Medium-Voltage Switchgear

Type SIMOSEC

up to 24 kV, Extendable, up to 1250 A

INSTALLATION AND OPERATING INSTRUCTIONS

Order No.: 832-6007.0
Revision: 05
Issue: 24.10.2008
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.
Safety instructions

1  Signal terms and definitions

DANGER!

as used in these instructions, this means that personal injuries can occur if the relevant precautionary measures are not taken.

⇒ Observe the safety instructions.

ATTENTION!

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.

NOTE!

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.

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>The perfect and safe operation of this switchgear is conditional on:</td>
</tr>
<tr>
<td>⊳ Observance of operating and installation instructions.</td>
</tr>
<tr>
<td>⊳ Qualified personnel.</td>
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<tr>
<td>⊳ Proper transportation and correct storage of the switchgear.</td>
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<td>⊳ Correct installation and commissioning.</td>
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<td>⊳ Diligent operation and maintenance.</td>
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<tr>
<td>⊳ Observance of the instructions applicable at site for installation, operation and safety.</td>
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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.

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 SF₆ 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
2. Niche for customer-side low-voltage equipment, cover can be unscrewed
3. Option: CAPDIS voltage detecting system
4. Option: Short-circuit/earth-fault indicator
5. Option: Ready-for-service indicator for switching device
6. Position indicator for load-break function "CLOSED-OPEN"
7. Position indicator for earthing function "OPEN-EARTHED"
8. Feeder designation label
9. Mimic diagram
10. Sockets for capacitive voltage detecting system
11. Option: Momentary-contact rotary control switch "CLOSED - OPEN" for motor operating mechanism with local-remote switch for three-position switch
12. Option: Locking device for three-position switch
13. Pressure relief device for switching device
14. Manual operation for the mechanism of the earthing function
15. Manual operation for the mechanism of the load-break / disconnecting function
16. Rating and type plate
17. Gas-insulated vessel for switching device
18. Interlocking of cable compartment cover
19. Bushing-type insulator for busbar
20. Bushing-type insulator for feeder
21. Insulating sleeve
22. Cable bracket with cable clamps (option) for fastening cables
23. Busbar
24. Insulating cap on busbar
25. Spring-operated mechanism for three-position switch-disconnector
26. Spring-operated/stored-energy mechanism for three-position switch
27. Three-position switch-disconnector
28. Cable connection
29. Cable compartment cover
30. Earthing connection (for location see dimension drawings)
31. Earthing switch for cable connection
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
41. 3AH5 vacuum circuit-breaker, fixed-mounted
42. 3AH6 vacuum circuit-breaker, withdrawable
43. Operating mechanism box
44. Manual operation- for closing with manual operating mechanism- for emergency operation with motor operating mechanism
45. Mechanical "OFF" pushbutton
46. Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
47. "Spring charged" indicator
48. Operations counter
49. Position indication
50. Option: Three-phase current transformer 4MC63 53
51. Option: Overcurrent protection relay SIPROTEC easy 7SJ45
52. Option: Multifunction protection relay SIPROTEC 4 7SJ62
53. Insulating cap/field control cap for cable connection
54. Insulating cap on bushing-type insulator
55. Option: Wiring duct, removable for control cables and/or bus wires
56. Cable compartment
57. Earthing busbar
58. Metallic partition of busbar compartment
59. Metallic partition of cable compartment
60. Busbar compartment cover for panel extension
61. Cable sealing end (not included in scope of supply)
62. Option: Feeder earthing via make-proof earthing switch
63. or feeder earthing via vacuum circuit-breaker (= locking device for feeder earthed when circuit-breaker is in "CLOSED" position)
64. Interlocking of cable compartment cover in circuit-breaker panels
65. Cover for transformer connection compartment
66. Bus riser bar
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)

* 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

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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
Description

3AH5 vacuum circuit-breaker

Features
- 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

1. Gear box  
2. Operation for charging the closing spring  
3. Auxiliary switch  
4. Mechanical "ON" pushbutton  
5. Mechanical "OFF" pushbutton  
6. 1st release Y1  
7. Operating rod with contact pressure spring  
8. Position indicator  
9. Motor M1  
10. "Spring charged" / "Spring not charged" indicator  
11. Operations counter  
12. Closing solenoid Y9  
13. Position switch S4  
14. Closing spring  
15. Logical mechanical interlock between three-position switch and 3AH vacuum circuit-breaker  
16. Locking device for feeder earthed when circuit-breaker is in "CLOSED" position
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\(^1\) Y2
- Current-transformer operated release 3AX 1102\(^1\) Y4
- Undervoltage release 3AX 1103\(^1\) Y7
- Current-transformer operated release 3AX 1104\(^1\) Y6
- Varistor circuit
- Mechanical interlocking (basic equipment for 1250 A)
- Wiring of electrical equipment to low-voltage connection cable with 10-pole module plugs

\(^1\) Additionally to or instead of the series shunt release Y1, 3AH vacuum circuit-breakers can be equipped with max. 1 release type 3AX 1...

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.
**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 SF₆ 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 disconnector

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

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

![Diagram of three-position disconnector 1250 A]

**Mode of operation**

The three-position disconnector combines the functions of a disconnector and an earthing switch. The three-position disconnector has no making capacity.

**Features**

- Disconnector
- Metal-enclosed, gas-insulated
- No external cross insulation between phases
- Designed as a three-position disconnector with the functions:
  - Disconnector and
  - Earthing switch
- Three-position 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 1250 A

**Equipment**

- **Auxiliary switch** (option)

Each operating mechanism of the three-position disconnector 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

**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.

![Diagram of operating mechanisms](image)

- **Indication “switching device TRIPPED”**
  - by HV HRC fuse-link
  - by shunt release / F-release

- **OPEN indication**

- **CLOSED indication, manual or motor operation**
• **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

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

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

6. Auxiliary contactors of motor operating mechanism
7. Auxiliary switch
8. Rectifier
9. Shunt release
Switch positions of the three-position switch

<table>
<thead>
<tr>
<th>Three-position switch-disconnector up to 630 A</th>
<th>Three-position disconnector up to 1250 A</th>
<th>Switch position</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td>EARTHED</td>
</tr>
<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Diagram" /></td>
<td>OPEN</td>
</tr>
<tr>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Diagram" /></td>
<td>CLOSED</td>
</tr>
</tbody>
</table>

1. Busbar connection
2. Feeder, e.g. for cable connection or for circuit-breaker

Switch-positions of the make-proof earthing switch

<table>
<thead>
<tr>
<th>Make-proof earthing switch</th>
<th>Switch position</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Diagram" /></td>
<td>EARTHED</td>
</tr>
<tr>
<td><img src="image8.png" alt="Diagram" /></td>
<td>OPEN</td>
</tr>
</tbody>
</table>

1. Busbar connection
2. Feeder, z.B. for cable connection (option) or for metering (option)
7.6 Current and voltage transformers

4MC63 three-phase current transformer
- Designed as a three-phase, galvanically separated ring-core current transformer on the bushings of the three-position switch
- 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.

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

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.
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.

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").

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.
Description

**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 disconnector, optional for switch-disconnector/make-proof earthing switch)*

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

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<table>
<thead>
<tr>
<th>EARTHING / DE-EARTHING</th>
<th>SWITCHING NOT POSSIBLE</th>
<th>OPENING/CLOSING the three-position switch</th>
</tr>
</thead>
</table>

---

**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 mm²
- Cable routing downwards

**Features for transformer feeder**

- For thermoplastic-insulated cables
- For connection cross-sections* up to 120 mm² (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 SF₆ gas

The ready-for-service indicator for SF₆ gas shows the gas density in the three-position switch required to operate the panel.

