Medium-Voltage Switchgear

Type 8DA, Extendable Fixed-Mounted Circuit-Breaker Switchgear up to 40.5 kV
Single Busbar, Single-Pole Metal-Enclosed, Metal-Clad, SF₆ - Insulated

OPERATING INSTRUCTIONS
PART 1/2
Description, Operation and Servicing

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Power Transmission and Distribution Group
Medium-Voltage Switchgear and Transmission Division

1992
Evaluation of the Technical Testing Station by DATech (German Accreditation Body for technology) in accordance with DIN EN 45001 and accreditation of the Technical Testing Station for the testing areas High-Voltage Switching Devices and Switchgear by DATech as Testing Laboratory Switchgear Factory Frankfurt/M., Siemens AG DAR (German Accreditation Council) registr. number: DAT-P-01362-00 and as PEHLA Testing Laboratory Frankfurt/M.
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1995
Introduction and application of a quality and environmental management system for the Medium-Voltage Switchgear and Systems Division in accordance with DIN EN ISO 9001 and DIN EN ISO 14001 Quality and environmental systems - Model for quality assurance in design, development, production, installation and serving.
Certification of the quality and environmental management system by DQS (German Association for the Certification of Quality and Environmental Management Systems)
DQS registr. number: 3473-02

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.

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 local Siemens Service Centre.

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Subject to modifications.
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.

⚠️ Caution!
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.

2 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.

The perfect and safe operation of this switchgear is conditional on:
• Proper transportation and correct storage
• Correct installation and commissioning
• Diligent operation and maintenance by qualified personnel
• Observance of these operating instructions
• Observance of the instructions applicable at site for installation, operation and safety (e.g. HD 637S1/EN 50110 or DIN VDE 0101/0105)

3 Safety rules

Do always observe the Five Safety Rules:

⚠️ Danger!
High voltage! Danger!
⇒ Isolate the switchgear.
⇒ Secure against reclosing.
⇒ Check safe isolation from supply.
⇒ Earth and short-circuit.
⇒ Cover or disconnect adjacent live parts.

4 Qualified personnel

as used in these instructions, these are persons who are familiar with the assembly, 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 and instruction or authorization in accordance with the relevant safety standards for the care and use of appropriate safety equipment.
• Training in first aids and behaviour in the event of possible accidents.
5 Application and typical uses

Extendable fixed-mounted circuit-breaker switchgear of the 8DA series is mainly used in transformer and distribution substations as well as for switching duties in industrial plants and railways systems.

The panels are designed for rated voltages up to 40.5 kV and rated currents up to 2500 A. They are suitable for a maximum permissible rated short-circuit current of 108 kA and a maximum short-circuit breaking current of 40 kA.

6 Features

The fixed-mounted circuit-breaker switchgear of the 8DA series has the following features:

• Factory-assembled, type-tested, metal-enclosed and metal-clad switchgear for indoor installations
• SF₆-gas
• Safe-to-touch connection systems for cables as well as for solid-insulated and SF₆-gas-insulated bar
• Single-pole metal enclosure
• Minimum fire load
• Low maintenance
• Continuous switchgear interlocking system with logical mechanical interlocks
• Primary part independent of environmental influences (pollution, humidity and small animals) due to hermetically sealed enclosure

This provides:

• Maximum personal safety
• Maximum security of operation
7 Type classification

The following table shows the different types of construction of the 8DA series.

![Fig. 1: 8DA11 (1-pole)](image1)
![Fig. 2: 8DA12 (2-pole)](image2)
![Fig. 3: 8DA10 (3-pole)](image3)

8 Circuit-breaker panel

8.1 Function

The circuit-breaker panel is the basic panel type of the 8DA series. The circuit-breaker panel can fulfill the function “incoming feeder” or “outgoing feeder”. It can carry or switch all rated busbar and feeder currents as well as the short-circuit currents quoted on the respective rating plates.

