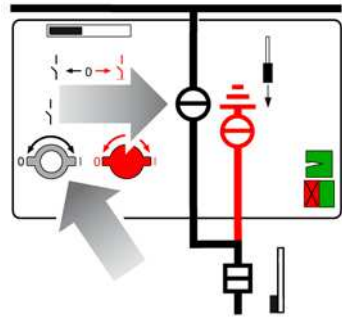
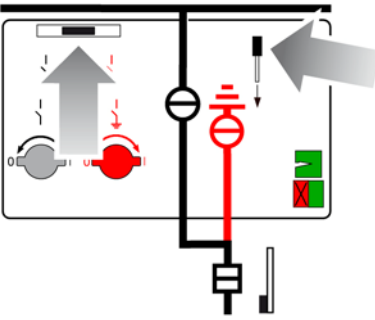
	
	Fig. 148: Operating lever
	
Fig. 147: Operating lever with adapter	Fig. 149: Adapter for DISCONNECTING function with DISCONNECTING symbol (see arrow)
	
	Fig. 150: Adapter for EARTHING function with EARTHING symbol (see arrow)

### 25.1 Operating circuit-breaker panels

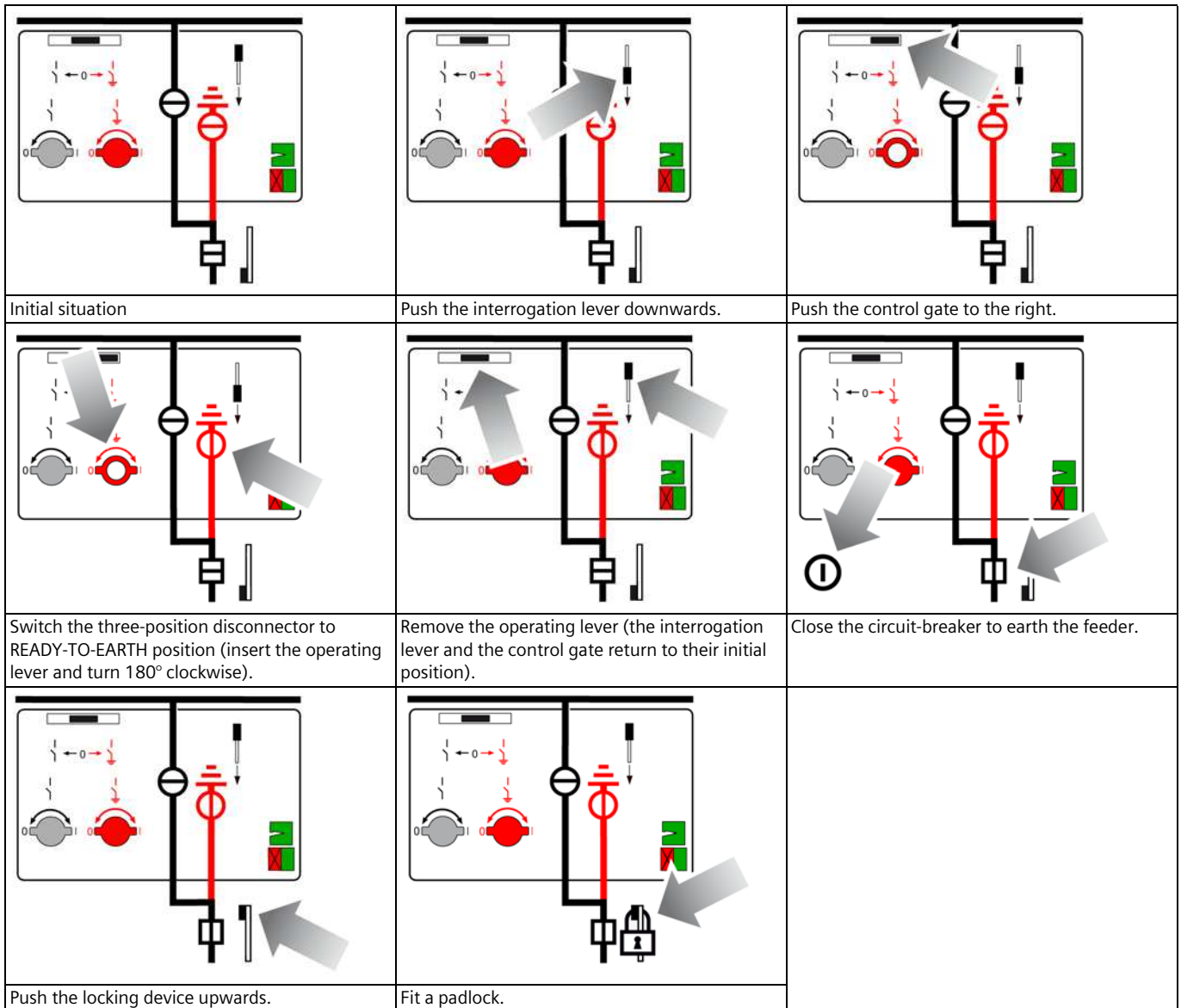
#### Circuit-breaker panel: Connecting the feeder to the busbar