![Indicator diagram](image)

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 SF₆ 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

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)
**HR/LRM system**

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

- 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

---

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

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAPDIS, fixed-mounted</td>
</tr>
<tr>
<td>2</td>
<td>HR/LRM indicator, plugged in</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Feeder designation label</td>
</tr>
<tr>
<td>2</td>
<td>Plug-in voltage indicator (make Horstmann)</td>
</tr>
<tr>
<td>3</td>
<td>Earth test socket</td>
</tr>
<tr>
<td>4</td>
<td>Capacitive test socket for L2</td>
</tr>
<tr>
<td>5</td>
<td>Socket cover</td>
</tr>
<tr>
<td>6</td>
<td>Symbol for measuring system</td>
</tr>
<tr>
<td>7</td>
<td>Identification field for repeat test of interface condition</td>
</tr>
</tbody>
</table>
Features of CAPDIS -S1+-S2+

- 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

**Display of CAPDIS -S1+-S2+**

<table>
<thead>
<tr>
<th>CAPDIS-S1+</th>
<th>CAPDIS-S2+</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Operating voltage not present (CAPDIS-S2+)</td>
<td>000</td>
</tr>
<tr>
<td>Operating voltage present</td>
<td>000</td>
</tr>
<tr>
<td>- Operating voltage not present</td>
<td></td>
</tr>
<tr>
<td>- Auxiliary power not present (CAPDIS-S2+)</td>
<td></td>
</tr>
<tr>
<td>Earth fault or failure in phase L1, operating voltage at L2 and L3</td>
<td>000</td>
</tr>
<tr>
<td>Voltage (not operating voltage) present</td>
<td>000</td>
</tr>
<tr>
<td>Indication &quot;Device-Function-Test&quot; passed</td>
<td>000</td>
</tr>
<tr>
<td>Indication &quot;ERROR&quot;, e.g. in case of missing auxiliary voltage (CAPDIS-S2+)</td>
<td>ERROR</td>
</tr>
</tbody>
</table>
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

![Alpha E indicator](image_url)

**Fig. 36: Alpha E indicator**

<table>
<thead>
<tr>
<th>Indicator type</th>
<th>Reset</th>
<th>Short-circuit current (A)</th>
<th>Earth-fault current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHA M</td>
<td>manually</td>
<td>400, 600, 800, 1000</td>
<td>–</td>
</tr>
<tr>
<td>ALPHA E</td>
<td>manually/automatically after 2 or 4 h</td>
<td>400, 600, 800, 1000</td>
<td>–</td>
</tr>
<tr>
<td>GAMMA 4.0</td>
<td>manually/after return of power supply/after 2 or 4 h</td>
<td>400, 600, 800, 1000</td>
<td>–</td>
</tr>
<tr>
<td>ALPHA automatic</td>
<td>manually (by pushbutton), remote reset (by auxiliary voltage), automatically after 3 h</td>
<td>Change of current DI= 150 A – 300 A (depending on the load current) at t=20 ms</td>
<td>–</td>
</tr>
</tbody>
</table>

**Earth-fault/short-circuit indicator**

<table>
<thead>
<tr>
<th>Indicator type</th>
<th>Reset</th>
<th>Short-circuit current (A)</th>
<th>Earth-fault current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EKA - 3</td>
<td>after return of power supply</td>
<td>450</td>
<td>40, 80, 160</td>
</tr>
<tr>
<td>DELTA M</td>
<td>manually</td>
<td>400, 600, 800, 1000</td>
<td>200</td>
</tr>
<tr>
<td>DELTA E</td>
<td>manually, automatically after 2 or 4 h</td>
<td>400, 600, 800, 1000</td>
<td>200</td>
</tr>
</tbody>
</table>

**Earth-fault indicator**

<table>
<thead>
<tr>
<th>Indicator type</th>
<th>Reset</th>
<th>Short-circuit current (A)</th>
<th>Earth-fault current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EKA - 3 1</td>
<td>after return of power supply</td>
<td>–</td>
<td>40, 80, 160</td>
</tr>
</tbody>
</table>

1) Further types and other makes available on request.
2) Standard values. Other values on request.
3) 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.

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

<table>
<thead>
<tr>
<th>Ring-main panel type RK; cable connection panel type K</th>
<th>Rated voltage ( U_r )</th>
<th>[kV]</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rated normal current ( I_{nr} )</td>
<td>[A]</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for feeder and transfer, panel type RK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for feeder, panel type K</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current ( I_{ma} )</td>
<td>up to [kA]</td>
<td>50</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
<td>63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transformer panel type TR</th>
<th>Rated voltage ( U_r )</th>
<th>[kV]</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rated normal current ( I_{nr} )</td>
<td>[A]</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for feeder (^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated peak withstand current ( I_{p} ) (^3)</td>
<td>up to [kA]</td>
<td>50</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
<td>63</td>
</tr>
<tr>
<td>Rated short-circuit making current ( I_{ma} ) (^3)</td>
<td></td>
<td>50</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
<td>63</td>
</tr>
<tr>
<td>Dimension &quot;e&quot; for HV HRC fuse-links</td>
<td>[mm]</td>
<td>292</td>
<td>292</td>
<td>442</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Circuit-breaker panel type LS

<table>
<thead>
<tr>
<th>Description</th>
<th>kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r$</td>
<td>[kV]</td>
<td>7.2</td>
<td>12</td>
<td>15</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated normal current $I_r ,^1$</td>
<td>[A]</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for feeder and transfer, panel types LS1 and LS1-U with 3AH5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for feeder and transfer, panel types LS11 and LS11-U with 3AH6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for feeder and transfer, panel types LS31, LS32 and LS31-U with 3AH6</td>
<td>up to 1250</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$</td>
<td>[kA]</td>
<td>50</td>
<td>63</td>
<td>50</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td>Rated short-circuit breaking current $I_{sc}$ for 3AH vacuum circuit-breaker</td>
<td>10,000 operating cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical endurance for 3AH vacuum circuit-breaker</td>
<td>35 breaking operations with 3AH6 at 25 kA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Busbar earthing panel type SE

<table>
<thead>
<tr>
<th>Description</th>
<th>kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r$</td>
<td>[kV]</td>
<td>7.2</td>
<td>12</td>
<td>15</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$</td>
<td>[kA]</td>
<td>50</td>
<td>63</td>
<td>50</td>
<td>63</td>
<td>40</td>
</tr>
</tbody>
</table>

### Busbar voltage metering panel types ME3 and ME31-F

<table>
<thead>
<tr>
<th>Description</th>
<th>kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r$</td>
<td>[kV]</td>
<td>7.2</td>
<td>12</td>
<td>15</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p ,^3$</td>
<td>[kA]</td>
<td>50</td>
<td>63</td>
<td>50</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma} ,^3$</td>
<td>[kA]</td>
<td>50</td>
<td>63</td>
<td>50</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td>Dimension “e” in panel type ME31-F</td>
<td>[mm]</td>
<td>292</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Billing metering panel type ME1

<table>
<thead>
<tr>
<th>Description</th>
<th>kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r$</td>
<td>[kV]</td>
<td>7.2</td>
<td>12</td>
<td>15</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated normal current $I_r ,^1$</td>
<td>[A]</td>
<td>630, 1250</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for transfer, panel type ME1 and panel type ME1-H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for feeder as cable connection panel, panel type ME1-K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for busbar connection, panel type ME1-S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for bus riser panel, panel type HF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1) 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).

