



## Medium-Voltage Switchgear

Type SIMOSEC

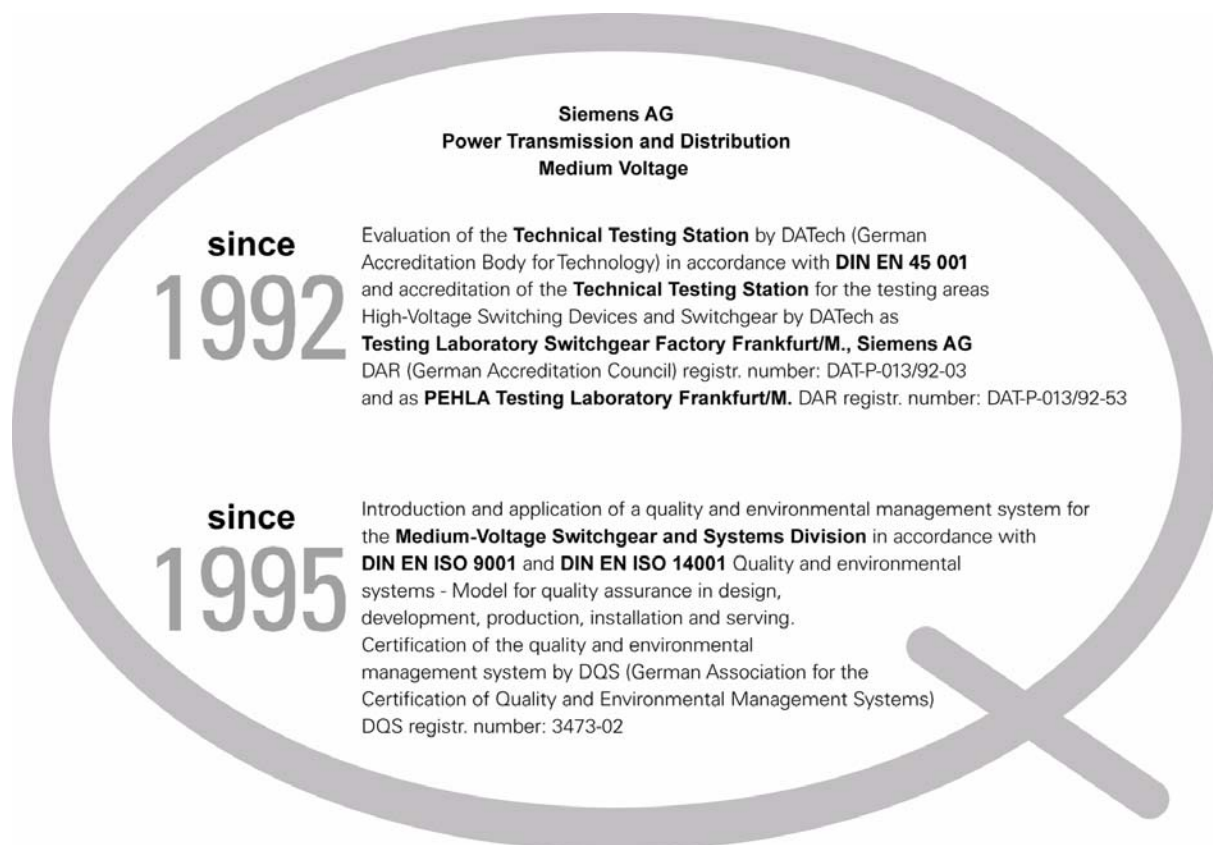
up to 24 kV, Extendable, up to 1250 A



Medium-Voltage  
Switchgear

### **INSTALLATION AND OPERATING INSTRUCTIONS**

Order No.: 832-6007.0  
Revision: 05  
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## About these Instructions

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

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

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

For further details, e.g. about additional equipment and information about other switchgear types, please refer to catalog HA 41.21.

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 Siemens representative.

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

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# Safety instructions

## 1 Signal terms and definitions

	<b>DANGER!</b>
	as used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken.  ⇒ Observe the safety instructions.

	<b>ATTENTION!</b>
	as used in these instructions, this means that damage to property or environment can occur if the relevant precautionary measures are not taken.  ⇒ Observe the safety instructions.

	<b>NOTE!</b>
	as used in these instructions, this points at facilitations of work, particularities for operation or possible maloperation.  ⇒ Observe the notes.

**Symbols used**

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

## 2 General instructions

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


### Five Safety Rules of Electrical Engineering

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

- Isolating.
- Securing against reclosing.
- Verifying safe isolation from supply.
- Earthing and short-circuiting.
- Covering or barriering adjacent live parts.

### 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 certified by the Switchgear Factory Frankfurt who are familiar with transport, installation, commissioning, maintenance and operation of the product and have appropriate qualifications for their work, e.g.:

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

SIMOSEC is an extendable, three-phase, metal-enclosed indoor switchgear.

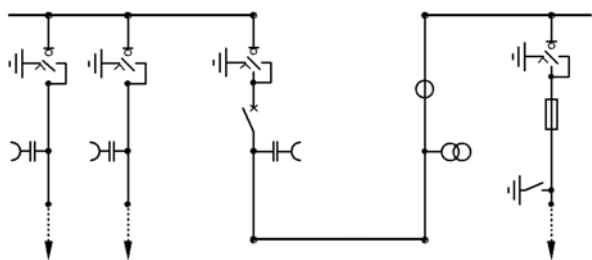
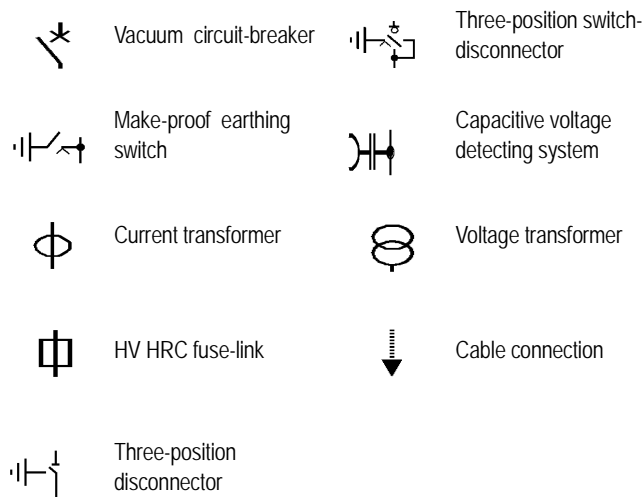


Fig. 1: Single-line diagram of SIMOSEC switchgear (Example: 2 ring-main panels RK; circuit-breaker panel LS11-U, metering panel ME1 and transformer panel TR)



SIMOSEC switchgear is used for power distribution in distribution systems up to 24 kV:

- As substations, customer transfer substations, distribution substations and switching substations of power supply and public utilities
- In public buildings such as high-rise buildings, railway stations, hospitals
- In industrial plants.

The ratings of your SIMOSEC panels are provided on the rating plates.

**The following technical features are used:**

- Individual panels, for free combination and extension
- Three-pole primary enclosure
- Phases arranged one behind the other
- Busbar system at top
- Air-insulated busbar and cable connection system for conventional cable sealing ends
- Three-position switch-disconnector, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions (maintenance-free quenching system)
- Three-position switch up to max. 1250 A, metal-enclosed, with air-insulated primary terminals, gas-insulated
- Switching devices in stainless-steel vessel, welded without seals, with welded-in bushings (sealed for life)
- Vacuum circuit-breaker 3AH5, metal-enclosed, up to 630 A, fixed-mounted in gas-insulated switchgear vessel
- Vacuum circuit-breaker 3AH6, air-insulated, up to 1250 A, easy to remove after loosening the fixing bolts
- Cubicle-type or metal-clad panel design
- Three-phase current transformer (option), factory-assembled on the feeder bushings
- Integrated low-voltage niche for installation of:
  - Terminals
  - MCBs
  - Pushbuttons
  - Protection devices
  - Low-voltage cables or bus wires
- Option: Top-mounted low-voltage compartment can be supplied in two overall heights
- Panel heating for severe climatic / ambient conditions to prevent condensation

**Security of operation and reliability due to:**

- Type and routine-tested panels
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 350,000 switchgear components in operation worldwide for many years
- No cross insulation between phases
- Operating mechanisms outside switchgear vessel
- Maintenance-free operating mechanism parts
- Mechanical position indication integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks
- Cable testing without the need to isolate the busbar (see Page 131, "Cable testing")
- Three-phase current transformer for selective shutdown of circuit-breaker panels
- Resistance to internal arc faults
  - not internal-arcing resistant design of SIMOSEC switchgear (standard)
  - internal-arcing resistant, with additional burn-through resistance (option)

**Low life-cycle costs and high availability throughout the entire product service life cycle as a result of:**

- Maintenance-free technology concept
- Minimum space requirement
- Possibility of extension and replacement (modular switchgear concept)
- Installation and extension without SF<sub>6</sub> gas work
- Long service life of switching devices
- Standardized protection and control equipment
- Ecological manufacture and utilization/recycling

## 6 Panel versions \*

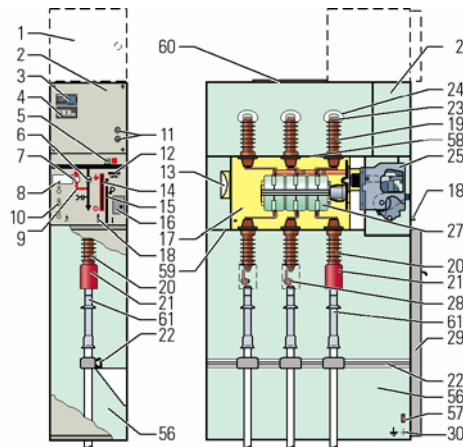


Fig. 2: Ring-main panel RK

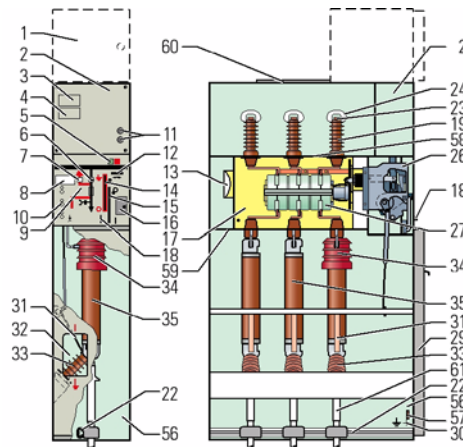


Fig. 3: Transformer panel TR

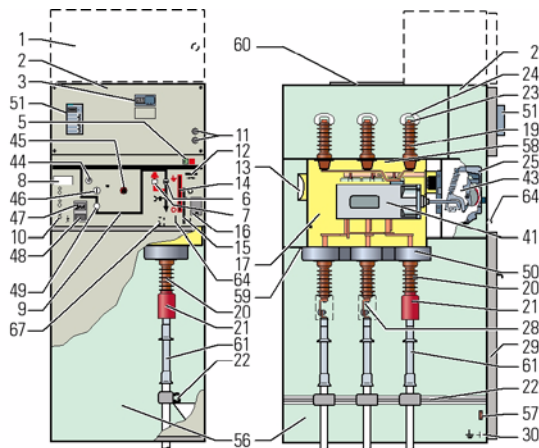


Fig. 4: Circuit-breaker panel LS1 with vacuum circuit-breaker 3AH5

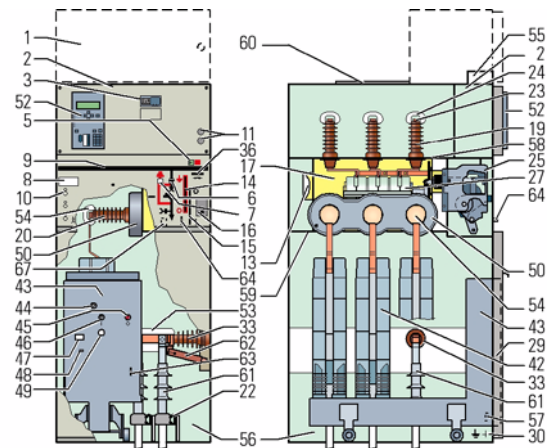


Fig. 5: Circuit-breaker panel LS11 with vacuum circuit-breaker 3AH6

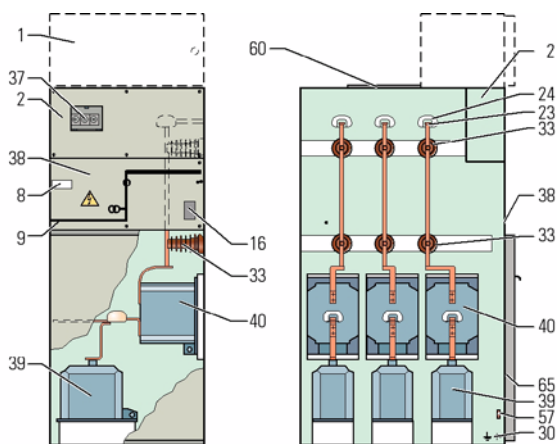


Fig. 6: Billing metering panel ME1

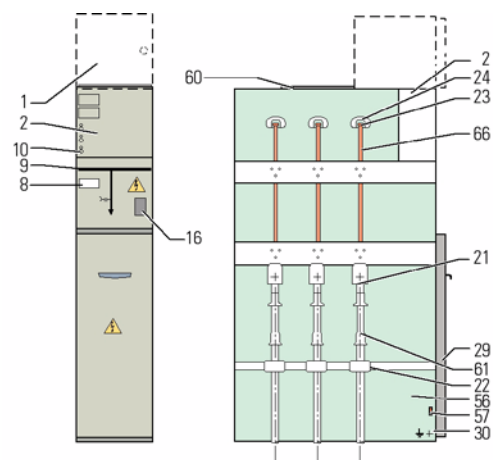


Fig. 7: Cable panel

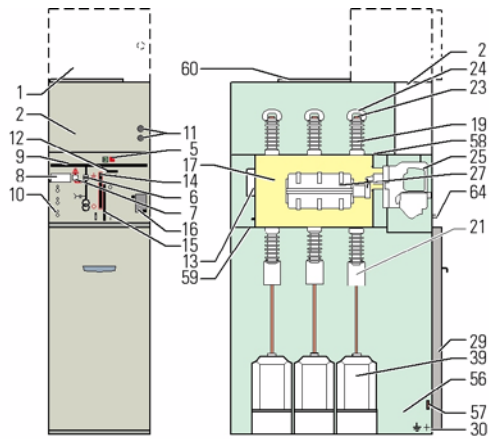


Fig. 8: Busbar voltage metering panel ME31

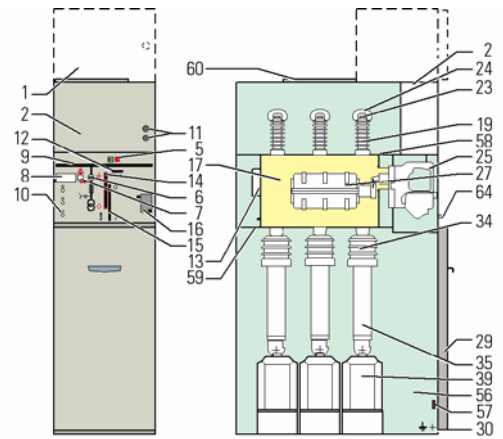


Fig. 9: Busbar voltage metering panel ME31-F with fuses

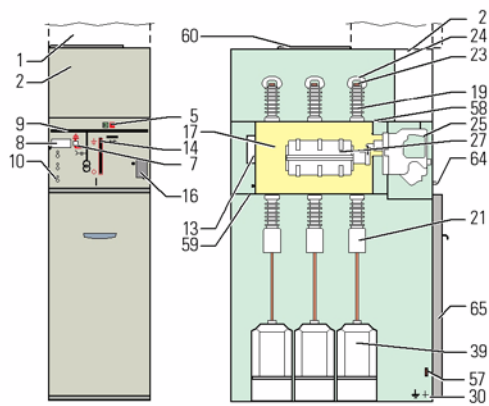


Fig. 10: Busbar earthing panel SE2 with transformers

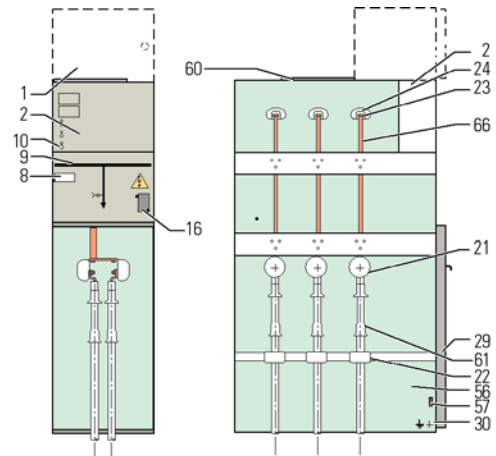


Fig. 11: Cable panel K1 with double cable connection

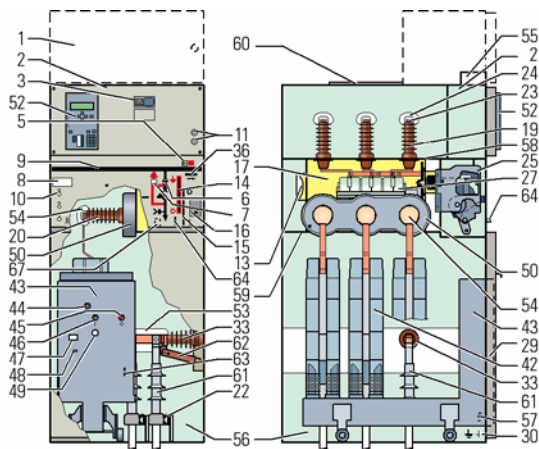


Fig. 12: Circuit-breaker panel LS31 with vacuum circuit-breaker 3AH6

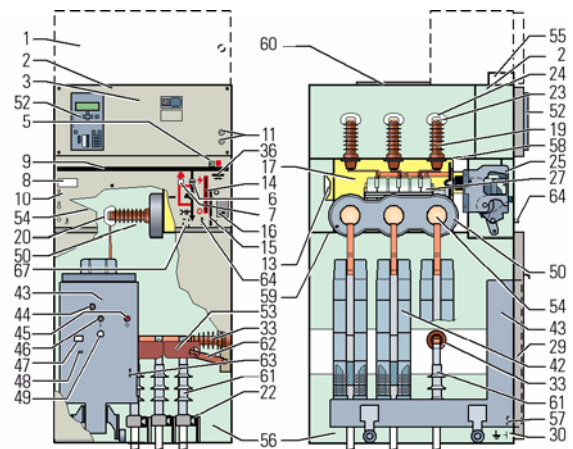


Fig. 13: Circuit-breaker panel LS32 with vacuum circuit-breaker 3AH6

## Legend to figs. 2 - 13

1	Option: Low-voltage compartment	41	3AH5 vacuum circuit-breaker, fixed-mounted
2	Niche for customer-side low-voltage equipment, cover can be unscrewed	42	3AH6 vacuum circuit-breaker, withdrawable
3	Option: CAPDIS voltage detecting system	43	Operating mechanism box
4	Option: Short-circuit/earth-fault indicator	44	Manual operation- for closing with manual operating mechanism- for emergency operation with motor operating mechanism
5	Option: Ready-for-service indicator for switching device		
6	Position indicator for load-break function "CLOSED-OPEN"	45	Mechanical "OFF" pushbutton
7	Position indicator for earthing function "OPEN-EARTHED"	46	Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
8	Feeder designation label	47	"Spring charged" indicator
9	Mimic diagram	48	Operations counter
10	Sockets for capacitive voltage detecting system	49	Position indication
11	Option: Momentary-contact rotary control switch "CLOSED - OPEN" for motor operating mechanism with local-remote switch for three-position switch	50	Option: Three-phase current transformer 4MC63 53
12	Option: Locking device for three-position switch	51	Option: Overcurrent protection relay SIPROTEC easy 7SJ45
13	Pressure relief device for switching device	52	Option: Multifunction protection relay SIPROTEC 4 7SJ62
14	Manual operation for the mechanism of the earthing function	53	Insulating cap/field control cap for cable connection
15	Manual operation for the mechanism of the load-break / disconnecting function	54	Insulating cap on bushing-type insulator
16	Rating and type plate	55	Option: Wiring duct, removable for control cables and/or bus wires
17	Gas-insulated vessel for switching device	56	Cable compartment
18	Interlocking of cable compartment cover	57	Earthing busbar
19	Bushing-type insulator for busbar	58	Metallic partition of busbar compartment
20	Bushing-type insulator for feeder	59	Metallic partition of cable compartment
21	Insulating sleeve	60	Busbar compartment cover for panel extension
22	Cable bracket with cable clamps (option) for fastening cables		
23	Busbar	61	Cable sealing end (not included in scope of supply)
24	Insulating cap on busbar	62	Option: Feeder earthing via make-proof earthing switch
25	Spring-operated mechanism for three-position switch-disconnector	63	or feeder earthing via vacuum circuit-breaker (=locking device for feeder earthed when circuit-breaker is in "CLOSED" position)
26	Spring-operated/stored-energy mechanism for three-position switch		
27	Three-position switch-disconnector		
28	Cable connection	64	Interlocking of cable compartment cover in circuit-breaker panels
29	Cable compartment cover	65	Cover for transformer connection compartment
30	Earthing connection (for location see dimension drawings)	66	Bus riser bar
31	Earthing switch for cable connection	67	Logical mechanical interlock between circuit-breaker "OPEN" and three-position switch (standard for panel types LS31, LT31 and LS32. Option for panel types LS11, LS11-U and LT11)
32	Inspection window		
33	Post insulator		
34	Insulating sleeve		
35	Option: HV HRC fuse-link		
36	Option only for panel types LS11... and LT11...: Logical mechanical interlock between of circuit-breaker "OPEN" and three-position switch-disconnector. Also locking device for three-position switch-disconnector		
37	Option: Secondary fuses		
38	Cover, screwed on		
39	4MR voltage transformer		
40	4MA7 block-type current transformer		

\* Illustrations without air guides (option) in the cable compartments



## 7 Components

For further information about modules or components of your SIMOSEC switchgear, please refer to the medium-voltage switchgear catalog HA 41.21.

### 7.1 3AH vacuum circuit-breaker

Siemens vacuum circuit-breakers are three-pole indoor circuit-breakers for rated voltages up to 24 kV.

The vacuum circuit-breakers are equipped with a trip-free mechanism.

#### 3AH5 and 3AH6 vacuum circuit-breakers

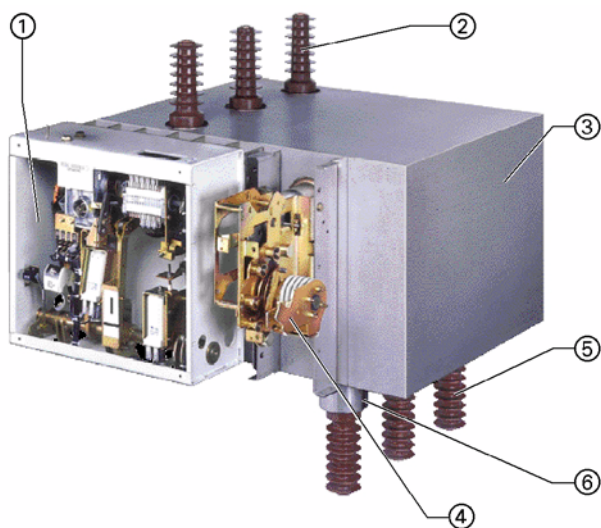


Fig. 14: 3AH5 vacuum circuit-breaker with operating mechanism box open

- ① Operating mechanism box of vacuum circuit-breaker
- ② Bushing-type insulator for busbar
- ③ Switchgear vessel, gas-filled, with 3AH5 vacuum circuit-breaker and three-position switch-disconnector
- ④ Spring-operated mechanism of three-position switch-disconnector
- ⑤ Bushing-type insulator for feeder
- ⑥ Mounting location for three-phase current transformer (option)



Fig. 15: 3AH6 vacuum circuit-breaker

- ⑦ Low-voltage connection cable
- ⑧ Logical mechanical interlock between three-position switch and 3AH6 vacuum circuit-breaker
- ⑨ Vacuum interrupter with upper and lower connection poles
- ⑩ Latch for de-earthing lock-out/Query for "CLOSED" position (option)(=locking device for feeder earthed when circuit-breaker is in "CLOSED" position)
- ⑪ Truck with single-sided lever mechanism for contact operation

**Features****3AH5 vacuum circuit-breaker**

- Fixed-mounted, metal-enclosed vacuum circuit-breaker
- Vacuum interrupters fixed-mounted in hermetically welded, gas-filled switchgear vessel
- System-conforming use with three-position switch-disconnector in gas-insulated switchgear vessel
- Operating mechanism arranged outside switchgear vessel and behind control board
- Three-position switch-disconnector coupled mechanically with the vacuum circuit-breaker through a logical interlock (option up to 630 A)
- Air-insulated primary terminals

**3AH6 vacuum circuit-breaker**

- Removable, air-insulated, lateral-mechanism vacuum circuit-breaker (withdrawable after loosening the associated contact connections and the fixing bolts)
- Circuit-breaker poles arranged one behind the other
- Operating mechanism in separate box behind the cable compartment cover
- De-earthing lock-out (option)
- Three-position disconnector coupled mechanically with the vacuum circuit-breaker through a logical interlock (standard for 1250 A)
- Air-insulated primary terminals

**Operating mechanisms**

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

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

Types of operating mechanisms for 3AH vacuum circuit-breakers:

- **Manual operating stored-energy mechanism with motor**

- for auto-reclosing (K)
- for synchronization and rapid transfer (U)

In the case of the manual operating stored-energy mechanism with motor, the closing spring is charged by means of a motor and latched in the charged position. After closing by means of the mechanical "ON" pushbutton or the closing solenoid, the closing spring is charged automatically for auto-reclosing.

- **Manual operating stored-energy mechanism**

- for auto-reclosing (K)

The closing spring is charged by means of the hand crank until latching of the closing latch is indicated. After closing by means of the mechanical "ON" pushbutton or the closing solenoid, the closing spring can be charged manually for auto-reclosing.

- **Manual spring-operated mechanism** (=spring-operated CLOSED, stored-energy OPEN)

- auto-reclosing (K) not possible
- for normal closing and
- for storing one opening operation

The closing spring is charged by means of the hand crank until the vacuum circuit-breaker closes. The vacuum circuit-breaker can be opened by means of the mechanical "OFF" pushbutton or electrically.

The operating mechanism of the 3AH vacuum circuit-breaker is designed for 10,000 operating cycles.

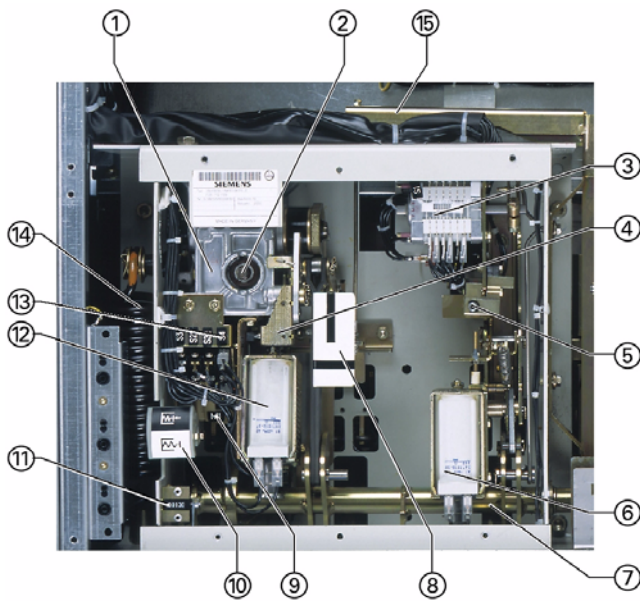


Fig. 16: Operating mechanism box for 3AH5 vacuum circuit-breaker

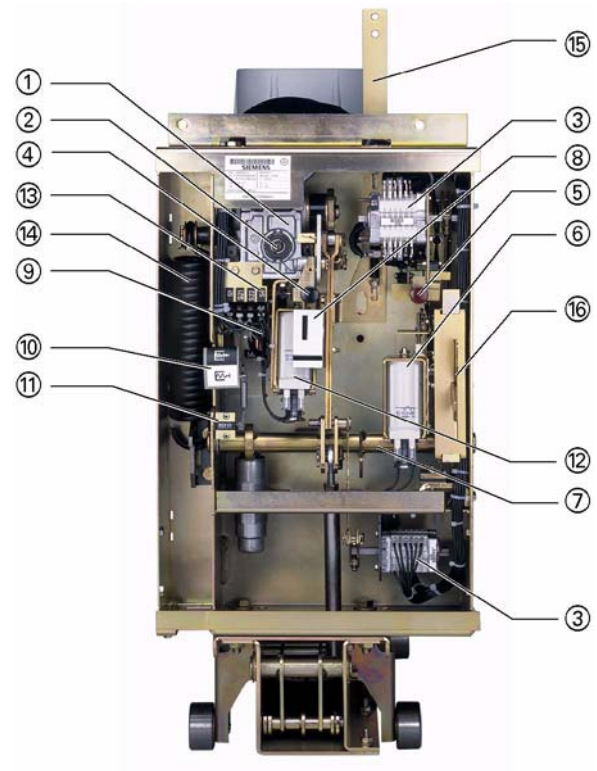


Fig. 17: Operating mechanism box for 3AH6 vacuum circuit-breaker

- |   |   |   |
|---|---|---|
| ① Gear box                                  | ⑦ Operating rod with contact pressure spring        | ⑬ Position switch S4  |
| ② Operation for charging the closing spring | ⑧ Position indicator                                | ⑭ Closing spring  |
| ③ Auxiliary switch                          | ⑨ Motor M1  | ⑮ Logical mechanical interlock between three-position switch and 3AH vacuum circuit-breaker |
| ④ Mechanical "ON" pushbutton                | ⑩ "Spring charged" / "Spring not charged" indicator | ⑯ Locking device for feeder earthed when circuit-breaker is in "CLOSED" position            |
| ⑤ Mechanical "OFF" pushbutton               | ⑪ Operations counter                                |   |
| ⑥ 1st release Y1                            | ⑫ Closing solenoid Y9                               |   |

**Equipment****The basic equipment consists of:**

- Manual spring-operated mechanism for closing
- Stored-energy OPEN with shunt release Y1
- Auxiliary switch S1 (6NO + 6NC)

**The additional equipment consists of:**

- Manual operating stored-energy mechanism for closing
- Closing solenoid Y9
- Auxiliary switch S1 (6NO + 6NC), 2nd auxiliary switch (6NO + 6NC)
- Position switch S4 for "Closing spring charged" indication
- Circuit-breaker tripping signal, cutout switches S6, S7
- Operations counter
- Shunt release 3AX 1101<sup>1)</sup> Y2
- Current-transformer operated release 3AX 1102<sup>1)</sup> Y4
- Undervoltage release 3AX 1103<sup>1)</sup> Y7
- Current-transformer operated release 3AX 1104<sup>1)</sup> Y6
- Varistor circuit
- Mechanical interlocking (basic equipment for 1250 A)
- Wiring of electrical equipment to low-voltage connection cable with 10-pole module plugs

<sup>1)</sup> Additionally to or instead of the series shunt release Y1, 3AH vacuum circuit-breakers can be equipped with max. 1 release type 3AX 11... .

**7.2 Three-position switch-disconnector**

The three-position switch-disconnector is designed to break normal currents up to 630 A and to earth the feeder circuit of the panel (see Page 95, "Operating the three-position switch").

For further information about the three-position switch-disconnector, please refer to catalogs HA 40.1/HA 41.21.

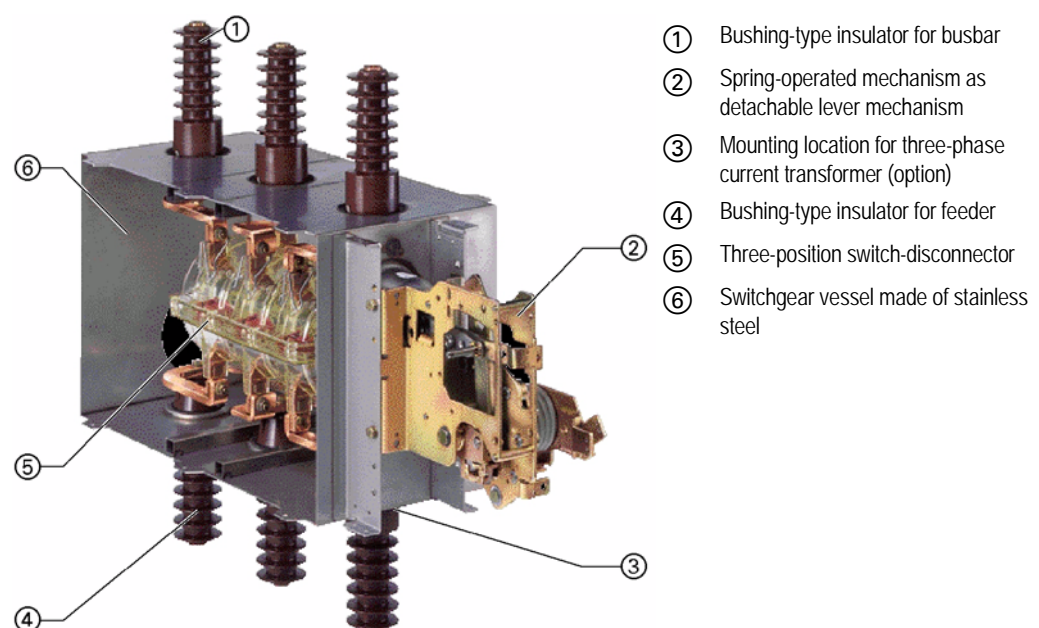


Fig. 18: Three-position switch-disconnector 630 A

**Mode of operation** The three-position switch-disconnector combines the functions of a switch-disconnector and a make-proof earthing switch. Make-proof earthing switches are earthing switches with short-circuit making capacity.

The switch shaft with the moving contact pieces rotates inside the chamber containing the fixed contact pieces. Compression vanes, which rotate in conjunction with the switch shaft, divide the arcing chamber into two subchambers, each of which changes in conjunction with the rotation. During the switching movement, the compression vanes generate a pressure difference between the subchambers. The SF<sub>6</sub> gas flows through a nozzle, causes a directional blow-out of the breaking arc and quenches it rapidly. Interlocking is not necessary as the "CLOSED" and "EARTHED" functions cannot be implemented simultaneously.

- Features**
- Switch-disconnector
  - Metal-enclosed, with gas-insulated, maintenance-free quenching principle
  - No external cross insulation between phases
  - Designed as a multi-chamber switch with the functions:
    - Switch-disconnector and
    - Make-proof earthing switch
  - Three-position switch-disconnector with air-insulated primary connections for busbar and feeder
  - Operation via rocker welded gas-tight in the front of the switchgear vessel
  - Hermetically welded, gas-tight stainless-steel vessel
  - Up to 630 A

- Equipment**
- **Shunt release (F-release)** (option)

Spring-operated/stored-energy mechanisms can be equipped with a shunt release. Remote electrical switching off / tripping of the three-position switch-disconnector is possible via the magnetic coil, e.g. transformer overtemperature tripping. For protection against thermal overload in case of a continuous signal, the shunt release is deactivated by means of an auxiliary switch which is coupled mechanically with three-position switch-disconnector, or, in versions without auxiliary switch, by means of a signaling switch.

- **Auxiliary switch** (option)

Each operating mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary switch for the position indication.

- 2NO + 1NC for "CLOSED/EARTHED"
- 2NO for "OPEN"

### 7.3 Three-position disconnecter

The three-position disconnecter is designed for normal currents up to 1250 A. With the three-position disconnecter, the feeder circuit of the panel is earthed (see Page 95, "Operating the three-position switch").

For further information about the three-position disconnecter, please refer to catalogue HA 41.21.

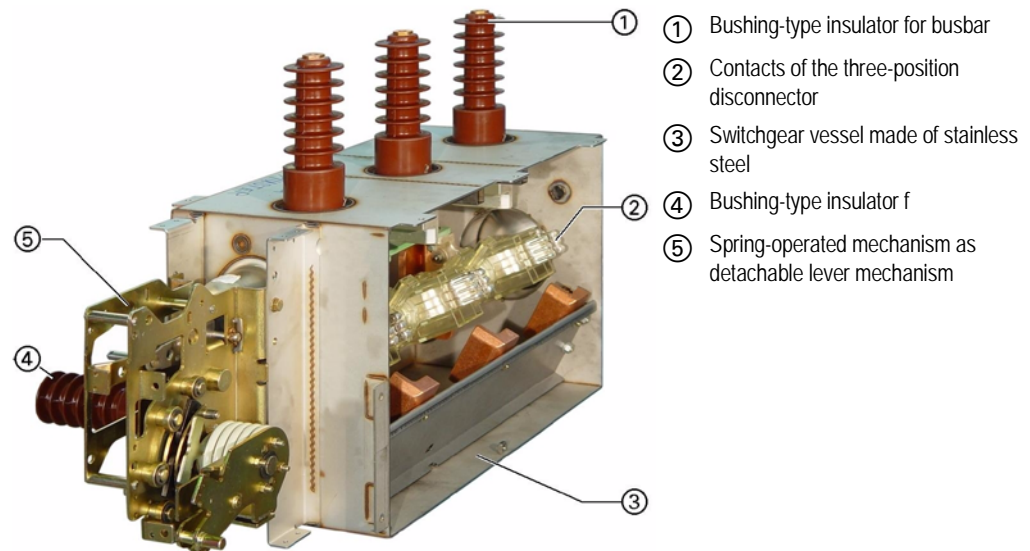


Fig. 19: Three-position disconnecter 1250 A

**Mode of operation** The three-position disconnecter combines the functions of a disconnecter and an earthing switch. The three-position disconnecter has no making capacity.