		
<p>Initial situation</p>	<p>Push the interrogation lever downwards.</p>	<p>Push the control gate to the left.</p>
		
<p>Close the three-position disconnector (insert the operating lever and turn 180° clockwise).</p>	<p>Remove the operating lever (the interrogation lever and the control gate return to their initial position).</p>	<p>Close the circuit-breaker.</p>

#### Circuit-breaker panel: Disconnecting the feeder from the busbar

		
<p>Initial situation</p>	<p>Open the circuit-breaker.</p>	<p>Push the interrogation lever downwards.</p>
		
<p>Push the control gate to the left.</p>	<p>Open the three-position disconnector (insert the operating lever and turn 180° counter-clockwise).</p>	<p>Remove the operating lever (the interrogation lever and the control gate return to their initial position).</p>

Circuit-breaker panel: Feeder earthing

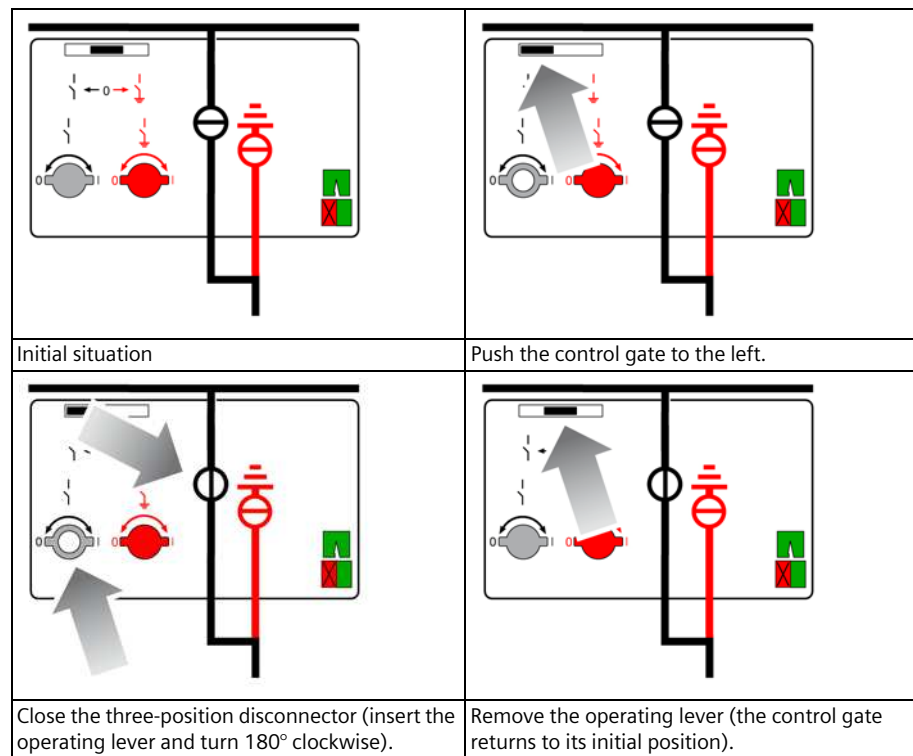


Circuit-breaker panel: De-earthing the feeder

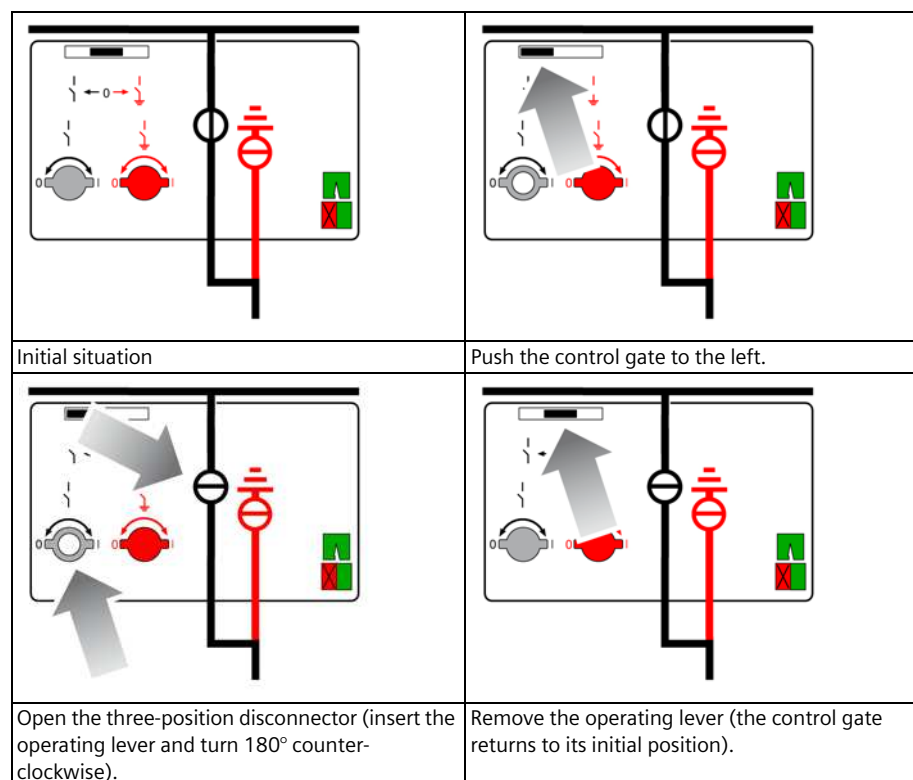
<p>Initial situation</p>	<p>Remove the padlock (the locking device goes down automatically).</p>	<p>Open the circuit-breaker to de-earth the feeder.</p>
<p>Push the interrogation lever downwards.</p>	<p>Push the control gate to the right.</p>	<p>Switch the three-position disconnector from READY-TO-EARTH to OPEN position (insert the operating lever and turn 180° counter-clockwise).</p>
<p>Remove the operating lever (the interrogation lever and the control gate return to their initial position).</p>		