2) Pressure values for SF6-insulated vessels.

3) Depending on the rated current or max. let-through current of the HV HRC fuse-link (I_D ≤ 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

<table>
<thead>
<tr>
<th>Panel type</th>
<th>Panel or panel combination</th>
<th>Transport unit (including packing) for standard panels (with / without pressure relief duct)</th>
<th>Gross weight</th>
<th>approx. [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual panel or combinations thereof for standard switchgear</td>
<td></td>
<td>Width B1</td>
<td>Net weight with LVC*</td>
<td>with LVC*</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------</td>
<td>----------</td>
<td>----------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Ring-main panel</td>
<td></td>
<td></td>
<td>375</td>
<td>190</td>
</tr>
<tr>
<td>RK</td>
<td></td>
<td></td>
<td>500</td>
<td>210</td>
</tr>
<tr>
<td>Ring-main panel for panel combinations</td>
<td></td>
<td></td>
<td>375</td>
<td>260</td>
</tr>
<tr>
<td>Cable panel</td>
<td></td>
<td></td>
<td>375</td>
<td>190</td>
</tr>
<tr>
<td>Transformer panel</td>
<td></td>
<td></td>
<td>375</td>
<td>210</td>
</tr>
<tr>
<td>Transformer panel for 630 A</td>
<td></td>
<td></td>
<td>500</td>
<td>230</td>
</tr>
<tr>
<td>transformer panel for 1250 A</td>
<td></td>
<td></td>
<td>375</td>
<td>340</td>
</tr>
<tr>
<td>transformer panel for 1250 A</td>
<td></td>
<td></td>
<td>500</td>
<td>340</td>
</tr>
</tbody>
</table>

### Additional weight

<table>
<thead>
<tr>
<th>For individual panel</th>
<th>Width B1 [mm]</th>
<th>Additional weight</th>
<th>approx. [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure relief duct for switchgear in free-standing arrangement</td>
<td>375</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>875</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>
Shipping data for one transport unit

<table>
<thead>
<tr>
<th>Overall width B3</th>
<th>Transport unit (including packing) for standard panels (with / without pressure relief duct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mm]</td>
<td>[m]</td>
</tr>
<tr>
<td>≤ 875</td>
<td>1.08</td>
</tr>
<tr>
<td>≤ 1000</td>
<td>1.20</td>
</tr>
<tr>
<td>≤ 1500</td>
<td>1.78</td>
</tr>
<tr>
<td>≤ 2125</td>
<td>2.33</td>
</tr>
</tbody>
</table>

* 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:

<table>
<thead>
<tr>
<th>Joint: material/material</th>
<th>Thread</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal joints:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sheet-steel/sheet-steel</td>
<td>M6 (self-cutting)</td>
<td>12 Nm</td>
</tr>
<tr>
<td>e. g.: front plates, top plates, etc.</td>
<td>M8</td>
<td>21 Nm</td>
</tr>
<tr>
<td>Earthing busbar:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sheet-steel/copper</td>
<td>M8</td>
<td>21 Nm</td>
</tr>
<tr>
<td>copper/copper</td>
<td>M8</td>
<td>21 Nm</td>
</tr>
<tr>
<td>sheet-steel/copper</td>
<td>M10</td>
<td>30 Nm</td>
</tr>
<tr>
<td>Current conductor joint:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>copper/copper</td>
<td>M8</td>
<td>21 Nm</td>
</tr>
<tr>
<td>copper/copper</td>
<td>M10</td>
<td>30 Nm</td>
</tr>
<tr>
<td>Switchgear earthing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sheet-steel/cable lug</td>
<td>M12</td>
<td>50 Nm*</td>
</tr>
<tr>
<td>Cable shield earthing</td>
<td>M10</td>
<td>30 Nm*</td>
</tr>
</tbody>
</table>

*The tightening torque at the cable lug joint depends on:
- material of cable lug
- instructions of sealing end manufacturer
- instructions of cable manufacturer

<table>
<thead>
<tr>
<th>Thread</th>
<th>Tightening torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>max. 21 Nm*</td>
</tr>
<tr>
<td>(TR panel)</td>
<td>(TR panel)</td>
</tr>
<tr>
<td>M12</td>
<td>max. 50 Nm*</td>
</tr>
<tr>
<td>(all other cable panels)</td>
<td>(all other cable panels)</td>
</tr>
</tbody>
</table>
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:

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

SIMOSEC switchgear complies with the following applicable prescriptions and standards:

<table>
<thead>
<tr>
<th></th>
<th>IEC/EN standard</th>
<th>VDE standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switchgear</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>62 271-1</td>
<td>0670-1</td>
</tr>
<tr>
<td></td>
<td>62 271-200</td>
<td>0671-200</td>
</tr>
<tr>
<td><strong>Switching devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit-breaker</td>
<td>62 271-100</td>
<td>0671-100</td>
</tr>
<tr>
<td>Disconnector/earthing</td>
<td>62 271-102</td>
<td>0671-102</td>
</tr>
<tr>
<td>Switch-disconnector</td>
<td>60 265-1</td>
<td>0670-301</td>
</tr>
<tr>
<td>Switch-disconnector/fuse</td>
<td>62 271-105</td>
<td>0671-105</td>
</tr>
<tr>
<td>combination</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage detecting</strong></td>
<td>61 243-5</td>
<td>0682-415</td>
</tr>
<tr>
<td>systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surge arresters</strong></td>
<td>60 099</td>
<td>0675</td>
</tr>
<tr>
<td><strong>Degree of protection</strong></td>
<td>60 529</td>
<td>0470-1</td>
</tr>
<tr>
<td><strong>Instrument transformers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current transformers</td>
<td>60 044-1</td>
<td>0414-1</td>
</tr>
<tr>
<td>Voltage transformers</td>
<td>60 044-2</td>
<td>0414-2</td>
</tr>
<tr>
<td>Combined transformers</td>
<td>60 044-3</td>
<td>0414-3</td>
</tr>
<tr>
<td><strong>SF₆</strong></td>
<td>60 376</td>
<td>0373-1</td>
</tr>
<tr>
<td></td>
<td>60 480</td>
<td>0373-2</td>
</tr>
<tr>
<td><strong>Installation and</strong></td>
<td>61 936-1 / HD 637 - S1</td>
<td>0101</td>
</tr>
<tr>
<td><strong>earthing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td>60 721-3-3</td>
<td>DIN EN 60 721-3-3</td>
</tr>
<tr>
<td><strong>conditions</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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/m³ 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.