- Features**
- Disconnecter
  - Metal-enclosed, gas-insulated
  - No external cross insulation between phases
  - Designed as a three-position disconnecter with the functions:
    - Disconnecter and
    - Earthing switch
  - Three-position disconnecter with air-insulated primary connections for busbar and feeder
  - Operation via rocker welded gas-tight in the front of the switchgear vessel
  - Hermetically welded, gas-tight stainless-steel vessel
  - Up to 1250 A

**Equipment** • **Auxiliary switch** (option)

Each operating mechanism of the three-position disconnecter can be optionally equipped with an auxiliary switch for the position indication.

- 2NO + 1NC for "CLOSED/EARTHED"
- 2NO for "OPEN"

## 7.4 Cable feeder earthing switch

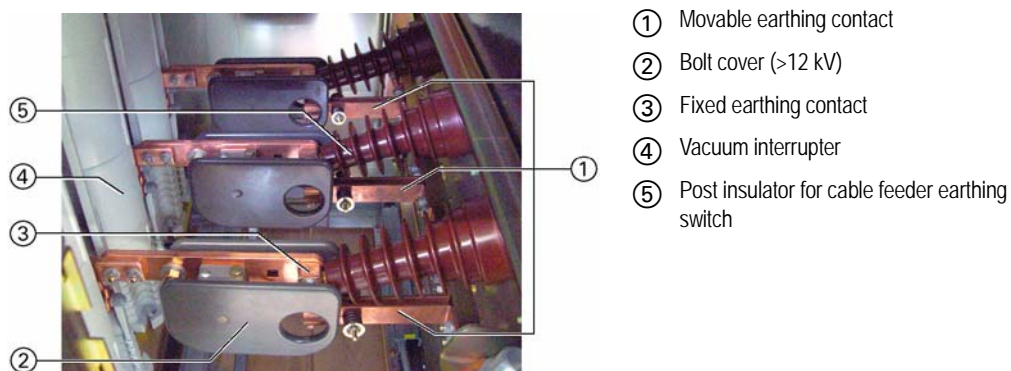


Fig. 20: Cable feeder earthing switch (EARTHED position)

**Mode of operation** The cable feeder earthing switch is operated when the three-position switch is operated. The cable feeder earthing switch has a short-circuit making capacity.

**Equipment** • **Auxiliary switch** (option)

For electrical indication of the position of the cable feeder earthing switch.

- 2NO + 1NC for "EARTHED"
- 2NO for "OPEN"



## 7.5 Operating mechanisms for the three-position switches

The mechanisms of the three-position switch-disconnector for normal currents up to max. 630 A and of the three-position disconnector for normal currents up to max. 1250 A are operated in the same way. In this section, the operating mechanisms for the three-position switches are described. For differences to be observed during operation (see Page 92, "To be observed for operation").

The operating mechanism box of the panel accommodates all electrical and mechanical control elements required for closing and opening the three-position switch.

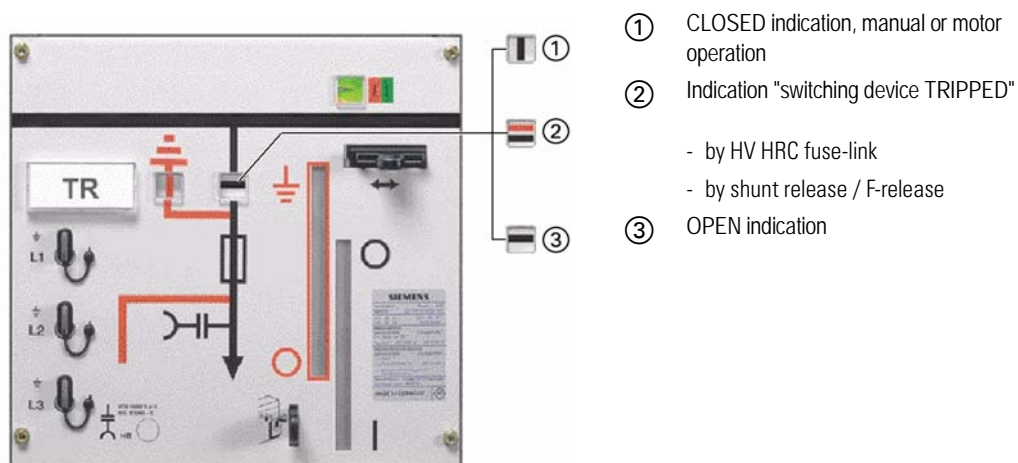
Types of operating mechanisms for the three-position switch:

- **Manual spring-operated mechanism**

- The spring-operated mechanism is used for the three-position switches. Switching movements are executed independently of the operating speed.

- **Manual spring-operated/stored-energy mechanism**

- The spring-operated/stored-energy mechanism is used for three-position switch-disconnectors in transformer feeders (as transformer switch). Switching movements are executed independently of the operating speed. An energy store is available to trip the switch by means of an operating HV HRC fuse-link or a shunt release (f-release). The energy store requires no additional charging process. It is already charged while switching from the "TRIPPED" to the "OPEN" position. To make sure that the switch-disconnector/fuse combination trips safely, the operating mechanism must be switched to the "EARTHED" position. After tripping (e. g. by means of the striker of the HV HRC fuse or the shunt release) the position indicator of the switch-disconnector shows a black and additionally a red bar.



- **Motor operating mechanism** (option)
  - Remote operation applied to terminals (standard)
  - Local operation by means of momentary-contact rotary control switch (option)
  - Local-remote switch as momentary-contact rotary control switch (option)

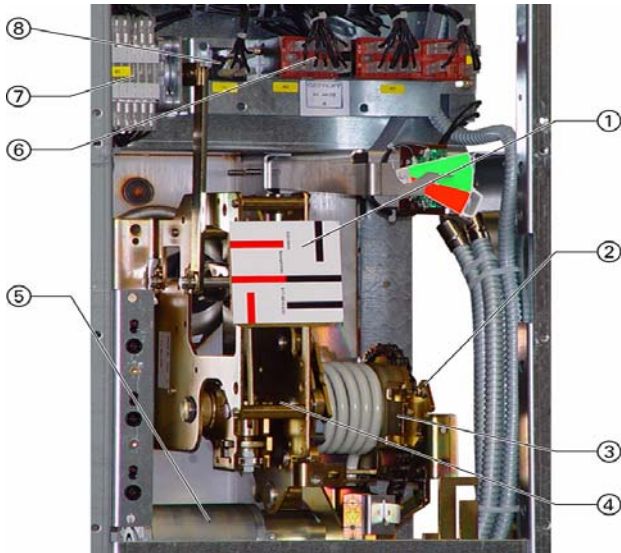


Fig. 21: Operating mechanism box of spring-operated mechanism in ring-main panel

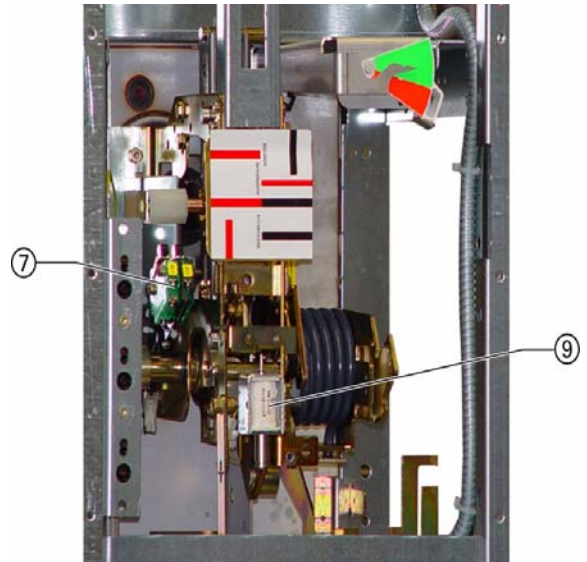
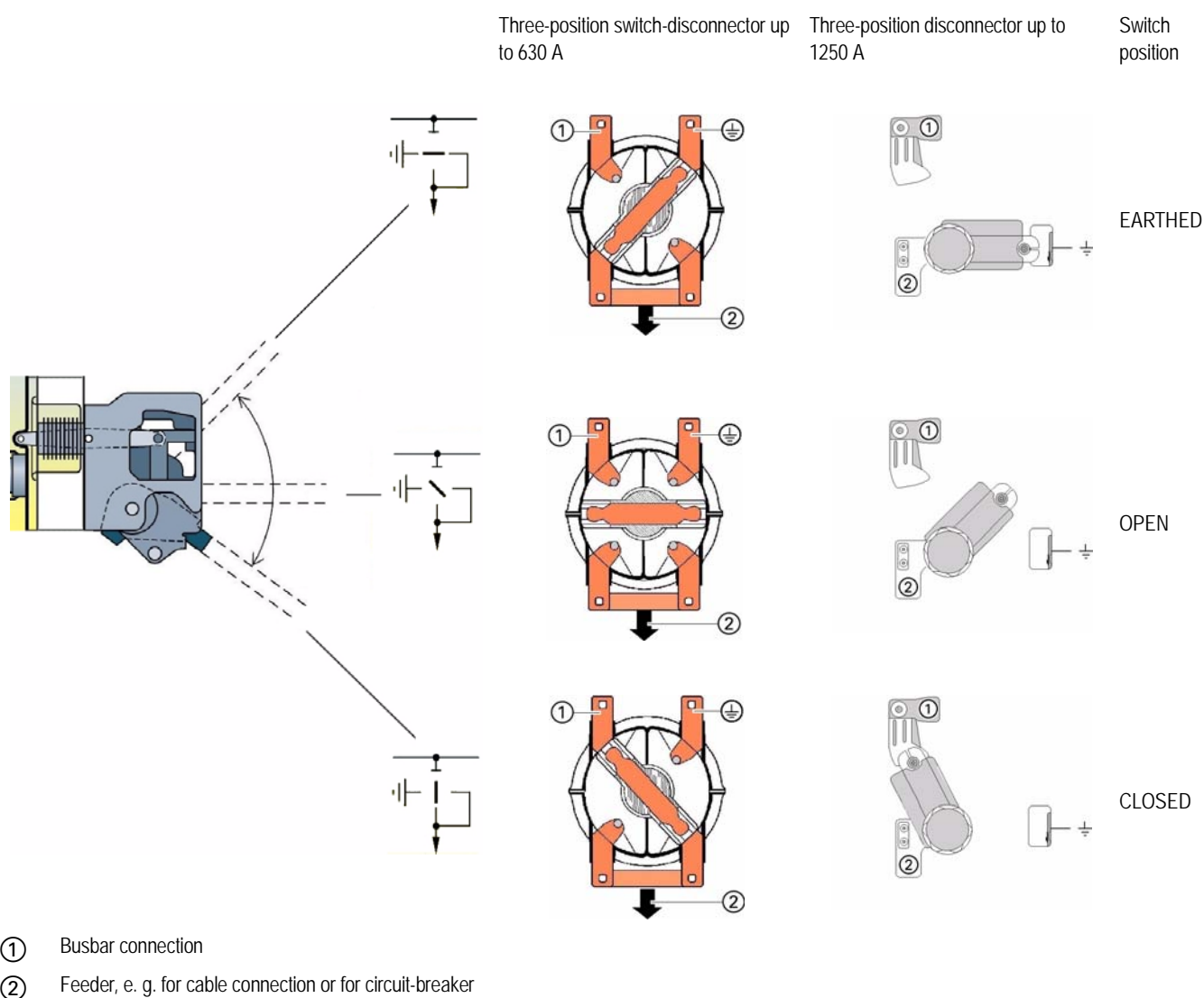


Fig. 22: Operating mechanism box of spring-operated/stored-energy mechanism in transformer panel

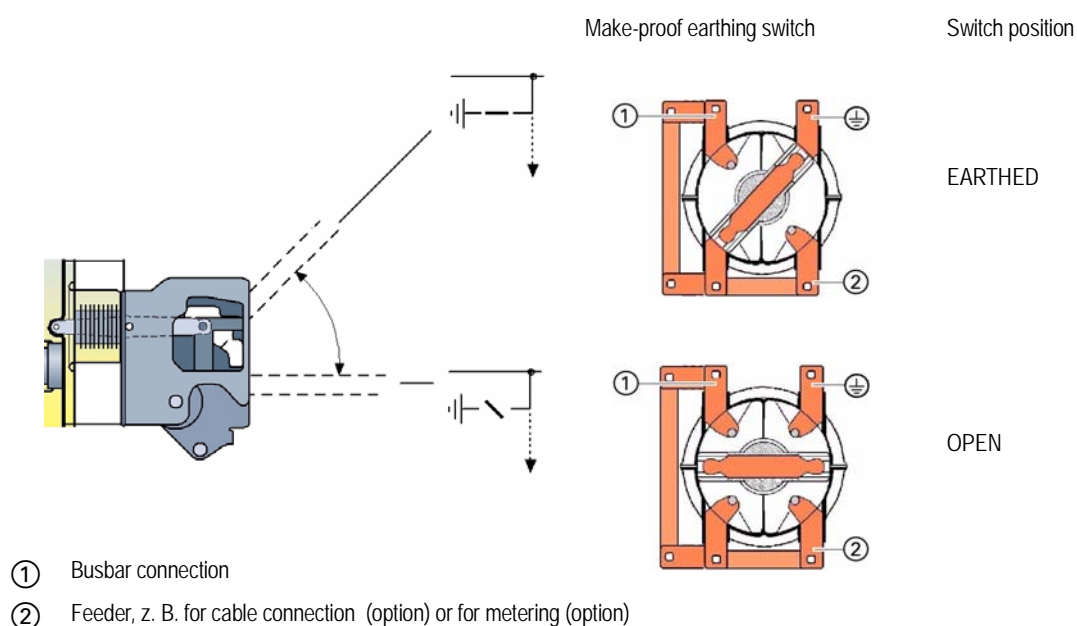
- ① Position indicator (mechanical)
- ② Manual operation of detachable lever mechanism for the load-break / disconnecting function
- ③ Manual operation of detachable lever mechanism for the earthing function
- ④ Operating mechanism for three-position switch-disconnector with optional motor operating mechanism
- ⑤ Motor operating mechanism

- ⑥ Auxiliary contactors of motor operating mechanism
- ⑦ Auxiliary switch
- ⑧ Rectifier
- ⑨ Shunt release

## Switch positions of the three-position switch



## Switch-positions of the make-proof earthing switch



## 7.6 Current and voltage transformers

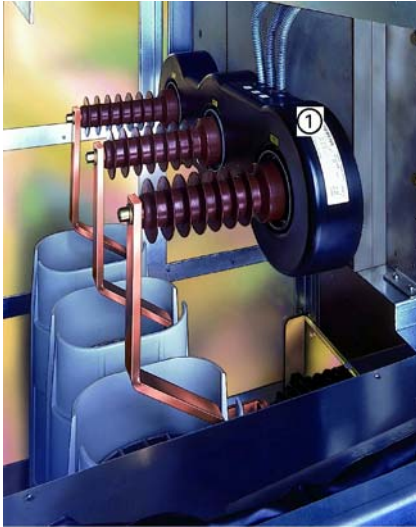


Fig. 23: Three-phase current transformer 4MC63 53 on the bushings of the three-position switch



Fig. 24: Cable-type current transformer on the cable at the panel connection



Fig. 25: Block-type current transformers and voltage transformers in the billing metering panel

- ① 4MC63 53 three-phase current transformer
- ② 4MC70 33 cable-type current transformer

- ③ 4MA7 block-type current transformer
- ④ 4MR voltage transformer 4MR

### 4MC63 three-phase current transformer

- Designed as a three-phase, galvanically separated ring-core current transformer on the bushings of the three-position switch-disconnector
- Free of dielectrically stressed cast-resin parts (due to design)
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip inside the panel
- Factory-assembled
- **Option:** Three-phase current transformer for protection equipment based on c.t. operation:
  - 7SJ4 protection relay as definite-time overcurrent protection
  - Definite-time overcurrent protection relay, make SEG, type WIP 1

### 4MC70 33, 4MC70 31 cable-type current transformers and 4MC70 32 bus-type current transformer

- Designed as a single-pole ring-core current transformer
- Free of dielectrically stressed cast-resin parts (due to design)
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip inside the panel

### 4MA7 block-type current transformer / 4MR voltage transformer

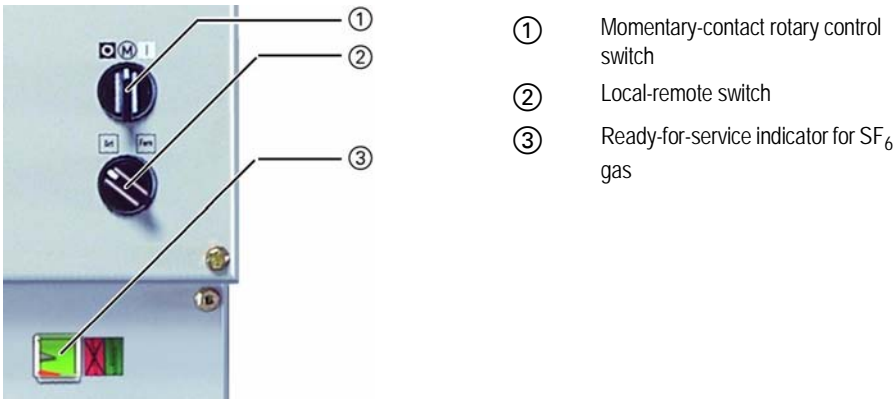
- Dimensions according to DIN 42 600 Part 8
- Designed as a single-pole indoor block-type current transformer
- Designed as a single-pole indoor voltage transformer
- Cast-resin insulated
- Secondary connection by means of screw-type terminals

7.7 Protection and control equipment

Protection and control equipment is supplied according to the customer's specifications. The devices are installed in the low-voltage compartment and/or in the low-voltage niche. For details please refer to the relevant schematic diagrams.

**Mimic diagram** The mimic diagram on the operating front corresponds to the switching functions of the panel.


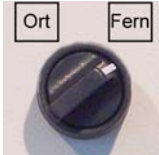
**Local-remote switch (option)** The local-remote switch determines the location from which the three-position switch can be motor-operated.



- ① Momentary-contact rotary control switch
- ② Local-remote switch
- ③ Ready-for-service indicator for SF<sub>6</sub> gas




Fig. 26: Control board section

The local-remote switch latches tight in the corresponding switch position.

	
LOCAL position: Local operation by motor	REMOTE position: Remote operation from the control room/monitoring station by motor

**Momentary-contact rotary control switch (option)** The three-position switch is CLOSED-OPENED locally with its motor operating mechanism. This function is only active when the local-remote switch is in the "LOCAL" position.

The momentary-contact rotary control switch operates in non-maintained command mode and returns to the central position (M position) automatically.

		
OPEN	CENTRAL POSITION	CLOSE



### Bay controller (option)



Fig. 27: Low-voltage compartment with SIPROTEC4 bay controller

For operation and equipment of the bay controller (e.g. SIPROTEC4), please refer to the manufacturer's documentation.

### 7.8 HV HRC fuse assembly

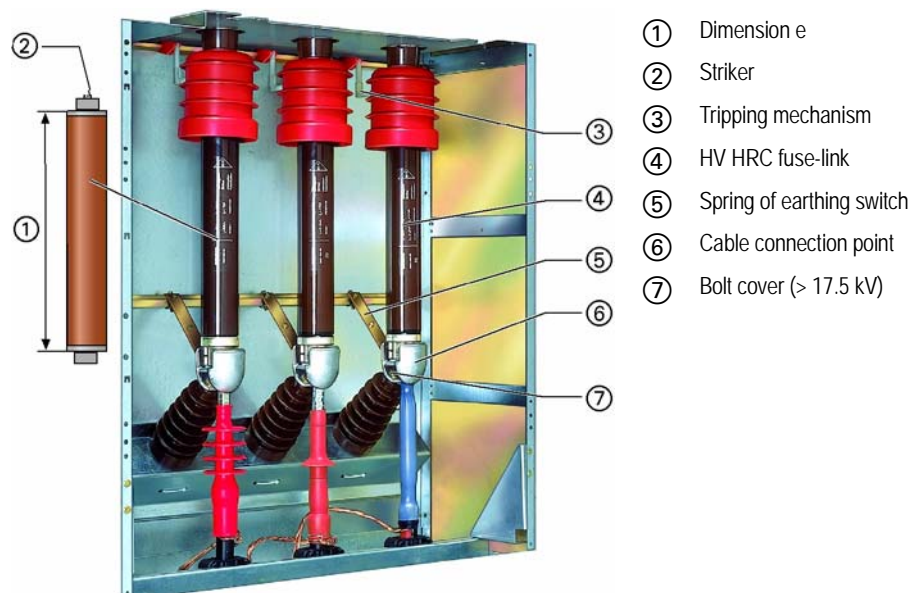


Fig. 28: HV HRC fuse-links in transformer panel

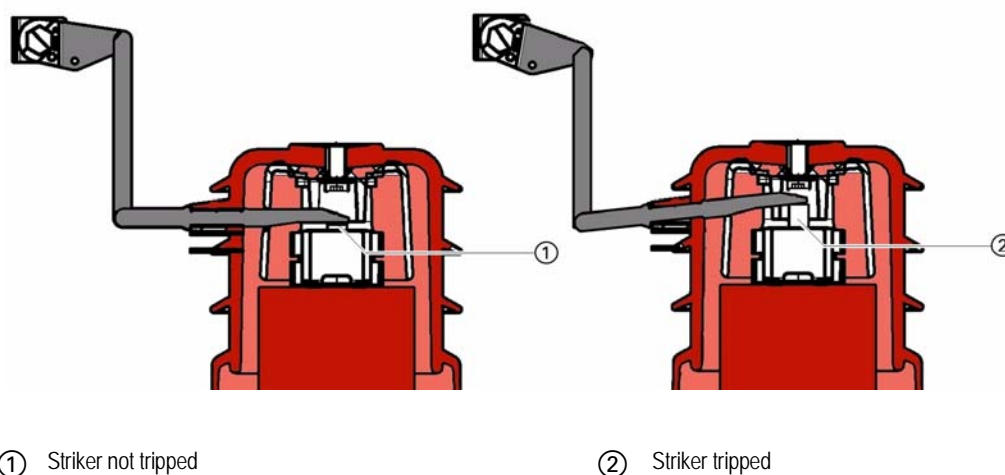
The HV HRC fuse assembly protects downstream cable runs and/or further switchgear components at the panel feeder.

### Features

- HV HRC fuse-links according to DIN 43 625 (main dimensions) with striker in "medium" version (see Page 48, "Selection of HV HRC fuse-links")
- Requirements of IEC 62 271-105 met by the combination of HV HRC fuse-links with the three-position switch-disconnector
- Thermal striker tripping when the corresponding HV HRC fuse-link is used
- Dimension e=292 mm (standard at 12 kV)
- Dimension e=442 mm at >12 kV and up to 24 kV prepared at the factory
- Fuse replacement is only possible when the feeder is earthed
- Option: When the cable compartment cover is removed, it is not possible to switch from the "EARTHED" position to the "OPEN" position
- Bolt covers for > 17.5 kV
- Option: Shunt release at the operating mechanism of the three-position switch-disconnector
- Option: "TRIPPED" indication" of the fuse in the transformer feeder (transformer switch) via remote electrical indication with a normally-open contact (1NO)

### Principle of fuse tripping

In the event that a HV HRC fuse-link has tripped (striker tripped), the three-position switch-disconnector of the transformer feeder is tripped via an articulation provided at the upper fuse contact.



## 7.9 Interlocks

### Switching gate of the three-position switch

The switching gate of the three-position switch prevents switching straight from "CLOSED" to "EARTH" resp. from "EARTH" to "CLOSED", as the operating lever must be re-inserted in the "OPEN" position.

### Logical mechanical interlock between 3AH5 or 3AH6 vacuum circuit-breaker and three-position switch

The three-position switch can only be operated when the vacuum circuit-breaker is in the "OPEN" position.



The switching gate of the three-position switch can only be released if the interlocking lever can be pulled upwards (3AH5) or to the left/right (3AH6). This is only possible when the circuit-breaker (3AH5 or 3AH6) is in the OPEN position.



Fig. 29: ① Interlocking lever for 3AH5 ② Interlocking lever for 3AH6

#### Interlocking of cable compartment cover

The cable compartment covers can only be removed when the associated feeder is earthed (see Page 126, "Removing the cable compartment cover").



Fig. 30: Interlocking of cable compartment cover (cable compartment cover removed in earthed circuit-breaker panel)

#### Cable compartment cover, screwed on


Screwed-on cable compartment covers may only be removed if the Five Safety Rules of Electrical Engineering are fulfilled (see Page 126, "Removing the cable compartment cover").

#### De-earthing lock-out at the three-position switch (option)

If the cable compartment cover is removed, the three-position switch of the transformer panel cannot be "DE-EARTHED".

#### Lock-in on 3AH6 vacuum circuit-breaker

When the three-position switch is earthed, the 3AH6 vacuum circuit-breaker is equipped with a lock-in facility for the CLOSED position if there is no separate earthing switch mounted at the cable feeder. If the cable compartment cover of the circuit-breaker panel (panel types LS11 / LS11-U / LT11 / LS31 / LS31-U / LT31 / LS32) is open, the CLOSED position of the 3AH6 vacuum circuit-breaker must be protected (locked) against unintentional opening.

	<b>NOTE!</b>
	The cable compartment cover can only be removed when:  ⇒ The three-position switch is in "EARTHED" position <b>and</b> ⇒ The 3H6 vacuum circuit-breaker is in "CLOSED" position.


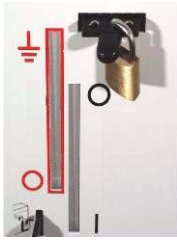
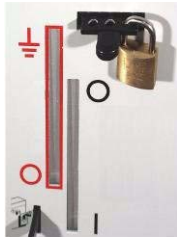
**Closing lock-out (option)**

If the cable compartment cover is removed, the three-position switch cannot be switched to the "CLOSED" position.

**Locking device**

**(Standard for three-position disconnecter, optional for switch-disconnector/make-proof earthing switch)**

The switching gate of the three-position switch-disconnector and the three-position disconnecter can be locked in all three switch positions.

		
EARTHING / DE-EARTHING	SWITCHING NOT POSSIBLE	OPENING/CLOSING the three-position switch

**7.10 Busbars**



Fig. 31: Busbar compartment (>12 kV)

**Features**

- Metal-clad busbar compartment
- Busbars bolted from panel to panel
- Versions:
  - Rated normal current 630 A / 1250 A
  - Rated operating voltage 12 kV / 24 kV

## 7.11 Cable connection

### Features

- Elbow couplings for cable sealing ends arranged one behind the other
- Uniform cable connection height per panel (see dimension drawings)
- With cable bracket and earthing points for cable shields
- Access to the cable compartment only if feeder has been earthed

### Features for ring-main feeder / circuit-breaker feeder / cable feeder

- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables
- For connection cross-sections\* up to 300 mm<sup>2</sup>
- Cable routing downwards

### Features for transformer feeder

- For thermoplastic-insulated cables
- For connection cross-sections\* up to 120 mm<sup>2</sup> (standard)
- Cable lug with a max. width of 32 mm
- For rated normal currents up to 200 A

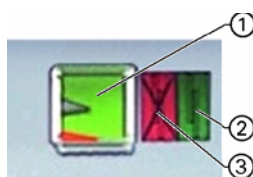
Applicable cable types are described in Section "Cable sealing ends" (see Page 56, "Cable sealing ends").

Installation of high-voltage cables is described specifically for each panel (see Page 77, "Connecting high-voltage cables").

\* Larger connection cross-sections on request.

## 7.12 Ready-for-service indicator for SF<sub>6</sub> gas

The ready-for-service indicator for SF<sub>6</sub> gas shows the gas density in the three-position switch required to operate the panel.



- ① Indication of operating state
- ② Green area: Panel ready for operation
- ③ Red area: Panel not ready for operation **DO NOT SWITCH!**

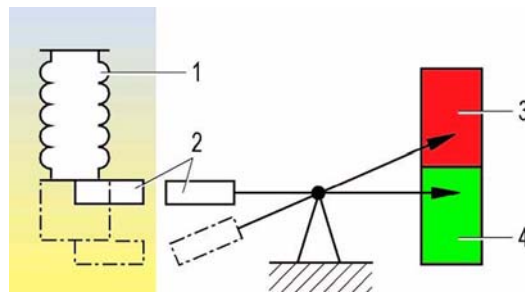
If a three-position switch filled with SF<sub>6</sub> gas is not ready for operation, then:

- Do not put the switchgear into operation
- Do not operate the switchgear
- Inform the Siemens representative.

### Features

- Self-monitoring, easy to read
- Independent of temperature and outside pressure variations
- Only responds to changes in gas density
- Option: Alarm switch 1 NO + 1 NC for remote electrical indication

## Mode of operation



Principle of gas monitoring with ready-for-service indicator

- ① Measurement box in filled stainless-steel vessel
- ② Magnetic coupling
- ③ Red indication: not ready for service
- ④ Green indication: ready for service

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

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

While changes in the gas density during the loss of gas, which are decisive for the insulating capacity, are displayed, changes in the gas pressure dependent on temperature and external pressure variations are not. The gas in the measurement box has the same temperature as that in the switchgear.

The temperature effect is compensated via the same pressure change in both gas volumes.

### 7.13 Voltage detecting systems

Voltage detecting systems are provided for verification of safe isolation from supply.

Regular tests of the voltage detecting systems are performed by the switchgear operator and documented in the identification field.

Voltage detecting systems according to IEC 61243-5 and EN 61243-5 (VDE 0682-415) with:

- HR system (standard)
- LRM system (option)
- Integrated voltage detecting system CAPDIS-S1 +/- S2+ (option)

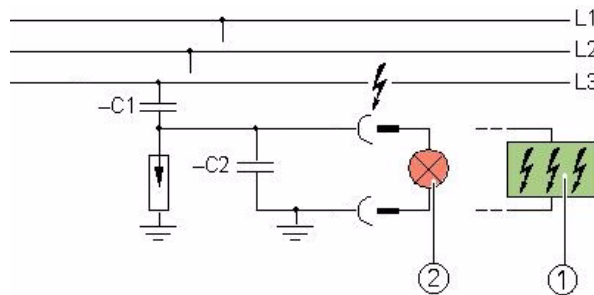


Fig. 32: Voltage detecting system via capacitive voltage divider (principle)

- ① CAPDIS, fixed-mounted
- ② HR/LRM indicator, plugged in

- -C1: capacity integrated into bushing or post insulator
- -C2: capacity of the connection leads and of the voltage indicator to earth

#### HR/LRM system

The control board section of the three-position switch-disconnector contains:

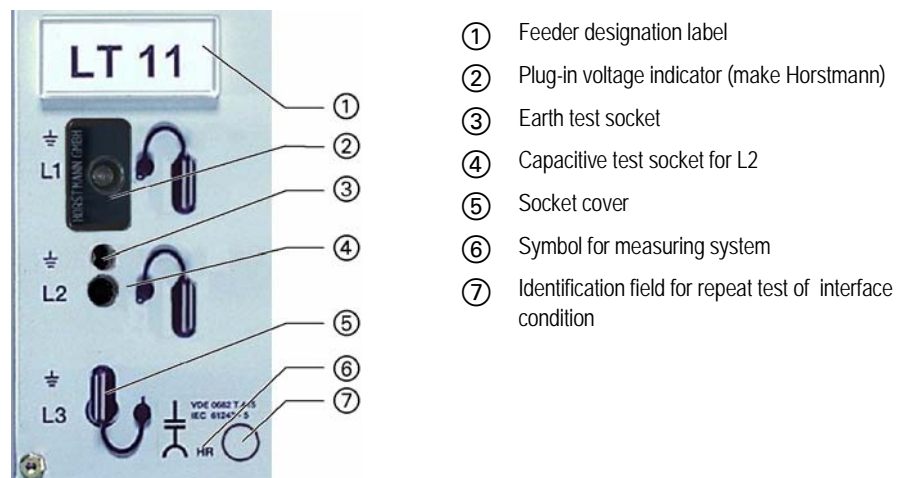


Fig. 33: Control board section: Sockets for capacitive voltage detecting system

#### Features of HR/LRM system

- Verification of safe isolation from supply phase by phase by insertion in each socket pair
- Voltage indicator flashes if high voltage is present
- Measuring system and voltage indicator can be tested
- Without auxiliary power

- Maintenance free
- Integrated repeat test of the interfaces (self-monitoring)
- Without auxiliary power
- Option: CAPDIS S2+ with remote indication of voltage state (auxiliary power required)
- With test sockets (LRM system) for phase comparison behind the cover

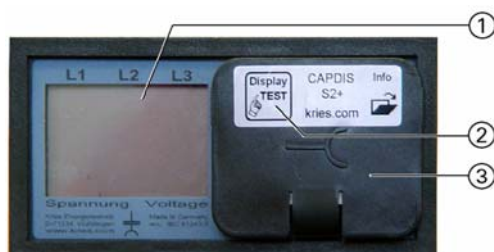






Fig. 34: CAPDIS-S2+: Cover closed

Fig. 35: CAPDIS-S2+: Cover open

- |   |                       |   |                   |
|---|-----------------------|---|-------------------|
| ① | LC display            | ⑤ | Test socket L2    |
| ② | Button "Display Test" | ⑥ | Test socket L3    |
| ③ | Cover                 | ⑦ | Earthing socket   |
| ④ | Test socket L1        | ⑧ | Short instruction |

### Display of CAPDIS -S1+/-S2+

CAPDIS-S1+			CAPDIS-S2+		
L1	L2	L3	L1	L2	L3
			Operating voltage not present (CAPDIS-S2+)		
			Operating voltage present		
			- Operating voltage not present - Auxiliary power not present (CAPDIS-S2+)		
			Earth fault or failure in phase L1, operating voltage at L2 and L3		
			Voltage ( <b>not</b> operating voltage) present		
			Indication "Device-Function-Test" passed		
			Indication "ERROR", e.g. in case of missing auxiliary voltage (CAPDIS-S2+)		

7.14 Short-circuit/earth-fault indicator (option)

All ring-main feeders can **optionally** be 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
  - Optical signals when a pre-selected pickup value is exceeded
  - Option: remote electrical indication via passing contact (changeover contact), connected to terminals (rear side of device).

Selection of short-circuit/earth-fault indicators

Make Horstmann <sup>1)</sup>



Fig. 36: Alpha E indicator

Indicator type	Reset	Short-circuit current <sup>2)</sup> [A]	Earth-fault current <sup>3)</sup> [A]
ALPHA M	manually	400, 600, 800, 1000	–
ALPHA E	manually/automatically after 2 or 4 h	400, 600, 800, 1000	–
GAMMA 4.0 <sup>3)</sup>	manually/after return of power supply/after 2 or 4 h	400, 600, 800, 1000	–
ALPHA automatic	manually (by pushbutton), remote reset (by auxiliary voltage), automatically after 3 h	Change of current DI= 150 A – 300 A (depending on the load current) at t=20 ms	–
Earth-fault/short-circuit indicator			
EKA - 3 <sup>3)</sup>	after return of power supply	450	40, 80, 160
DELTA M	manually	400, 600, 800, 1000	200
DELTA E	manually, automatically after 2 or 4 h	400, 600, 800, 1000	200
Earth-fault indicator			
EKA - 3/1 <sup>3)</sup>	after return of power supply	–	40, 80, 160

<sup>1)</sup> Further types and other makes available on request.  
<sup>2)</sup> Standard values. Other values on request.  
<sup>3)</sup> External auxiliary voltage AC 240 V required.



### 7.15 Accessories

#### Standard accessories:

- SIMOSEC documentation (operating and installation instructions)
- Operating lever for three-position switch/make-proof earthing switch
- Hand crank for 3AH vacuum circuit-breaker

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

- HV HRC fuse-links
- Cable plugs / adapter systems
- Surge arresters
- Test fuses for mechanical simulation of the striker of HV HRC fuse-links in transformer feeders



Fig. 37: Test fuse with extension tube

- HR/LRM voltage indicators
- Test units to check the capacitive interface and the voltage indicators (e.g. make Horstmann).



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



## 8 Technical data

### 8.1 Electrical data, pressure values, temperature

The technical data of your switchgear/panels are shown on the rating plate.