## 25.2 Operating disconnecter panels

### Connecting the disconnecter with the busbar

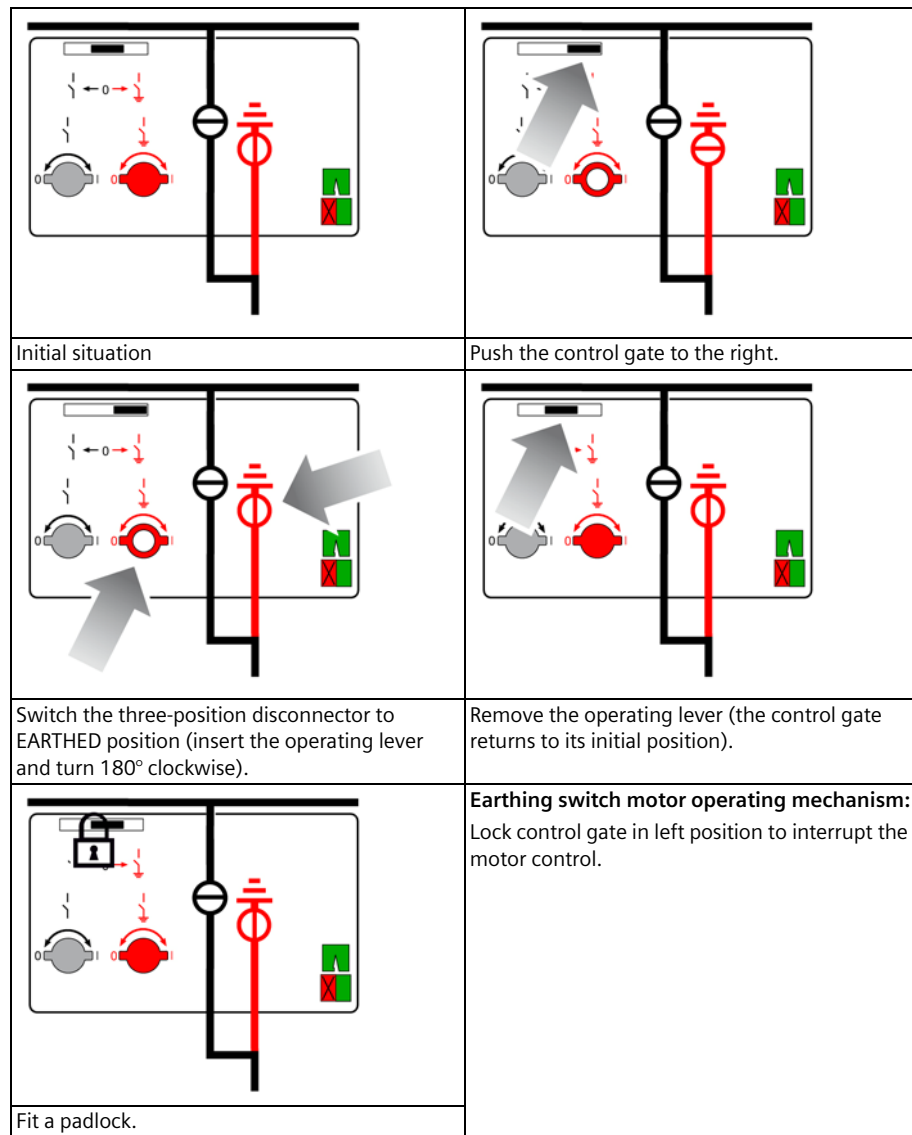


### Disconnecting the disconnecter from