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

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

$\geq$ Rated short-duration power-frequency withstand voltage up to $\leq 1000$ m $\times K_a$

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

$\geq$ Rated lightning impulse withstand voltage up to $\leq 1000$ m $\times K_a$

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

$95 \text{ kV} \times 1.28 = 122 \text{ kV}$

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated normal current</td>
<td>10,000 times</td>
</tr>
<tr>
<td>Short-circuit breaking current</td>
<td>50 times with max. 25 kA</td>
</tr>
<tr>
<td></td>
<td>35 times with max. 25 kA for 3AH6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating times of 3AH5/3AH6 vacuum circuit-breakers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating times</strong></td>
</tr>
<tr>
<td>Closing time for stored-energy mechanism</td>
</tr>
<tr>
<td>Charging time for electrical operation</td>
</tr>
<tr>
<td>Opening time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Arcing time</td>
</tr>
<tr>
<td>Break time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Dead time</td>
</tr>
<tr>
<td>Close-open contact time</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Minimum command duration</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Short-time impulse duration of the circuit-breaker tripping signal</td>
</tr>
</tbody>
</table>

- **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:

<table>
<thead>
<tr>
<th>Rated supply voltage</th>
<th>Recommended rated current for the protection equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 24 V</td>
<td>8 A</td>
</tr>
<tr>
<td>DC 48 V</td>
<td>6 A</td>
</tr>
<tr>
<td>DC 60 V</td>
<td>4 A</td>
</tr>
<tr>
<td>DC/AC 110 V 50/60 Hz</td>
<td>2 A</td>
</tr>
<tr>
<td>DC 220/AC 230 V 50/60 Hz</td>
<td>1.6 A</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Breaking capacity</th>
<th>Operating voltage V</th>
<th>Normal current A</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC 40 up to 60 Hz</td>
<td>up to 230</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Breaking capacity</th>
<th>Operating voltage [V]</th>
<th>Normal current [A]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>24</td>
<td>Resistive load</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>220</td>
<td>2.5</td>
</tr>
</tbody>
</table>

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.
Description

**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: ≤13 VA or ≤15 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**

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching overvoltages can cause damages on electronic control units.</td>
</tr>
<tr>
<td>✗ Do not switch off inductive consumers in DC circuits.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>U_r, kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
</table>

Test duty 1
- Rated mainly active load breaking current 100 operations 
  l1_1 A 630 630 630 630 630
- Rated mainly active load breaking current 20 operations 
  l1_3 A 31.5 31.5 31.5 31.5 31.5

Test duty 2a
- Rated line closed-loop breaking current 20 operations 
  l2a A 630 630 630 630 630

Test duty 3
- Rated transformer breaking current 20 operations 
  l3 A 40 40 40 40 40

Test duty 4a
- Rated cable-charging breaking current 10 operations 
  l4a A 68 68 68 68 68

Test duty 4b
- Rated line-charging breaking current 10 operations 
  l4b A 68 68 68 68 68

Test duty 5
- Rated short-circuit making current 5 operations 
  lma A up to kA 63 63 63 63 50

Test duty 6a
- Rated earth-fault breaking current 10 operations 
  l6a 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 
  l6b A 35 35 35 35 35

- Cable-charging breaking current under earth-fault conditions with superposed load current 10 operations 
  l1+l6b 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

<table>
<thead>
<tr>
<th>Rated transfer current</th>
<th>I4 A 1150 1150 830 830 830</th>
</tr>
</thead>
</table>

8.12 Three-position disconnector

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>U_r, kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
</table>

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 l_k A up to kA 25 25 25 25 20

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

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<th>Rated voltage</th>
<th>U_r, kV</th>
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Make-proof earthing function of the three-position switch-disconnector
- Rated short-circuit making current l_ma A up to kA 63 63 63 63 50
- Rated short-time withstand current l_k A up to kA 25 25 25 25 20

Make-proof earthing function in panels LS11, LS31, LS32
- Rated short-circuit making current l_ma A up to kA 63 63 63 63 50
- Rated short-time withstand current l_k A 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

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<th>HV HRC fuse</th>
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Description

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

*) Extension tube l=100 mm required

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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

**4M C63 three-phase current transformer for panel types LS..., LT..., and RK-U**

#### Primary data

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<th>For $I_N \leq 400$ A</th>
<th>For $I_N \leq 1000$ A</th>
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<td>Rated thermal short-time withstand current $I_{th}$ [kA]</td>
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<tr>
<td>Current at $I_D$ [A]</td>
<td>4.2</td>
<td>1.575</td>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection core Class</td>
<td>10 P</td>
<td>10 P</td>
<td>10 P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent factor</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Description**

4M C70 33, 4M C70 31 cable-type current transformers and 4 M C70 32 bus-type transformer

### Primary data

<table>
<thead>
<tr>
<th></th>
<th>4M C70 33</th>
<th>4M C70 31</th>
<th>4M C70 32</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. equipment operating voltage</strong> $U_m$ [kV]</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated current</strong> $I_N$ [A]</td>
<td>30 to 600</td>
<td>50 to 600</td>
<td>200 to 600</td>
</tr>
<tr>
<td><strong>Rated short-duration power-frequency withstand voltage (winding test)</strong> [kV]</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated thermal short-time withstand current</strong> $I_{th}$ [kA]</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated continuous thermal current</strong> $I_D$ [A]</td>
<td>max. $1.2^*I_N$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transient overload current</strong> $1.5 \times I_D / 1 \text{ h} \text{ or } 2 \times I_D / 0.5 \text{ h}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated peak withstand current</strong> $I_{dyn}$</td>
<td>unlimited</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Secondary data

<table>
<thead>
<tr>
<th></th>
<th>4M C70 33</th>
<th>4M C70 31</th>
<th>4M C70 32</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated current</strong> [A]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option [A]</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><strong>Measuring core</strong> Class</td>
<td>0.2</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Overcurrent factor</strong></td>
<td>FS 10</td>
<td>FS 5</td>
<td>FS 10</td>
</tr>
<tr>
<td><strong>Rating</strong> [VA]</td>
<td>2.5 - 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protection core</strong> Class</td>
<td>10 P</td>
<td>5 P</td>
<td>----</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Overcurrent factor</strong></td>
<td>FS 5</td>
<td>FS 10</td>
<td>FS 5</td>
</tr>
<tr>
<td><strong>Rating</strong> [VA]</td>
<td>2.5 - 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option: Secondary tap</strong></td>
<td>1 : 2(e.g. 150 - 300 A)</td>
<td>1 : 2</td>
<td>1 : 2(e.g. 150 - 300 A)</td>
</tr>
</tbody>
</table>

### Dimensions

<table>
<thead>
<tr>
<th></th>
<th>4M C70 33</th>
<th>4M C70 31</th>
<th>4M C70 32</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall height</strong> $H^{**}$ [mm]</td>
<td>50*</td>
<td>100*</td>
<td>285*</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall width</strong> $B$ [mm]</td>
<td>---</td>
<td>80*</td>
<td>150*</td>
</tr>
<tr>
<td><strong>Outside dimension</strong> [mm]</td>
<td>Ø 145</td>
<td>85 x 114</td>
<td>Ø 125</td>
</tr>
<tr>
<td><strong>Inside dimension</strong> [mm]</td>
<td>Ø 55</td>
<td>Ø 40</td>
<td>Ø 55</td>
</tr>
<tr>
<td><strong>for cable</strong> [mm]</td>
<td>Ø 40</td>
<td>Ø 36</td>
<td>Ø 40</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. equipment operating voltage $U_{in}$</td>
<td>12, 24</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>38, 50</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>95, 125</td>
</tr>
<tr>
<td>Rated current $I_N$</td>
<td>25 - 1250</td>
</tr>
<tr>
<td>Rated thermal short-time withstand current $I_{th}$</td>
<td>up to 25</td>
</tr>
<tr>
<td>Rated continuous thermal current $I_D$</td>
<td>up to 1.2 x $I_N$</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{dyn}$</td>
<td>max. 2.5 x $I_{th}$</td>
</tr>
</tbody>
</table>

#### Secondary data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current</td>
<td>1 or 5</td>
</tr>
<tr>
<td>Measuring core</td>
<td>Class 0.2, 0.5, 1</td>
</tr>
<tr>
<td></td>
<td>Overcurrent factor FS 5 or FS 10</td>
</tr>
<tr>
<td></td>
<td>Rating [VA] 10 - 15</td>
</tr>
<tr>
<td>Protection core</td>
<td>Class 5 or 10 P</td>
</tr>
<tr>
<td></td>
<td>Overcurrent factor 10</td>
</tr>
<tr>
<td></td>
<td>Rating [VA] 5 - 15</td>
</tr>
</tbody>
</table>