Complete switchgear															
Rated insulation level	Rated voltage $U_r$	[kV]	7.2		12		15		17.5		24				
	Rated short-duration power-frequency withstand voltage $U_d$		20		28		35		38		50				
	Rated lightning impulse withstand voltage $U_p$		60		75		95		95		125				
Rated frequency $f_r$		[Hz]	50/60												
Rated normal current $I_r$ <sup>1)</sup> of busbar	Standard	[A]	630												
	Option		1250												
Rated short-time withstand current $I_k$	for switchgear with $t_k = 1$ s	up to [kA]	20	25	20	25	16	20	25	16	20	25	16	20	
	for switchgear with $t_k = 3$ s		20	---	20	---	---	20	---	---	20	---	---	20	
Rated peak withstand current $I_p$			50	63	50	63	40	50	63	40	50	63	40	50	
Rated filling level $p_{re}$ <sup>2)</sup>	for insulation	[hPa] at 20 °C	1500												
Min. functional level $p_{me}$ <sup>2)</sup>	for insulation		1300												
Ambient air temperature T	for panels without secondary equipment	[°C]	-25 to +55												
	for panels with secondary equipment		-5 to +55												

Ring-main panel type RK; cable connection panel type K															
Rated voltage U <sub>r</sub>		[kV]	7.2	12	15	17.5	24								
Rated normal current I <sub>r</sub> <sup>1)</sup>	for feeder and transfer, panel type RK	[A]	630												
	for feeder, panel type K		630												
Rated short-circuit making current I <sub>ma</sub>		up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50	

Transformer panel type TR															
Rated voltage U <sub>r</sub>	[kV]	7.2	12	15	17.5	24									
Rated normal current I <sub>r</sub> <sup>1)</sup> for feeder <sup>3)</sup>	[A]	200													
Rated peak withstand current I <sub>p</sub> <sup>3)</sup>	up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50		
Rated short-circuit making current I <sub>ma</sub> <sup>3)</sup>		50	63	50	63	40	50	63	40	50	63	40	50		
Dimension "e" for HV HRC fuse-links	[mm]	292	292	442											

Circuit-breaker panel type LS														
Rated voltage U <sub>r</sub>		[kV]	7.2	12	15	17.5	24							
Rated normal current I <sub>r</sub> <sup>1)</sup>	for feeder and transfer, panel types LS1 and LS1-U with 3AH5	[A]	630											
	for feeder and transfer, panel types LS11 and LS11-U with 3AH6		630											
	for feeder and transfer, panel types LS31, LS32 and LS31-U with 3AH6		up to 1250											
Rated short-circuit making current I <sub>ma</sub>		up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50
Rated short-circuit breaking current I <sub>sc</sub> for 3AH vacuum circuit-breaker			20	25	20	25	16	20	25	16	20	25	16	20
Electrical endurance for 3AH vacuum circuit-breaker	- at rated normal current I <sub>r</sub>		10.000 operating cycles											
	- at rated short-circuit breaking current I <sub>sc</sub>		50 breaking operations											
			35 breaking operations with 3AH6 at 25 kA											

Busbar earthing panel type SE													
Rated voltage U <sub>r</sub>	[kV]	7.2		12		15			17.5			24	
Rated short-circuit making current I <sub>ma</sub>	up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50

Busbar voltage metering panel types ME3 and ME31-F														
Rated voltage U <sub>r</sub>	[kV]	7.2		12		15			17.5			24		
Rated peak withstand current I <sub>p</sub> <sup>3)</sup>	up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50	
Rated short-circuit making current I <sub>ma</sub> <sup>3)</sup>		50	63	50	63	40	50	63	40	50	63	40	50	
Dimension "e" in panel type ME31-F	[mm]	292												

Billing metering panel type ME1							
Rated voltage U <sub>r</sub>		[kV]	7.2	12	15	17.5	24
Rated normal current I <sub>r</sub> <sup>1)</sup>	for transfer, panel type ME1 and panel type ME1-H	[A]	630, 1250				
	for feeder as cable connection panel, panel type ME1-K						
	for busbar connection, panel type ME1-S						
	for bus riser panel, panel type HF						

Bus sectionalizer panel type LT														
Rated voltage U <sub>r</sub>		[kV]	7.2	12	15	17.5			24					
Rated normal current I <sub>r</sub> <sup>1)</sup>	for panel type LT1 with 3AH5: On request		[A]	630										
	for panel type LT10 and HF with 3AH5													
	for panel type LT11 and HF with 3AH6													
	for panel type LT2													
	for panel type LT22													
	for panel type LT31 and HF with 3AH6			1250										
Rated short-circuit making current I <sub>ma</sub>		up to [kA]	50	63	50	63	40	50	63	40	50	63	40	50
Rated short-circuit breaking current I <sub>sc</sub> for 3AH vacuum circuit-breaker			20	25	20	25	16	20	25	16	20	25	16	20
Electrical endurance for 3AH vacuum circuit-breaker	- at rated normal current I <sub>r</sub>			10.000 operating cycles										
	- at rated short-circuit breaking current I <sub>sc</sub>			50 breaking operations										
				35 breaking operations with 3AH6 at 25 kA										

<sup>1)</sup> The rated normal currents apply to ambient air temperatures of 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62 271-1/VDE 0670-1).

<sup>2)</sup> Pressure values for SF<sub>6</sub>-insulated vessels.

<sup>3)</sup> Depending on the rated current or max. let-through current of the HV HRC fuse-link ( $I_D \leq 25$  kA).

## 8.2 Dimensions and weights

(Binding switchgear dimensions are given in the order documents (dimension drawing, front view))

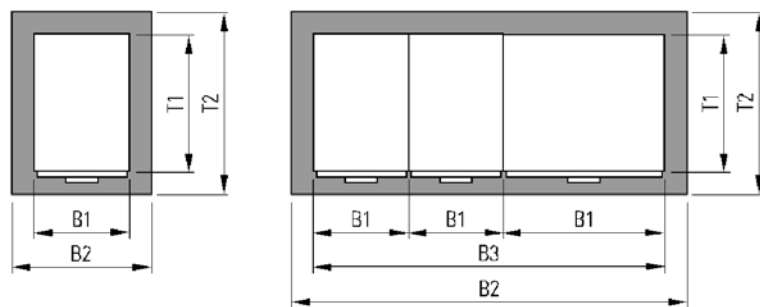


Fig. 38: Dimensions of transport units (left side: individual panel, right side: several panels)

Information about packing of transport units (see Page 62, "Unloading the switchgear and transporting to the place of installation").

Shipping data of individual panels																		
Individual panel or combinations thereof for standard switchgear	Panel type	Panel or panel combination			Transport unit (including packing) for standard panels (with / without pressure relief duct)													
		Width B1	Net weight		Width B2	Height		Depth T2	Volume		Gross weight							
			wit- hout LVC*	with LVC*		wit- hout LVC*	with LVC*		wit- hout LVC*	with LVC*	wit- hout LVC*	with LVC*						
		[mm]	approx. [kg]		[m]				[m³]		approx. [kg]							
Ring-main panel	RK	375	190	250	1.08	1.95	2.3	1.40	2.95	3.48	250	310						
	RK1	500	210	270							270	330						
Ring-main panel for panel combinations	RK-U	375	260	320							320	380						
Cable panel	K, K-E	375	190	250							250	310						
	K1, K1-E	500	190	250							250	310						
Transformer panel	TR	375	210	270							270	330						
	TR1	500	230	290							290	350						
Circuit-breaker panel 630 A	LS1	750	340	400							410	460						
	LS11		340	400							410	460						
Circuit-breaker panel 1250 A																		
- for connection of max. two cables	LS31	750	400	460								470	520					
- for connection of three cables	LS32	875	460	520								530	580					
Bus sectionalizer panel 1250 A	LT31	750	450	510								520	570					
Bus sectionalizer panel 630 A with vacuum circuit-breaker	LT10		320	380								390	440					
	LT11		320	380								390	440					
Bus sectionalizer panel with one three-position switch-disconnector	LT2		250	310								320	370					
	LT2-W		310	370								380	430					
Bus sectionalizer panel with two three-position switch-disconnectors	LT22		290	350								360	410					
	LT22-W		350	410								420	470					
Billing metering panel	ME1...			270							330		340	390				
	ME1-H			330							390		400	450				
Busbar voltage metering panel	ME3	375	210	270								270	330					
	ME31-F	500	270	330								330	390					
Bus riser panel	without transformers	HF	375	170							230		230	290				
	with transformers	HF	375	260							320		320	380				
Busbar earthing panel	SE1	375	190	250								250	310					
	SE2	500	270	330								330	390					

Additional weight				
For individual panel		Width B1 [mm]	Additional weight approx. [kg]	
Pressure relief duct for switchgear in free-standing arrangement		375	30	
		500	40	
		750	60	
		875	70	

Shipping data for one transport unit									
<b>Transport unit:</b> - Standard: As individual panels arranged side by side and not screwed together - Option: As multi-panel transport unit, panels screwed together	Overall width B3	Transport unit (including packing) for standard panels (with / without pressure relief duct)							
		Width B2	Height		Depth T2	Volume		Gross weight	
			wit- hout LVC*	with LVC*		wit- hout LVC*	with LVC*	wit- hout LVC*	with LVC*
	[mm]	[m]				[m³]	approx. [kg]		
	≤ 875	1.08	1.95	2.3	1.40	2.95	3.48	+ 70**	
	≤ 1000	1.20				3.28	3.86	+ 80**	
	≤ 1500	1.78				4.86	5.73	+ 100**	
	≤ 2125	2.33				6.36	7.50	+ 120**	

\* Low-voltage compartment (**LVC**), 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped.

\*\* Sum of the net weights of individual panels.

The net weight of a panel depends on the extent to which it is equipped (e.g. current transformers, motor operating mechanisms) and is therefore given as a mean value.

### 8.3 Tightening torques

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

Joint: material/material	Thread	Tightening torque
Metal joints:		
sheet-steel/sheet-steel	M6 (self-cutting)	12 Nm
e. g.: front plates, top plates, etc.	M8	21 Nm
Earthing busbar:		
sheet-steel/copper	M8	21 Nm
copper/copper	M8	21 Nm
sheet-steel/copper	M10	30 Nm
Current conductor joint:		
copper/copper	M8	21 Nm
copper/copper	M10	30 Nm
Switchgear earthing:		
sheet-steel/cable lug	M12	50 Nm*
Cable shield earthing	M10	30 Nm*
*The tightening torque at the cable lug joint depends on :	M8	max. 21 Nm*
- material of cable lug	(TR panel)	(TR panel)
- instructions of sealing end manufacturer	M12	max. 50 Nm*
- instructions of cable manufacturer	(all other cable panels)	(all other cable panels)

#### 8.4 Protection against solid foreign objects, access to hazardous parts and water

The medium-voltage switchgear fulfils the following degrees of protection according to IEC 62271-1, IEC 62271-200 and IEC 60529:

Degree of protection	Type of protection	Application
IP2X	<b>Protection against solid foreign bodies:</b> Protected against solid foreign objects of 12.5 mm diameter and greater. <b>Protection against access to hazardous parts:</b> Protected against access to hazardous parts with a finger (the jointed test finger of 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts). <b>Protection against water:</b> No definition.	Compartments Enclosure of parts under high voltage
IP3X (option)	<b>Protection against solid foreign objects:</b> Protected against solid foreign objects of 2.5 mm diameter and greater. <b>Protection against water:</b> No definition. <b>Protection against access to hazardous parts:</b> Protected against access to hazardous parts with a tool (the access probe of 2.5 mm diameter, 100 mm length, shall not penetrate)	Enclosure of parts under high voltage in switchgear with locking device
IP3XD (on request)	<b>Protection against solid foreign objects:</b> Protected against solid foreign objects of 2.5 mm diameter and greater. <b>Protection against water:</b> No definition. <b>Protection against access to hazardous parts:</b> Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter, 100 mm length, shall have adequate clearance from hazardous parts)	Enclosure of parts under high voltage in switchgear with locking device
IP65	<b>Protection against solid foreign objects:</b> Dust-tight (no ingress of dust). <b>Protection against water:</b> Protected against water jets (water projected in jets against the enclosure from any direction shall have no harmful effects) <b>Protection against access to hazardous parts:</b> Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter shall not penetrate)	Metal enclosure of gas-filled switchgear vessels



## 8.5 Standards and guidelines

SIMOSEC switchgear complies with the following applicable prescriptions and standards:

		IEC/EN standard	VDE standard
Switchgear		62 271-1	0670-1
		62 271-200	0671-200
Switching devices	Circuit-breaker	62 271-100	0671-100
	Disconnect/earthing switch	62 271-102	0671-102
	Switch-disconnector	60 265-1	0670-301
	Switch-disconnector/fuse combination	62 271-105	0671-105
Voltage detecting systems		61 243-5	0682-415
Surge arresters		60 099	0675
Degree of protection		60 529	0470-1
Instrument transformers	Current transformers	60 044-1	0414-1
	Voltage transformers	60 044-2	0414-2
	Combined transformers	60 044-3	0414-3
SF <sub>6</sub>		60 376	0373-1
		60 480	0373-2
Installation and earthing		61 936-1 / HD 637 - S1	0101
Environmental conditions		60 721-3-3	DIN EN 60 721-3-3

### Transport regulations

According to "Annex 1 of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) dated September 30th, 1957" Siemens gas insulated medium-voltage switchgear does not belong to the category of dangerous goods regarding transportation, and is exempted from special transport regulations according to ADR, Clause 1.1.3.1 b.

### Electromagnetic compatibility - EMC

The a.m. standards as well as the "EMC Guideline 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 guideline.

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

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

## 8.6 Resistance to internal arc faults (option)

- Safety of operating personnel ensured by tests to verify resistance to internal arc faults in accordance with IEC 62271-200.
- Moreover, the effects of possible arc faults in SIMOSEC switchgear are considerably reduced due to:
  - Metal-enclosed and gas-insulated switching functions (e.g. on three-position switch and vacuum circuit-breaker 3AH5)
  - Logical arrangement of operating mechanism elements and mechanical interlocks
  - Short-circuit-proof feeder earthing by means of the three-position switch-disconnector and the cable feeder earthing switch

## 8.7 Type of service location

SIMOSEC switchgear can be used as an indoor installation in accordance with IEC 61 936 (Power installations exceeding AC 1kV) and VDE 0101:

- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear require tools for removal.
- Inside lockable electrical service locations. A lockable electrical service location is a room or place which is reserved exclusively for the operation of electrical equipment and 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.

## 8.8 Climate and ambient conditions

SIMOSEC switchgear may be used, subject to possible additional measures - e.g. panel heaters or floor covers - under the following ambient conditions and climate classes:

- Ambient conditions:
  - Natural foreign materials
  - Small animals
- Climate classes: The climate classes are classified according to IEC 60 721-3-3.

SIMOSEC switchgear is largely insensitive to climate and ambient conditions by virtue of the following features:

- No cross insulation for isolating distances between phases
- Metal enclosure of switching devices (e.g. three-position switch) in gas-filled stainless-steel switchgear vessel
- Dry-type bearings in operating mechanism
- Essential parts of the operating mechanism made of corrosion-proof materials
- Use of climate-independent three-phase current transformers

## 8.9 Dielectric strength and site altitude

### Dielectric strength

- The dielectric strength is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to VDE 0670-1 or IEC 62 271-1.
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11g/m<sup>3</sup> water content according to VDE 0111 and IEC 60 071).
- The dielectric strength decreases with increasing altitude.

For site altitudes above 1000 m, the correction factor  $K_a$  is recommended, depending on the actual site altitude above sea level.

Rated voltage (r.m.s. value)	[kV]	7.2	12	15	17.5	24
Rated short-duration power-frequency withstand voltage (r.m.s. value)						
- across the isolating distance	[kV]	23	32	39	45	60
- between phases and to earth		20	28	36	38	50
Rated lightning impulse withstand voltage (peak value)						
- across the isolating distance	[kV]	70	85	105	110	145
- between phases and to earth		60	75	95	95	125

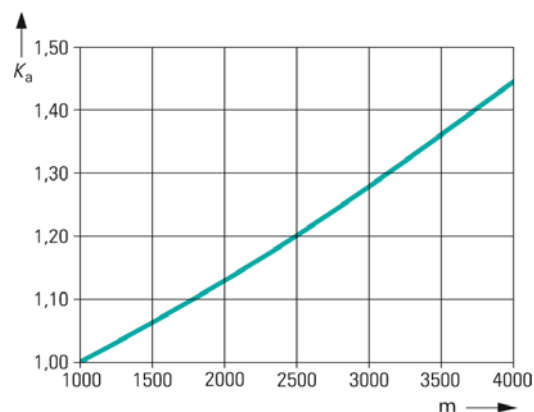


Fig. 39: Correction factor  $K_a$  as a function of the site altitude in m above sea level

**Rated short-duration power-frequency withstand voltage to be selected for site altitudes > 1000 m**

≥ Rated short-duration power-frequency withstand voltage up to ≤ 1000 m \*  $K_a$

**Rated lightning impulse withstand voltage to be selected for site altitudes > 1000 m**

≥ Rated lightning impulse withstand voltage up to ≤ 1000 m \*  $K_a$

#### Calculation example

3000 m site altitude above sea level

17.5 kV switchgear rated voltage

95.0 kV rated lightning impulse withstand voltage

Rated lightning impulse withstand voltage to be selected

95 kV \* 1.28 = 122 kV

#### Result

According to the above table, switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV should be selected.

## 8.10 3AH vacuum circuit-breakers

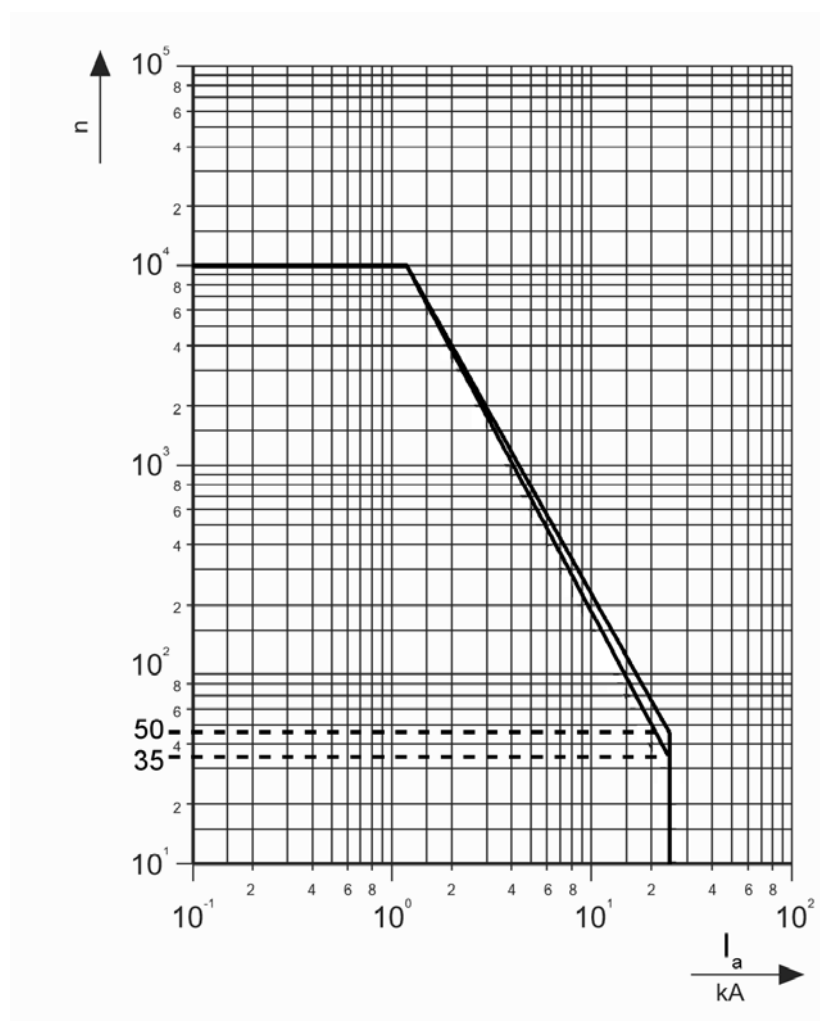


Fig. 40: Permissible number of operating cycles  $[n]$  as a function of the breaking current (r.m.s.-value)  $[I_a]$  (values of 3AH vacuum circuit-breaker)

**Number of operating cycles**

Rated normal current	10 000 times
Short-circuit breaking current	50 times with max. 25 kA 35 times with max. 25 kA for 3AH6

Operating times of 3AH5/3AH6 vacuum circuit-breakers				
Operating times	Vacuum circuit-breaker equipment		Unit	Duration
Closing time for stored-energy mechanism			[ms]	< 75
Charging time for electrical operation		(M1)	[s]	<10
Opening time	1st shunt release 3AY1510	(Y1)	[ms]	<65
	2nd release 3AX1101	(Y2), (Y4), (Y6), (Y7)		<50
Arcing time			[ms]	<15
Break time	1st shunt release 3AY1510	(Y1)	[ms]	<80
	2nd release 3AX1101	(Y2), (Y4), (Y6), (Y7)		<65
Dead time			[ms]	300
Close-open contact time	1st shunt release 3AY1510	(Y1)	[ms]	<75
	2nd release 3AX1101	(Y2), (Y4), (Y6), (Y7)		<60
Minimum command duration	Closing solenoid	(Y9)	[ms]	45
	1st shunt release 3AY1510	(Y1)		40
	2nd release 3AX1101	(Y2), (Y4), (Y6), (Y7)		20
Short-time impulse duration of the circuit-breaker tripping signal			[ms]	>10

**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 arc extinction in the last-pole-to-clear (= opening time plus 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** The interval of time between the end of the current flow in all poles and the initiation of the current flow in the first pole.

The vacuum interrupters fitted in the vacuum circuit-breakers 3AH 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 July 25th, 1996 (Federal Law Gazette Page 1172) §8 and Annex III Section 5 up to the rated short-duration power-frequency withstand voltage stipulated by DIN VDE/IEC.

**Motor operating mechanism** The operating mechanisms of the 3AH circuit-breakers are suitable for auto-reclosing.

For DC operation, the maximum power consumption is 300 W. For AC operation, the maximum power consumption is 350 VA.

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

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

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 two tables:

Breaking capacity	Operating voltage V	Normal current A
AC 40 up to 60 Hz	up to 230	10

Breaking capacity	Operating voltage [V]	Normal current [A]	
		Resistive load	Inductive load
DC	24	10	10
	48	10	9
	60	9	7
	110	5	4
	220	2,5	2

Rated insulating voltage	AC/DC 250 V
Insulation group	C according to DIN VDE 0110
Continuous current	10 A
Making capacity	50 A

#### Closing solenoid

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 DC or AC operation. Power consumption: 140 W/VA.

#### Shunt releases

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

Shunt releases based on two different principles are used:

The **shunt release 3AY1510** is used as standard in the basic circuit-breaker version. With this design, the circuit-breaker is tripped electrically. Power consumption: 140 W or VA.


The **shunt release 3AX1101** is fitted if more than one shunt release is required. With this design, the electrical command to trip the circuit-breaker is transferred magnetically. Power consumption: 60 W or VA.

**Undervoltage release** Undervoltage releases are tripped automatically through an electromagnet or deliberately.

The deliberate tripping of the undervoltage release generally takes place via a NC contact in the tripping circuit or via a 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:  $\leq 13\text{ VA}$  or  $\leq 15\text{ VA}$ .

**Circuit-breaker tripping signal** When the circuit-breaker is tripped by a release, there is a signal. If the circuit-breaker is tripped deliberately and mechanically, this signal is suppressed.

**Varistor module**

	<b>ATTENTION!</b>
	Switching overvoltages can cause damages on electronic control units.  ⇒ Do not switch off inductive consumers in DC circuits.

With the varistor module 3AX1526, the inductances of the circuit-breaker operating mechanism and the circuit-breaker control (motor, closing solenoid and auxiliary contactor) can be operated in DC circuits. The varistor module limits overvoltages to approx. 500 V and is available for rated operating voltages from 60 V (DC) to 220 V (DC). The module contains two separate varistor circuits.



### 8.11 Three-position switch -disconnector

Switching capacity for general-purpose switches (Class E3) according to IEC 60 265-1/VDE 0670 Part 301									
Rated voltage			$U_r$	kV	7.2	12	15	17.5	24
Test duty 1	Rated mainly active load breaking current	100 operations	$I_1$	A	630	630	630	630	630
	Rated mainly active load breaking current	20 operations	$I_1$	A	31,5	31,5	31,5	31,5	31,5
Test duty 2a	Rated line closed-loop breaking current	20 operations	$I_{2a}$	A	630	630	630	630	630
Test duty 3	Rated transformer breaking current	20 operations	$I_3$	A	40	40	40	40	40
Test duty 4a	Rated cable-charging breaking current	10 operations	$I_{4a}$	A	68	68	68	68	68
Test duty 4b	Rated line-charging breaking current	10 operations	$I_{4b}$	A	68	68	68	68	68
Test duty 5	Rated short-circuit making current	5 operations	$I_{ma}$	up to kA	63	63	63	63	50
Test duty 6a	Rated earth-fault breaking current	10 operations	$I_{6a}$	A	60	60	60	60	60
Test duty 6b	Rated cable-charging breaking current and line-charging breaking current under earth-fault conditions	10 operations	$I_{6b}$	A	35	35	35	35	35
–	Cable-charging breaking current under earth-fault conditions with superposed load current	10 operations	$I_1 + I_{6b}$	A	630+50	630+50	630+50	630+50	630+50
Switching capacity according to IEC 62 271-105, DIN EN 60 420 and VDE 0670 Part 303									
Rated transfer current			$I_4$	A	1150	1150	830	830	830

### 8.12 Three-position disconnector

Rated voltage		$U_r$	kV	7.2	12	15	17.5	24
Rated current			A					
Number of operating cycles				1000 operating cycles CLOSED/OPEN; 1000 operating cycles OPEN/EARTHED				
Rated short-time withstand current				25 kA/1 s / 20 kA/3 s				20 kA/3 s
Rated peak withstand current			kA	63	63	63	63	50
Earthing function of the three-position disconnector	Rated short-time withstand current	$I_k$	up to kA	25	25	25	25	20

### 8.13 Make-proof earthing switch (cable feeder earthing switch)

Rated voltage		$U_r$	kV	7.2	12	15	17.5	24
Make-proof earthing function of the three-position switch-disconnector	Rated short-circuit making current	$I_{ma}$	up to kA	63	63	63	63	50
	Rated short-time withstand current	$I_k$	up to kA	25	25	25	25	20
Make-proof earthing function in panels LS11, LS31, LS32	Rated short-circuit making current	$I_{ma}$	up to kA	63	63	63	63	50
	Rated short-time withstand current	$I_k$	up to kA	25	25	25	25	20

#### **8.14 Selection of HV HRC fuse-links**

##### **Allocation of HV HRC fuses and transformers**

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined with HV HRC fuse-links and tested in accordance with IEC 62 271-105.

The transformer protection table below shows HV HRC fuse-links recommended for transformer protection.

Please contact us for further applications or HV HRC fuse-links from other manufacturers.

**Transformer protection table: Recommendation for allocation of HV HRC fuse-links make SIBA and transformers**

Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
6 - 7,2	50	4	4,8	10	3 - 7,2	292	30 098 13.10
				10	6 - 12	292	30 004 13.10
				10	6 - 12	442	30 101 13.10
	75	4	7,2	16	3 - 7,2	292	30 098 13.16
				16	6 - 12	292	30 004 13.16
				16	6 - 12	442	30 101 13.16
	100	4	9,6	16	3 - 7,2	292	30 098 13.16
				16	6 - 12	292	30 004 13.16
				16	6 - 12	442	30 101 13.16
				20	3 - 7,2	292	30 098 13.20
				20	6 - 12	292	30 004 13.20
				20	6 - 12	442	30 101 13.20
	125	4	12	20	3 - 7,2	292	30 098 13.20
				20	6 - 12	292	30 004 13.20
				20	6 - 12	442	30 101 13.20
				25	3 - 7,2	292	30 098 13.25
				25	6 - 12	292	30 004 13.25
				25	6 - 12	442	30 101 13.25
	160	4	15,4	31,5	3 - 7,2	292	30 098 13.31,5
				31,5	6 - 12	292	30 004 13.31,5
				31,5	6 - 12	442	30 101 13.31,5
	200	4	19,2	31,5	3 - 7,2	292	30 098 13.31,5
				31,5	6 - 12	292	30 004 13.31,5
				31,5	6 - 12	442	30 101 13.31,5
				40	3 - 7,2	292	30 098 13.40
				40	6 - 12	292	30 004 13.40
				40	6 - 12	442	30 101 13.40
	250	4	24	40	3 - 7,2	292	30 098 13.40
				40	6 - 12	292	30 004 13.40
				40	6 - 12	442	30 101 13.40
				50	3 - 7,2	292	30 098 13.50
				50	6 - 12	292	30 004 13.50
				50	6 - 12	442	30 101 13.50
	315	4	30,3	50	3 - 7,2	292	30 098 13.50
				50	6 - 12	292	30 004 13.50
				50	6 - 12	442	30 101 13.50
				63	6 - 12	292	30 012 43.63
	400	4	38,4	63	3 - 7,2	292	30 099 13.63
				63	6 - 12	292	30 012 13.63
				63	6 - 12	442	30 102 13.63
				63	6 - 12	292	30 012 43.63
				80	6 - 12	292	30 012 43.80
				80	6 - 12	442	30 102 43.80

Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
	500	4	48	80	6 - 12	292	30 012 43.80
				80	6 - 12	442	30 102 43.80
				80	3 - 7,2	292	30 099 13.80
				80	6 - 12	292	30 012 13.80
				80	6 - 12	442	30 102 13.80
				100	6 - 12	292	30 012 43.100
				100	6 - 12	442	30 102 43.100
	630	4	61	100	3 - 7,2	292	30 012 43.100
				100	6 - 12	292	30 102 43.100
	10 - 12	4	2,9	10	6 - 12	292	30 004 13.10
				10	6 - 12	442	30 101 13.10
				10	10 - 17,5	292	30 255 13.10
				10	10 - 17,5	442	30 231 13.10
				10	10 - 24	442	30 006 13.10
		4	4,3	10	6 - 12	292	30 004 13.10
				10	6 - 12	442	30 101 13.10
				10	10 - 17,5	292	30 255 13.10
				10	10 - 17,5	442	30 231 13.10
				10	10 - 24	442	30 006 13.10
	100	4	5,8	16	6 - 12	292	30 004 13.16
				16	6 - 12	442	30 101 13.16
				16	10 - 17,5	292	30 255 13.16
				16	10 - 17,5	442	30 231 13.16
	125	4	7,2	16	6 - 12	292	30 004 13.16
				16	6 - 12	442	30 101 13.16
				16	10 - 17,5	292	30 255 13.16
				16	10 - 17,5	442	30 231 13.16
				16	10 - 24	442	30 006 13.16
				16	10 - 24	442	30 006 13.16
	160	4	9,3	20	6 - 12	292	30 004 13.20
				20	6 - 12	442	30 101 13.20
				20	10 - 17,5	292	30 221 13.20
				20	10 - 17,5	442	30 231 13.20
				20	10 - 24	442	30 006 13.20
				20	10 - 24	442	30 006 13.20
	200	4	11,5	25	6 - 12	292	30 004 13.25
				25	6 - 12	442	30 101 13.25
				25	10 - 17,5	292	30 221 13.25
				25	10 - 17,5	442	30 231 13.25
				25	10 - 24	442	30 006 13.25
				25	10 - 24	442	30 006 13.25

Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
10 - 12	250	4	14,5	25	6 - 12	292	30 004 13.25
				25	6 - 12	442	30 101 13.25
				25	10 - 17,5	292	30 221 13.25
				25	10 - 17,5	442	30 231 13.25
				25	10 - 24	442	30 006 13.25
				31,5	6 - 12	292	30 004 13.31,5
				31,5	6 - 12	442	30 101 13.31,5
				31,5	10 - 17,5	292	30 221 13.31,5
				31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
	315	4	18,3	31,5	6 - 12	292	30 004 13.31,5
				31,5	6 - 12	442	30 101 13.31,5
				31,5	10 - 17,5	292	30 221 13.31,5
				31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
				40	6 - 12	292	30 004 13.40
				40	6 - 12	442	30 101 13.40
				40	10 - 17,5	292	30 221 13.40
				40	10 - 17,5	442	30 231 13.40
				40	10 - 24	442	30 006 13.40
	400	4	23,1	40	6 - 12	292	30 004 13.40
				40	6 - 12	442	30 101 13.40
				40	10 - 17,5	292	30 221 13.40
				40	10 - 17,5	442	30 231 13.40
				40	10 - 24	442	30 006 13.40
	500	4	29	50	6 - 12	292	30 004 13.50
				50	6 - 12	442	30 101 13.50
				50	10 - 17,5	292	30 221 13.50
				50	10 - 17,5	442	30 232 13.50
				50	10 - 24	442	30 014 13.50
				63	6 - 12	292	30 012 43.63
				63	10 - 24	442	30 014 43.63
	630	4	36,4	63	6 - 12	292	30 012 13.63
				63	6 - 12	442	30 102 13.63
				63	10 - 17,5	442	30 232 13.63
				63	6 - 12	292	30 012 43.63
				63	10 - 24	442	30 014 43.63
				80	6 - 12	292	30 012 43.80
				80	6 - 12	442	30 102 43.80
				80	10 - 24	442	30 014 43.80
	800	5 - 6	46,2	63	6 - 12	292	30 012 13.63
				63	6 - 12	442	30 102 13.63
				63	10 - 17,5	442	30 232 13.63
				80	6 - 12	292	30 012 43.80
				80	6 - 12	442	30 102 43.80
				80	10 - 24	442	30 014 43.80
	1000	5 - 6	58	100	6 - 12	292	30 012 43.100
				100	6 - 12	442	30 102 43.100
				100	10 - 24	442	30 022 43.100

Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
10 - 12	1250	5 - 6	72,2				on request
	1600	5 - 6	92,4				on request
13,8	50	4	2,1	6,3	10 - 17,5	442	30 231 13.6,3
				6,3	10 - 24	442	30 006 13.6,3
	75	4	3,2	6,3	10 - 17,5	442	30 231 13.6,3
	100	4	4,2	10	10 - 17,5	442	30 231 13.10
	125	4	5,3	10	10 - 17,5	442	30 231 13.10
	160	4	6,7	16	10 - 17,5	442	30 231 13.16
	200	4	8,4	16	10 - 17,5	442	30 231 13.16
	250	4	10,5	20	10 - 17,5	442	30 231 13.20
	315	4	13,2	25	10 - 17,5	442	30 231 13.25
	400	4	16,8	31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
	500	4	21	40	10 - 17,5	442	30 231 13.40
				40	10 - 24	442	30 006 13.40
	630	4	26,4	50	10 - 17,5	442	30 232 13.50
				50	10 - 24	442	30 014 13.50
	800	5 - 6	33,5	63	10 - 24	442	30 014 43.63
	1000	5 - 6	41,9	80	10 - 24	442	30 014 43.80
	1250	5 - 6	52,3	100	Okt 24	442	30 022 43.100
15 - 17,5	50	4	1,9	6,3	10 - 17,5	442	30 231 13.6,3
				6,3	10 - 24	442	30 006 13.6,3
	75	4	2,9	6,3	10 - 17,5	442	30 231 13.6,3
	100	4	3,9	10	10 - 17,5	442	30 231 13.10
	125	4	4,8	16	10 - 17,5	442	30 231 13.16
				16	10 - 24	442	30 006 13.16
	160	4	6,2	16	10 - 17,5	442	30 231 13.16
	200	4	7,7	20	10 - 17,5	442	30 231 13.20
				20	10 - 24	442	30 006 13.20
	250	4	9,7	25	10 - 17,5	442	30 231 13.25
				25	10 - 24	442	30 006 13.25
	315	4	12,2	31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
	400	4	15,5	31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
	500	4	19,3	31,5	10 - 17,5	442	30 231 13.31,5
				31,5	10 - 24	442	30 006 13.31,5
	630	4	24,3	40	10 - 17,5	442	30 231 13.40
				40	10 - 24	442	30 006 13.40
	800	5 - 6	30,9	63	10 - 24	442	30 014 43.63
	1000	5 - 6	38,5	63	10 - 24	442	30 014 43.63
				80	10 - 24	442	30 014 43.80
	1250	5 - 6	48,2	100	10 - 24	442	30 022 43.100


Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
20 - 24	50	4	1,5	6,3	10 - 24	442	30 006 13.6,3
	75	4	2,2	6,3	10 - 24	442	30 006 13.6,3
	100	4	2,9	6,3	10 - 24	442	30 006 13.6,3
	125	4	3,6	10	10 - 24	442	30 006 13.10
	160	4	4,7	10	10 - 24	442	30 006 13.10
	200	4	5,8	16	10 - 24	442	30 006 13.16
	250	4	7,3	16	10 - 24	442	30 006 13.16
	315	4	9,2	16	10 - 24	442	30 006 13.16
				20	10 - 24	442	30 006 13.20
	400	4	11.6	20	10 - 24	442	30 006 13.20
				25	10 - 24	442	30 006 13.25
	500	4	14.5	25	10 - 24	442	30 006 13.25
				31.5	10 - 24	442	30 006 13.31,5
	630	4	18.2	31.5	10 - 24	442	30 006 13.31,5
				40	10 - 24	442	30 006 13.40




Transformer				HV HRC fuse			
U [kV]	S <sub>N</sub> [kVA]	u <sub>K</sub> [%]	I <sub>1</sub> [A]	I <sub>S</sub> [A]	U <sub>S</sub> [V]	e [mm]	Order No.
20 - 24	800	5 - 6	23,1	31,5	10 - 24	442	30 006 13.31,5
	1000	5 - 6	29	40	10 - 24	442	30 006 13.40
	1250	5 - 6	36	50	10 - 24	442	30 014 13.50
	1600	5 - 6	46,5	80	10 - 24	442	30 014 43.80
				100	10 - 24	442	30 022 43.100
	2000	5 - 6	57,8	100	10 - 24	442	30 022 43.100
U      Rated system voltage S <sub>N</sub> Rated power u <sub>K</sub> Relative impedance voltage I <sub>1</sub> Rated current I <sub>S</sub> Rated current of fuse U <sub>S</sub> Rated voltage of fuse e      Reference dimension							

- Note**
- Dimension e=292 mm (standard for 12 kV)
  - Dimension e=442 mm for >12 up to 24 kV

\*) Extension tube l=100 mm required

## 8.15 Current and voltage transformers

4MC63 three-phase current transformer for panel types LS..., LT... and RK-U												
Primary data												
		for I <sub>N</sub> ≤150 A				for I <sub>N</sub> ≤400 A			for I <sub>N</sub> ≤1000 A			
		for I <sub>D</sub> = 630 A				for I <sub>D</sub> =630 A			for I <sub>D</sub> =1250 A			
Max. equipment operating voltage U <sub>m</sub>	[kV]	0.72				0.72			0.72			
Rated current I <sub>N</sub>	[A]	150	100	75	50	400	300	200	1000	750	600	500
Rated short-duration power-frequency withstand voltage (winding test)	[kV]	3				3			3			
Rated thermal short-time withstand current I <sub>th</sub>	[kA]	25				25			25			
Rated continuous thermal current I <sub>D</sub>	[A]	630				630			1205			
Transient overload current		1.5xI <sub>D</sub> / 1h				2xI <sub>D</sub> / 0.5 h			1.5xI <sub>D</sub> / 1h			
Rated peak withstand current I <sub>dyn</sub>		unlimited				unlimited			unlimited			
Secondary data												
Rated current	[A]	1	0.67	0.5	0.33	1	0.75	0.5	1	0.75	0.6	
Rating	[VA]	5	3.33	2.5	1.67	5	3.75	2.5	5	3.75	3	
Rated current (option)	[A]	5				5			5			
Current at I <sub>D</sub>	[A]	4.2				1.575			1.25			
Protection core	Class	10 P				10 P			10 P			
	Overc urrent factor	10				10			10			

4MC70 33, 4MC70 31 cable-type current transformers and 4 MC70 32 bus-type transformer				
<b>Primary data</b>				
		<b>Cable-type current transformer 4MC70 33</b>	<b>Cable-type current transformer 4MC70 31</b>	<b>Bus-type current transformer 4MC70 32</b>
Max. equipment operating voltage $U_m$	[kV]	0.72		
Rated current $I_N$	[A]	30 to 600	50 to 600	200 to 600
Rated short-duration power-frequency withstand voltage (winding test)	[kV]	3		
Rated thermal short-time withstand current $I_{th}$	[kA]	25		
Rated continuous thermal current $I_D$	[A]	max. $1.2 \cdot I_N$		
Transient overload current		$1.5 \times I_D / 1 \text{ h}$ or $2 \times I_D / 0.5 \text{ h}$		
Rated peak withstand current $I_{dyn}$		unlimited		

Secondary data									
			4MC70 33			4MC70 31		4MC70 32	
Rated current		[A]	1						
	Option	[A]	5						
Measuring core	Class		0.2	0.5	1	1	0.2	0.5	1
	Overcurrent factor		FS 10			FS 5	FS 10		
	Option		FS 5			FS 10	FS 5		
	Rating	[VA]	2.5 - 10						
Protection core	Class		10 P	5 P	----		10 P	5 P	
	Overcurrent factor		10	10	----		10	10	
	Rating	[VA]	2.5 - 10			----		2.5 - 10	
Option: Secondary tap			1 : 2(e.g. 150 - 300 A)			1 : 2		1 : 2(e.g. 150 - 300 A)	
Dimensions									
Overall height H**	[mm]	50*	100*	170*	285*	89	---	---	
Overall width B	[mm]	---	---	---	---	---	80*	150*	
Outside dimension	[mm]	Ø 145				85 x 114		Ø 125	
Inside dimension	[mm]	Ø 55				Ø 40		Ø 55	
for cable	[mm]	Ø 40				Ø 36		Ø 40	

\* Depending on the core data

\*\* Available installation height inside panel types RK and RK1: Approx. 285 mm, depending on make, type and cross-section of sealing end.