the busbar

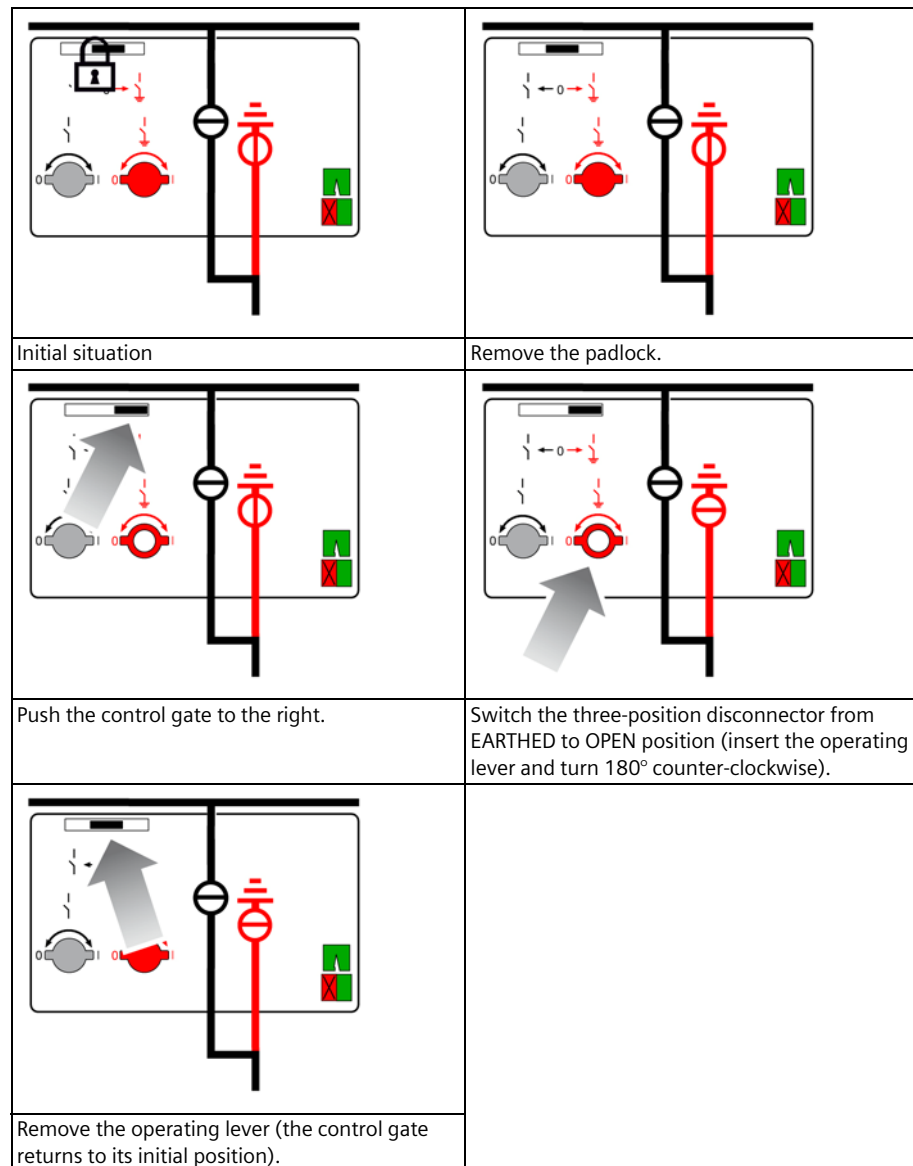




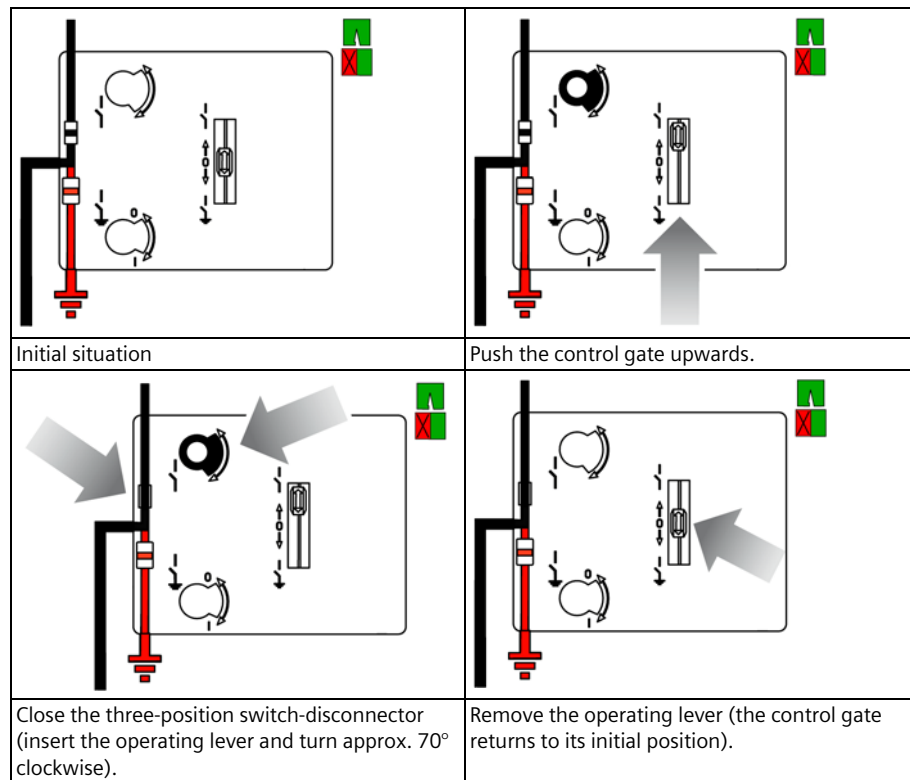
Disconnecter panel: Feeder earthing



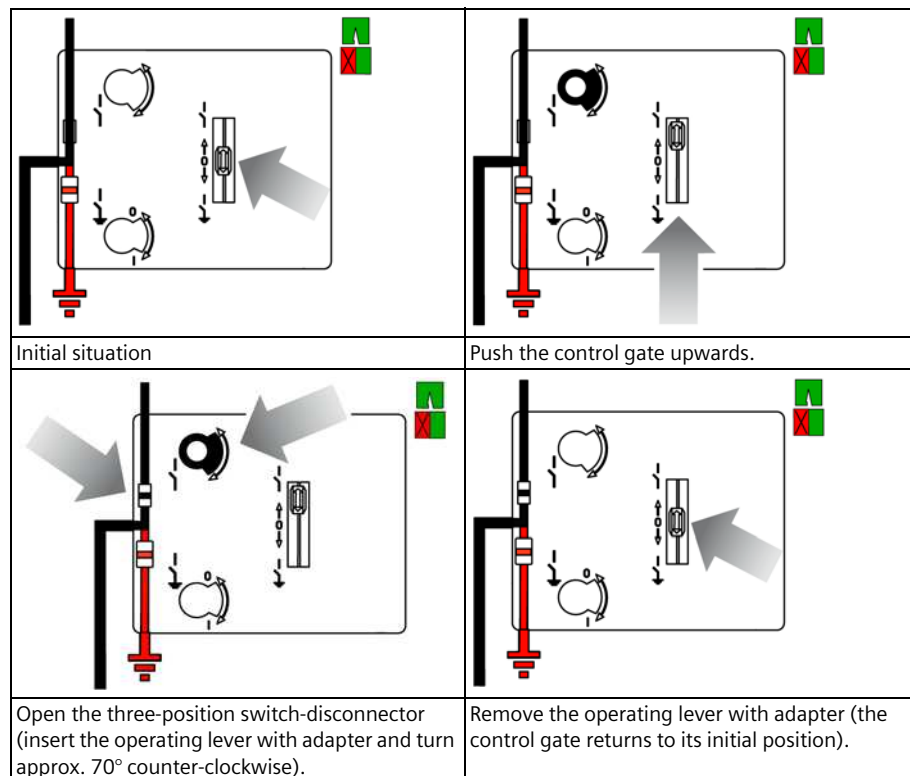