Other values available on request.
### 4M R block-type voltage transformer, single-pole

#### Primary data

<table>
<thead>
<tr>
<th>Description</th>
<th>[kV]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. equipment operating voltage ( U_m ) ( (=1.2 \times U_n) )</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Rated voltage ( U_n ) at max. rated short-duration power-frequency withstand voltage ( U_d )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 10,kV</td>
<td>3.3√3</td>
<td></td>
</tr>
<tr>
<td>at 20,kV</td>
<td>3.6√3</td>
<td></td>
</tr>
<tr>
<td>at 28,kV</td>
<td>4.8√3</td>
<td></td>
</tr>
<tr>
<td>at 38,kV</td>
<td>6.0√3</td>
<td></td>
</tr>
<tr>
<td>at 50,kV</td>
<td>6.6√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.2√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.0√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11.0√3</td>
<td></td>
</tr>
<tr>
<td>at 10,kV</td>
<td>13.8√3</td>
<td></td>
</tr>
<tr>
<td>at 20,kV</td>
<td>15.0√3</td>
<td></td>
</tr>
<tr>
<td>at 28,kV</td>
<td>17.5√3</td>
<td></td>
</tr>
<tr>
<td>at 38,kV</td>
<td>20.0√3</td>
<td></td>
</tr>
<tr>
<td>at 50,kV</td>
<td>22.0√3</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage ( U_p )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. voltage factor (8 h) ( U_n )</td>
<td>1.9 ( U_n )</td>
<td></td>
</tr>
</tbody>
</table>

#### Secondary data

<table>
<thead>
<tr>
<th>Description</th>
<th>[V]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>100√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>110√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120√3</td>
<td></td>
</tr>
<tr>
<td>Rated voltage for auxiliary winding (option)</td>
<td>100√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>110√3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120√3</td>
<td></td>
</tr>
<tr>
<td>Rating</td>
<td>[VA]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Class</td>
<td>0.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Cross-section in mm²</th>
<th>Note for application in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euromold</td>
<td>35 MSC</td>
<td>16 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optionally with insulation shields</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>AIN 10</td>
<td>25 - 300 (500*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITK / S 212</td>
<td>35 - 300 (400*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pirelli</td>
<td>ELTI mb-1C-12</td>
<td>35 - 240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELTI-1C-12</td>
<td>25 - 300</td>
<td></td>
</tr>
<tr>
<td>Tyco Electronics Raychem GmbH</td>
<td>IXSU-F</td>
<td>16 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TFTI</td>
<td>25 - 300 (400*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPKT</td>
<td>16 - 300</td>
<td>Lower edge of sealing end below panel. Panel type TR...1)</td>
</tr>
<tr>
<td>Corning Cables (RXS)</td>
<td>IAEM 10</td>
<td>25 - 300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IAES 10</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>3M</td>
<td>92-EP 6xx-1</td>
<td>35 - 300 (400*)</td>
<td></td>
</tr>
<tr>
<td>ABB Energiekabel GmbH</td>
<td>SEHDI 10.2</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>Nkt cables</td>
<td>TI 12</td>
<td>25 - 240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV 10 C</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV 10 E</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
</tbody>
</table>

* 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)

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Cross-section in mm²</th>
<th>Note for application in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euromold</td>
<td>35 MSC</td>
<td>25 - 70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>optionally with insulation shields</td>
<td>25 - 185</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36 MSC</td>
<td>95 - 300 (500*)</td>
<td>Lower edge of sealing end below panel. Panel types LS11/LS31/LS32</td>
</tr>
<tr>
<td></td>
<td>optionally with insulation shields</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIN 20</td>
<td>25 - 300 (630*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITK / S 212</td>
<td>35 - 240</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pirelli</td>
<td>ELTI mb-1C-24</td>
<td>35 - 240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ELTI-1C-24</td>
<td>25 - 300</td>
<td></td>
</tr>
<tr>
<td>Tyco Electronics Raychem GmbH</td>
<td>IXSU-F</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TFTI</td>
<td>25 - 300 (400*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPKT</td>
<td>16 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>Corning Cables (RXS)</td>
<td>IAEM 20</td>
<td>25 - 300</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IAES 20</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>3M</td>
<td>93-EP 6xx-1</td>
<td>25 - 300 (400*)</td>
<td></td>
</tr>
<tr>
<td>ABB Energiekabel GmbH</td>
<td>SEHD I 20,2</td>
<td>35 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>Nkt cables</td>
<td>Ti 24</td>
<td>25 - 240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV 20 E</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AV 10 E</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
</tbody>
</table>

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

Three-core thermoplastic-insulated cables up to 12 kV (6/10 kV)

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Cross-section in mm²</th>
<th>Note for application in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euromold</td>
<td>AIN 10</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SR-DI 12</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
<tr>
<td>Pirelli</td>
<td>ELTI-3C-12</td>
<td>25 - 300</td>
<td></td>
</tr>
<tr>
<td>Tyco Electronics Raychem GmbH</td>
<td>IXSU-F</td>
<td>16 - 300 (500*)</td>
<td></td>
</tr>
</tbody>
</table>

Three-core thermoplastic-insulated cables from 12 kV up to 24 kV (12/20) kV

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Cross-section in mm²</th>
<th>Note for application in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euromold</td>
<td>SR-DI 24</td>
<td>35 - 300 (500*)</td>
<td>Lower edge of sealing end below panel. Panel types LS11...</td>
</tr>
<tr>
<td>Corning Cables (RXS)</td>
<td>GHKI</td>
<td>25 - 300 (500*)</td>
<td></td>
</tr>
</tbody>
</table>

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

Note!
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)](example)

![Rating plate inside the operating mechanism box (example)](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

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of injury and damage to the stored goods if the storage space is overloaded.</td>
</tr>
</tbody>
</table>

- Observe the load-bearing capacity of the floor.
- Do not stack the transport units.
- Do not overload lighter components by stacking.

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire risk. The transport unit is packed in flammable materials.</td>
</tr>
</tbody>
</table>

- No smoking.
- Keep fire extinguishers in a weatherproof place.
- Mark the location of the fire extinguisher.

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplied desiccant bags lose their effectiveness if they are not stored in the undamaged original packings.</td>
</tr>
</tbody>
</table>

- Do not damage or remove packing of desiccant bags.
- Do not unpack desiccant bags before use.
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 screwdriver 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 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 SF₆ gas (see Page 28, “Ready-for-service indicator for SF₆ 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

**DANGER!**

- If incorrectly transported, transport units falling down can endanger people or damage transport units.

- Make sure that the lifting and transport gear used meets the requirements as regards construction and load-bearing capacity.

- Observe even weight distribution and the center of gravity.

**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

**ATTENTION!**

- Incorrect transport will damage the transport unit.

- The spreading angle of the fixing gear is smaller than 90° (< 90°).

- Observe the center of gravity of the transport unit.

- Use permissible fixing gear only.

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

**ATTENTION!**
Incorrect transport will distort the panel frames.

- Use roller pads with adequate size only.
- Apply roller pads only at the points provided for this purpose.

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

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

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.

Installing left end wall

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

Fig. 46: Fixing points of left end wall
Fig. 47: Fixing points of left end wall
(with optional burn-through protection)

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.