Other values available on request





4MA7 block-type current transformer, single-pole				
Primary data				
Max. equipment operating voltage U <sub>m</sub>		[kV]	12	24
Rated short-duration power-frequency withstand voltage		[kV]	38	50
Rated lightning impulse withstand voltage		[kV]	95	125
Rated current I <sub>N</sub>		[A]	25 - 1250	
Rated thermal short-time withstand current I <sub>th</sub>		[kA]	up to 25	
Rated continuous thermal current I <sub>D</sub>			up to 1.2 x I <sub>N</sub>	
Rated peak withstand current I <sub>dyn</sub>			max. 2.5 x I <sub>th</sub>	
Secondary data				
Rated current		[A]	1 or 5	
Measuring core	Class		0.2	0.5
	Overcurrent factor		FS 5 or FS 10	
	Rating	[VA]	10 - 15	
Protection core	Class		5 or 10 P	
	Overcurrent factor		10	
	Rating	[VA]	5 - 15	

Other values available on request.



4MR block-type voltage transformer, single-pole				
Primary data				
Max. equipment operating voltage U <sub>m</sub> (= 1.2 x U <sub>N</sub> )		[kV]	12	24
Rated voltage U <sub>N</sub> at max. rated short-duration power-frequency withstand voltage U <sub>d</sub>	at 10 kV	[kV]		
			3.3/√3	
			3.6/√3	
	at 20 kV		4.8/√3	
			5.0/√3	
			6.0/√3	
	at 28 kV		6.6/√3	
			7.2/√3	
			10.0/√3	
	at 38 kV		11.0/√3	
				13.8/√3
				15.0/√3
	at 50 kV			17.5/√3
				20.0/√3
				22.0/√3
Rated lightning impulse withstand voltage U <sub>p</sub>		[kV]	75	125
Rated voltage factor (8 h)			1.9 x U <sub>N</sub>	
Secondary data				
Rated voltage		[V]	100/√3	
			110/√3	
			120/√3	
Rated voltage for auxiliary winding (option)			100/√3	
			110/√3	
			120/√3	
Rating		[VA]	20	50
Class			0.2	0.5

Other values available on request.

## 8.16 Cable sealing ends

### Connection height

Connection height of cables above the floor or the lower edge of the panel.

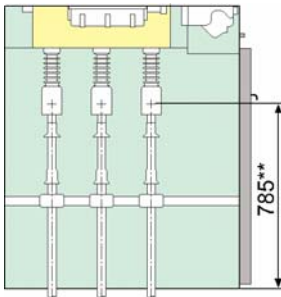


Fig. 41: Panel type RK...

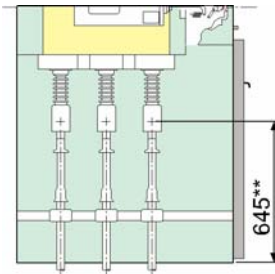


Fig. 42: Panel type LS1...

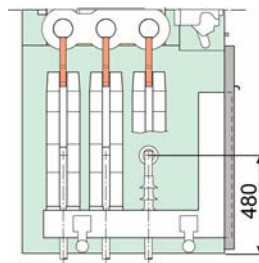


Fig. 43: Panel type LS11...

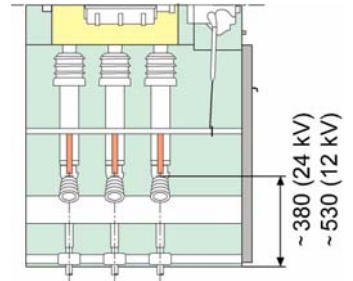


Fig. 44: Panel type TR...

\*\* When 4MA cast-resin block-type current transformers are installed, the cable connection height in RK1, K1 panels is reduced to 380 mm and in LS1 panels to 430 mm

Single-core thermoplastic-insulated cables up to 12 kV (6/10 kV)			
Make	Type	Cross-section in mm <sup>2</sup>	Note for application in
Euromold	35 MSC	16 - 300 (500*)	
	optionally with insulation shields	25 - 300 (500*)	
	AIN 10	25 - 300 (500*)	
	ITK / S 212	35 - 300 (400*)	
Pirelli	ELTI mb-1C-12	35 - 240	
	ELTI-1C-12	25 - 300	
Tyco Electronics Raychem GmbH	IXSU-F	16 - 300 (500*)	
	TFTI	25 - 300 (400*)	
	EPKT	16 - 300	Lower edge of sealing end below panel. Panel type TR... <sup>1)</sup>
Corning Cables (RXS)	IAEM 10	25 - 300	
	IAES 10	25 - 300 (500*)	
3M	92-EP 6xx-1	35 - 300 (400*)	
ABB Energiekabel GmbH	SEHDI 10,2	25 - 300 (500*)	
Nkt cables	TI 12	25 - 240	
	AV 10 C	25 - 300 (500*)	
	AV 10 E	25 - 300 (500*)	

\* On request: Max. connection cross-section of cable sealing end types.

1) On transformer panels, cable sealing ends with lugs up to 32 mm width can be connected. Owing to the various sealing end lengths, some of the mounted cable clamps (option) are underneath the panel.


Single-core thermoplastic-insulated cables from 12 kV up to 24 kV (12/20 kV)			
Make	Type	Cross-section in mm <sup>2</sup>	Note for application in
Euromold	35 MSC	25 - 70	
	optionally with insulation shields	25 - 185	
	36 MSC	95 - 300 (500*)	Lower edge of sealing end below panel. Panel types LS11/LS31/LS32
	optionally with insulation shields		
Pirelli	AIN 20	25 - 300 (630*)	
	ITK / S 212	35 - 240	
	ELTI mb-1C-24	35 - 240	
Tyco Electronics Raychem GmbH	ELTI-1C-24	25 - 300	
	IXSU-F	25 - 300 (500*)	
	TFTI	25 - 300 (400*)	
Corning Cables (RXS)	EPKT	16 - 300 (500*)	
	IAEM 20	25 - 300	
3M	IAES 20	25 - 300 (500*)	
	93-EP 6xx-1	25 - 300 (400*)	
ABB Energiekabel GmbH	SEHDI 20,2	35 - 300 (500*)	
Nkt cables	TI 24	25 - 240	
	AV 20 E	25 - 300 (500*)	
	AV 10 E	25 - 300 (500*)	

\* On request: Max. connection cross-section of cable sealing end types.

Three-core thermoplastic-insulated cables up to 12 kV (6/10 kV)			
Make	Type	Cross-section in mm <sup>2</sup>	Note for application in
Euromold	AIN 10	25 - 300 (500*)	
	SR-DI 12	35 - 300 (500*)	
Pirelli	ELTI-3C-12	25 - 300	
Tyco Electronics Raychem GmbH	IXSU-F	16 - 300 (500*)	

Three-core thermoplastic-insulated cables from 12 kV up to 24 kV (12/20) kV			
Make	Type	Cross-section in mm <sup>2</sup>	Note for application in
Euromold	SR-DI 24	35 - 300 (500*)	Lower edge of sealing end below panel. Panel types LS11...
Corning Cables (RXS)	GHKI	25 - 300 (500*)	

\* On request: Max. connection cross-section of cable sealing end types.

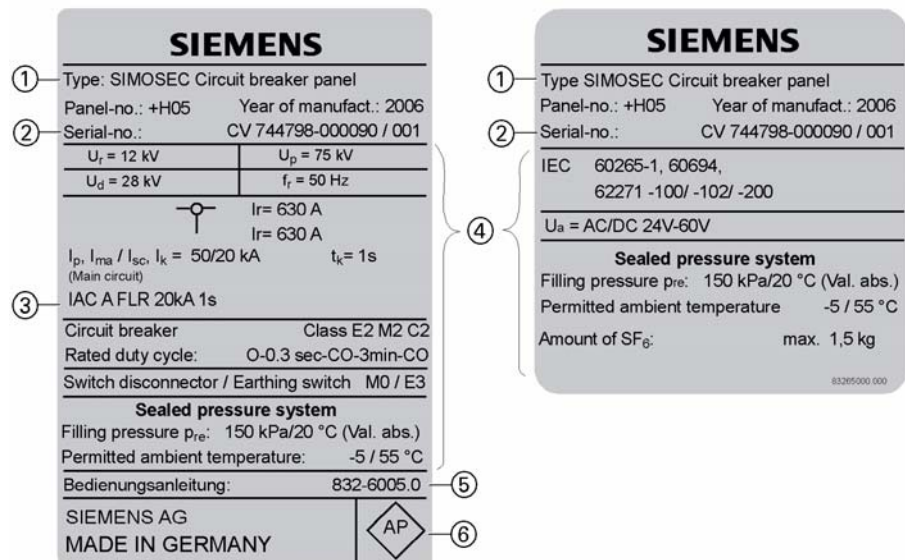
	<b>Note!</b>
	Depending on make and type, the termination of the cable sealing end (=shield earth) for the three-core thermoplastic-insulated cable and the mounted cable clamp (option) may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

### 8.17 Rating plates

The rating plate identifies the components and informs about the technical data.

A rating plate is provided each:

- bottom-right on the control board of the panel
- in the operating mechanism box (inside cover)
- at the front on the operating mechanism of the 3AH vacuum circuit-breaker



Rating plate on the front (example)

Rating plate inside the operating mechanism box (example)

- ① Switchgear type and year of manufacture
- ② Serial number
- ③ Internal arc classification (option)

- ④ Technical data
- ⑤ Number of operating instructions
- ⑥ Test mark for the performed acceptance test (German: Abnahme-Prüfung) (pressure test) of the vessel

- IAC classification** This data (see item ③) describes the internal arc classification of the panel according to IEC 62271-200. The entries **IAC A FL 20 kA 1 s** in the example shown mean:
- **IAC:** Internal Arc Classification
  - **A:** Type of accessibility A; for authorized personnel only; switchgear in closed service location; access for expert personnel only.
  - **F:** Internal arc classification for the front side (Front)
  - **L:** Internal arc classification for the lateral sides (Lateral)
  - **R:** Internal arc classification for the rear side (Rear)
  - **20 kA:** Tested short-circuit current
  - **1 s:** Test duration

The IAC classification is referred to each panel. The data on the rating plate (see item ③) describes the areas classified for the corresponding panel.

# Installation


## 9 Before installation


### Preliminary clarifications


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

- Sketch of the installation room including the locations and numbers of the individual switchpanels 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, ...)
- 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.

### Intermediate storage

	DANGER!
	<p>Risk of injury and damage to the stored goods if the storage space is overloaded.</p> <p>⇒ Observe the load-bearing capacity of the floor.</p> <p>⇒ Do not stack the transport units.</p> <p>⇒ Do not overload lighter components by stacking.</p>

	ATTENTION!
	<p>Fire risk. The transport unit is packed in flammable materials.</p> <p>⇒ No smoking.</p> <p>⇒ Keep fire extinguishers in a weatherproof place.</p> <p>⇒ Mark the location of the fire extinguisher.</p>

	ATTENTION!
	<p>Supplied desiccant bags lose their effectiveness if they are not stored in the undamaged original packings.</p> <p>⇒ Do not damage or remove packing of desiccant bags.</p> <p>⇒ Do not unpack desiccant bags before use.</p>

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

Intermediate storage of the transport units:

- In original packing as far as possible
- Observe the permissible storage temperature from -25° C to +70° C in accordance with the installed secondary devices.
- In a weatherproof place
- Protected against damage
- If packed in seaworthy crates, the switchgear can be stored for a maximum of 6 months (desiccant bags)
- Store transport units in such a way that they can be taken out later in the correct order for installation.

#### **Switchgear storage in closed rooms**

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
- Dry and protected against humidity and vermin (e.g. insects, mice, rats)
- 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 also 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.

#### **Switchgear room**

Please observe the following points when selecting and preparing the switchgear room:

- Transport ways to the switchgear room
- Room size
- Door dimensions
- 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



### Tools/auxiliary means

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

- Angular screddriver 10 DIN 911 (Allen screwdriver)
- Torx screwdriver Tx30 M6
- Torque wrench 20 - 50 Nm
- Ratchet, reconnectable DIN 3122
- Extension DIN 3123 40 - 125
- Socket spanner inserts DIN 3124
- Rivet pliers for blind rivets 4,8x10 mm
- Water level
- Compensation shims for floor unevenness 0.5 - 1.0 mm
- Cleaning agent (see Page 143, "Cleaning the switchgear")
- Lifting truck
- Reinforcing bars, roller crowbars
- Transport rollers

## 10 Unloading the switchgear and transporting to the place of installation

### Transport unit and packing

#### Transport unit

Transport units consist either of:

- individual switchpanels
  - one panel per pallet (for customer-side arrangement/panel interconnection)
  - several panels per pallet without panel interconnection
- or pre-assembled panel groups up to a maximum of 3 panels, with mounted busbars (depending on the customer's request)
- and accessories.

#### 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 protective foil)
- other packings in special cases (e.g. latticed crate, cardboard box for air-freight).

### Completeness and transport damage


#### 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 on the delivery note with that on the packing and the rating plates of the panels.
- ⇒ Check whether the accessories are complete according to the item numbers of the "List of loose delivery" (annex to the delivery note)
  - The accessories are supplied in the switchgear subframe or in a separate packing.

**Checking for transport damages**

- ⇒ Temporarily open the packing in a weatherproof place to check for damages. Do not remove the PE foil until reaching the mounting position in order to keep the switchgear as clean as possible.
- ⇒ Option: Check the ready-for-service indicator for SF<sub>6</sub> gas (see Page 28, "Ready-for-service indicator for SF<sub>6</sub> gas").
- ⇒ 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 the Siemens representative immediately.
- ⇒ Refit the packing.


**Unloading and transport at site**

	<b>DANGER!</b>
	<p>If incorrectly transported, transport units falling down can endanger people or damage transport units.</p> <ul style="list-style-type: none"> <li>⇒ Make sure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity.</li> <li>⇒ Observe even weight distribution and the center of gravity.</li> </ul>

**Please observe:**

- Read the weight on the delivery note.
- Leave the transport units packed as long as possible.
- Open the PE protective foil only as far as required for transport.
- Attach ropes far enough on the hoisting tackle so that they cannot exert any forces on the switchpanel walls under load.
- Move the transport unit as far as possible together with the wooden pallet.

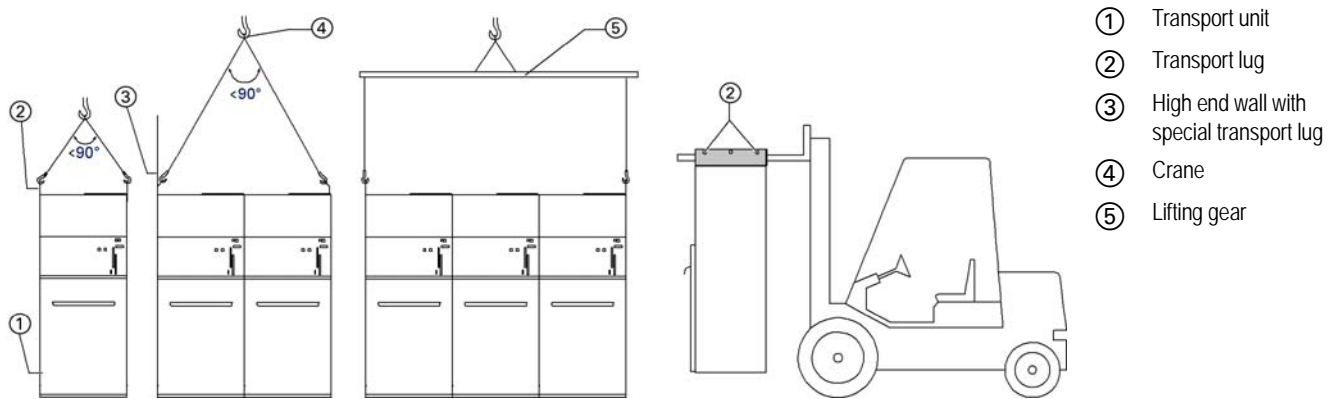
**Transport with transport lugs**

	<b>ATTENTION!</b>
	<p>Incorrect transport will damage the transport unit.</p> <ul style="list-style-type: none"> <li>⇒ The spreading angle of the fixing gear is smaller than 90° (&lt; 90°).</li> <li>⇒ Observe the center of gravity of the transport unit.</li> <li>⇒ Use permissible fixing gear only.</li> </ul>

A panel group consisting of more than two panels is transported with a lifting gear to prevent the panels from being pressed together.


Transport units with switchgear end walls are equipped with a special transport lug.

For transport with a fork-lift truck the transport unit is lifted by means of two carrying rods which are fitted through the transport lugs.



- ⇒ Remove seaworthy crate / latticed crate, if required.
- ⇒ Hang the transport slings/lifting gear in at the transport unit.
- ⇒ Remove the cable compartment cover from the panel subframe (see Page 126, "Removing the cable compartment cover").
- ⇒ Remove the transport unit from the wooden pallet. The transport unit is screwed onto the wooden pallet at the switchgear subframe.
- ⇒ Remove PE protective foil.
- ⇒ Take out the accessories, if applicable.
- ⇒ Remove the fixing screws of the switchgear frame from the wooden pallet.
- ⇒ Dispose of the packing material in an environmentally compatible way.
- ⇒ Lift the transport unit slowly.
- ⇒ Transport the transport unit.
- ⇒ Slowly lower the transport unit.
- ⇒ Remove the transport slings/lifting gear.
- ⇒ Remove the transport lugs.
  - Undo the screws.
  - Remove the transport lugs.
  - Refit the screws (protection against access to hazardous parts and foreign objects).

### Transport at site without wooden pallet

	<b>ATTENTION!</b>
	<p>Incorrect transport will distort the panel frames.</p> <p>⇒ Use roller pads with adequate size only.</p> <p>⇒ Apply roller pads only at the points provided for this purpose.</p>

If the transport unit cannot be lowered directly onto its mounting position, please proceed as follows:

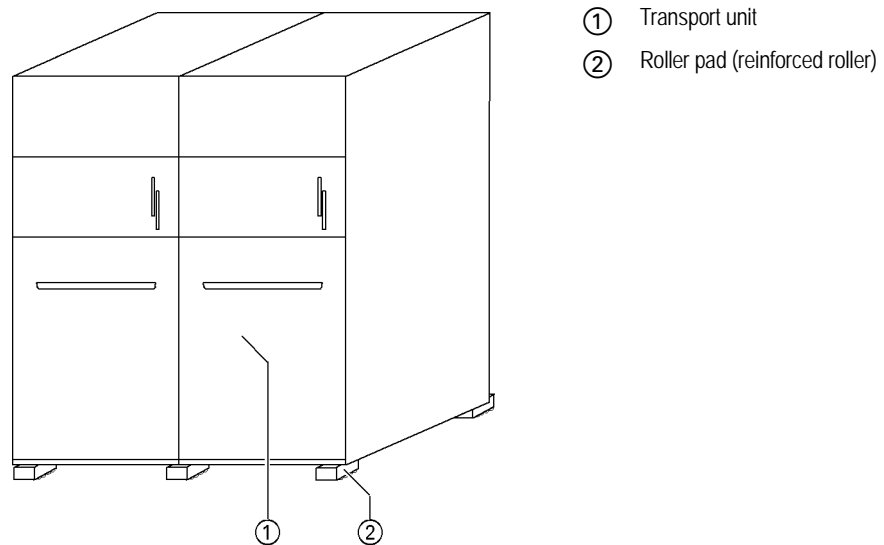


Fig. 45: Transport with roller pads

- ⇒ Transport the transport unit as far as possible using the transport lugs.
- ⇒ Slowly lower the transport unit onto the roller pads (reinforced rollers).
- ⇒ Push the transport unit to the mounting position.
- ⇒ Lift the transport unit at the side edges with roller crowbars and lower it slowly onto the mounting position.

## 11 Installing the panels

If required, the actions described in this section must be repeated until all panels are bolted together.

In the operations described in the following sections, it is assumed that

- the transport units are installed starting from the left.
- a new switchgear is being installed which has not been connected to the mains yet, and that it is therefore not live.

### 11.1 Installing the end wall

There must not be any separation wall between the end wall and the frame of the end panel. Separation walls are only used to separate individual panels, respectively the cable compartments. The end panels are delivered ex works without separation wall, except for group orders without a specified panel configuration. In this case, remove the separation wall before starting installation.

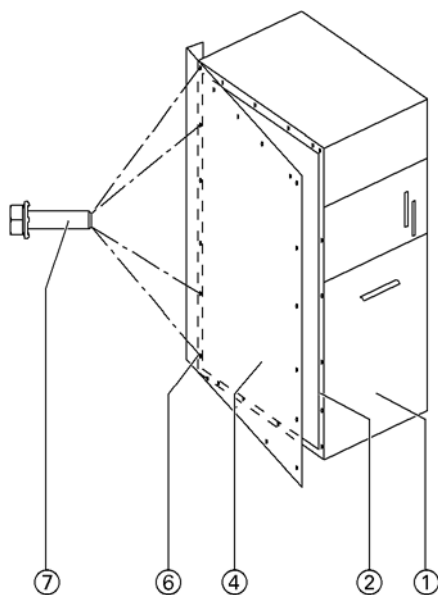


Fig. 46: Fixing points of left end wall

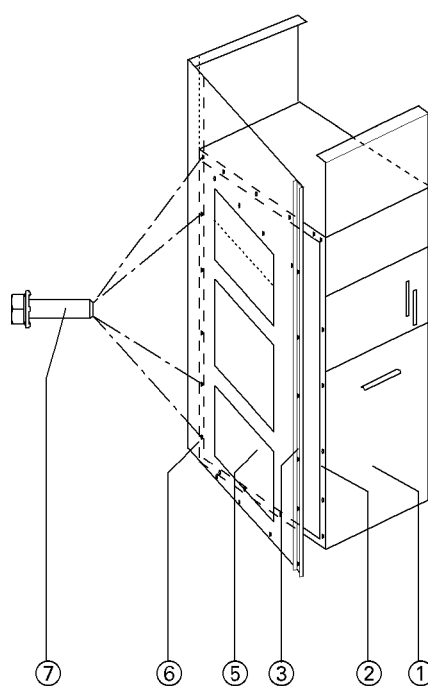


Fig. 47: Fixing points of left end wall (with optional burn-through protection)

- ① Left end panel
- ② Frame of end panel
- ③ U-profile (option)
- ④ Left end wall
- ⑤ Left end wall with optional burn-through protection
- ⑥ Fixing points
- ⑦ Bolt with contact washer

#### Installing left end wall

- ⇒ Press the end wall onto the frame of the panel and hold it.
- ⇒ Bolt the end wall and the U-profile (option) together with the frame of the panel.
- ⇒ In switchgear with pressure relief duct on the rear: In addition, rivet end wall together with pressure relief duct.

#### Installing right end wall

The right end wall is mounted in analogy to the left end wall.

## 11.2 Aligning the panel and fastening to the foundation

### Aligning the panel

Observe the minimum distances to the side and rear wall of the switchgear room in accordance with the switchgear arrangement.

As for the exact dimensions and minimum distances of the panels, please refer to the relevant dimension drawing and arrangement diagram.



#### ATTENTION!

A distorted panel frame will impair the function of the switchgear.

⇒ Lay shims under the panel frame if required.

The switchgear may have a level difference of 1 mm/m as a maximum.

⇒ Align the panel in horizontal position.

⇒ Align the panel in vertical position.

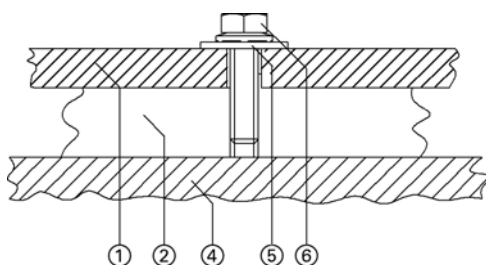
✓ The panel is aligned (levelled to max. 1 mm/m).

### Fastening the panel to the foundation

Fasten the panel to the foundation at 4 points at least.

There are two possibilities for fastening the panel durably to the foundation:

- Bolting to foundations rails
- Bolting into foundation dowels.



- ① Base frame of the panel
- ② Foundation rail
- ③ Dowel
- ④ Foundation
- ⑤ Washer  $d_a = 3 \times d_i$ ;  $d_i = 10.5 \text{ mm}$
- ⑥ Bolt with contact washer

Fig. 48: Bolted joint with foundation rail

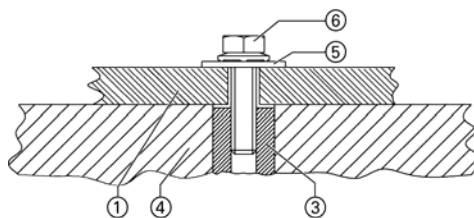


Fig. 49: Bolted joint with foundation dowel

### Bolting the panel to the foundation rails

⇒ Align the panel in horizontal and vertical position.

⇒ Bolt the panel onto the foundation rails, free from distortions.

### Bolting the panel into the foundation dowels

- ⇒ Drill dowel holes according to the hole pattern (see dimension drawing).
- ⇒ Fit the dowels.
- ⇒ Clean the panel from drilling dust.
- ⇒ Align the panel in horizontal and vertical position.
- ⇒ Bolt the panel into the foundation dowels, free from distortions.

### 11.3 Aligning and joining another panel

For trouble-free operation, all panels must be in vertical position and may only have a horizontal level difference of 1 mm/m.

- ⇒ Establish the same level (1 mm/m) using compensation shims ④.
- ⇒ Align the panel ③ in horizontal and vertical position.

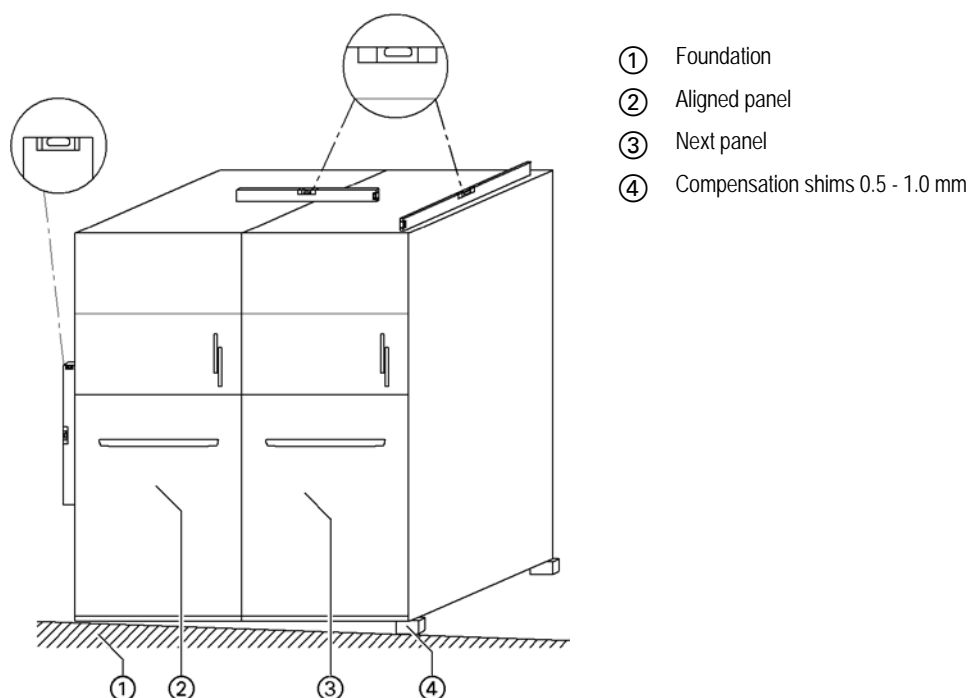


Fig. 50: Level compensation of panels

**Joining panels** The panels are joined with the supplied fixing material.

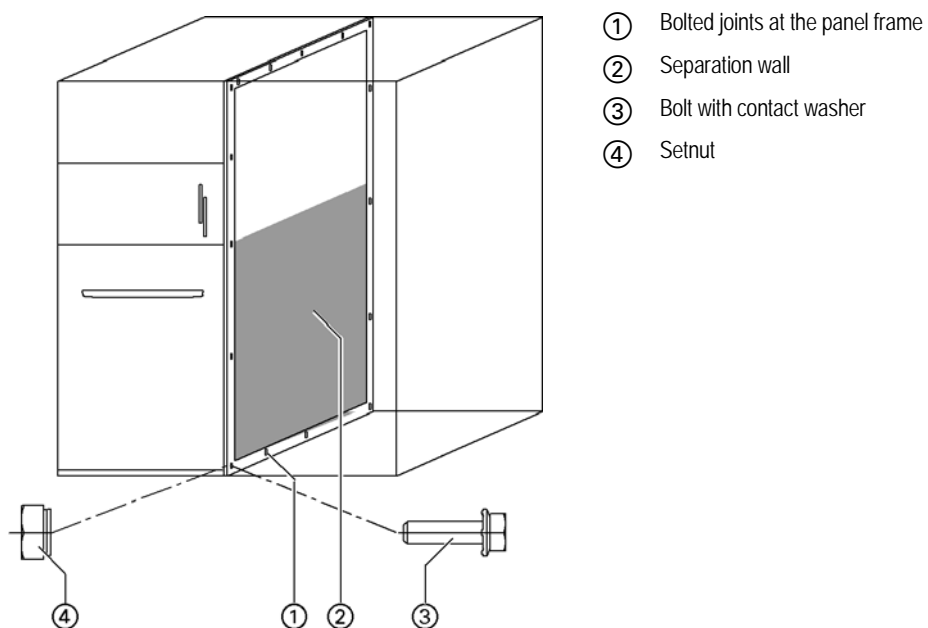


Fig. 51: Bolted joint of panels

- ⇒ Bolt panels together, free from distortions.
- ⇒ Verify horizontal and vertical alignment of panels.



### Joining rear walls (for free-standing arrangement)

In case of free-standing arrangement, the rear walls of the panels must be joined with connecting links.

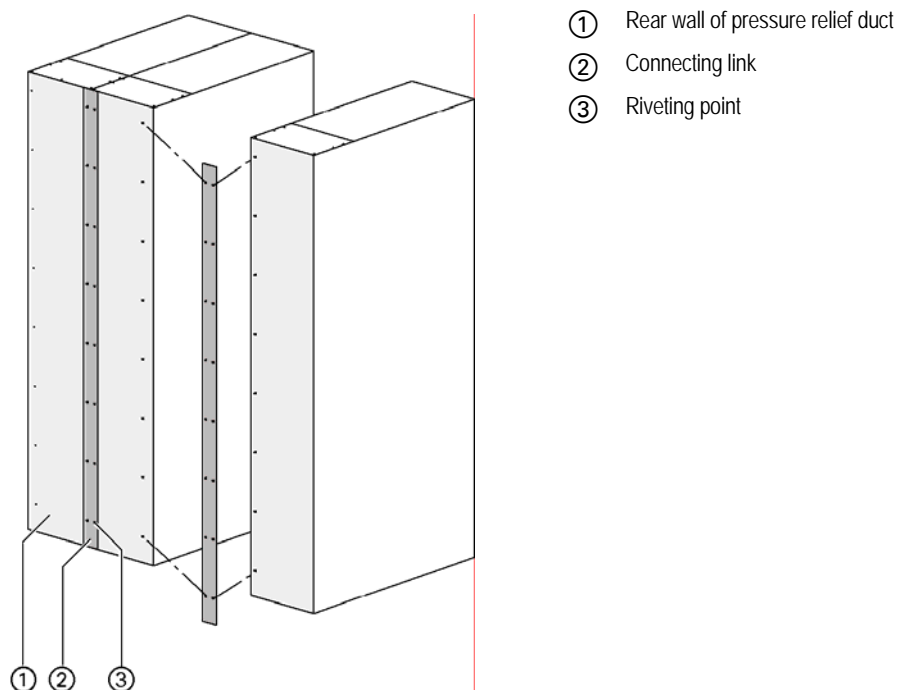



Fig. 52: Joining rear walls (for free-standing arrangement only)


⇒ Rivet the connecting link onto the pressure relief ducts at the rear.

11.4 Installing the busbar

Additional operations on switchgear with rated voltages of more than 12 kV are identified with "(>12 kV)". Skip these operations when installing switchgear with rated voltages up to 12 kV.

	<b>ATTENTION!</b>
	Insufficient electrical contact increases the transition resistance.
	⇒ Clean oxidized points of contact.
	⇒ Do not damage contact surfaces.

⇒ Mount the busbar tight and free from distortions and gaps.

	<b>ATTENTION!</b>
	Flashover due to polluted bushing-type insulators / busbars.
	⇒ Clean bushing-type insulators.
	⇒ Clean busbars.

Accessibility of busbar compartment

- Accessibility of busbar compartment:
- From the side (during installation)
  - From above through the cover of the busbar compartment

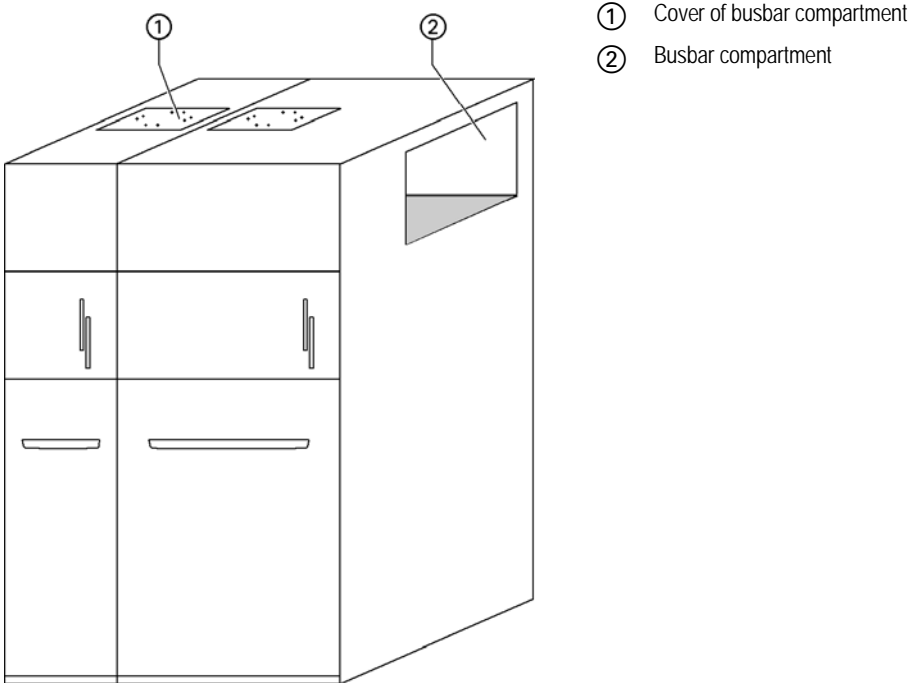


Fig. 53: Accessibility of busbar compartment

**Cleaning points of contact** ⇒ Rub points of contact bright with wire brush or emery paper.

**Cleaning bushing-type insulators / busbars** ⇒ Clean bushing-type insulators / busbars with cleaning agent and a lint-free rag.  
⇒ Dry bushing-type insulators / busbars with a lint-free rag.