8.2 Frame

- As support for the switchpanel poles and the switchgear front
- It forms the cable connection compartment

8.3 Low-voltage compartment

- For accommodation of protection, control, measuring and metering equipment
- With plug-in cables of primary components connected to terminal strips with screw-type connections for the incoming and outgoing cables.
- Devices can be optionally mounted on or in the door

8.4 Switchpanel pole

- Poles arranged one behind the other.
- One switchpanel pole consists of a vertically arranged housing with a vacuum interrupter inside.
- The busbar housing with the three-position switch inside is arranged horizontally over the switchpanel pole.
8.5 Switchpanel

Fig. 4: Circuit-breaker panel, example 8DA10

Fig. 5: Three-position switch: Control and indication board
9 Circuit-breaker

9.1 Design

The vacuum circuit-breaker is an integral component of the switchpanel and consists of the following components:
- Operating mechanism with stored-energy spring mechanism and control elements
- Switching rods for contact operation
- 1 to 3 switchpanel poles with vacuum interrupters

Mechanical interlock

The circuit-breaker is protected mechanically against maloperation. The mechanical protection prevents the circuit-breaker from being closed as long as the three-position switch is in faulty position. Furthermore the mechanical protection prevents the three-position switch from being operated when the circuit-breaker is closed.

Vacuum interrupters

![Image of vacuum interrupter](image_url)

Fig. 6: Example of a vacuum interrupter

1. Bushing
2. Top flange
3. Interrupter support
4. Vacuum interrupter (example type)
5. Current transformer

The vacuum interrupter is fixed at the interrupter support. The fixed-mounted contact (bottom) is directly connected to the housing. The moving contact (top) is firmly connected to the connection bolt and is centrally aligned in the guide. The metal bellows inside the interrupter forms the vacuum-tight connection to the gas compartment.
10 Operating mechanism box

10.1 Function

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

Fig. 7: Operating mechanism box circuit-breaker

The circuit-breaker is closed using the ON pushbutton. The operating power is transmitted to the vacuum interrupters through a common operating shaft outside the interrupters. A motor re-charges the spring immediately after.

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

10.2 Design

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

Fig. 8: Operating front of the circuit-breaker

1 ON pushbutton (mechanical). Sealed in case of motor operating disconnectors and earthing switches
2 OFF pushbutton (mechanical)
3 Locking device (padlock)
4 Counter for operating cycles
5 Switch position indicator for circuit-breaker "CLOSED" / "OPEN"
6 "Spring charged" / "Spring not charged" indicator
7 Covered opening for hand crank (for charging the circuit-breaker closing spring)
11 Three-position switch

11.1 Function

The three-position switch combines the functions of a disconnector and an earthing switch. It is designed for no-load operation only (max. 0.5 A according to IEC/VDE).

![Diagram of three-position switch]

**Fig. 9:** Three-position switch with busbar and bushing

1. Disconnector contact
2. Busbar housing
3. Busbar
4. "CLOSED"
5. "OPEN"
6. "READY-TO-EARTH"
7. Earthing contact
8. Bushing
9. Circuit-breaker housing
11.2 Switch positions

<table>
<thead>
<tr>
<th>Switch positions</th>
<th>Switch position indication</th>
<th>Basic scheme</th>
</tr>
</thead>
</table>
| Feeder OFF       | Switch position 1          | - Three-position switch OPEN  
|                  |                            | - Circuit-breaker OPEN |
| Feeder ON        | Switch position 2          | - Three-position switch CLOSED  
|                  |                            | - Circuit-breaker CLOSED |
| Feeder earthed   | Switch position 3          | - Three-position switch "EARTHED"  
|                  |                            | - Circuit-breaker CLOSED |
12 Instrument transformers

12.1 Voltage transformers

Features
• According to IEC 60044-2 / VDE 0414 Part 2
• Cast-resin insulated
• Inductive operation
• Safe-to-touch due to metal enclosure
• Pluggable at the panel connection

Voltage transformer types

<table>
<thead>
<tr>
<th>Mounting locations</th>
<th>Type</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Busbar</td>
<td>4MT42</td>
<td>with/without disconnector</td>
</tr>
<tr>
<td></td>
<td>4MT44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4MT46</td>
<td></td>
</tr>
<tr>
<td>Panel connection</td>
<td>GBE12</td>
<td>external</td>
</tr>
<tr>
<td></td>
<td>GBE24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GBE36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4MT72</td>
<td>directly pluggable</td>
</tr>
<tr>
<td></td>
<td>4MT74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4MT76</td>
<td></td>
</tr>
</tbody>
</table>