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>A distorted panel frame will impair the function of the switchgear.</td>
</tr>
<tr>
<td>➔ Lay shims under the panel frame if required.</td>
</tr>
</tbody>
</table>

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.

![Fig. 48: Bolted joint with foundation rail](image)

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

![Fig. 49: Bolted joint with foundation dowel](image)

➔ 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.

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

Fig. 51:  Bolted joint of panels

1. Bolted joints at the panel frame
2. Separation wall
3. Bolt with contact washer
4. Setnut
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.

![Diagram showing rear wall joining](image)

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.

**ATTENTION!**

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.

**ATTENTION!**

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

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

Assemble the busbars and the fixing material on the points of contact of the panel.

Bolt the busbar tight (tightening torque 50 Nm).

Fit insulating caps (>12 kV)

ATTENTION!
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.
### 11.5 Installing the earthing busbar

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

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient electrical contact increases the transition resistance.</td>
</tr>
<tr>
<td>⇒ Clean oxidized points of contact.</td>
</tr>
<tr>
<td>⇒ Mount the earthing busbar tight and free from distortions and gaps.</td>
</tr>
<tr>
<td>⇒ Select the earthing busbars according to the panel width.</td>
</tr>
<tr>
<td>⇒ Bolt the first earthing busbar together with the end panel.</td>
</tr>
<tr>
<td>⇒ Bolt the earthing busbars of the other panels together.</td>
</tr>
</tbody>
</table>

**Fig. 56: Fitting insulating cap**

![Diagram showing parts of the busbar system](image)
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)

1. Right end panel
2. Substation earth
3. Nut
4. Cable lug
5. Panel frame
6. Strain washer
7. 3 washers $d_1 = 3 \times d_i$; $d_i = 17$ mm
8. Saucer-head bolt
9. Earthing point
10. Left end panel
12 Installing low-voltage compartments

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

⇒ 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

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger due to live parts.</td>
</tr>
<tr>
<td>➔ Isolate the panel.</td>
</tr>
<tr>
<td>➔ Secure against reclosing.</td>
</tr>
<tr>
<td>➔ Verify safe isolation from supply.</td>
</tr>
<tr>
<td>➔ Earth and short-circuit.</td>
</tr>
<tr>
<td>➔ Cover or barrier adjacent live parts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient electrical contact increases the transition resistance.</td>
</tr>
<tr>
<td>➔ Clean oxidized points of contact.</td>
</tr>
<tr>
<td>➔ Mount cable lug of cable sealing end tight and free from distortions and gaps.</td>
</tr>
</tbody>
</table>

Cleaning points of contact

| Cleaning cable elbow coupling / cable lug |
| ➔ Rub points of contact bright with wire brush or emery paper. |

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.

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.

- Route the cable shield directly and tightly to the C-profile, keeping the maximum possible distance to live parts.

ATTENTION!

Switchgear damages due to flashover.

- 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

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

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

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

Fig. 62: Bolt cover (12 kV)
Installation

- 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

NOTE! Use cable sealing ends with a maximum cable lug width of 32 mm.

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.
Installation

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

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.

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

16.1 Checking readiness for service

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

16.2 Cleaning the switchgear

**NOTE!**

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.

**DANGER!**

Switchgear damages due to flashover caused by foreign objects.

☞ Remove all foreign objects from the switchgear.

**ATTENTION!**

☞ 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 earthing connections (switchgear earthing / earthing busbar).
- 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.

<table>
<thead>
<tr>
<th>DANGER!</th>
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<tbody>
<tr>
<td>Mortal danger due to live parts.</td>
</tr>
<tr>
<td>- Verify safe isolation from supply.</td>
</tr>
<tr>
<td>- Isolate adjacent panels.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger when putting defective switchgear into operation.</td>
</tr>
<tr>
<td>- If there are any functional failures during test operation, stop commissioning immediately.</td>
</tr>
<tr>
<td>- Inform the regional Siemens representative.</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger of injury and switchgear damages due to beating hand crank when the motor operating mechanism starts up.</td>
</tr>
<tr>
<td>Use original hand crank with freewheel.</td>
</tr>
<tr>
<td>Make sure that hand crank is removed.</td>
</tr>
</tbody>
</table>

- 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”).

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger due to live parts.</td>
</tr>
<tr>
<td>➔ Observe the Five Safety Rules of Electrical Engineering.</td>
</tr>
<tr>
<td>➔ Observe the specifications for prevention of accidents.</td>
</tr>
<tr>
<td>➔ Observe the operating and working instructions of the switchgear operator.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger due to different phase sequence of incoming feeders.</td>
</tr>
<tr>
<td>➔ Ensure correct phase sequence.</td>
</tr>
<tr>
<td>➔ Do only use adequate phase meters.</td>
</tr>
</tbody>
</table>

➢ 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.
### DANGER!
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.

- Determine the IAC classification of the switchgear by means of the data on the rating plate (see Page 58, “Rating plates”).
- 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.
Indicators and control elements

1. Three-position switch
2. Sockets for capacitive voltage detecting system
3. Ready-for-service indicator for SF6 gas (option)
4. Niche for customer-side low-voltage equipment
5. Recess for indicators:
   - Short-circuit indicator (option)
   - Earth-fault indicator (option)
   - CAPDIS (option)
6. Momentary-contact rotary control switch "ON - OFF" and local-remote switch for the motor operating mechanism of the three-position switch (option)
7. Low-voltage compartment (option)
8. SIPROTEC4 bay controller (option)
9. 3A6 vacuum circuit-breaker
11. Control board with mimic diagram and interlocking elements
12. Interlocking lever for cable compartment cover
13. Rating plate
14. Cable compartment
15. Earthing switch for transformer panel

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

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 SF₆ gas (option) shows the gas density in the three-position switch required to operate the panel.

![Ready-for-service indicator for SF₆ gas (option)](image)

If a three-position switch filled with SF₆ 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

**DANGER!**

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.

**DANGER!**

Mortal danger if safe isolation from supply is verified incorrectly!

⇒ Verify the perfect operation of the voltage indicator and the coupling section:
  - On live equipment
  - With a test unit according to IEC 61243-5/EN 61243-5
  - On all phases

⇒ 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

![Control board section: Sockets for capacitive voltage detecting system](image)

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 disconnector (see Page 17, “Three-position disconnector”) 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 disconnector:
- Circuit-breaker panel LS31, LS32, LS31-U
- Bus sectionalizer panel LT31

19.1 Indicators and control elements of the three-position switch

![Diagram of ring-main panel with three-position switch-disconnector]

![Diagram of transformer panel with three-position switch-disconnector]

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

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

1. Position indicator
2. Ready-for-service indicator for SF₆ 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
Possible switch positions of the three-position switch-disconnector

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

Fig. 73: Operating levers for three-position switch

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

<table>
<thead>
<tr>
<th><strong>EARTHED</strong></th>
<th><img src="image" alt="Diagram" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Switch-disconnector/disconnector open</td>
<td></td>
</tr>
<tr>
<td>- Earthing switch closed</td>
<td></td>
</tr>
<tr>
<td>- Cable compartment cover unlocked</td>
<td></td>
</tr>
</tbody>
</table>

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”).