Fastening busbars

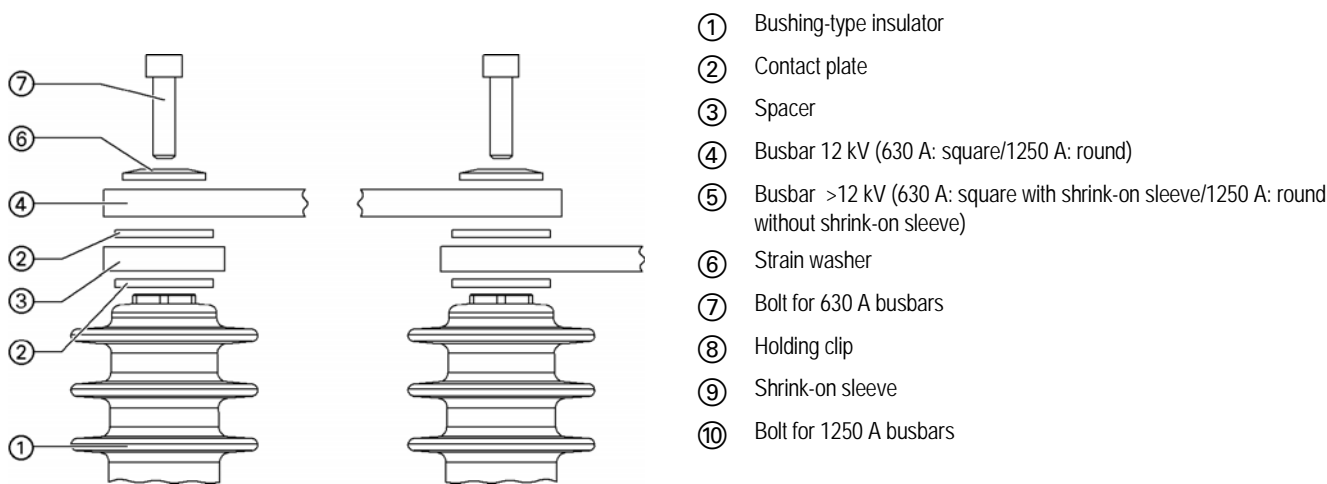


Fig. 54: Fastening busbars (up to 12 kV)

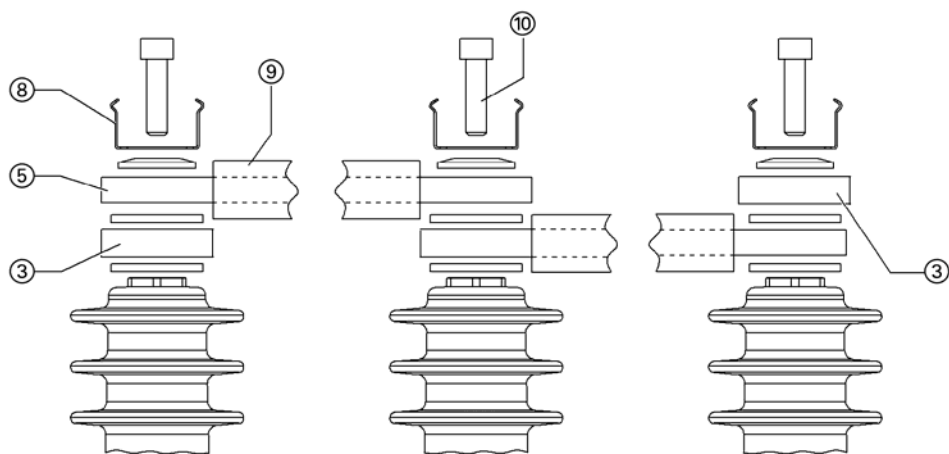


Fig. 55: Fastening busbars (>12 kV)

- ⇒ Assemble the busbars and the fixing material on the points of contact of the panel.
- ⇒ Bolt the busbar tight (tightening torque 50 Nm).

Fitting insulating caps (> 12 kV)

	<b>ATTENTION!</b>
	Switchgear damages due to flashover caused by lacking insulation at the busbar.
	⇒ Push the insulating cap onto the holding clip of the bolted busbar joint. ⇒ Check busbar insulation for damages.

- ⇒ Fit insulating cap on point of contact of busbar.
- ⇒ Snap insulating cap onto holding clip.
- ⇒ Check seat of insulating cap.

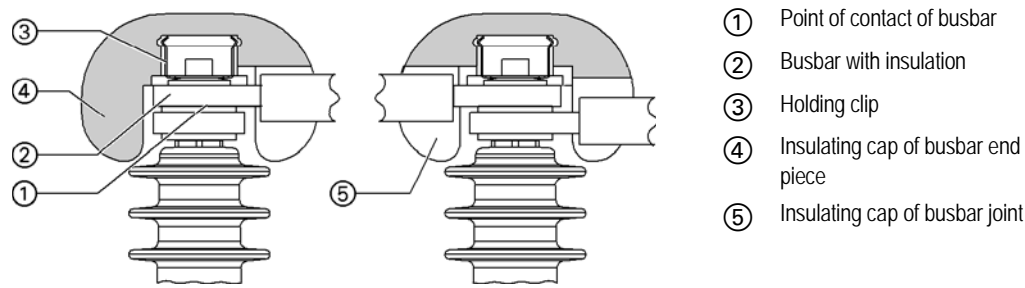


Fig. 56: Fitting insulating cap

11.5 Installing the earthing busbar

All panels of the switchgear are conductively connected by means of the earthing busbar.

	<b>ATTENTION!</b>
	Insufficient electrical contact increases the transition resistance.
	⇒ Clean oxidized points of contact. ⇒ Mount the earthing busbar tight and free from distortions and gaps.

- ⇒ Select the earthing busbars according to the panel width.
- ⇒ Bolt the first earthing busbar together with the end panel.
- ⇒ Bolt the earthing busbars of the other panels together.

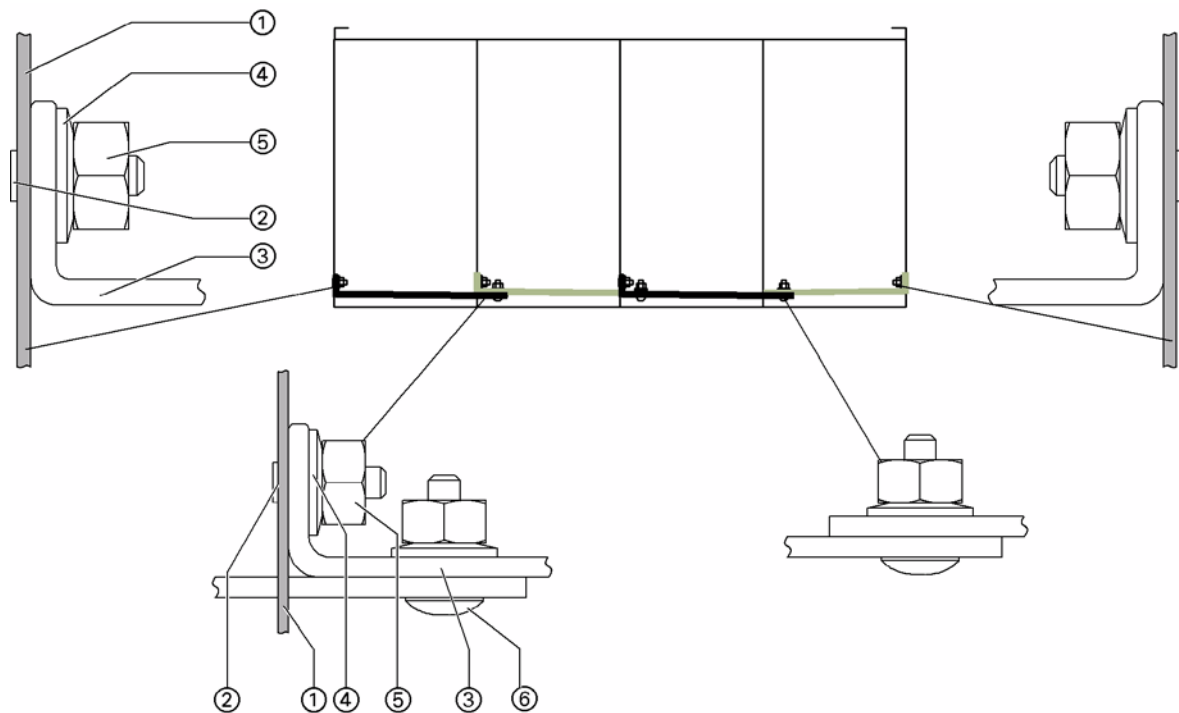


Fig. 57: Bolted joint of earthing busbar (top view)

- |                   |                    |
|-------------------|--------------------|
| ① Panel frame     | ④ Strain washer    |
| ② Setbolt         | ⑤ Nut              |
| ③ Earthing busbar | ⑥ Saucer-head bolt |

### 11.6 Installing the end wall

The installation of the switchpanels is completed by installing the second end wall (see Page 66, "Installing the end wall").

### 11.7 Connecting the substation earth to the switchgear frame

The switchgear must be connected to the substation earth at the earthing points. The position of the earthing points is shown in the dimension drawing.

Recommended points of connection for the station earth:

- The two exterior panels
- Every third panel of the switchgear
- Each metering panel.

The substation earth can be optionally connected to the panel inside or outside.

- ⇒ Select mounting direction of substation earth (to the inside / outside).
- ⇒ Bolt the substation earth together with the switchgear frame.
- ✓ The switchgear frame is earthed.

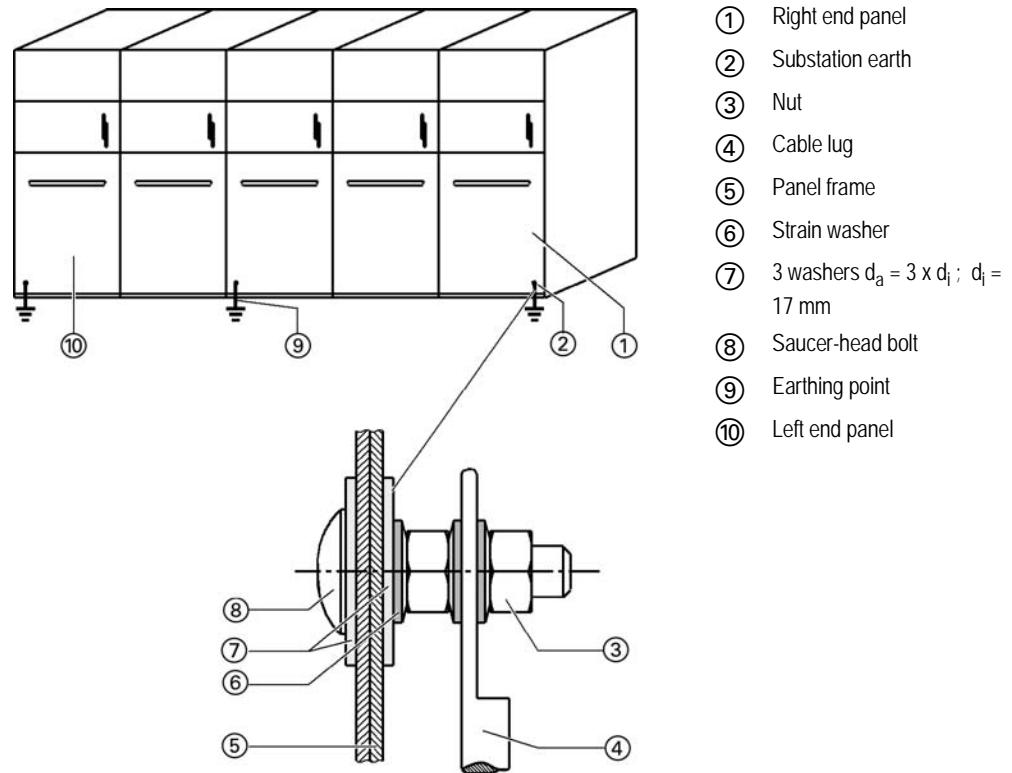


Fig. 58: Switchgear frame with earthing point (bolted joint M12)

## 12 Installing low-voltage compartments

⇒ Mount all low-voltage compartments onto the panels and interconnect them, if required.

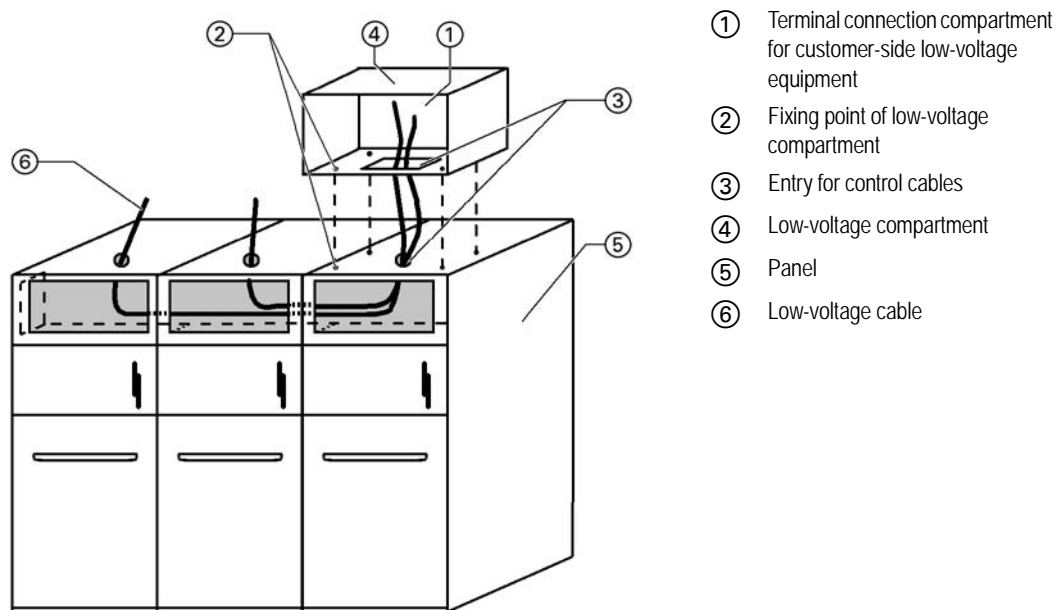


Fig. 59: Installation of low-voltage compartment

⇒ Connect all low-voltage cables to the switchgear according to the terminal, plug and cable designations of the circuit diagrams.

## 13 Connecting high-voltage cables

Additional operations on switchgear with rated voltages of more than 12 kV are identified with ">12 kV". Skip these operations when installing switchgear with rated voltages up to 12 kV.


### 13.1 Preparing connection of high-voltage cables


#### Preconditions


Preconditions for connecting high-voltage cables to the panels:

- The switchgear frame is connected to the substation earth.
- The **cable-type current transformers are mounted on the high-voltage cables**.
- The cable sealing ends have been assembled according to the manufacturer's instructions (see user information of cable sealing end manufacturer).

#### Safety instructions

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Isolate the panel.</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>ATTENTION!</b>
	<p>Insufficient electrical contact increases the transition resistance.</p> <ul style="list-style-type: none"> <li>⇒ Clean oxidized points of contact.</li> <li>⇒ Mount cable lug of cable sealing end tight and free from distortions and gaps.</li> </ul>

	<b>ATTENTION!</b>
	<p>Switchgear damages due to flashover caused by lacking insulation at the cable connection.</p> <ul style="list-style-type: none"> <li>⇒ Do not damage the insulating sleeve over the points of contact of the cable connections.</li> <li>⇒ Check cable insulation for damages.</li> <li>⇒ Do not damage the bolt cover over the points of contact of the cable connections.</li> </ul>

#### Cleaning points of contact

- ⇒ Rub points of contact bright with wire brush or emery paper.

#### Cleaning cable elbow coupling / cable lug

- ⇒ Clean cable elbow coupling / cable lug with a lint-free rag.

#### Aligning high-voltage cable


- ⇒ Untwist cable.
- ⇒ Hold cable sealing end at the point of cable connection.
- ⇒ Align the hole pattern of the cable elbow coupling / cable lug of the cable sealing end.



### Fixing high-voltage cable on cable bracket

If the C-profile is located in the area of the cable sealing end, shift the cable bracket / air guide so that the cable clamps or the air guide (optional) are located underneath the cable sealing end.

While fixing the cables, please observe that the cable shields are not caught in the cable clamps.

	<b>ATTENTION!</b>
	<p>Switchgear damages due to missing strain relief.</p> <ul style="list-style-type: none"> <li>⇒ Eliminate cable twisting.</li> <li>⇒ Mount strain relief underneath cable sealing end.</li> </ul>

⇒ Fix the cable in the cable clamp.

✓ The strain relief is mounted.

### Fixing cable-type current transformers

If there is not enough space available for the cable-type current transformer between the cable clamps and the floor cover (protection against small animals), the transformer can also be fixed underneath the optional floor cover.

⇒ Break the recess for the retaining device out of the optional floor cover at the point provided for this purpose.


⇒ Bolt the retaining device for the cable-type current transformer together with the cable bracket.

⇒ Fix the cable-type current transformer on the retaining device.

⇒ Lay the secondary leads of the cable-type current transformer through the metal tube to the associated terminal strip in the terminal connection compartment for customer-side low-voltage equipment.

### Connecting cable shields

The cable shields of all three phases (L1, L2 and L3) are connected to one common earthing point.

	<b>ATTENTION!</b>
	<p>Switchgear damages due to flashover.</p> <ul style="list-style-type: none"> <li>⇒ Route the cable shield directly and tightly to the C-profile, keeping the maximum possible distance to live parts.</li> </ul>

⇒ Route the cable shields downwards to the C-profile.

⇒ Bolt the cable shields to the C-profile.

⇒ Push the air guide close to the cable underneath the cable shield (optional).

### 13.2 Connecting cable panel to high voltage

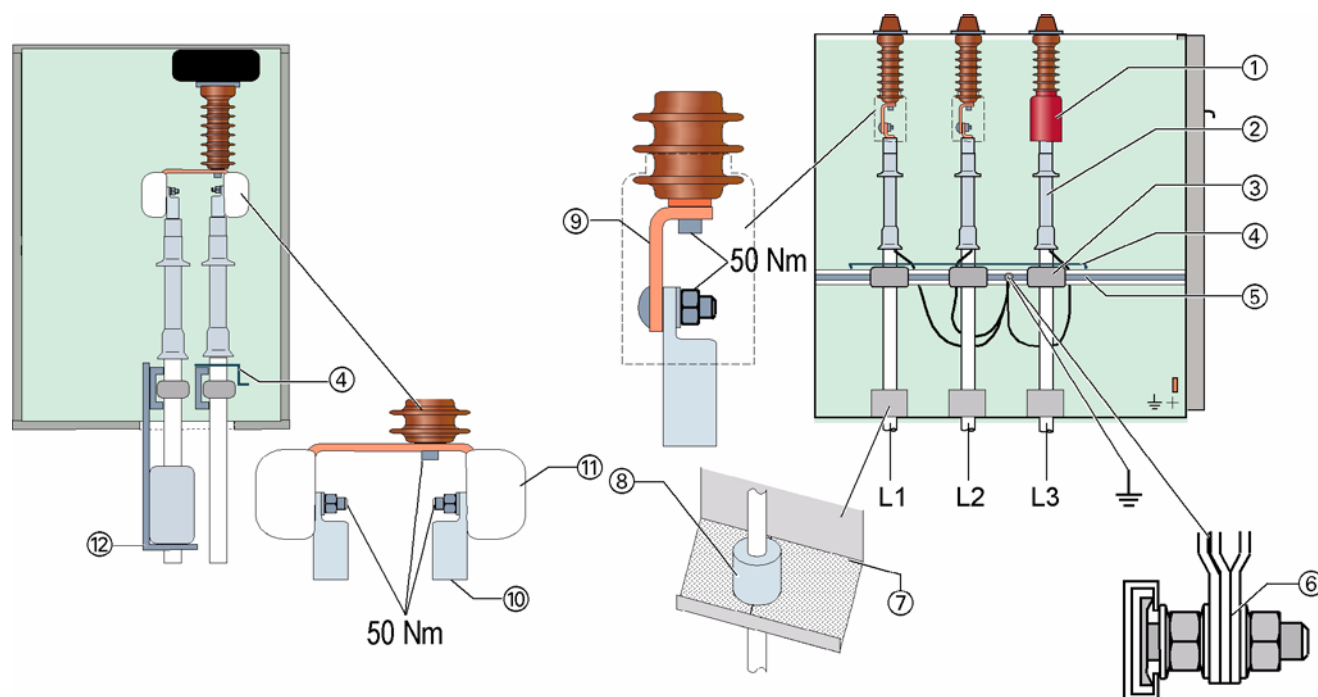


Fig. 60: Cable connection in the cable panel

- |                                 |   |   |
|---------------------------------|---|---|
| ① Insulating sleeve (> 17,5 kV) | ⑤ Cable bracket (C-profile)                 | ⑨ Cable elbow coupling, copper                        |
| ② Cable sealing end             | ⑥ Earthing point of cable shields           | ⑩ Double cable connection                             |
| ③ Cable clamp (option)          | ⑦ Protection against small animals (option) | ⑪ Bolt cover (>17.5 kV)                               |
| ④ Air guide (option)            | ⑧ Cable-type current transformer(option)    | ⑫ Retaining device for cable-type current transformer |

All cable panels have an identical cable connection.

Cable panels:

- Ring-main panel
- Circuit-breaker panel with fixed-mounted vacuum circuit-breaker
- Cable panel with make-proof earthing switch
- Cable panels without switching devices

As for the exact panel dimensions, such as e.g. the cable connection height, please refer to the relevant dimension drawing and arrangement diagram.

#### Connecting high-voltage cables

- ⇒ Check the tightening torque (50 Nm) of the bolted joint between the cable elbow coupling and the bushing-type insulator.
- ⇒ Bolt cable lug of cable sealing end and cable elbow coupling together tightly and free from distortions and gaps. The tightening torque at the cable elbow coupling is 50 Nm. As for the tightening torques of the cable lugs / cable sealing ends, please observe the manufacturer's instructions.
- ⇒ Put the insulating sleeve (> 17.5 kV) over the cable connection.

### 13.3 Connecting circuit-breaker panel to high voltage

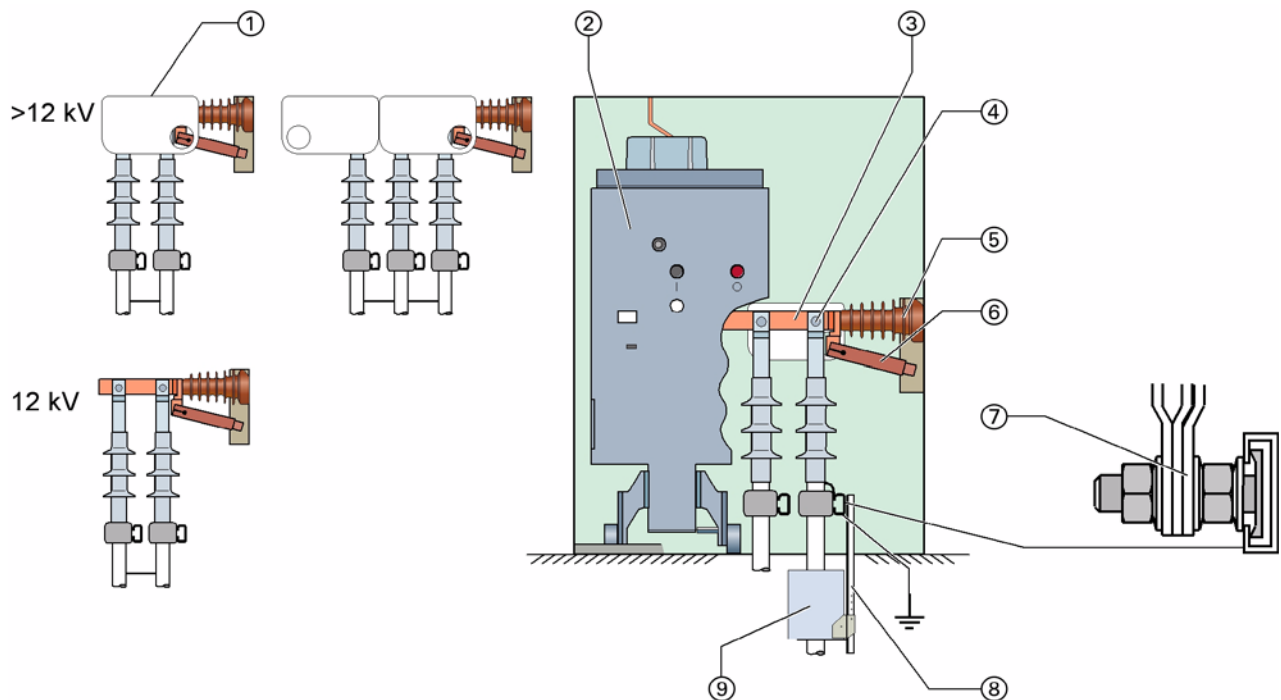


Fig. 61: Cable connection in circuit-breaker panel with 3AH6 vacuum circuit-breaker

- |   |  |   |
|---|--|---|
| ① Bolt cover (> 12 kV)                                  | ⑤ Post insulator   | ⑨ Cable-type current transformer (option) |
| ② 3AH6 vacuum circuit-breaker                           | ⑥ Movable earthing switch contact                              |   |
| ③ Cable elbow coupling, copper                          | ⑦ Earthing point of cable shields                              |   |
| ④ Bolted joint at point of cable connection / cable lug | ⑧ Retaining device for cable-type current transformer (option) |   |

As for the exact panel dimensions, such as e.g. the cable connection height, please refer to the relevant dimension drawing and arrangement diagram.

#### Connecting high-voltage cables

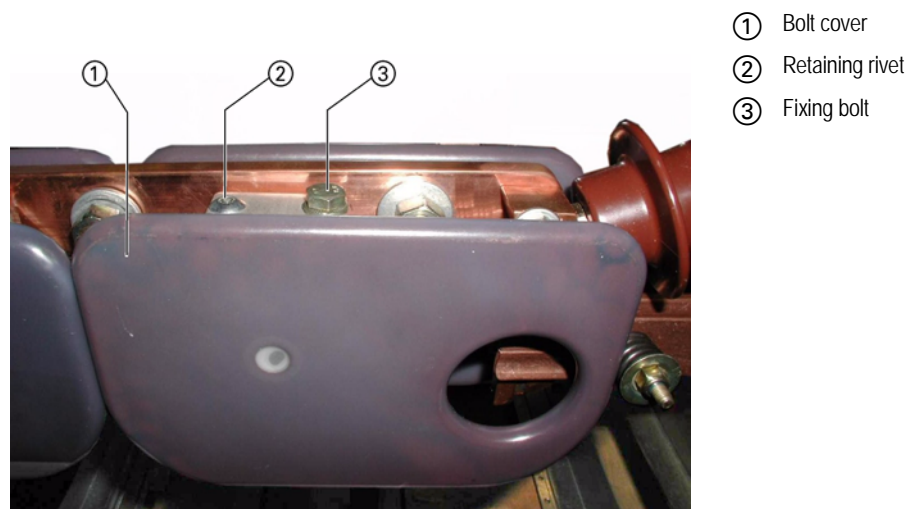


Fig. 62: Bolt cover (12 kV)

- ⇒ Remove fixing bolt ③ of bolt cover.
- ⇒ Take bolt cover ① upwards out of the hole for the retaining rivet ②.
- ⇒ Bolt cable lug and point of cable connection together tightly and free from distortions and gaps. The tightening torque at the point of cable connection is 50 Nm. As for the tightening torques of the cable lugs / cable sealing ends, please observe the manufacturer's instructions.
- ⇒ Refit the bolt cover.
- ⇒ Tighten the fixing bolt of the bolt cover.

### 13.4 Connecting transformer panel to high voltage

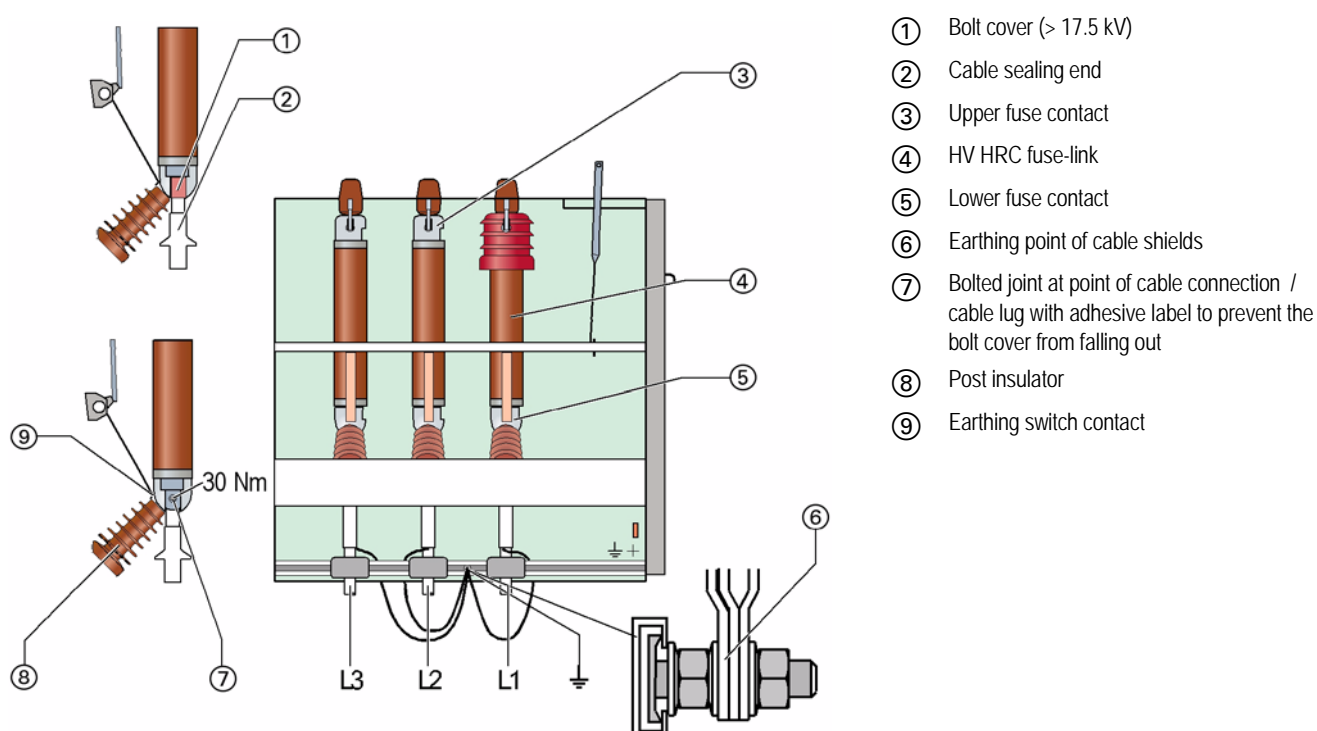



Fig. 63: Cable connection in transformer panel

As for the exact panel dimensions, such as e.g. the cable connection height, please refer to the relevant dimension drawing and arrangement diagram.

	<p><b>NOTE!</b></p> <p>Use cable sealing ends with a maximum cable lug width of 32 mm.</p>
---	--

### Connecting high-voltage cables

- ⇒ Remove adhesive label from point of cable connection.
- ⇒ Remove bolt cover (> 17.5 kV).
- ⇒ Bolt cable lug and point of cable connection together tightly and free from distortions and gaps. The tightening torque at the point of cable connection is 30 Nm. As for the tightening torques of the cable lugs / cable sealing ends, please observe the manufacturer's instructions.
- ⇒ Hang the bolt cover (>17.5 kV) in over the point of cable connection.

### 13.5 Connecting metering panel to high voltage

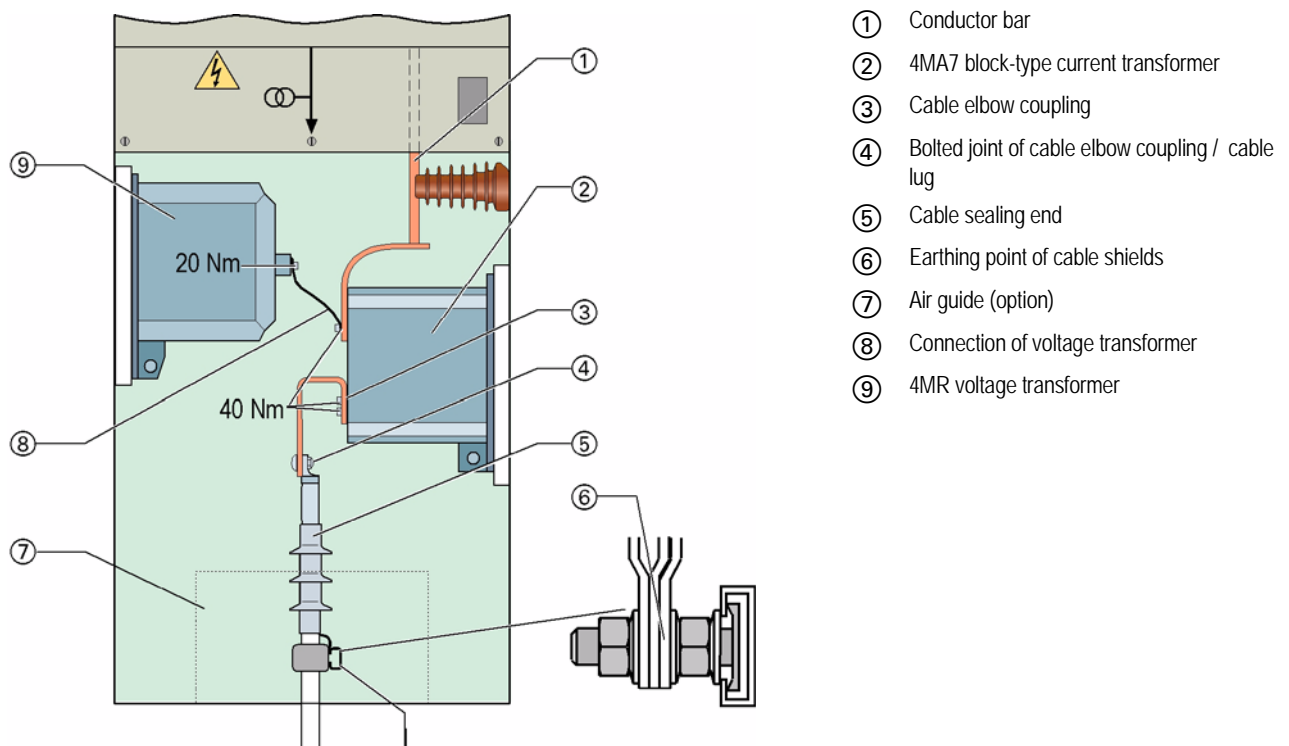


Fig. 64: Cable connection in metering panel

As for the exact panel dimensions, such as e.g. the cable connection height, please refer to the relevant dimension drawing and arrangement diagram.

### Installing block-type current transformers or voltage transformers

- ⇒ Bolt block-type current and/or voltage transformers onto the transformer mounting plate(s).
- ⇒ Connect block-type current and/or voltage transformers on the high-voltage side.
- ⇒ Lay the secondary leads of the block-type current transformers and/or voltage transformers through the metal tube to the associated terminal strip.
- ✓ The block-type current transformers and/or voltage transformers are installed.

**Connecting high-voltage cables**

- ⇒ Check the tightening torque (40 Nm) of the bolted joint between the cable elbow coupling and the block-type current transformer or voltage transformer.
- ⇒ Bolt the cable lug of the cable sealing end and the cable elbow coupling tight free from distortions and gaps. The tightening torque at the cable elbow coupling is 50 Nm. As for the tightening torques of the cable lugs / cable sealing ends, please observe the manufacturer's instructions.
- ⇒ Remove the air guide in order to connect the high-voltage cables, and mount it again afterwards (optional).