Disconnecter panel: Feeder de-earthing



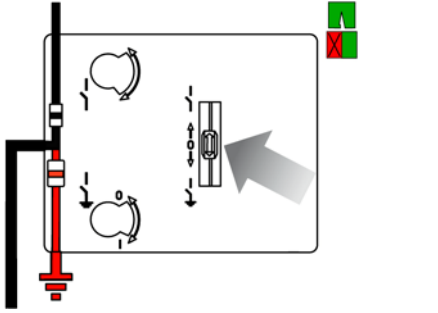
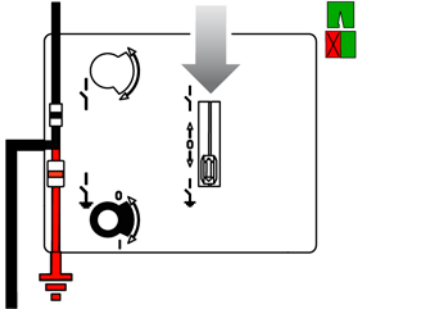
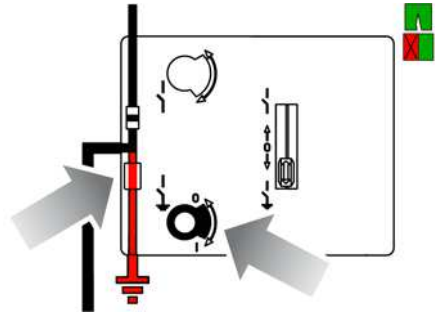
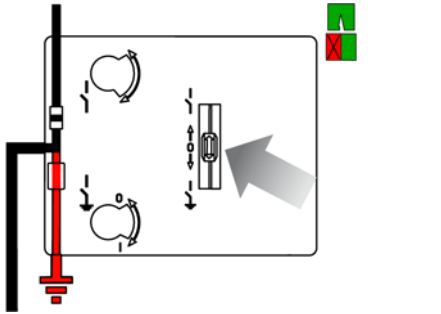
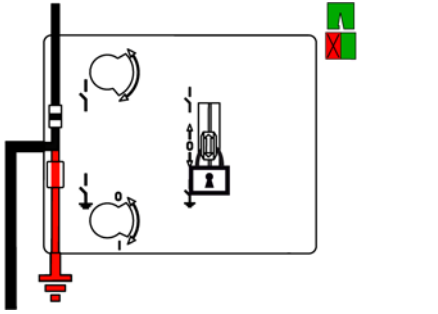
**Operate ring-main panel: Connect the switch-disconnector with the busbar**