<table>
<thead>
<tr>
<th><strong>OPEN</strong></th>
<th><img src="image" alt="Diagram" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Switch-disconnector/disconnector open</td>
<td></td>
</tr>
<tr>
<td>- Earthing switch open</td>
<td></td>
</tr>
<tr>
<td>- Cable compartment cover locked</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CLOSED</strong></th>
<th><img src="image" alt="Diagram" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Switch-disconnector/disconnector closed</td>
<td></td>
</tr>
<tr>
<td>- Earthing switch open</td>
<td></td>
</tr>
<tr>
<td>- Cable compartment cover locked</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TRIPPED</strong></th>
<th><img src="image" alt="Diagram" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Switch-disconnector tripped by a HV HRC fuse-link or a shunt release</td>
<td></td>
</tr>
<tr>
<td>- Earthing switch open</td>
<td></td>
</tr>
<tr>
<td>- Cable compartment cover locked</td>
<td></td>
</tr>
</tbody>
</table>
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

---

**DANGER!**

During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.

- Do not remove covers.
- Do not reach into openings.

---

**DANGER!**

Personal injuries and material damages if the SF₆ gas density is too low.

- Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF₆ gas (option) in the green area).

---

**DANGER!**

Risk of injuries and switchgear damage due to operating levers inserted in the operating mechanism.

- Make sure that the operating lever has been removed.

---

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.
Operation

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

**ATTENTION!**
Earthing a live incoming cable will trip the upstream circuit-breaker.

- 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.

**ATTENTION!**
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.
Operation

1. Remove operating lever.
2. Fit padlock at central position of control gate of three-position switch (option).
3. Stow operating lever away.
4. 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

1. Remove padlock from control gate of three-position switch (option).
2. Push control gate of three-position switch to the right and hold.
3. Push operating lever onto operating shaft of operating mechanism.
4. Move operating lever straight to the “OPEN” position.

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
### Operation

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

![Diagram of switch positions]

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

<table>
<thead>
<tr>
<th>EARTHED</th>
<th>OPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>![EARTHED diagram]</td>
<td>![OPEN diagram]</td>
</tr>
</tbody>
</table>

- **EARTHED position**
  - Make-proof earthing switch earthed
  - Cable compartment unlocked

- **OPEN position**
  - Make-proof earthing switch open
  - Cable compartment locked
20.2 Preconditions for operation

Preconditions for operating the make-proof earthing switch:
- Switchgear ready for service
- Operating lever available

**ATTENTION!**

Earthing a live incoming cable will trip the upstream circuit-breaker.

- Verify safe isolation from supply of the panel feeder before earthing.
- Verify safe isolation from supply of the busbars before earthing.

**DANGER!**

During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.

- Do not remove covers.
- Do not reach into openings.

**DANGER!**

Personal injuries and material damages if the SF₆ gas density is too low.

- Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF₆ gas (option) in the gree area).

**DANGER!**

Risk of injuries and switchgear damage due to operating levers inserted in the operating mechanism.

- Make sure that the operating lever has been removed.
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 disconnector

**NOTE!**
Panels up to 630 A are equipped with a three-position switch-disconnector. Panels up to 1250 A are equipped with a three-position disconnector.

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

![Diagram of control board section of circuit-breaker panel](image)

- Opening for the hand crank of the spring energy store
- Mechanical “ON” pushbutton (not for manual spring-operated mechanism)
- Position indicator for 3AH vacuum circuit-breaker
- Mechanical “OFF” pushbutton
- Three-position switch-disconnector / Three-position switch
- Operations counter
- Spring charged indicator
- Earthing switch (option)
- Position indicator for three-position switch-disconnector / three-position disconnector
- Logical mechanical interlock between three-position disconnector and 3AH6 vacuum circuit-breaker
- Optional logical mechanical interlock between three-position switch-disconnector and 3AH6 vacuum circuit-breaker
Spring charged indicator

<table>
<thead>
<tr>
<th>NOT CHARGED</th>
<th>CHARGED</th>
</tr>
</thead>
</table>

Switch positions of the 3AH vacuum circuit-breaker

<table>
<thead>
<tr>
<th>OPEN</th>
<th>CLOSED</th>
<th>TYPE of vacuum circuit-breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td>3AH5</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
<td>3AH6</td>
</tr>
</tbody>
</table>

Fig. 80: Hand crank for spring energy store

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”)

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

---

**DANGER!**

During operation of electrical equipment and switchgear, parts of this equipment are under dangerous electrical voltage. Mechanical components may move quickly, even remotely controlled.

⇒ Do not remove covers.
⇒ Do not reach into openings.

**DANGER!**

Personal injuries and material damages if the SF₆ gas density is too low.

⇒ Do only operate if the three-position switch is ready for service (ready-for-service indicator for SF₆ gas (option) in the green area).

**DANGER!**

Risk of injuries and switchgear damage due to beating hand crank.

⇒ Use original hand crank with freewheel.
⇒ Make sure that the hand crank has been removed.
Operation

- 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.

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 closing latch can be heard to latch tight.

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.

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.
Operation

- 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

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

1. Remove the hand crank.
2. Fit the cover back onto the opening for the hand crank.
3. Stow the hand crank away.
4. 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.

**ATTENTION!**

Earthing a live incoming cable will trip the upstream circuit-breaker.

- Verify safe isolation from supply of the panel feeder or the busbar section before earthing.

- 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)

<table>
<thead>
<tr>
<th>3AH5 vacuum circuit-breaker</th>
<th>3AH6 vacuum circuit-breaker with feeder earthing switch</th>
<th>3AH6 vacuum circuit-breaker without feeder earthing switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>630 A</td>
<td>630 A</td>
<td>630 A</td>
</tr>
<tr>
<td></td>
<td>1250 A</td>
<td>1250 A</td>
</tr>
</tbody>
</table>

#### 3AH5 vacuum circuit-breaker in "OPEN" position

1. Three-position switch in "OPEN" position
2. Switch three-position switch to "EARTHED" position
3. Check whether the position indicator of the three-position switch is in "EARTHED" position.

#### 3AH6 vacuum circuit-breaker in "OPEN" position

1. 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.

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

1. 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
Operation

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

NOTE!

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.

☞ 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

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

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").

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthing a live incoming cable will trip the upstream circuit-breaker.</td>
</tr>
<tr>
<td>Verify safe isolation from supply of the panel feeder before earthing.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Panel: Switch position</th>
<th>3AH5 vacuum circuit-breaker</th>
<th>Three-position switch-disconnector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN (1)</td>
<td>OPEN (2)</td>
</tr>
<tr>
<td>EARTHED</td>
<td>EARTHED (3)</td>
<td>OPEN (4)</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN (5)</td>
<td>CLOSED (6)</td>
</tr>
</tbody>
</table>

### Circuit-breaker panels with 3AH6 vacuum circuit-breaker and with feeder earthing switch

<table>
<thead>
<tr>
<th>Panel: Switch position</th>
<th>3AH6 vacuum circuit-breaker</th>
<th>Three-position switch-disconnector / Three-position disconnector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN (1)</td>
<td>OPEN (2)</td>
</tr>
<tr>
<td>EARTHED</td>
<td>EARTHED (3)</td>
<td>OPEN (4)</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN (5)</td>
<td>CLOSED (6)</td>
</tr>
</tbody>
</table>

*) Test position "CLOSED" for cable testing (see Page 131, "Cable testing").
Circuit-breaker panels with 3AH6 vacuum circuit-breaker and without feeder earthing switch

<table>
<thead>
<tr>
<th>Panel: Switch position</th>
<th>3AH6 vacuum circuit-breaker</th>
<th>Three-position switch-disconnector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
<tr>
<td></td>
<td>OPEN (1)</td>
<td></td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN (2)</td>
<td>EARTHED (3)</td>
</tr>
<tr>
<td>EARTHED</td>
<td>CLOSED (4)</td>
<td>EARTHED</td>
</tr>
<tr>
<td></td>
<td>OPEN (5)</td>
<td></td>
</tr>
<tr>
<td>OPEN</td>
<td>*</td>
<td>OPEN (6)</td>
</tr>
<tr>
<td></td>
<td>OPEN</td>
<td>CLOSED (7)</td>
</tr>
<tr>
<td>CLOSED</td>
<td>CLOSED (8)</td>
<td></td>
</tr>
</tbody>
</table>

Cable panel, bus sectionalizer panel or transformer panel with three-position switch-disconnector

<table>
<thead>
<tr>
<th>Panel: Switch position</th>
<th>Three-position switch-disconnector</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>EARTHED</td>
<td>EARTHED</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
</tbody>
</table>

Cable panel or busbar earthing panel

<table>
<thead>
<tr>
<th>Panel: Switch position</th>
<th>Make-proof earthing switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>EARTHED</td>
<td>EARTHED</td>
</tr>
<tr>
<td>OPEN</td>
<td>OPEN</td>
</tr>
</tbody>
</table>
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.