## 14 Installing and connecting low-voltage equipment

### 14.1 Laying secondary cables

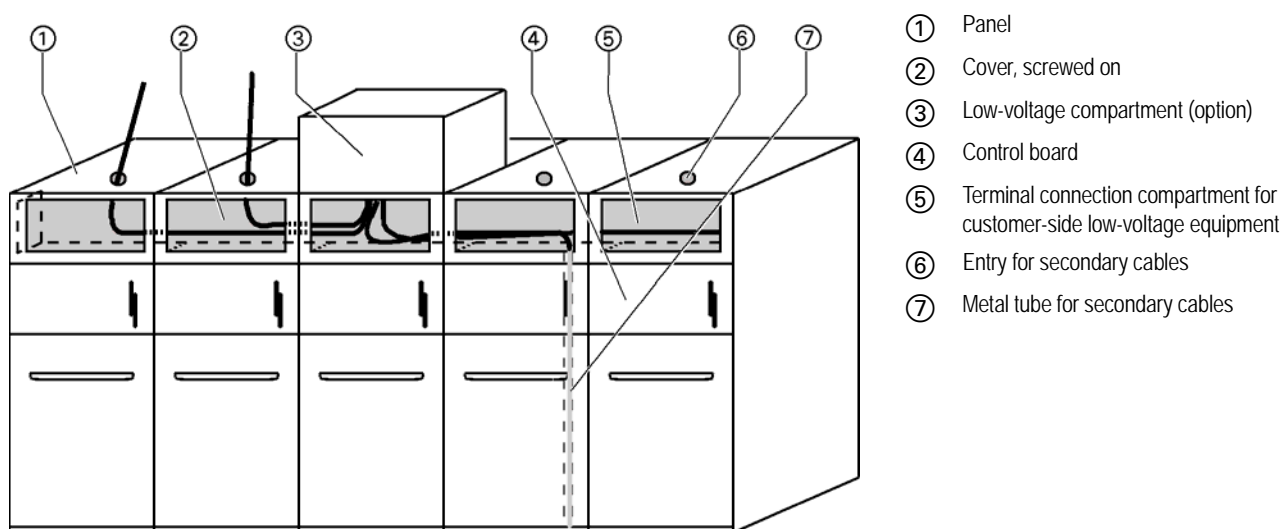


Fig. 65: Cable routing for customer-side low-voltage equipment

The secondary cables are routed over the control boards behind the screwed-on cover.

The secondary cables can be laid directly into the terminal connection compartment either from above through a plastic stopper or from below through a metal tube arranged along the switchgear frame.

Please observe the correct connection of the secondary leads for the cable-type current transformers and the block-type current transformers and/or the voltage transformers.

### 14.2 Connecting low-voltage

Connect all customer-specific low-voltage cables according to the terminal, plug and cable designations of the circuit diagrams of the switchgear.

### 14.3 Connecting the panel heater

The individual panels of SIMOSEC switchgear are equipped with a panel heater to prevent condensation.

#### Technical data


Rating	75 W for 375 mm and 500 mm wide panel types 100 W for 750 mm and 875 mm wide panel types
--------	---

⇒ Connect the panel heater according to the enclosed circuit diagram.

## 15 Switchgear extension

If required, existing switchgear can be extended with further panels or the existing panel configuration can be modified. After isolating, earthing and discharging the spring energy stores of the operating mechanisms (see Page 92, "To be observed for operation"), additional panels can be installed and connected. The procedure to be followed for switchgear extension is the same as for first installation.


## 16 Commissioning SIMOSEC switchgear


	<b>NOTE!</b>
	In the operations described in the following sections, it is assumed that a new switchgear is being installed which has not been connected to the mains yet, and that it is therefore not live.  ⇒ The tests described may only be performed by authorized and qualified personnel.

### 16.1 Checking readiness for service

Check readiness for service (see INSTALLATION INSTRUCTIONS, "Verification of readiness for service").

### 16.2 Cleaning the switchgear

	<b>DANGER!</b>
	Switchgear damages due to flashover caused by foreign objects.  ⇒ Remove all foreign objects from the switchgear.

	<b>ATTENTION!</b>
	⇒ Dry humid parts of the switchgear.

Clean the switchgear (see Page 143, "Cleaning the switchgear").

### 16.3 Final work

#### Visual inspection of switchgear

- ⇒ Check data on the rating plates according to the circuit diagrams.
- ⇒ Close all covers/doors.
- ⇒ Check safety/warning labels provided at the switchgear.

#### Checking the accessories

The following accessories are ready to hand at the switchgear:

- Operating instructions
- Circuit diagrams
- Double-bit keys (option)
- Operating lever for three-position switch
- Hand crank for 3AH vacuum circuit-breaker
- Voltage detecting systems / plug-in indicator (option)
- HV HRC fuse-links (option) (see Page 134, "Checking the fuse tripping mechanism")
- Test fuse (option)
- Warning label "DO NOT SWITCH!" (option)

### 16.4 Testing the switchgear electrically

#### Checking the earthing

Check the following at the panels:

- All earthing connections are provided
- Conductive connection of all earthing switches
  - **Transformer panel:** Movable earthing contacts touching on all three phases in EARTHED position
  - **Circuit-breaker panel with 3AH6 vacuum circuit-breaker:** Closed movable earthing contact on all three phases in EARTHED position

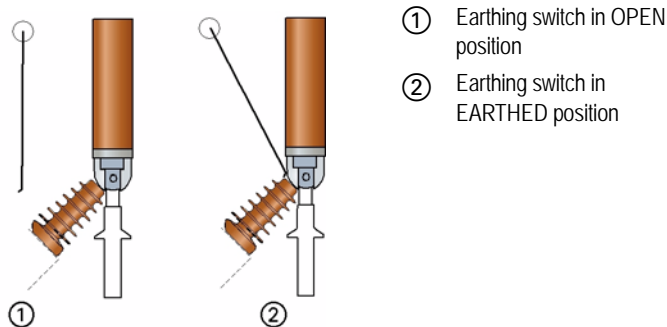


Fig. 66: Movable earthing contact in transformer panel

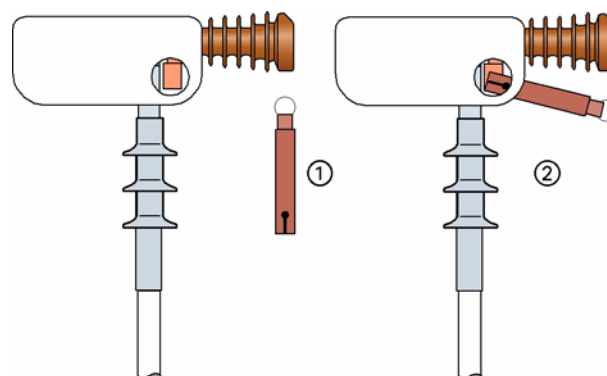


Fig. 67: Movable earthing contact in circuit-breaker panel with 3AH6 vacuum circuit-breaker



**Checking high-voltage connections**


- ⇒ Check complete designations of cable connections.
- ⇒ Check correct phase sequence of cables.
- ⇒ Check correct laying and earthing of cable shields.
- ⇒ Check covers of capacitive test sockets.
- ⇒ Check earthing connections (switchgear earthing / earthing busbar).
- ⇒ Check insulating caps for completeness and damages.
- ⇒ Check insulations for damages.
- ⇒ Check tightening torque of bolted joints.
- ⇒ Check strain relief of cables.


**Checking low-voltage connections**

- ⇒ Check complete designations of terminals and plugs.
- ⇒ Check firm seat of cables.
- ⇒ Check secondary wiring of transformers.
- ⇒ Check correct connection of control cables of 3AH6 vacuum circuit-breaker.

**16.5 Operating the switchgear for test**

SIMOSEC switchgear is operated mechanically and electrically for test at the factory. Before commissioning, operate the switchgear again mechanically and electrically for test.

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Verify safe isolation from supply.</li> <li>⇒ Isolate adjacent panels.</li> </ul>

	<b>DANGER!</b>
	<p>Mortal danger when putting defective switchgear into operation.</p> <ul style="list-style-type: none"> <li>⇒ If there are any functional failures during test operation, stop commissioning immediately.</li> <li>⇒ Inform the regional Siemens representative.</li> </ul>

For mechanical operation and for testing the low-voltage system, the undervoltage release (option) on the circuit-breaker must be deactivated.


- ⇒ Deactivate the undervoltage release (option) on the vacuum circuit-breaker:
  - Remove the cover of the vacuum circuit-breaker.
  - Remove the cover of the operating mechanism box.
  - Adjust the retaining screw of the striker according to the instructions provided in the operating mechanism box.
  - Fit the cover of the operating mechanism box.
  - Fit the cover of the vacuum circuit-breaker.

**Mechanical operation** The panels are delivered ex works with all switching devices in "OPEN" position, and the closing and opening springs of the stored-energy mechanisms are partly pre-charged.

- ⇒ Operate the different switching options of each panel several times.
- ⇒ Switch the three-position switches and circuit-breakers several times to CLOSED/ OPEN respectively EARTHED position, verifying the correct indication of the associated position indicators at the same time.
- ⇒ Test interlocking conditions of each switching option (without using force).
- ⇒ Test the mechanical tripping (striker) of the HV HRC fuse assembly with the test fuse (see Page 134, "Checking the fuse tripping mechanism")
- ✓ The switchgear has been completely operated mechanically for test.

The switch positions of the SIMOSEC switchgear are described in the operating instructions (see OPERATING INSTRUCTIONS, "To be observed for operation").

### Testing low-voltage system

	<b>DANGER!</b>
	<p>Danger of injury and switchgear damages due to beating hand crank when the motor operating mechanism starts up.</p> <ul style="list-style-type: none"> <li>⇒ Use original hand crank with freewheel.</li> <li>⇒ Make sure that hand crank is removed.</li> </ul>

- ⇒ Check the auxiliary circuits according to the circuit diagram and manual.
- ⇒ Switch on low voltage externally.
- ✓ The motor operating stored-energy mechanisms charge the closing springs automatically.
- ⇒ Check the indicators according to the circuit diagram and the mimic diagram of the switchgear.
- ⇒ Check the control elements according to the circuit diagram and the mimic diagram of the switchgear.
- ✓ The low-voltage system has been tested.

**Electrical operation** The switch positions of SIMOSEC switchgear are described in the operating instructions (see OPERATING INSTRUCTIONS, "To be observed for operation").


- ⇒ Operate the different switching options of each panel several times.
- ⇒ Verify correspondence between the position indication on the control board and the actual switch position.
- ⇒ Test interlocking conditions of each switching option (without using force).
- ✓ The switchgear has been completely operated electrically for test.


### 16.6 Performing power-frequency voltage test

A power-frequency voltage test can be carried out after consultation and authorization by the Siemens representative.

## 16.7 Connecting operating voltage (high voltage)

The connection is conditional on complete and trouble-free commissioning (see Page 84, "Commissioning SIMOSEC switchgear").

	<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 operator.</li> </ul>

	<b>ATTENTION!</b>
	<p>Mortal danger due to different phase sequence of incoming feeders.</p> <ul style="list-style-type: none"> <li>⇒ Ensure correct phase sequence.</li> <li>⇒ Do only use adequate phase meters.</li> </ul>

- ⇒ Earth cable feeders without connected high-voltage cables at the feeder, and secure the earthing switch against de-earthing.
- ⇒ Switch all switching devices to "OPEN" position.
- ⇒ Reset short-circuit indicators.
- ⇒ Verify correct terminal-phase connections with respect to next incoming feeder:
  - Apply operational high voltage to opposite substation.
  - If applicable, close vacuum circuit-breaker on panel to be tested.
  - Connect phase comparison test unit to the capacitive test sockets of one phase at the panel and at the adjacent panel.




- Test all three phases.
- ⇒ Connect tested incoming feeder (busbars / feeders) according to the specifications / the instructions of the switchgear operator.
- ✓ The operating voltage is connected.

### **16.8 Documentation of commissioning**

Modifications due to installation or commissioning have to be

- included in the circuit diagrams,
- submitted to the regional Siemens representative.

# Operation

	<b>DANGER!</b>
	<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> <ul style="list-style-type: none"><li>⇒ Determine the IAC classification of the switchgear by means of the data on the rating plate (see Page 58, "Rating plates").</li><li>⇒ Regulations for access to switchgear areas without internal arc classification according to IEC 62271-200 must be defined by the entrepreneur or the switchgear owner.</li></ul>

## 17 Indicators and control elements

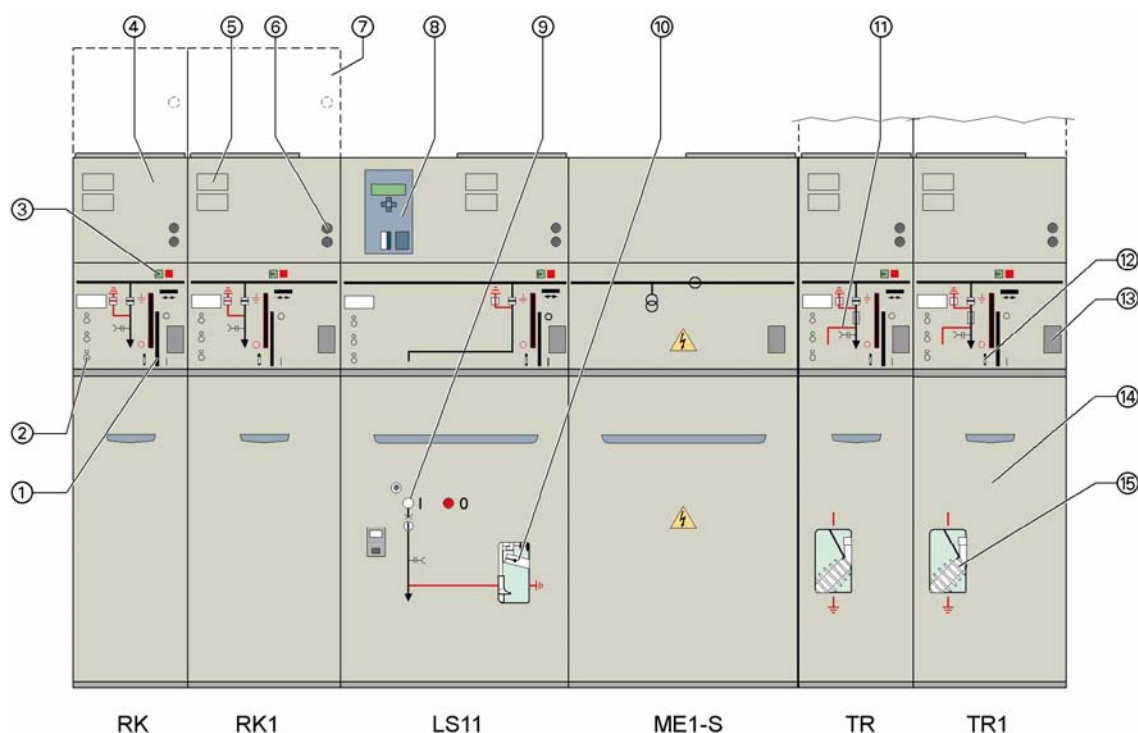


Fig. 68: Indicators and control elements

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>① Three-position switch</li> <li>② Sockets for capacitive voltage detecting system</li> <li>③ Ready-for-service indicator for SF<sub>6</sub> gas (option)</li> <li>④ Niche for customer-side low-voltage equipment</li> <li>⑤ Recess for indicators:               <ul style="list-style-type: none"> <li>- Short-circuit indicator (option)</li> <li>- Earth-fault indicator (option)</li> <li>- CAPDIS (option)</li> </ul> </li> <li>⑥ Momentary-contact rotary control switch "ON - OFF" and local-remote switch for the motor operating mechanism of the three-position switch (option)</li> </ul> | <ul style="list-style-type: none"> <li>⑦ Low-voltage compartment (option)</li> <li>⑧ SIPROTEC4 bay controller (option)</li> <li>⑨ 3AH6 vacuum circuit-breaker</li> <li>⑩ Option: Earthing switch for circuit-breaker panel LS11/LS31/LS32</li> <li>⑪ Control board with mimic diagram and interlocking elements</li> <li>⑫ Interlocking lever for cable compartment cover</li> <li>⑬ Rating plate</li> <li>⑭ Cable compartment</li> <li>⑮ Earthing switch for transformer panel</li> </ul> |
|---|--|

For detailed information about the modules and components, see Page 12, "Components" and the medium-voltage switchgear catalog HA 41.21.

## 18 To be observed for operation

Before operation, always verify readiness for service and safe isolation from supply - if required - of the panels to be operated.

During operation, always observe the following:

- Safety instructions
- Perfect operation of safety equipment
- Only authorized and qualified personnel is working on the switchgear.

### 18.1 Verification of readiness for service

The ready-for-service indicator for SF<sub>6</sub> gas (option) shows the gas density in the three-position switch required to operate the panel.



Fig. 69: Ready-for-service indicator for SF<sub>6</sub> gas (option)

If a three-position switch filled with SF<sub>6</sub> gas is not ready for operation:


- Do not put the switchgear into operation
- Do not operate the switchgear
- Inform the regional Siemens representative.


#### 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.

18.2 Verification of safe isolation from supply of a panel feeder

	<b>DANGER!</b>
	Short-circuit due to jumpers in the coupling section. Short-circuit jumpers will impair the function of the surge arrester.  ⇒ Do not bridge the coupling section.

	<b>DANGER!</b>
	Mortal danger if safe isolation from supply is verified incorrectly!  ⇒ Verify the perfect operation of the voltage indicator and the coupling section: <ul style="list-style-type: none"><li>- On live equipment</li><li>- With a test unit according to IEC 61243-5/EN 61243-5</li><li>- On all phases</li></ul> ⇒ Perform the repeat test of the interface conditions on the capacitive interfaces and the indicators according to the customer's specifications.

Verify safe isolation from supply of the switchgear or the panel:

- With the indicator of the capacitive voltage detecting system
- With the integrated voltage detecting system CAPDIS (option)

HR/LRM system

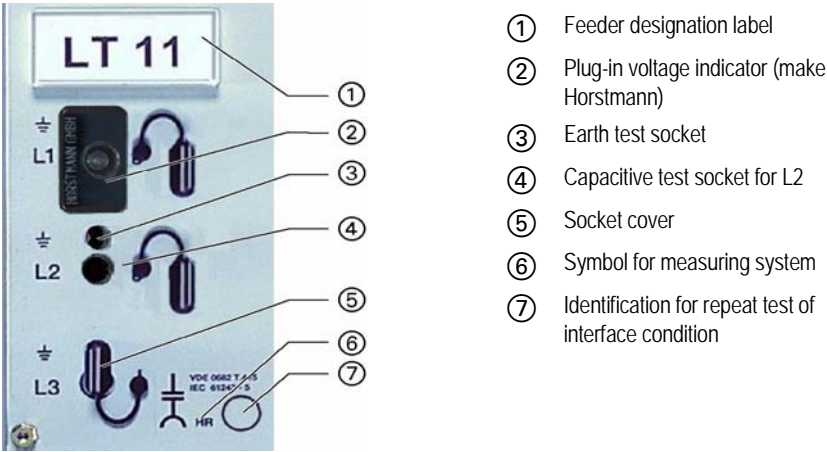


Fig. 70: Control board section: Sockets for capacitive voltage detecting system



### Proceed as follows:

- ⇒ Determine type of measuring system (HR/LRM).
- ⇒ Select suitable indicator.
- ⇒ Verify perfect operation of indicator if required.
- ⇒ Remove cover of coupling section.
- ⇒ Plug voltage indicator in.
- ⇒ Read indicator:
  - ☐ If the indicator flashes or lights up, the feeder is live.
  - ☐ If the indicator does not flash or light up, the feeder is isolated from supply.
- ⇒ Remove indicator.
- ⇒ Fit cover of coupling section.
- ⇒ Check the other phases in the same way.
- ✓ The measurement of this feeder panel is completed.

### Indicators CAPDIS -S1+/-S2+

- ⇒ Verify safe isolation from supply on the display of CAPDIS-S1+/-S2+ see Page 29, "Voltage detecting systems".

## 19 Operating the three-position switch

Cable panels, bus sectionalizer panels and transformer panels are equipped with a three-position switch. Depending on the maximum normal current, the panels are equipped with a three-position disconnecter (see Page 17, "Three-position disconnecter") **or** a three-position switch-disconnector (see Page 15, "Three-position switch-disconnector"). The two three-position switches are operated in the same way.

Panels with three-position switch-disconnector:

- Ring-main panel RK, RK1, RK-U
- Bus sectionalizer panel LT2(-W), LT22(-W)
- Transformer panel TR, TR1
- Metering panels with switching devices ME3, ME31-F

Panels with three-position disconnecter:

- Circuit-breaker panel LS31, LS32, LS31-U
- Bus sectionalizer panel LT31

### 19.1 Indicators and control elements of the three-position switch

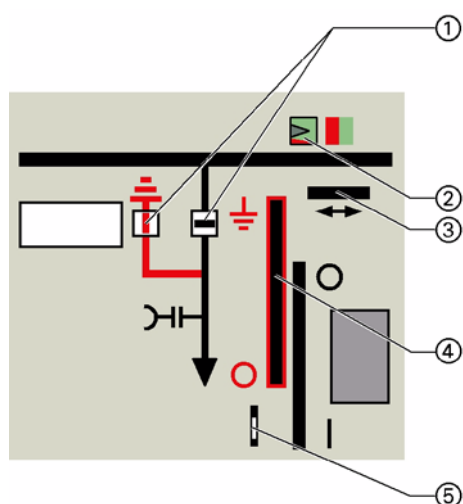


Fig. 71: Control board section of ring-main panel with three-position switch-disconnector / three-position disconnecter

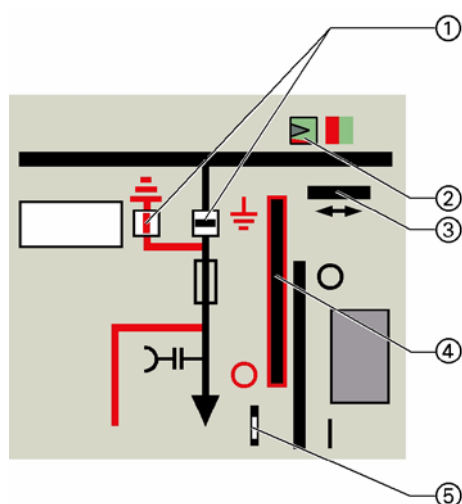


Fig. 72: Control board section of transformer panel with three-position switch-disconnector

- ① Position indicator
- ② Ready-for-service indicator for SF<sub>6</sub> gas (option)
- ③ Control gate for three-position switch
- ④ Actuating opening for the operating mechanism of the three-position switch
- ⑤ Interlocking lever for cable compartment cover

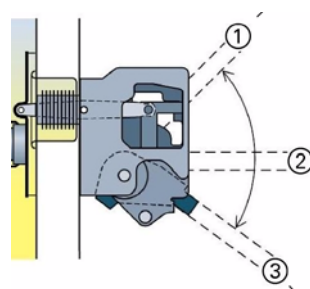


- ① Coded operating lever for the earthing switch (red handle - option)
- ② Coded operating lever for the feeder earthing switch in the circuit-breaker panel (LS) (red handle - option)
- ③ Operating lever (single-lever operation) / coded operating lever for disconnector / switch-disconnector (black handle)
- ④ Anti-reflex lever (to reverse the switching direction, re-insert the operating lever - option)

Fig. 73: Operating levers for three-position switch

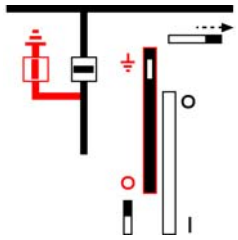
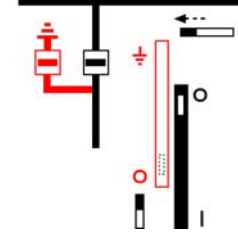
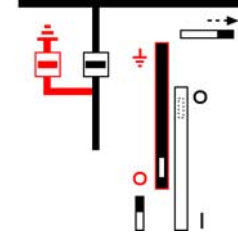
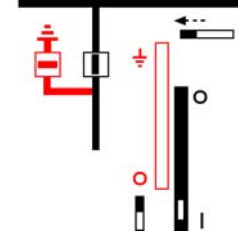
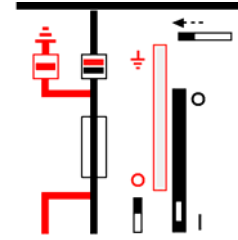
#### Possible switch positions of the three-position switch-disconnector

The operating lever is mechanically assigned to the switching operation through the operating shaft.



- ① EARTHED position
- ② OPEN position
- ③ CLOSED position


Fig. 74: Switch positions of the three-position switch-disconnector with detachable lever mechanism


	<p><b>EARTHED</b></p> <ul style="list-style-type: none"> <li>- Switch-disconnector/disconnector open</li> <li>- Earthing switch closed</li> <li>- Cable compartment cover unlocked</li> </ul> <p>In the transformer panel, the panel feeder is earthed via a mechanical, positively coupled make-proof earthing switch located in the panel subframe. To earth the circuit-breaker panel, (see Page 116, "Switching circuit-breaker panel and bus sectionalizer panel to EARTHED position").</p>
	<p><b>OPEN</b></p> <ul style="list-style-type: none"> <li>- Switch-disconnector/disconnector open</li> <li>- Earthing switch open</li> <li>- Cable compartment cover locked</li> </ul>
	
	<p><b>CLOSED</b></p> <ul style="list-style-type: none"> <li>- Switch-disconnector/disconnector closed</li> <li>- Earthing switch open</li> <li>- Cable compartment cover locked</li> </ul>
	<p><b>TRIPPED (transformer panel only)</b></p> <ul style="list-style-type: none"> <li>- Switch-disconnector tripped by a HV HRC fuse-link or a shunt release</li> <li>- Earthing switch open</li> <li>- Cable compartment cover locked</li> </ul>


### 19.2 Preconditions for operation

Preconditions for operating the three-position switch:

- Cable compartment cover fitted (closing lock-out, de-earthing lock-out)
- Switchgear ready for service
- Operating lever available
- 3AH vacuum circuit-breaker in OPEN position

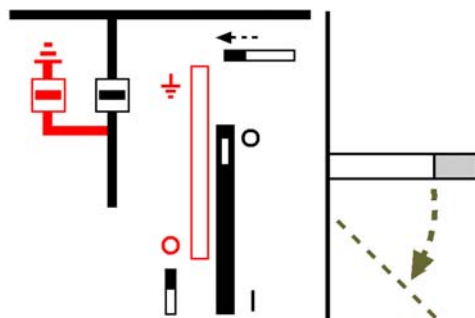
	<b>DANGER!</b>
	<p>During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.</p> <p>⇒ Do not remove covers.</p> <p>⇒ Do not reach into openings.</p>

	<b>DANGER!</b>
	<p>Personal injuries and material damages if the SF<sub>6</sub> gas density is too low.</p> <p>⇒ Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF<sub>6</sub> gas (option) in the green area).</p>

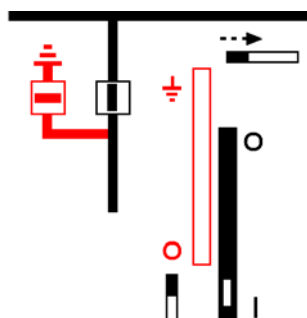
	<b>DANGER!</b>
	<p>Risk of injuries and switchgear damage due to operating levers inserted in the operating mechanism.</p> <p>⇒ Make sure that the operating lever has been removed.</p>

### 19.3 Switching the three-position switch to CLOSED position

- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the left and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "CLOSED" position.



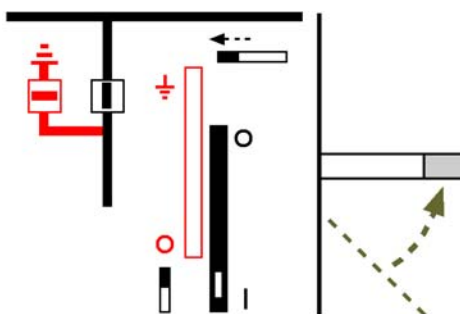
- ✓ The panel feeder of the ring-main / bus sectionalizer and transformer panel is switched on.



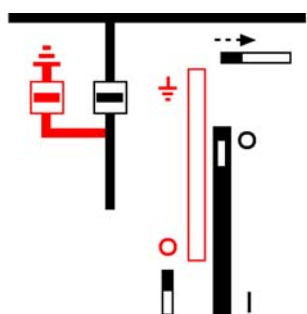
- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

#### 19.4 Switching the three-position switch to OPEN position

- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the left and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "OPEN" position.




- ✓ The panel feeder of the ring-main / bus sectionalizer and transformer panel is switched off.

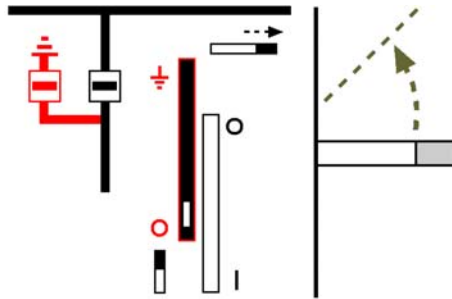


- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

## 19.5 Switching the three-position switch to EARTHED position

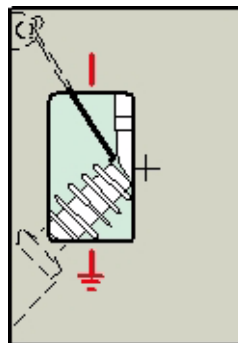
	<b>ATTENTION!</b>
	<p>Earthing a live incoming cable will trip the upstream circuit-breaker.</p> <p>⇒ Verify safe isolation from supply of the panel feeder before earthing.</p>

- ⇒ Verify safe isolation from supply (see Page 93, "Verification of safe isolation from supply of a panel feeder").
- ⇒ Establish safe isolation from supply if required.
- ✓ The panel feeder of the three-position switch is isolated from supply.
- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "EARTHED" position.

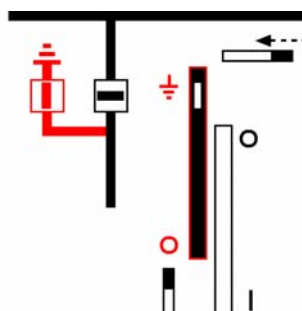


EARTHED position in transformer panel

- ⇒ **Through the inspection window of the cable compartment cover, check whether the earthing switch is closed, i.e. the movable earthing contact is touching the lower fuse contact.**



- ✓ The panel feeder of the ring-main / bus sectionalizer and transformer panel is earthed.



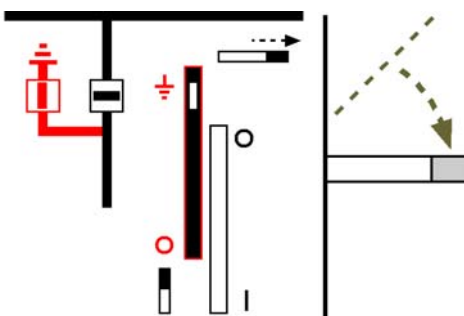
- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

#### 19.6 Switching the three-position switch from EARTHED to OPEN position

**Please observe that the reason for earthing has been eliminated, e.g.:**

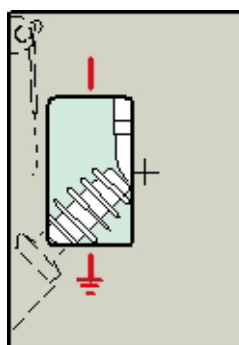
- **Short-circuit jumpers have been removed**
- **Work in the adjacent panel has been completed**

- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "OPEN" position.



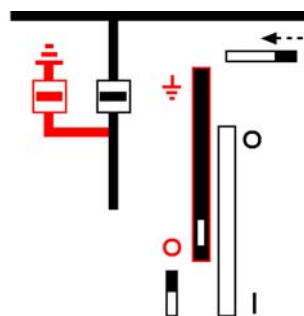
**OPEN position in  
transformer panel**

- ⇒ **Through the inspection window of the cable compartment cover, check whether the earthing switch is in OPEN position.**



- ✓ The panel feeder of the ring-main / bus sectionalizer and transformer panel is de-earthed.





- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

## 20 Operating the make-proof earthing switch

Panels with make-proof earthing switch:

- Cable panel K-E, K1-E
- Busbar earthing panel SE1, SE2

### 20.1 Indicators and control elements of the make-proof earthing switch

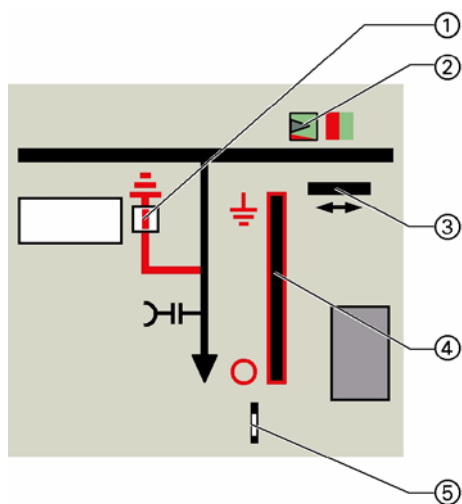


Fig. 75: Control board section of ring-main panel with make-proof earthing switch

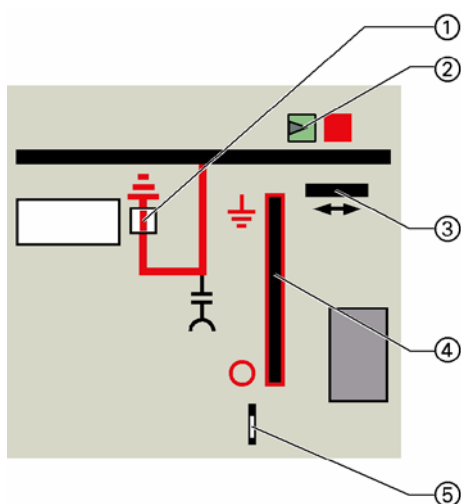


Fig. 76: Control board section of busbar earthing panel with make-proof earthing switch

- ① Position indicator
- ② Ready-for-service indicator for SF<sub>6</sub> gas (option)
- ③ Control gate for make-proof earthing switch
- ④ Actuating opening for the operating mechanism of the make-proof earthing switch
- ⑤ Interlocking lever for cable compartment cover

### Possible switch positions of the make-proof earthing switch

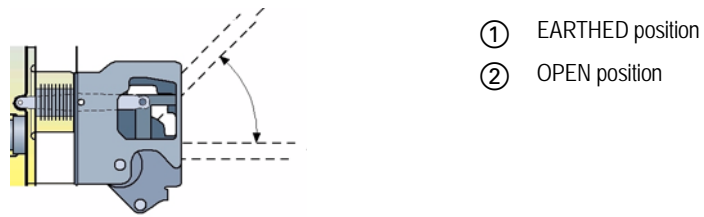



Fig. 77: Switch positions of the make-proof earthing switch with detachable lever mechanism


	<p><b>EARTHED</b></p> <ul style="list-style-type: none"> <li>- Make-proof earthing switch earthed</li> <li>- Cable compartment unlocked</li> </ul>		<p><b>OPEN</b></p> <ul style="list-style-type: none"> <li>- Make-proof earthing switch open</li> <li>- Cable compartment locked</li> </ul>
--	--	--	--


## 20.2 Preconditions for operation


Preconditions for operating the make-proof earthing switch:

- Switchgear ready for service
- Operating lever available

	<b>ATTENTION!</b>
	<p>Earthing a live incoming cable will trip the upstream circuit-breaker.</p> <p>⇒ Verify safe isolation from supply of the panel feeder before earthing.</p> <p>⇒ Verify safe isolation from supply of the busbars before earthing.</p>

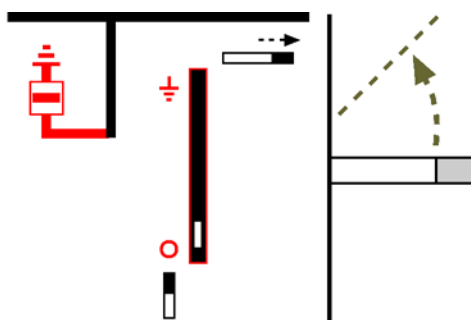
	<b>DANGER!</b>
	<p>During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.</p> <p>⇒ Do not remove covers.</p> <p>⇒ Do not reach into openings.</p>

	<b>DANGER!</b>
	<p>Personal injuries and material damages if the SF<sub>6</sub> gas density is too low.</p> <p>⇒ Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF<sub>6</sub> gas (option) in the green area).</p>

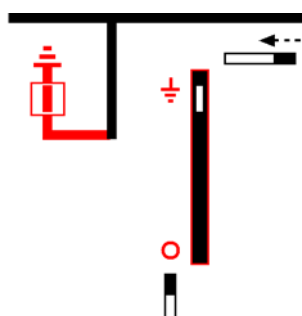
	<b>DANGER!</b>
	<p>Risk of injuries and switchgear damage due to operating levers inserted in the operating mechanism.</p> <p>⇒ Make sure that the operating lever has been removed.</p>

### 20.3 Switching the make-proof earthing switch to EARTHED position

- ⇒ Verify safe isolation from supply of busbar (see Page 93, "Verification of safe isolation from supply of a panel feeder").
- ⇒ Establish safe isolation from supply if required.
- ✓ The busbars and the panel feeder of the make-proof earthing switch are isolated from supply.
- ⇒ Remove padlock from control gate of make-proof earthing switch (option).
- ⇒ Push control gate of make-proof earthing switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "EARTHED" position.



- ✓ The cable / busbar earthing panel is earthed.