12.2 Voltage indication systems

For voltage indication, a capacitively coupled voltage indication system according to the LRM-system is used:
• For pole-wise verification of safe isolation from supply
• A plug-in indicator flashes if high voltage is present
• Phase comparison possible on socket pairs
• Indicator suitable for continuous operation (can remain plugged in permanently)
• System always safe-to-touch
• System routine-tested at the factory
• Indicator can be easily tested

12.3 Current transformers

Features:
• According to IEC 60044-1 / VDE 0414 Part 1
• Designed as ring-core current transformers:
  – Ring core as carrier of secondary winding
  – Main circuit corresponds to primary winding
• Arranged outside the primary enclosure (switchgear housing) due to single-pole design of the panel
• Free of dielectrically stressed cast-resin parts (due to design)
Description

13 Gas compartments

Function
The distribution of the gas compartments is decisive for the feasibility of work during operation and the resulting operational restrictions. In case of fault, the distribution of the gas compartments determines the extent of work.

Example
The following example shows the distribution of the gas compartments in a single-pole insulated switchgear. Several panels have been combined to illustrate the principle. In practice, however, the individual gas compartment scheme is decisive.

Fig. 10: Example of a panel combination with twelve compartments. Gas compartments with identical numbers are interconnected

14 Panel connections

14.1 Overview
The fully insulated panel connections are available for inside-cone cable plugs, or for solid-insulated or gas-insulated bars. Three different sizes of cable plugs are available, depending on the cable cross-section and on the rated voltage. Besides single connections, multiple connections for a maximum of six cables are possible. Multiple connections for two cables can also be used to connect a voltage transformer (external or plug-in type) instead of the second cable.

14.2 Panel connection types

<table>
<thead>
<tr>
<th>Plug-in cable</th>
<th>single</th>
</tr>
</thead>
<tbody>
<tr>
<td>multiple</td>
<td>with transf.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>without transf.</td>
</tr>
<tr>
<td></td>
<td>with surge arrester</td>
</tr>
</tbody>
</table>

Bar

<table>
<thead>
<tr>
<th>solid-ins.</th>
<th>single</th>
</tr>
</thead>
<tbody>
<tr>
<td>with transf.</td>
<td>external</td>
</tr>
<tr>
<td></td>
<td>pluggable</td>
</tr>
<tr>
<td>without transf.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>gas-ins.</th>
<th>single</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14.3 Examples

**Fig. 11:** Single plug-in cable connection

**Fig. 12:** Multiple plug-in cable connection

**Fig. 13:** Connection for solid-insulated bar

**Fig. 14:** Multiple plug-in cable connection with voltage transformer (plugged in)

**Fig. 15:** Connection for gas-insulated bar

**Legend**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper part of frame</td>
</tr>
<tr>
<td>2</td>
<td>Lower part of frame</td>
</tr>
<tr>
<td>3</td>
<td>Floor (e.g. concrete)</td>
</tr>
<tr>
<td>4</td>
<td>SF_6-insulation</td>
</tr>
</tbody>
</table>
15. Technical data

15.1 Rated voltages and currents

<table>
<thead>
<tr>
<th></th>
<th>8DA10</th>
<th>8DA11 / 8DA12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td></td>
</tr>
<tr>
<td>(V)</td>
<td>12</td>
<td>17.5</td>
</tr>
<tr>
<td>24</td>
<td>24</td>
<td>27.5</td>
</tr>
<tr>
<td>36</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>40.5</td>
<td>40.5</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td></td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td></td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td></td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td></td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>kV</td>
<td>28</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>kV</td>
<td>75</td>
</tr>
<tr>
<td>Disconnector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>kV</td>
<td>32</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>kV</td>
<td>85</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>kA</td>
<td>40</td>
</tr>
<tr>
<td>Rated short-time withstand current 3s</td>
<td>kA</td>
<td>40</td>
</tr>
<tr>
<td>Rated short-circuit making current</td>
<td>kA</td>
<td>100</td>
</tr>
<tr>
<td>Rated peak withstand current</td>
<td>kA</td>
<td>100</td>
</tr>
<tr>
<td>Max. rated normal current of busbar</td>
<td>A</td>
<td>4000</td>
</tr>
<tr>
<td>Max. rated normal current of feeders</td>
<td>A</td>
<td>2500</td>
</tr>
</tbody>
</table>