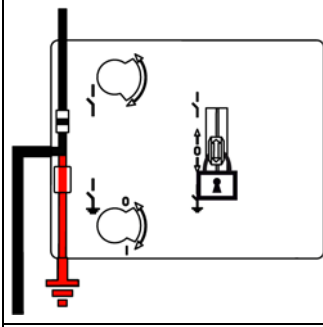
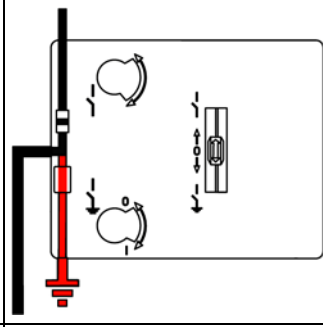
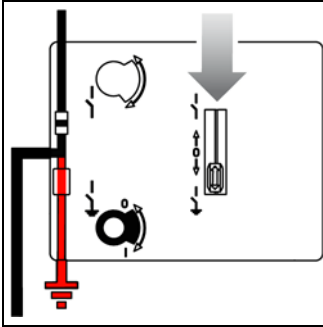
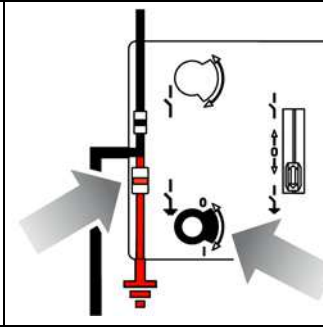
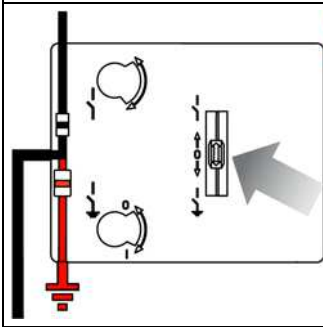
**Disconnecting the switch-disconnector from the busbar**



Ring-main panel: Earthing the feeder

	
<p>Initial situation</p>	<p>Push the control gate downwards.</p>
	
<p>Switch earthing switch to CLOSED position (insert the operating lever and turn approx. 55° clockwise).</p>	<p>Remove the operating lever (the control gate returns to its initial position).</p>
	<p><b>Earthing switch with motor operating mechanism:</b> Push the control gate upwards and lock in order to interrupt the motor operating mechanism.</p>
<p>Fit a padlock.</p>	

Ring-main panel: De-earthing the feeder


	
<p>Initial situation</p>	<p>Remove the padlock.</p>
	
<p>Push the control gate downwards.</p>	<p>Switch earthing switch to OPEN position (insert the operating lever and turn approx. 55° counter-clockwise).</p>
	
<p>Remove the operating lever (the control gate returns to its initial position).</p>	

## 26 Cable testing

- Preconditions** Before testing the cables, the switch positions must be as follows:
- Circuit-breaker in OPEN position
  - Three-position switch in OPEN position.

The following table contains the maximum values for the test voltages:

Rated voltage of the switchgear [kV]	DC test voltage		AC test voltage 0.1 Hz	
	maximum value [kV]	Test duration [min.]	maximum value [kV]	Test duration [min.]
12	36	15	19	60
24	72	15	38	60
36	72	15	57	60

	<b>ATTENTION!</b>
	<p>If DC voltage is applied to the cable and there are incoming overvoltages on the busbar, there is risk of flashovers.</p> <p>⇒ Keep safety distances.</p> <p>⇒ Install barriers.</p> <p>⇒ Switch on warnings.</p>