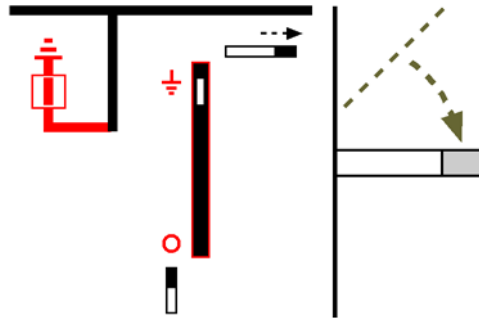
- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of make-proof earthing switch (option).
- ⇒ Stow operating lever away.
- ✓ The make-proof earthing switch is protected against unauthorized use.

#### 20.4 Switching the make-proof earthing switch to OPEN position

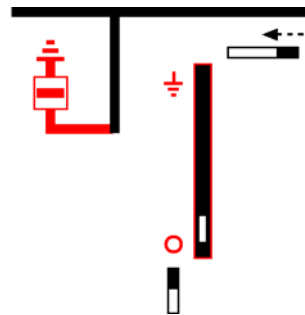
**Please observe that the reason for earthing has been eliminated, e.g.:**

- **Short-circuit jumpers have been removed**
- **Work in the adjacent panel has been completed**

- ⇒ Remove padlock from control gate of make-proof earthing switch (option).
- ⇒ Push control gate of make-proof earthing switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "OPEN" position.



- ✓ The cable / busbar earthing panel is de-earthed.




- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of make-proof earthing switch (option).
- ⇒ Stow operating lever away.
- ✓ The make-proof earthing switch is protected against unauthorized use.

## 21 Operating circuit-breaker panel or bus sectionalizer panel

Panels with 3AH vacuum circuit-breaker:

- Circuit-breaker panel 630 A (LS1, LS1-U) and bus sectionalizer panel (LT10) with 3AH5 vacuum circuit-breaker and three-position switch-disconnector
- Circuit-breaker panel 630 A (LS11, LS11-U) and bus sectionalizer panel (LT11) with 3AH6 vacuum circuit-breaker and three-position switch-disconnector
- Circuit-breaker panels up to 1250 A (LS31, LS31-U, LS32) and bus sectionalizer panel (LT31) with 3AH6 vacuum circuit-breaker and three-position disconnecter

	<b>NOTE!</b>
	Panels up to 630 A are equipped with a <b>three-position switch-disconnector</b> . Panels up to 1250 A are equipped with a <b>three-position disconnecter</b> .

### 21.1 Indicators and control elements of the 3AH vacuum circuit-breakers

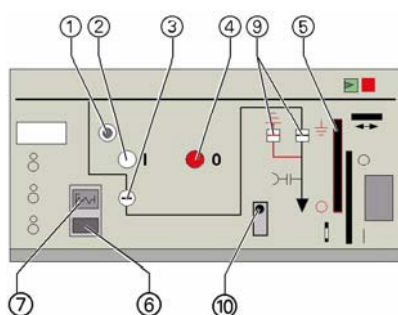


Fig. 78: Control board section of circuit-breaker panel with 3AH5 vacuum circuit-breaker

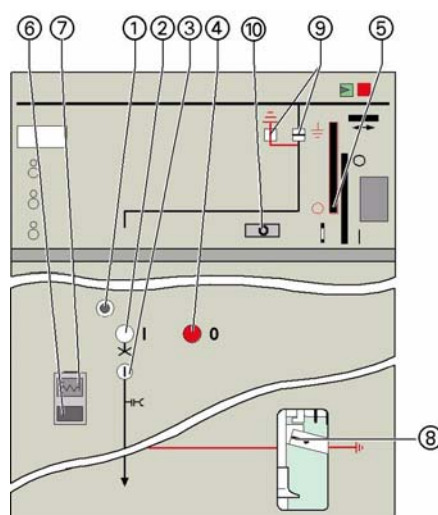


Fig. 79: Control board section of circuit-breaker panel with 3AH6 vacuum circuit-breaker

- ① Opening for the hand crank of the spring energy store
- ② Mechanical "ON" pushbutton (not for manual spring-operated mechanism)
- ③ Position indicator for 3AH vacuum circuit-breaker
- ④ Mechanical "OFF" pushbutton
- ⑤ Three-position switch-disconnector / Three-position switch
- ⑥ Operations counter
- ⑦ Spring charged indicator
- ⑧ Earthing switch (option)
- ⑨ Position indicator for three-position switch-disconnector / three-position disconnecter
- ⑩ - Logical mechanical interlock between three-position disconnecter and 3AH6 vacuum circuit-breaker  
- Optional logical mechanical interlock between three-position switch-disconnector and 3AH6 vacuum circuit-breaker

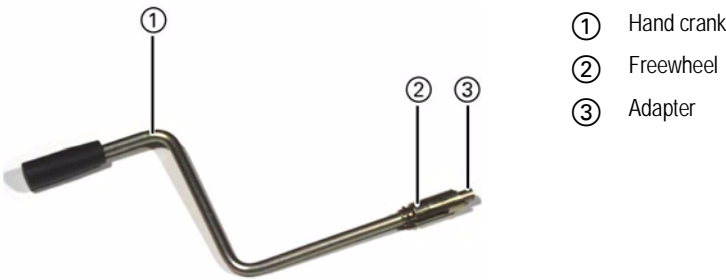




Fig. 80: Hand crank for spring energy store

Spring charged indicator

	
NOT CHARGED	CHARGED

Switch positions of the 3AH vacuum circuit-breaker

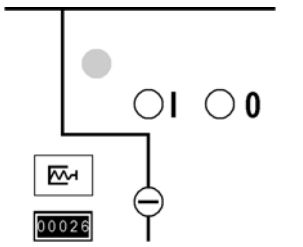
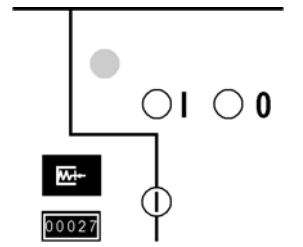
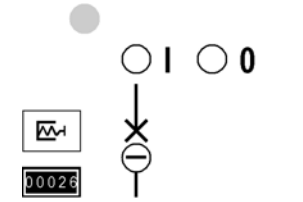
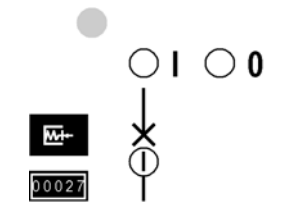
OPEN	CLOSED	TYPE of vacuum circuit-breaker
		3AH5
		3AH6





Fig. 81: Operations counter


## 21.2 Preconditions for operation

Preconditions for operation:

- Switchgear ready for service
- Operating lever not inserted at three-position switch
- Hand crank available
- The lock-in of the 3AH6 vacuum circuit-breaker is not blocked or locked (see Page 12, "3AH vacuum circuit-breaker")

	<b>DANGER!</b>
	<p>During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.</p> <p>⇒ Do not remove covers.</p> <p>⇒ Do not reach into openings.</p>

	<b>DANGER!</b>
	<p>Personal injuries and material damages if the SF<sub>6</sub> gas density is too low.</p> <p>⇒ Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF<sub>6</sub> gas (option) in the green area).</p>

	<b>DANGER!</b>
	<p>Risk of injuries and switchgear damage due to beating hand crank.</p> <p>⇒ Use original hand crank with freewheel.</p> <p>⇒ Make sure that the hand crank has been removed.</p>

## 21.3 Switching on circuit-breaker panel or bus sectionalizer panel

The closing operation is dependent on the operating mechanism of the vacuum circuit-breaker:

- Manual operating stored-energy mechanism with motor



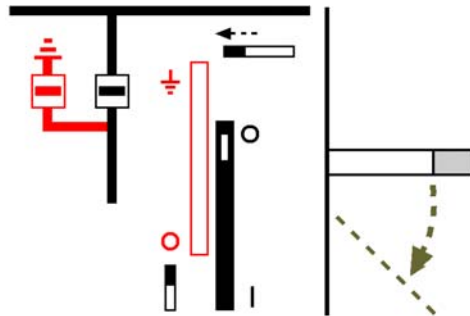
- Manual operating stored-energy mechanism
- Manual spring-operated mechanism.

Preconditions for operation:

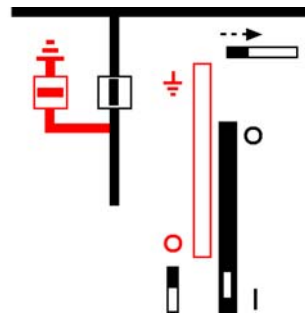
- Vacuum circuit-breaker in "OPEN" position
- Three-position switch in "OPEN" position

## Closing three-position switch

- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the left and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "CLOSED" position.



- ✓ The circuit behind the three-position switch is switched on.

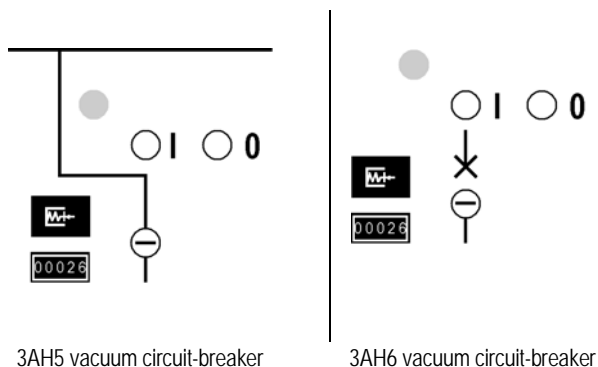


- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

## Closing 3AH vacuum circuit-breaker with manual operating stored-energy mechanism with motor

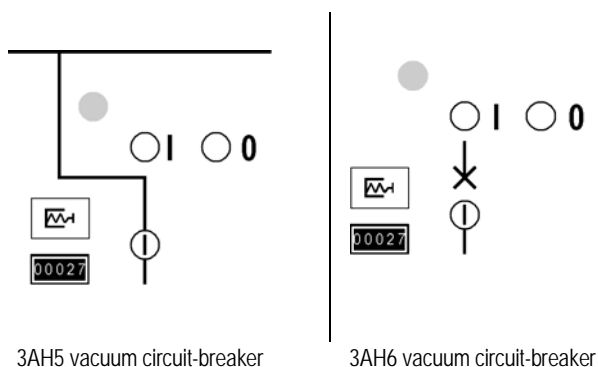
The closing operation is only possible if the spring energy store is charged. When supply voltage is applied, the closing spring is charged automatically.

If the supply voltage has failed, the spring energy store of the vacuum circuit-breaker can be charged by hand.



⇒ Press mechanical "ON" pushbutton "I".

✓ The panel feeder of the circuit-breaker / bus sectionalizer panel with 3AH vacuum circuit-breaker is switched on.

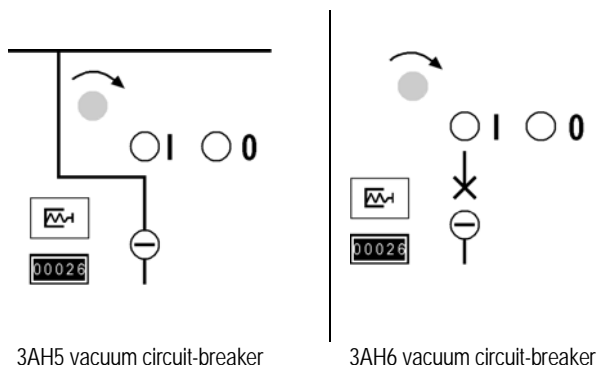


On 3AH vacuum circuit-breakers with manual operating stored-energy mechanism with motor, the motor recharges the closing spring automatically. The energy required for the operating sequence "OPEN - CLOSED - OPEN" (auto-reclosing) is available after 10 seconds.

### Closing 3AH vacuum circuit-breaker with manual operating stored-energy mechanism

The closing operation is only possible if the spring energy store is charged.

#### Charging the spring energy store



⇒ Remove the cover from the opening for the hand crank.

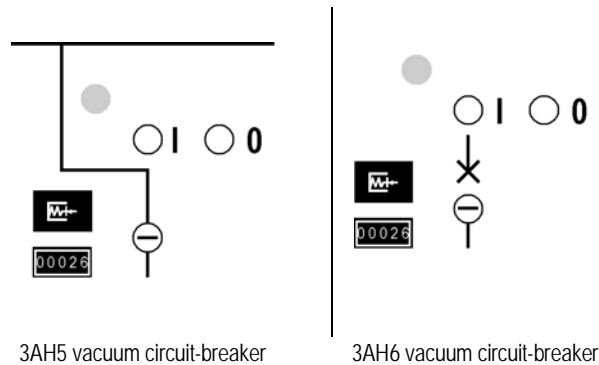
⇒ Insert the hand crank.

⇒ Turn the hand crank clockwise (approx. 20 times).

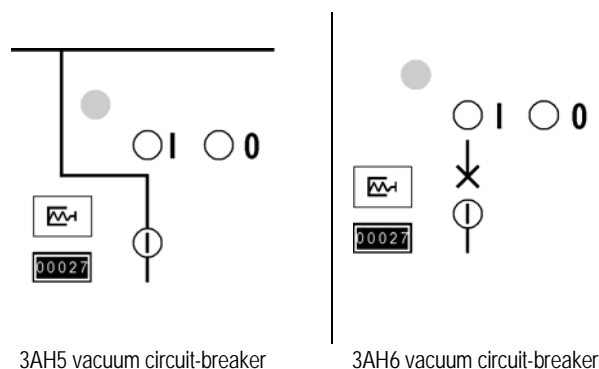
✓ The closing latch can be heard to latch tight.

- ⇒ Remove the hand crank.
- ⇒ Fit the cover back onto the opening for the hand crank.
- ⇒ Stow the hand crank away.
- ✓ The closing/opening spring of the vacuum circuit-breaker is charged.

#### Closing 3AH vacuum circuit-breaker

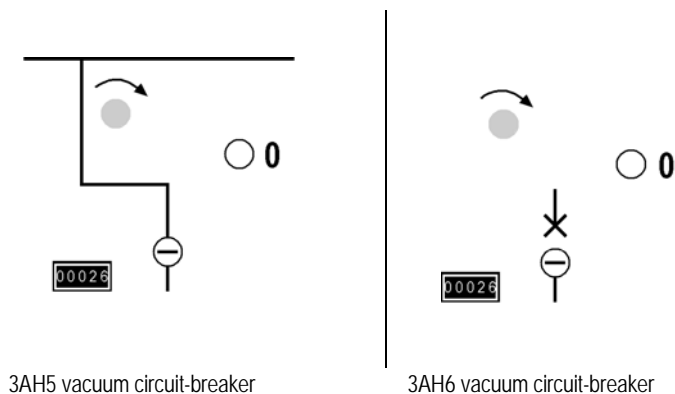


- ⇒ Press mechanical "ON" pushbutton "I".
- ✓ The panel feeder of the circuit-breaker / bus sectionalizer panel with 3AH vacuum circuit-breaker is switched on.

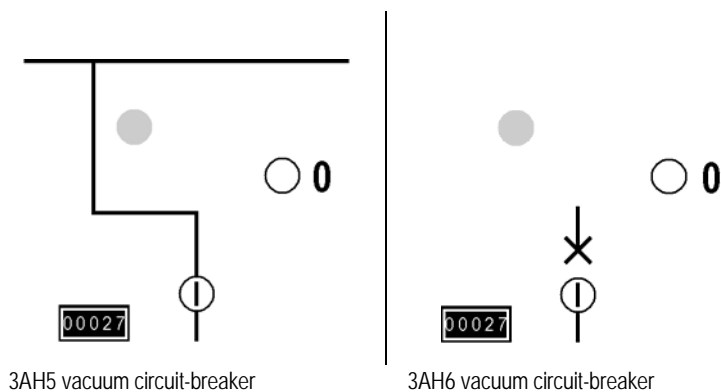


On 3AH vacuum circuit-breakers with manual operating stored-energy mechanism, the closing spring can be recharged. The energy required for the operating sequence "OPEN - CLOSED - OPEN" (auto-reclosing) is available after 20 full turns.

**Closing 3AH vacuum circuit-breaker with manual spring-operated mechanism**



- ⇒ Remove the cover from the opening for the hand crank.
- ⇒ Insert the hand crank.
- ⇒ Turn the hand crank clockwise (approx. 20 times).
- ✓ The vacuum circuit-breaker switches.
- ✓ The panel feeder of the circuit-breaker / bus sectionalizer panel with 3AH vacuum circuit-breaker is switched on.



- ⇒ Remove the hand crank.
- ⇒ Fit the cover back onto the opening for the hand crank.
- ⇒ Stow the hand crank away.
- ✓ The opening spring of the vacuum circuit-breaker is charged.

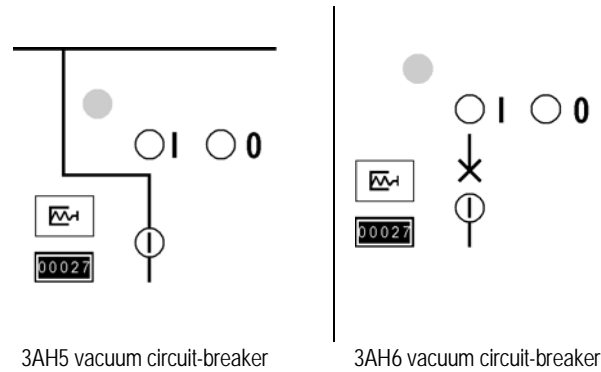
## 21.4 Switching off circuit-breaker panel or bus sectionalizer panel

Preconditions for operation:

- Vacuum circuit-breaker in "CLOSED" position
- Three-position switch in "CLOSED" position

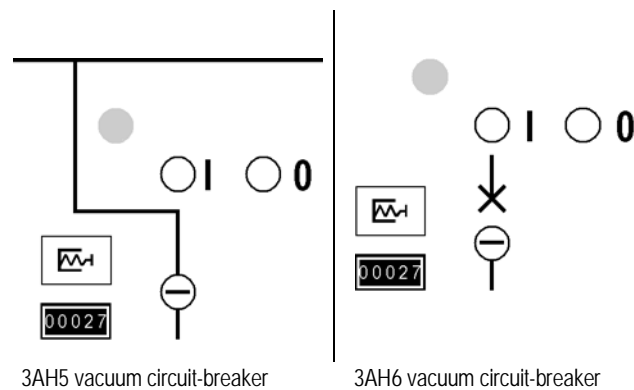
### Opening 3AH vacuum circuit-breaker

The opening operation is independent of the operating mechanism version of the vacuum circuit-breaker.



⇒ Press mechanical "OFF" pushbutton "O".

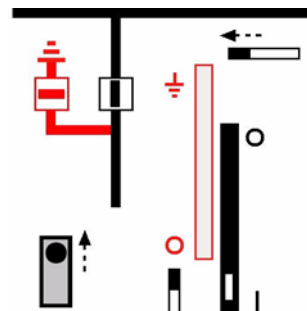
- ✓ The panel feeder of the circuit-breaker / bus sectionalizer panel with 3AH vacuum circuit-breaker is switched off.



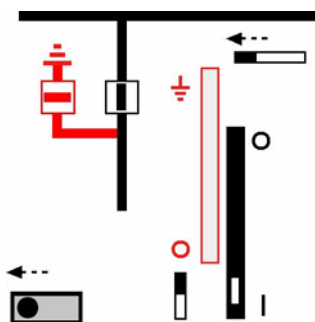
### Opening three-position switch

⇒ Remove padlock from control gate of three-position switch (option).

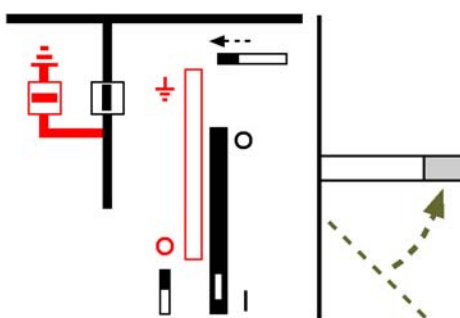
- ⇒ **On 3AH5 vacuum circuit-breaker:** Push logical mechanical interlock (optional) upwards and push control gate of three-position switch to the left and hold.



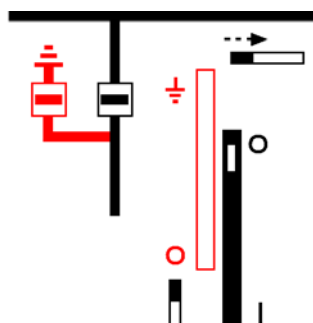
- ⇒ **On 3AH6 vacuum circuit-breaker:** Push logical mechanical interlock (optional for three-position switch-disconnector) to the left and push control gate of three-position switch to the left and hold.



- ⇒ Insert operating lever.
- ⇒ Move operating lever straight to the "OPEN" position.



- ✓ The circuit between the three-position switch and the 3AH vacuum circuit-breaker is switched off.




- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

## 21.5 Switching circuit-breaker panel and bus sectionalizer panel to EARTHED position

Preconditions for operation :

- Vacuum circuit-breaker in "OPEN" position
- Three-position switch in "OPEN" position

Please observe that - in a bus sectionalizer panel - the subsequent busbar section is earthed.

	<b>ATTENTION!</b>
	<p>Earthing a live incoming cable will trip the upstream circuit-breaker.</p> <p>⇒ Verify safe isolation from supply of the panel feeder or the busbar section before earthing.</p>

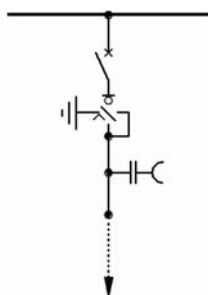
⇒ Verify safe isolation from supply of the panel feeder or the busbar section (see Page 93, "Verification of safe isolation from supply of a panel feeder").

⇒ Establish safe isolation from supply if required.

### Operating sequence for earthing circuit-breaker panels (depending on the circuit-breaker type)

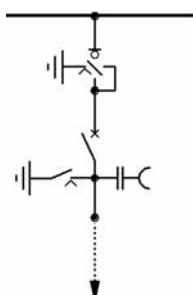
3AH5 vacuum circuit-breaker

630 A

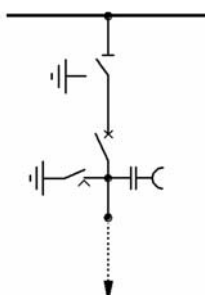


3AH6 vacuum circuit-breaker with feeder earthing switch

630 A

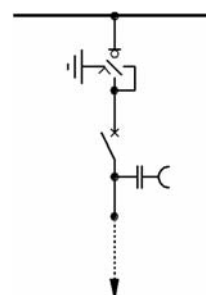


1250 A

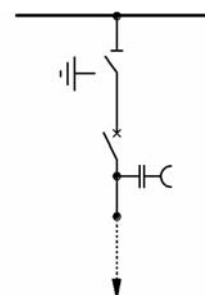


3AH6 vacuum circuit-breaker without feeder earthing switch

630 A



1250 A



3AH5 vacuum circuit-breaker in "OPEN" position

3AH6 vacuum circuit-breaker in "OPEN" position



Three-position switch in "OPEN" position



Switch three-position switch to "EARTHED" position



3AH6 in "CLOSED" position (only for panels without feeder earthing switch)



Check whether the position indicator of the three-position switch is in "EARTHED" position.

Check whether the position indicator of the three-position switch is in "EARTHED" position and whether the earthing switch is closed **through the inspection window of the cable compartment cover**.

Check whether the position indicator of the three-position switch is in "EARTHED" position **and** whether the position indicator of the circuit-breaker is in "CLOSED" position.



Circuit-breaker panel is earthed

Circuit-breaker panel without feeder earthing switch is earthed

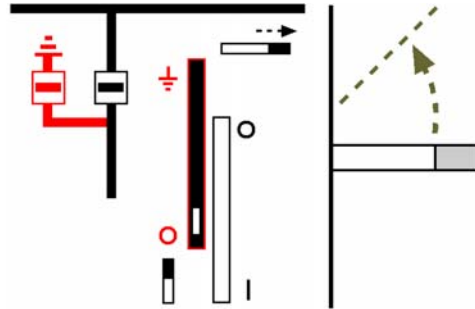


**Switching three-position switch to EARTHED position**

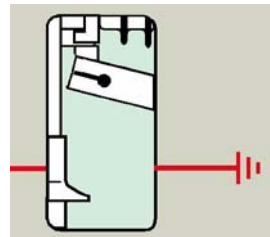
Preconditions for operation:

- Vacuum circuit-breaker in "OPEN" position
- Three-position switch in "OPEN" position

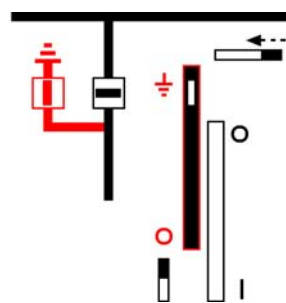
- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "EARTHED" position.



- ⇒ **In circuit-breaker panels with 3AH6 vacuum circuit-breaker with feeder earthing switch: Through the inspection window of the cable compartment cover, check whether the movable earthing contact is in CLOSED position.**




- ✓ The circuit-breaker / bus sectionalizer panel with 3AH5 vacuum circuit-breaker or 3AH6 vacuum circuit-breaker with feeder earthing switch is earthed.

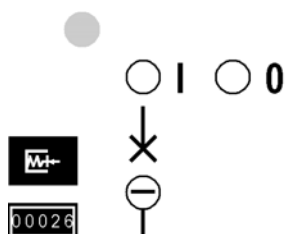


- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

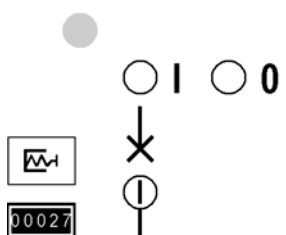
### Earthing 3AH6 circuit-breaker panel without feeder earthing switch

	<p><b>NOTE!</b></p> <p>To earth a 3AH6 circuit-breaker panel without feeder earthing switch, the circuit-breaker must be switched to CLOSED position in addition to the earthed three-position switch.</p>
---	--

⇒ Close vacuum circuit-breaker.



- ⇒ Fit padlock on control gate of vacuum circuit-breaker (only 3AH6 vacuum circuit-breaker without feeder earthing switch).
- ✓ The 3AH6 vacuum circuit-breaker without feeder earthing switch is protected against unauthorized use. The circuit-breaker / bus sectionalizer panel is earthed.



## 21.6 Switching circuit-breaker panel from EARTHED position to OPEN position

**Please observe that the reason for earthing has been eliminated, e.g.:**

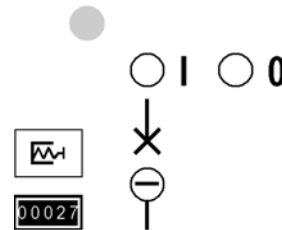
- **Short-circuit jumpers have been removed**
- **Work in the adjacent panel has been completed**

### Circuit-breaker panel without feeder earthing switch

Preconditions for operation:

- Vacuum circuit-breaker in "CLOSED" position
- Three-position switch in "EARTHED" position

- ⇒ Remove padlock from control gate of 3AH6 vacuum circuit-breaker without feeder earthing switch.
- ⇒ Open 3AH6 vacuum circuit-breaker without feeder earthing switch.



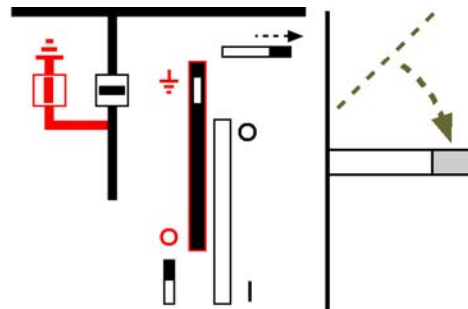
- ✓ 3AH6 vacuum circuit-breaker without feeder earthing switch is in "OPEN" position.
- ✓ The circuit behind the 3AH6 vacuum circuit-breaker without feeder earthing switch is de-earthed.

### Circuit-breaker panel with feeder earthing switch

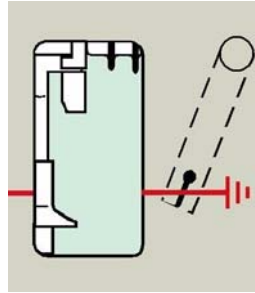
Preconditions for operation:

- Vacuum circuit-breaker in "CLOSED" position
- Three-position switch in "EARTHED" position

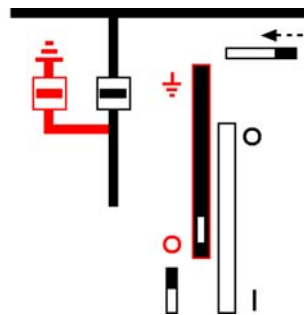
- ⇒ Remove padlock from control gate of three-position switch (option).
- ⇒ Push control gate of three-position switch to the right and hold.
- ⇒ Push operating lever onto operating shaft of operating mechanism.
- ⇒ Move operating lever straight to the "OPEN" position.



- ⇒ **In circuit-breaker panels with 3AH6 vacuum circuit-breaker with feeder earthing switch: Through the inspection window of the cable compartment, check whether the movable earthing contact is in OPEN position cover.**



- ✓ The circuit-breaker / bus sectionalizer panel is switched off.





- ⇒ Remove operating lever.
- ⇒ Fit padlock at central position of control gate of three-position switch (option).
- ⇒ Stow operating lever away.
- ✓ The three-position switch is protected against unauthorized use.

## 22 Earthing panels without earthing switch

### Panels without earthing switch:

- Cable panel K, K1
- Bus riser panel HF without transformers, HF with transformers
- Metering panels ME1, ME1-S, ME1-H, ME1-K, ME1-KS

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <p>⇒ Isolate the panel.</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>

	<b>DANGER!</b>
	<p>Earthing a live incoming cable will trip the upstream circuit-breaker.</p> <p>⇒ Verify safe isolation from supply of the panel feeder before earthing.</p>

Cable panels, bus riser panels or metering panels must be earthed via the corresponding switching operations in the adjacent panel or by means of earthing accessories.

Remove the cable compartment cover (see Page 126, "Removing the cable compartment cover").

## 23 Panel-specific switch positions and operating sequences

This section shows a summary of the possible switching states and operating sequences of the SIMOSEC panel types.

The switching devices are described in the section "Description" (see Page 12, "Components").

The exact operating sequence and preconditions for operation are described in this section (see Page 92, "To be observed for operation").

The item numbers ①, ②, ... in the following tables define the operating sequence of the circuit-breaker panels.

Circuit-breaker panels with 3AH5 vacuum circuit-breaker		
Panel: Switch position	3AH5 vacuum circuit-breaker	Three-position switch-disconnector
CLOSED	CLOSED	CLOSED
	OPEN ①	
OPEN		OPEN ②
EARTHED		EARTHED ③
OPEN		OPEN ④
		CLOSED ⑤
CLOSED	CLOSED ⑥	

Circuit-breaker panels with 3AH6 vacuum circuit-breaker and with feeder earthing switch		
Panel: Switch position	3AH6 vacuum circuit-breaker	Three-position switch-disconnector / Three-position disconnecter
CLOSED	CLOSED	CLOSED
	OPEN ①	
OPEN		OPEN ②
EARTHED		EARTHED ③
OPEN	*)	OPEN ④
	OPEN	CLOSED ⑤
CLOSED	CLOSED ⑥	

\*) Test position "CLOSED" for cable testing (see Page 131, "Cable testing").

Circuit-breaker panels with 3AH6 vacuum circuit-breaker and without feeder earthing switch		
Panel: Switch position	3AH6 vacuum circuit-breaker	Three-position switch-disconnector / Three-position disconnect
CLOSED	CLOSED	CLOSED
	OPEN ①	
OPEN		OPEN ②
		EARTHED ③
EARTHED	CLOSED ④	EARTHED
	OPEN ⑤	
OPEN	*)	OPEN ⑥
	OPEN	CLOSED ⑦
CLOSED	CLOSED ⑧	

Cable panel, bus sectionalizer panel or transformer panel with three-position switch-disconnector	
Panel: Switch position	Three-position switch-disconnector
CLOSED	CLOSED
OPEN	OPEN
EARTHED	EARTHED
OPEN	OPEN
CLOSED	CLOSED

Cable panel or busbar earthing panel	
Panel: Switch position	Make-proof earthing switch
OPEN	OPEN
EARTHED	EARTHED
OPEN	OPEN

# Servicing

After having completed the work described in this section, you have to perform full commissioning on the corresponding panel or switchgear (see Page 84, "Commissioning SIMOSEC switchgear").

If you have any questions about the subjects described in here, please contact your regional Siemens representative.

## Always observe the following:


- Safety rules
- Perfect operation of the safety equipment
- Only authorized and qualified personnel is working on the switchgear.

## 24 Access to the switchgear

### 24.1 Observing the safety instructions

Switchgear covers may only be removed by duly qualified and authorized personnel.

After completing the work, the covers must be refitted immediately.

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Isolate the panel.</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>

Please verify that the local-remote switch (option) is in the position "**Local electrical operation**".

### 24.2 Identifying the panel


The accessibility, safety measures and work operations are dependent on the panel type. Identify the panel type and proceed accordingly.



### 24.3 Removing the cable compartment cover

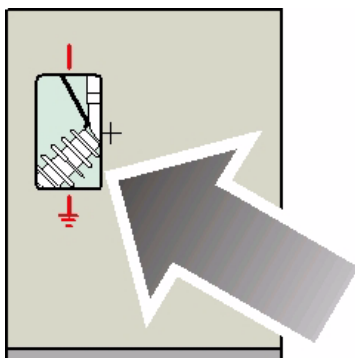
There are two kinds of locking systems available for the cable compartment cover:

- Interlocked cable compartment cover (panels with switching devices)
- Screwed-on cable compartment cover (panels without switching devices, e. g. ME1)

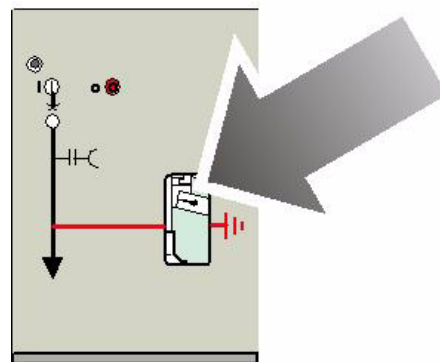
	<b>DANGER!</b>
	<p>Electric shock due to applied voltage.</p> <p>⇒ Remove covers only if the panel is earthed.</p>

#### Removing interlocked cable compartment cover

⇒ Check panel earthing.




Spring of earthing switch touching in transformer panel



Earthing contact swung in on 3AH6 with cable feeder earthing switch, or "CLOSED" position on 3AH6 without cable feeder earthing switch

⇒ Check closed earthing switch through inspection window of the cable compartment cover.

⇒ Push interlocking lever downwards and hold in this position.

	<b>NOTE!</b>
	<p>For 3AH6 vacuum circuit-breakers without cable feeder earthing switch, the mechanical lock-in is only released upwards if the panel is earthed. This means:</p> <p>⇒ Circuit-breaker in "CLOSED" position</p> <p>⇒ Three-position switch in "EARTHED" position</p>

⇒ Unhinge the cover.

⇒ Push the cable compartment cover upwards in inclined position.

⇒ Release the interlocking lever.

⇒ Remove the cable compartment cover to the front.

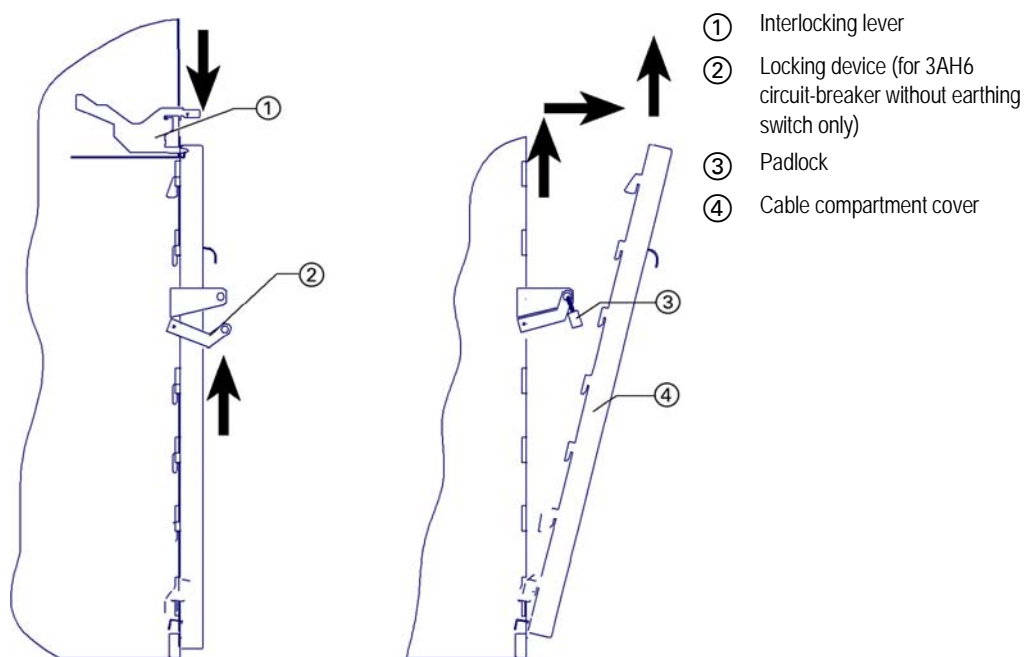


Fig. 82: Interlocked cable compartment cover

The locking device of the 3AH6 vacuum circuit-breaker is automatically lifted when the cable compartment cover is pushed upwards. The locking device can be padlocked before removing the cable compartment cover.

#### Removing screwed-on cable compartment cover

⇒ Check panel earthing.