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

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)

---

**Removing interlocked cable compartment cover**

- Check panel earthing.

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric shock due to applied voltage.</td>
</tr>
<tr>
<td>Remove covers only if the panel is earthed.</td>
</tr>
</tbody>
</table>

- Check closed earthing switch through inspection window of the cable compartment cover.
- Push interlocking lever downwards and hold in this position.

---

**NOTE!**

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:

- Circuit-breaker in “CLOSED” position
- Three-position switch in “EARTHED” position

- Unhinge the cover.
- Push the cable compartment cover upwards in inclined position.
- Release the interlocking lever.
- Remove the cable compartment cover to the front.
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

Fig. 82: Interlocked cable compartment cover

Fig. 83: Removing screwed-on cable compartment cover
Servicing

- 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.

NOTE!

When fitting the cable compartment covers, please observe that the respective cover is assigned to the correct panel.

DANGER!

- 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.

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

DANGER!

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

1. Niche cover
2. Screwed joint of cover
3. Niche for customer-side low-voltage equipment
4. Control board cover for a panel without switching devices
5. Control board cover for a panel with switching devices

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

DANGER!
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

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short circuit in case of different phase sequence of the incoming feeders.</td>
</tr>
<tr>
<td>✔ Make sure that all incoming feeders have the same phase sequence.</td>
</tr>
<tr>
<td>✔ To check the phase sequence, use only phase comparison test units which are adequate for HR or LRM test sockets.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Rated voltage of switchgear</th>
<th>DC test voltage, maximum value</th>
<th>DC test voltage VLF* 0.1 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 kV</td>
<td>48 kV</td>
<td>19 kV</td>
</tr>
<tr>
<td>24 kV</td>
<td>72 kV</td>
<td>38 kV</td>
</tr>
</tbody>
</table>

* Very Low Frequency

**DANGER!**

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.

**DANGER!**

Flashover due to applied test voltage.

✓ Do not exceed the maximum test duration.
✓ Do not exceed the maximum test voltage.
✓ Isolate the switchgear and the opposite switchgear (test voltage <72 kV DC).
✓ Undo the cable connection and insulate it for the measurement (test voltage >72 kV DC).

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

---

**DANGER!**

Normally, the switch-disconnector panel is not interlocked during the cable sheath test. Prevent switching from “EARTH” to “OPEN” or “CLOSED” as follows:

- Place switching prohibition signs.
- Padlock the locking device (option).

---

**DANGER!**

Live cable in SIMOSEC panel types K, K-E, ME1-K und ME1-KS.

- Isolate and earth incoming cables.
- Isolate and earth the busbar.

- 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.

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger due to live parts.</td>
</tr>
</tbody>
</table>

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

### 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

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger of burning due to hot HV HRC fuse-links.</td>
</tr>
</tbody>
</table>

- Let HV HRC fuse-links cool down.
- Wear protection gloves.
Servicing

1. Insulating sleeve with upper fuse contact
2. HV HRC fuse-link
3. Lower fuse contact
4. Bolt cover (> 17.5 kV)
5. Cable sealing end

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.
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 -ink uniformly into upper and lower contact.
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.

**DANGER!**

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.
271 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.

![Fig. 89: Low-voltage equipment](image)

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

The low-voltage cable can be damaged by sharp edges.

⇒ Pull the low-voltage cable downwards carefully.

⇒ 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

**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.
Unbolting bolts of logical mechanical interlock.

Unbolting bolted joint between connecting bar and 3AH6 vacuum circuit-breaker.

Unbolting bolted joint between truck and panel frame at the front and rear.

Unbolting fixing bolt from bolt cover (>12 kV).

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

Unbolting bolted joint between 3AH6 vacuum circuit-breaker and cable elbow coupling.

Unbolting bolted joint between truck and panel frame at the front and rear.
Removing circuit-breaker

<table>
<thead>
<tr>
<th><strong>ATTENTION!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of damaging the post insulators and the cable interconnections when the circuit-breaker is removed.</td>
</tr>
<tr>
<td>⇒ Pull the circuit-breaker out of the panel carefully.</td>
</tr>
<tr>
<td>⇒ Keep the circuit-breaker in inclined position to pass the cable interconnections.</td>
</tr>
<tr>
<td>⇒ 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.</td>
</tr>
<tr>
<td>⇒ Keep the 3AH6 vacuum circuit-breaker inclined while pulling out in order to pass the cable interconnections.</td>
</tr>
<tr>
<td>⇒ 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.</td>
</tr>
</tbody>
</table>

![Image of circuit-breaker being removed](image)

✔ 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.

<table>
<thead>
<tr>
<th>DANGER!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortal danger due to live parts.</td>
</tr>
<tr>
<td>⇒ Isolate the panel/switchgear.</td>
</tr>
<tr>
<td>⇒ Secure against reclosing.</td>
</tr>
<tr>
<td>⇒ Verify safe isolation from supply.</td>
</tr>
<tr>
<td>⇒ Earth and short-circuit.</td>
</tr>
<tr>
<td>⇒ Cover or barrier adjacent live parts.</td>
</tr>
<tr>
<td>⇒ Observe all specifications and internal safety instructions</td>
</tr>
<tr>
<td>⇒ Only authorized and qualified personnel is working on the switchgear.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENTION!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgear damages due to flashover caused by pollution.</td>
</tr>
<tr>
<td>⇒ Remove chips and dust.</td>
</tr>
<tr>
<td>⇒ Clean bushing-type insulators.</td>
</tr>
<tr>
<td>⇒ Clean high-voltage connections, bars and cables.</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Touch-up set</th>
<th>Contents</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>8DX2 011</td>
<td>Paint pen in color &quot;Light Basic SN700&quot;</td>
<td>Scratches, impacts, bare spots</td>
</tr>
<tr>
<td>8DX2 012</td>
<td>Paint tin in color &quot;Light Basic SN700&quot;</td>
<td>Scratches, impacts, bare spots</td>
</tr>
</tbody>
</table>

30 End of service life

**SF₆ gas**

**NOTE!**
The equipment contains the fluorized greenhouse gas SF₆ registered by the Kyoto Protocol with a global warming potential (GWP) of 22 200. SF₆ has to be reclaimed and must not be released into the atmosphere.

 مواضيع נפגעות של חומרים קרחונייםدان משתמשים במינרלים

For use and handling of SF₆, IEC 62271-303 has to be observed: High-voltage switchgear and controlgear - Part 303 Use and handling of sulphur hexafluoride (SF₆) zu beachten.

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 SF₆ 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 (arching 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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