	<b>ATTENTION!</b>
	<p>The voltage indicators CAPDIS-S1+, CAPDIS-S2+, LRM, VOIS+, VOIS R+, WEGA 1.2 and WEGA 2.2 may be damaged if test voltage is applied.</p> <p>⇒ Short-circuit the voltage indicators with the earthing points of the test sockets.</p>



Fig. 116: Short-circuit plug, make Kries, order number 2500029



Fig. 117: Short-circuit plug, make Horstmann, order number 51-9904-001

**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:

Supplier of cable T-plug	Test adapter	for cable T-plug
Nexans Euromold	400TR	M400TB/G; M430TB/G; M440TB/G
nkt cables	PAK 630 M12	CB36-630; CC36-630
	PAK 630 M16	CB36-630(1250); CC36-630(1250)
Südkabel	–	SEHDT 33
Tyco Electronics Raychem	RSTI-56TR	RSTI-66xx, RSTI-CC-66xx
	RSTI-56TR	RSTI-66Lxx
	RSTI-68TR	RSTI-68xx;RSTI-CC-68xx
	RSTI-68TR	RSTI-69xx;RSTI-CC-69xx

- ⇒ Earth the feeder (see page 138, "Earthing/ready-to-earth with the three-position switch").
- ⇒ Secure against reclosing.
- ⇒ Verify safe isolation from supply (see page 152, "Verification of safe isolation from supply").
- ⇒ Undo the fixing screws of the cable compartment cover.
- ⇒ Remove the cable compartment cover.
- ⇒ Remove the screw insert of the connected cable T-plug according to the manufacturer's instructions.
- ⇒ Insert / screw the test adapter in the cable T-plug.
- ⇒ Connect test lead.
- ⇒ Short-circuit and earth the capacitive test sockets at the LRM, VOIS, WEGA or CAPDIS system.
- ⇒ De-earth the feeder (see page 138, "De-earthing with the three-position switch").
- ⇒ Perform voltage test.
- ⇒ Proceed in reverse order to return to the initial situation.

## 27 Service instructions

### 27.1 Maintenance

The fixed-mounted circuit-breaker switchgear NXPLUS C Wind with the vacuum circuit-breaker 3AH55 is maintenance-free under normal operating conditions. The switchgear vessel is designed as a "sealed pressure system" according to IEC 62 271-200, i.e. maintenance of the insulation filling is not required.

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


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

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

**Special operating conditions** If the switchgear is used in abnormally unfavorable indoor conditions beyond the normal operating conditions (e.g. frequent heavy condensation, dust-ridden air, etc.) we recommend to clean the external parts of the vacuum circuit-breaker operating mechanism, and, if necessary, to renew the anti-corrosion protection greasing at regular intervals. To do this, you may only use the materials specified hereafter on the individual functional parts of the circuit-breaker.

Permissible cleaning agents/lubricants:

- **For bearings, sliding surfaces:** Isoflex Topas L 32, Klüber - Lubrication KG, Geisenhauer Str. 7, Postfach 70 10 47, D-81310 München
- **For bearings that are inaccessible for grease, and bearings of the auxiliary switch S1:** Tellus Oil 32, Shell Direct GmbH, Suhrenkamp 71, D-22335 Hamburg

	<b>ATTENTION!</b>
	<p>Parts of the switchgear that cannot be dismantled may be damaged if they come into contact with cleaning agents.</p> <p>⇒ Do <b>not</b> wash joints and bearings which cannot be dismantled with a cleaning agent.</p>

⇒ Clean the external parts of the circuit-breaker at regular intervals.

⇒ Renew the anti-corrosion protection greasing.

⇒ Operate the circuit-breaker several times mechanically by hand for test.

### 27.2 Switchgear extension and replacement of panels and components

The individual components, such as measuring instruments, current transformers, etc. can be replaced. For switchgear extension and replacement of components, please contact the regional Siemens representative. Due to the busbar concept, switchgear extension or panel replacement is possible without gas work.

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

- Type and serial number of the switchgear and the circuit-breaker (see rating plates)
- Precise designation of the device or component, if applicable on the basis of the information and illustrations in the associated instructions, a drawing, sketch or circuit diagram



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