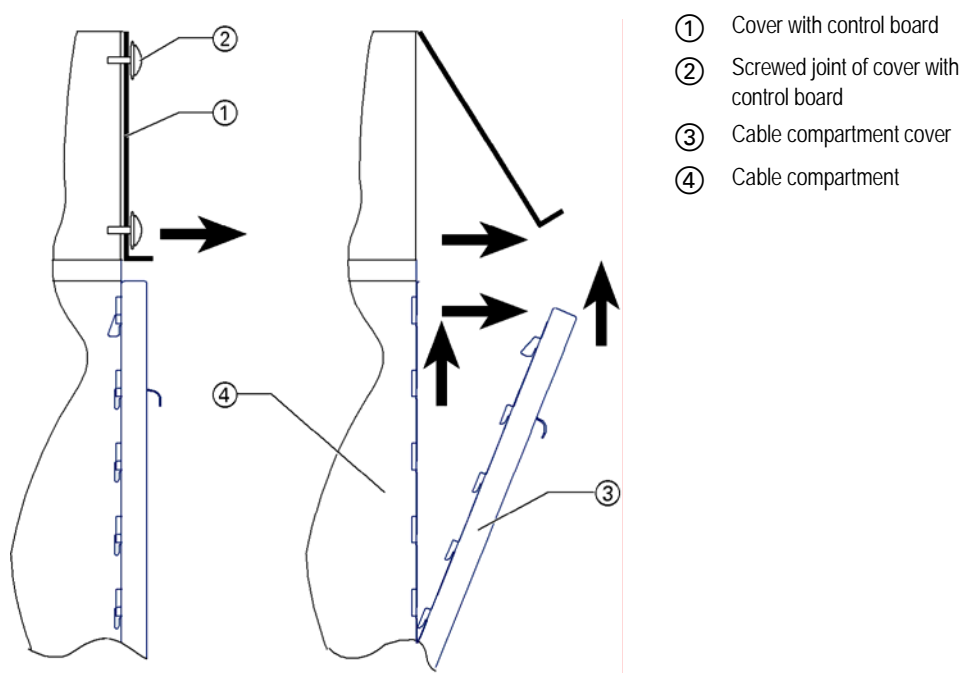



Fig. 83: Removing screwed-on cable compartment cover


- ⇒ Remove the cover with the control board.
- ⇒ Push the cable compartment cover upwards in inclined position.
- ⇒ Remove the cable compartment cover to the front.

**Fitting the cable compartment cover**

To refit the cable compartment cover, proceed in reverse order.

	<b>NOTE!</b>
	When fitting the cable compartment covers, please observe that the respective cover is assigned to the <b>correct</b> panel.

**24.4 Removing the cover of the niche for customer-side low-voltage equipment**

	<b>DANGER!</b>
	Electric shock due to live parts.  ⇒ Observe the specifications for prevention of accidents. ⇒ Observe the Safety Rules of Electrical Engineering. ⇒ Do not remove the control board cover.

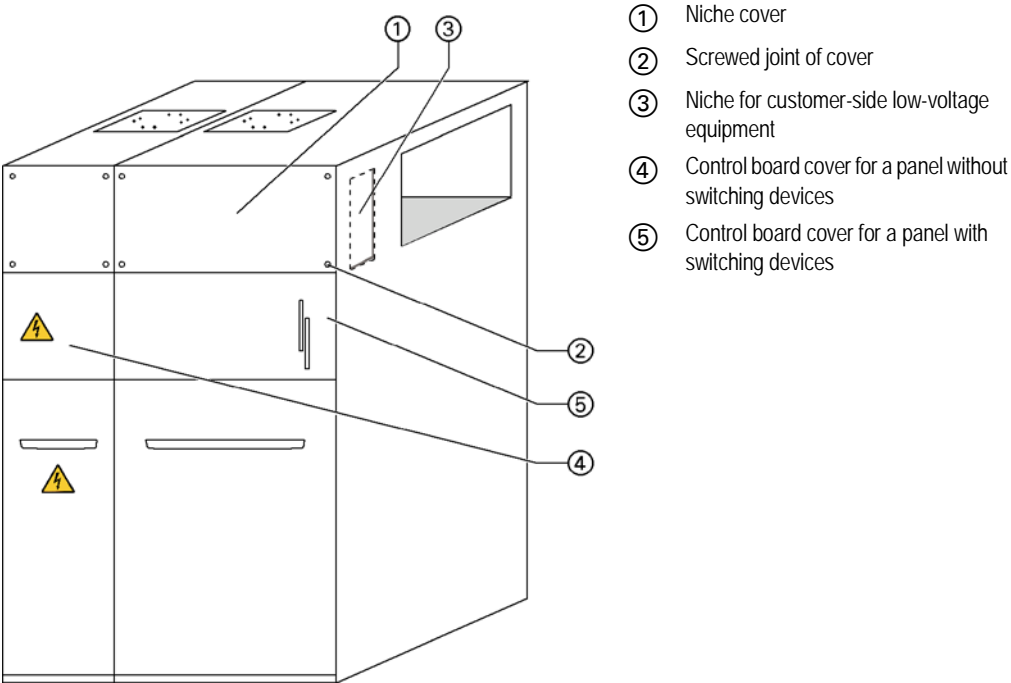



Fig. 84: Access to the niche for customer-side low-voltage equipment

	<b>NOTE!</b>
	The control board cover must not be removed on any panels without switching devices.


Panels without switching devices:

- Cable panel K, K1
- Bus riser panel HF without transformers, HF with transformers
- Metering panels ME1, ME1-S, ME1-H, ME1-K, ME1-KS

#### Removing the niche cover

- ⇒ Undo the screws on the niche cover.
- ⇒ Remove the niche cover to the front.

### 24.5 Removing the cover of the busbar compartment

	<b>DANGER!</b>
	Electric shock due to applied voltage.  ⇒ Remove covers only if the busbar is earthed.

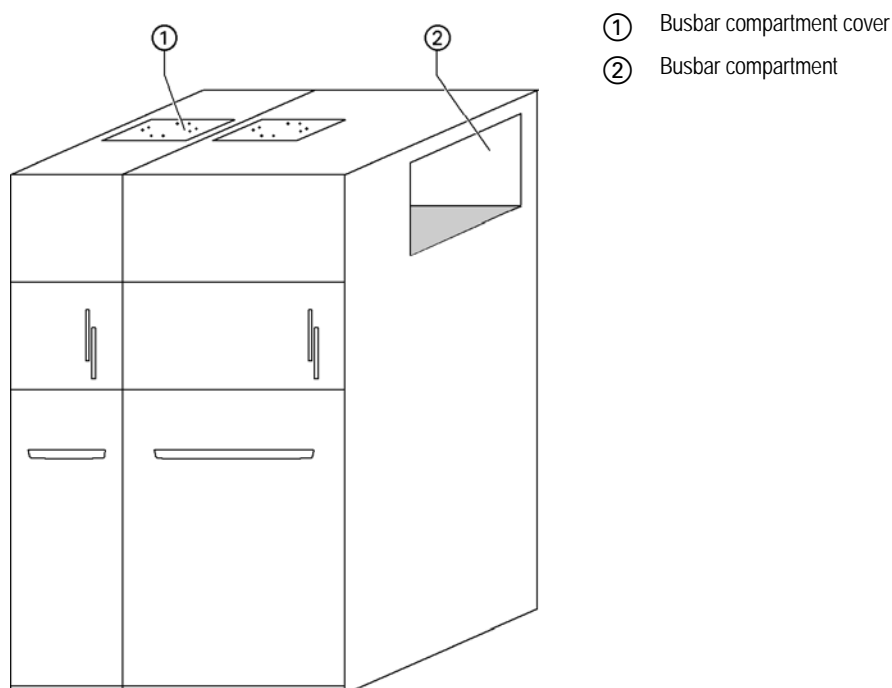


Fig. 85: Access to busbar compartment


- ⇒ Undo the screws on the busbar compartment cover.
- ⇒ Remove the busbar compartment cover to the front.

## 25 Measuring

### 25.1 Checking the earthing

The connection between the SIMOSEC switchgear and the substation earth is established and documented before any commissioning (see Page 73, "Installing the earthing busbar").

### 25.2 Verification of correct terminal-phase connections

	<b>DANGER!</b>
	<p>Short circuit in case of different phase sequence of the incoming feeders.</p> <p>⇒ Make sure that all incoming feeders have the same phase sequence.</p> <p>⇒ To check the phase sequence, use only phase comparison test units which are adequate for HR or LRM test sokkets.</p>

The three-position switch-disconnector 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 capacitive test sockets of the panel to be tested and an already closed panel using a phase comparison test unit.

- ⇒ Plug the test leads of the phase comparison test unit into the "L1" test sockets of the two panels.



- ⇒ Read the indication.
- ⇒ Proceed in the same way with the test sockets of the other phases ("L2" and "L3").
- ✓ If the test unit shows "coincidence" in each case, the phase sequence of the tested feeder is correct.


### 25.3 Cable testing


A DC voltage test can be performed after consultation and authorization by the regional Siemens representative. For cable testing, the operating and installation instructions of SIMOSEC switchgear and the standards IEC 60298/VDE 0670 Part 6-Section 5.107 must be observed as well as the specifications and recommendations of the cable and sealing end manufacturers.

Possibly existing voltage transformers at the cable connection must be removed or disconnected.

SIMOSEC switchgear is designed for rated voltages up to 24 kV and can be tested with a DC test voltage of max. 72 kV (higher values on request) for cable tests. During this test, the busbar voltage can be 24 kV.

Rated voltage of switchgear	DC test voltage, maximum value	DC test voltage VLF* 0,1 Hz
12 kV	48 kV	19 kV
24 kV	72 kV	38 kV
* Very Low Frequency		

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Isolate the panel.</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>Flashover due to applied test voltage.</p> <ul style="list-style-type: none"> <li>⇒ Do not exceed the maximum test duration.</li> <li>⇒ Do not exceed the maximum test voltage.</li> <li>⇒ Isolate the switchgear and the opposite switchgear (test voltage &lt;72 kV DC).</li> <li>⇒ Undo the cable connection and insulate it for the measurement (test voltage &gt;72 kV DC).</li> </ul>


**Preconditions for testing:**


- 3AH6 vacuum circuit-breaker in "CLOSED" position
- Three-position switch in "OPEN" position

**Procedure to be followed  
for cable testing:**

- ⇒ Isolate the panel feeder to be tested.
- ⇒ Isolate the panel feeder in the opposite substation and secure it against reclosing.
- ⇒ Verify safe isolation from supply.
- ⇒ Earth the panel to be tested.
- ⇒ Remove the cable compartment cover (see Page 126, " Removing the cable compartment cover").
- ⇒ Fit test equipment on cable lug of cable to be tested.
- ⇒ Switch switching devices of panel to be tested to test position (OPEN position).
- ⇒ Test cable with mobile test generator.
- ⇒ Earth switching devices of panel to be tested.
- ⇒ Remove test equipment from cable lug.
- ⇒ Refit the cable compartment cover.
- ✓ The cable has been tested. Other panels can be tested, or the panel can be put into operation again.

**25.4 Cable sheath testing**

	<b>DANGER!</b>
	<p>Normally, the switch-disconnector panel is not interlocked during the cable sheath test. Prevent switching from "EARTH" to "OPEN" or "CLOSED" as follows:</p> <ul style="list-style-type: none"> <li>⇒ Place switching prohibition signs.</li> <li>⇒ Padlock the locking device (option).</li> </ul>


	<b>DANGER!</b>
	<p>Live cable in SIMOSEC panel types K, K-E, ME1-K und ME1-KS.</p> <ul style="list-style-type: none"> <li>⇒ Isolate and earth incoming cables.</li> <li>⇒ Isolate and earth the busbar.</li> </ul>

- ⇒ Isolate the panel feeder to be tested.
- ⇒ Isolate the panel feeder in the opposite substation and secure it against reclosing.
- ⇒ Verify safe isolation from supply.
- ⇒ Earth the panel to be tested.
- ⇒ Remove the cable compartment cover (see Page 126, " Removing the cable compartment cover").
- ⇒ De-earth the cable shield on the C-profile.
- ⇒ Perform cable sheath test in accordance with cable manufacturer's recommendations or customer's specifications.
- ⇒ Earth the cable shield on the C-profile again.
- ⇒ Refit the cable compartment cover.
- ✓ The cable sheath has been tested. Other cable sheaths can be tested, or the panel can be put into operation again.

## 26 Replacing HV HRC fuse-links

**As a rule, always replace the HV HRC fuse-links of all three phases.**


The actions described in this section are in logical order. In practice it may be necessary to deviate from the sequence recommended in here.

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Isolate the panel.</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>

### 26.1 Preparing fuse replacement

- ⇒ Earth transformer panel or metering panel ME 31 F (see Page 100, "Switching the three-position switch to EARTHED position").
- ⇒ Remove cable compartment cover (see Page 126, "Removing the cable compartment cover").
- ✓ The cable compartment with the HV HRC fuse-links is accessible.

### 26.2 Removing HV HRC fuse-link

	<b>DANGER!</b>
	<p>Danger of burning due to hot HV HRC fuse-links.</p> <ul style="list-style-type: none"> <li>⇒ Let HV HRC fuse-links cool down.</li> <li>⇒ Wear protection gloves.</li> </ul>



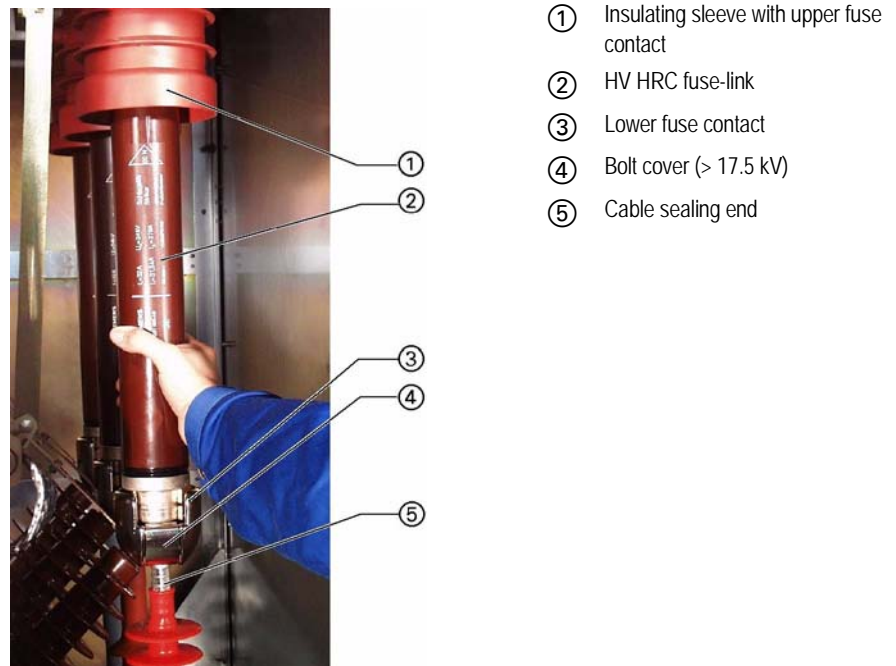


Fig. 86: Removing HV HRC fuse-link

- ⇒ Seize the HV HRC fuse-link **in the lower third**.
- ⇒ Take the HV HRC fuse-link out of the holder.
- ✓ The HV HRC fuse-link has been removed.

### 26.3 Checking the fuse tripping mechanism

During first commissioning and before fitting the HV HRC fuse-links, check the tripping behavior of the switch-disconnector in all three phases by means of test fuses.

To check the fuse tripping mechanism on switchgear connected to the power system, the panel to be tested must be isolated, including the busbars.

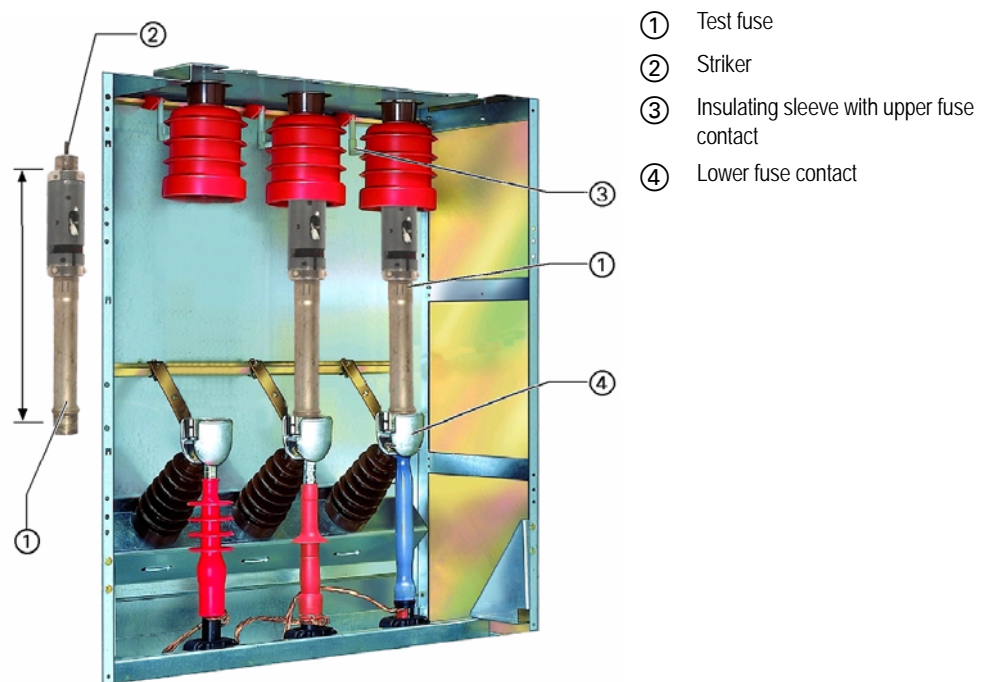


Fig. 87: HV HRC fuse assembly with test fuse

- ⇒ Fit test fuse.
- ⇒ Close switch-disconnector.
- ⇒ Trip striker.
- ✓ The striker of the test fuse trips the switch-disconnector. The switch-disconnector is in the "TRIPPED" position.
- ⇒ Open switch-disconnector.
- ✓ The tripping mechanism is charged.

#### 26.4 Fitting the HV HRC fuse-link



##### **DANGER!**

The fuse compartment or the switchgear will be destroyed by incorrectly fitted or incorrectly dimensioned HV HRC fuse-links.

- ⇒ Provide correct dimensioning of HV HRC fuse-links.
- ⇒ Fit HV HRC fuse-links correctly.
- ⇒ Fit striker of HV HRC fuse-links pointing upwards.

- ⇒ Select HV HRC fuse-links (see Page 48, "Selection of HV HRC fuse-links").
- ⇒ Seize HV HRC fuse-link **in the middle** (striker upwards).
- ⇒ Push HV HRC fuse-link in inclined position under the insulating sleeve and fit into upper and lower contact.
- ⇒ Press HV HRC fuse-link uniformly into upper and lower contact.

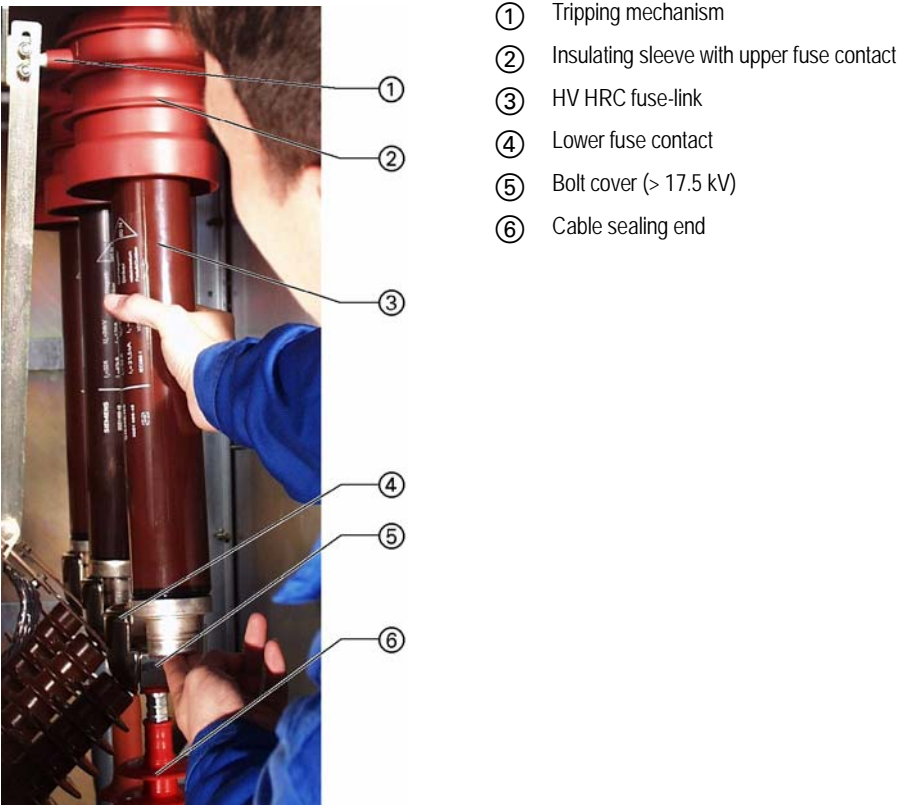


Fig. 88: Fitting HV HRC fuse-link

**26.5    Completing fuse replacement**

- ⇒ Fit cable compartment cover (see Page 126, "Removing the cable compartment cover").
- ⇒ Put transformer panel into operation (see Page 84, "Commissioning SIMOSEC switchgear").

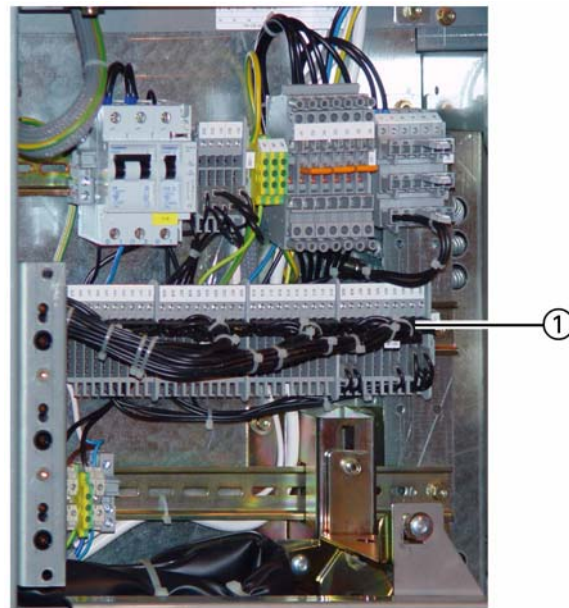
**27       Removing/installing 3AH6 vacuum circuit-breaker**

The actions described in this section are in logical order. In practice it may be necessary to deviate from the order recommended in here.

	<b>DANGER!</b>
	Mortal danger due to live parts.
	⇒ Isolate the panel.
	⇒ Secure against reclosing.
	⇒ Verify safe isolation from supply.
	⇒ Earth and short-circuit.
	⇒ Cover or barrier adjacent live parts.

### 27.1 Preparing circuit-breaker replacement

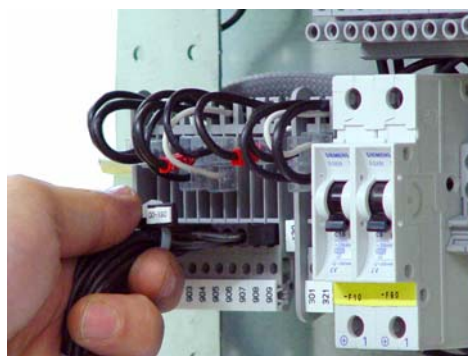
- ⇒ Earth circuit-breaker panel (see OPERATING INSTRUCTIONS, "Switching circuit-breaker panel and bus sectionalizer panel to EARTHED position").
- ⇒ Remove cable compartment cover (see Page 126, "Removing the cable compartment cover").
- ✓ The cable compartment with the 3AH6 vacuum circuit-breaker is accessible.
- ⇒ Unscrew control board of three-position switch
- ✓ The low-voltage connection of the 3AH6 vacuum circuit-breaker is accessible.




① Low-voltage connection cable with 10-pole connector

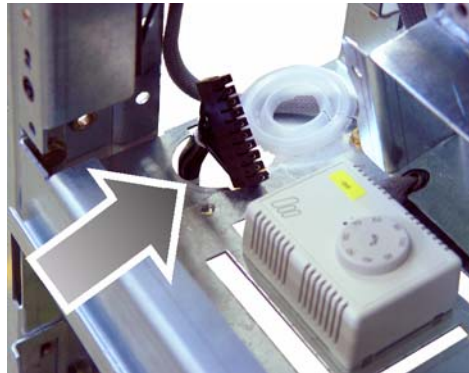
Fig. 89: Low-voltage equipment

- ⇒ Remove low-voltage connection of 3AH6 vacuum circuit-breaker ①.



	<b>ATTENTION!</b>
	<p>The low-voltage cable can be damaged by sharp edges.</p> <p>⇒ Pull the low-voltage cable downwards carefully.</p>

- ⇒ Remove the low-voltage cable bushing and pull the low-voltage cable downwards into the cable compartment.



- ✓ The replacement of the 3AH6 vacuum circuit-breaker is prepared.

## 27.2 Removing 3AH6 vacuum circuit-breaker

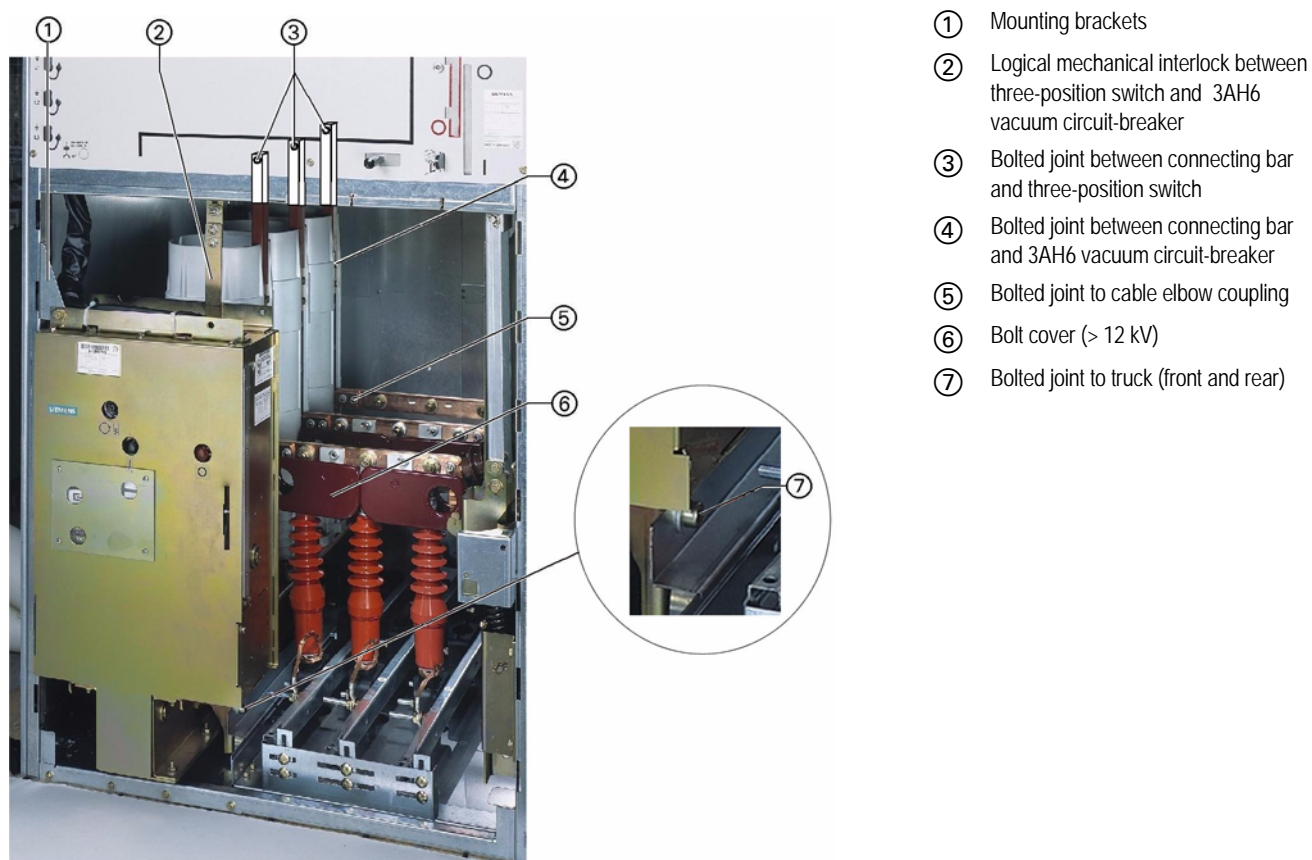
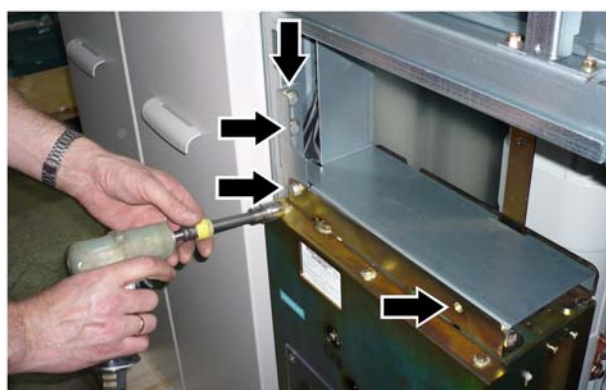


Fig. 90: Bolted joints on 3AH6 vacuum circuit-breaker

**Undo bolted joint**    **Preconditions:** Before removing the 3AH6 vacuum circuit-breaker, all cables must be earthed.

⇒ Undo top-left mounting brackets ① on the 3AH6 operating mechanism box





⇒ Undo bolted joint ② of logical mechanical interlock.



⇒ Undo bolted joint between connecting bar and 3AH6 vacuum circuit-breaker ④.




⇒ Undo fixing bolt from bolt cover ⑥ (>12 kV).

⇒ Remove bolt cover ⑥ (>12 kV) upwards out of the hole for the fixing rivet.

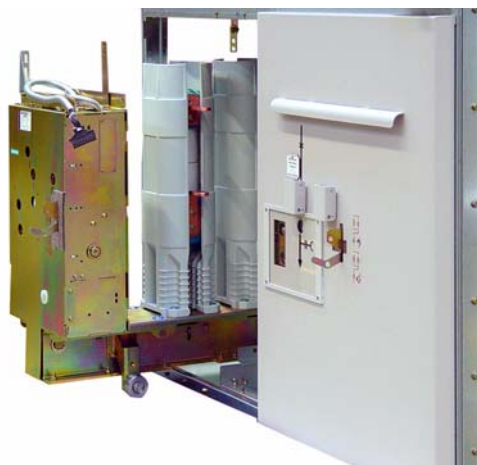
⇒ Undo bolted joint between 3AH6 vacuum circuit-breaker and cable elbow coupling ⑤.

⇒ Undo bolted joint between truck and panel frame at the front **and** rear ⑦.

## Removing circuit-breaker

	<b>ATTENTION!</b>
	<p>Risk of damaging the post insulators and the cable interconnections when the circuit-breaker is removed.</p> <p>⇒ Pull the circuit-breaker out of the panel carefully.</p> <p>⇒ Keep the circuit-breaker in inclined position to pass the cable interconnections.</p>

- ⇒ Pull the 3AH6 vacuum circuit-breaker out of the panel frame until phase L3 of the 3AH6 vacuum circuit-breaker touches phase L2 of the cable interconnections.
- ⇒ Keep the 3AH6 vacuum circuit-breaker inclined while pulling out in order to pass the cable interconnections.
- ⇒ Carefully lift the 3AH6 vacuum circuit-breaker at the front to take it out of the panel frame. Please observe that the post insulators and the cable interconnections are neither buckled nor damaged.



- ✓ The 3AH6 vacuum circuit-breaker has been removed.

### 27.3 Installing 3AH6 vacuum circuit-breaker

Install the 3AH6 vacuum circuit-breaker in reverse order of removal.

Make sure that you are installing the same circuit-breaker type. To do this, compare the technical data on the rating plate (see Page 58, "Rating plates").

Please tell the technical data of the replaced vacuum circuit-breaker to the Siemens representative.

**Please observe** that the bolted joints (M8) of the connecting bars and the cable elbow coupling at the circuit-breaker have to be tightened with 30 Nm.

**Please observe** that the logical mechanical interlock is fastened without distortion. The logical mechanical interlock must move easily.





Fig. 91: Fitting the locking device

If applicable, dispose the packing materials in an environmentally compatible way.

#### **27.4 Completing circuit-breaker replacement**

- ⇒ Remove the portable earthing device (if existing).
- ⇒ Fit cable compartment cover.
- ⇒ Check the mechanical function of the vacuum circuit-breaker.
- ⇒ Check the electrical function of the vacuum circuit-breaker.
- ⇒ Check if all steps of replacement were observed.
- ⇒ Put vacuum circuit-breaker panel into operation.
- ✓ The circuit-breaker panel is ready for operation.

## **28 Replacing current and voltage transformers**

Current and voltage transformers can be replaced in the panels concerned after consultation and authorization by the regional Siemens representative.

## 29 Switchgear maintenance

- Under indoor operating conditions, SIMOSEC requires low maintenance.
- The climatic and local ambient conditions determine the extent of cleaning work to be performed.
- We recommend an annual visual inspection. If required, the intervals have to be adjusted to the climatic and local ambient conditions.
- Independently of the regular maintenance, immediately determine the cause of faults and short circuits as well as partial discharges, and replace damaged parts by original parts if required.
- If you have any questions, please contact your business partner at your local Siemens representative.

Please observe the relevant safety instructions and rules as well as internal specifications for maintenance of SIMOSEC switchgear.


### 29.1 Cleaning the switchgear


To clean the switchgear or single components please use the recommended cleaning agents and aids.


Before reclosing the cleaned SIMOSEC switchgear, full commissioning has to be performed (see Page 84, "Commissioning SIMOSEC switchgear").

Always observe the following:

- Safety rules
- Perfect operation of the safety equipment
- Only authorized and qualified personnel is working on the switchgear.

	<b>DANGER!</b>
	<p>Mortal danger due to live parts.</p> <ul style="list-style-type: none"> <li>⇒ Isolate the panel/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> <li>⇒ Observe all specifications and internal safety instructions</li> <li>⇒ Only authorized and qualified personnel is working on the switchgear.</li> </ul>

	<b>ATTENTION!</b>
	<p>Switchgear damages due to flashover caused by pollution.</p> <ul style="list-style-type: none"> <li>⇒ Remove chips and dust.</li> <li>⇒ Clean bushing-type insulators.</li> <li>⇒ Clean high-voltage connections, bars and cables.</li> </ul>

	<b>ATTENTION!</b>
	<p>Damaged insulating parts due to cleaning agents containing carbon hydrogen .</p> <p>⇒ Clean cast-resin parts with water and household cleaner.</p>

Cleaning agents and cleaning aids		
Cleaning agents and cleaning aids	Contents	Use
WD40	Water-resistant spray-oil	Corrosion protection for parts sliding on each other
Household cleaner and water		Cast-resin parts, control boards, covers, transformers
Brush		Dust
Lint-free cleaning rag		Humid cleaning, drying
Vacuum cleaner		Drilling chips, rubble, dust

## 29.2 Checking corrosion protection

Scratches, impacts or bare spots in the surface painting of the switchgear enclosure can produce corrosion.

Always observe the following:


- Safety rules
- Perfect operation of the safety equipment
- Only authorized and qualified personnel is working on the switchgear.

### Touch-up set

Touch-up set	Contents	Use
8DX2 011	Paint pen in color "Light Basic SN700"	Scratches, impacts, bare spots
8DX2 012	Paint tin in color "Light Basic SN700"	Scratches, impacts, bare spots

## 30 End of service life

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

	<b>NOTE!</b>
	<p>The equipment contains the fluorized greenhouse gas SF<sub>6</sub> registrated by the Kyoto Protocol with a global warning potential (GWP) of 22 200. 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 62271-303 has to be observed: High-voltage switchgear and controlgear - Part 303 Use and handling of sulphur hexafluoride (SF<sub>6</sub>) zu beachten.</p>

Before recycling the materials, evacuate the 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:

- Sheet-steel, galvanized (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (conductor bars)
- Silver (contacts)
- Cast-resin based on epoxy resin (bushings and fuse boxes)
- Plastic material (arcing chamber and fuse slide)
- Silicone rubber

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

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

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 regulations must be followed.

For further information please contact your regional Siemens representative.

## 31 Help

Should these operating instructions not answer all your questions about installation, operation and servicing of your SIMOSEC switchgear, please contact your Siemens sales partner or the regional Siemens representative.

**Reporting faults** Should an operational fault have occurred on your SIMOSEC switchgear, which you cannot clear by yourself according to the information given in these operating instructions, please inform your Siemens sales partner or the regional Siemens representative immediately.

With this data, you will make it easier for us to delimit, identify and clear the fault:

- Type, serial and panel number of the switchgear (see rating plate)
- If required, type and serial number of the vacuum circuit-breaker (see rating plate)
- Precise description of the fault (e.g. with a copy of the associated page of these instructions, photos, drawings, sketches or circuit diagrams).

## 32 Siemens representative

Your Siemens sales partner or the regional Siemens representative will be pleased to help you as for any questions, difficulties and faults on your SIMOSEC switchgear.

### Switchgear Factory Frankfurt/Main, Germany

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