15.2 Protection against ingress of solid foreign bodies, electric shock and water

The fixed-mounted circuit-breaker switchgear of the 8DA series complies with the following types of protection (IP) according to IEC 60529 and DIN VDE 0470, Part 1:

- **IP3XD** for external enclosure
- **IP65** for high-voltage components

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Degree of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP3XD</strong></td>
<td><strong>Protection against ingress of solid foreign bodies:</strong> Protected against ingress of solid foreign bodies, diameter 2.5 mm. <strong>Protection against ingress of water:</strong> No specification. <strong>Protection against electric shock:</strong> Protected against access to hazardous parts with a wire probe with diameter 1 mm, length 100 mm, must be sufficiently clear of hazardous parts.</td>
</tr>
<tr>
<td><strong>IP65</strong></td>
<td><strong>Protection against ingress of solid foreign bodies:</strong> Dust-tight, protection against ingress of dust. <strong>Protection against ingress of water:</strong> Protected against water jets; water directed against the enclosure from any direction in the form of a jet must not must not have any harmful effect. <strong>Protection against electric shock:</strong> Protected against access to hazardous parts: Wire (test probe with diameter 1 mm), must not be allowed to ingress.</td>
</tr>
</tbody>
</table>

15.3 Insulating gas SF₆

Sulphur hexafluoride is used as insulating gas. SF₆ insulates live parts between each other and against the wall of the housing.

**Filling degree of the pressure gas cylinders**

1.04 kg SF₆ / liter cylinder volume (valid at a max. ambient temperature of + 65 °C).

**Vapour pressure over liquid SF₆**

In the supplied cylinders - at + 20 °C - about 2/3 of the cylinder volume is liquid, the rest is saturated SF₆-vapour.

**Vapour pressure as a function of temperature**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Vapour pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>+20 °C</td>
<td>2100 kPa</td>
</tr>
<tr>
<td>+30 °C</td>
<td>2700 kPa</td>
</tr>
<tr>
<td>+65 °C</td>
<td>7000 kPa [test pressure of cylinder]</td>
</tr>
</tbody>
</table>

**Storage of insulating gas SF₆**

Store the cylinders in vertical position in a cool place
Gas pressures in kPa at 20°C

<table>
<thead>
<tr>
<th>Description</th>
<th>Busbar housing</th>
<th>Busbar voltage transformer housing</th>
<th>Circuit-breaker housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage/ kV</td>
<td>≤36</td>
<td>&gt;36</td>
<td>≤36</td>
</tr>
<tr>
<td>BIL/kV *</td>
<td>170</td>
<td>185</td>
<td>200</td>
</tr>
<tr>
<td>Rated operating pressure (filling pressure)</td>
<td>50</td>
<td>70</td>
<td>120</td>
</tr>
<tr>
<td>Min. oper. pressure</td>
<td>30</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Max. oper. pressure</td>
<td>90</td>
<td>120</td>
<td>180</td>
</tr>
<tr>
<td>Signal &quot;pressure drops&quot;</td>
<td>30</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Signal &quot;pressure increases&quot;</td>
<td>90</td>
<td>120</td>
<td>180</td>
</tr>
<tr>
<td>Operate value of rupture diaphragm</td>
<td>&gt;300</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All gas pressures are gauge pressures. The operating pressure depends on the temperature. The value can be corrected according to characteristics to suit the conditions at the place of installation.

* rated lightning impulse withstand voltage

Example for 20°C

<table>
<thead>
<tr>
<th>Rated operating pressure**</th>
<th>Min. operating pressure</th>
<th>Signal &quot;pressure drops&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value at 20°C</td>
<td>Characteristic</td>
<td>Value at 20°C</td>
</tr>
<tr>
<td>120 kPa</td>
<td>Nr. 1</td>
<td>100 kPa</td>
</tr>
<tr>
<td>100 kPa</td>
<td>Nr. 4</td>
<td>80 kPa</td>
</tr>
<tr>
<td>70 kPa</td>
<td>Nr. 7</td>
<td>50 kPa</td>
</tr>
<tr>
<td>50 kPa</td>
<td>Nr. 10</td>
<td>30 kPa</td>
</tr>
</tbody>
</table>

Characteristic 1 = characteristic 11, characteristic 4 = characteristic 8

** Permissible deviation 10 kPa

Fig. 16: Characteristics of gas pressure as a function of temperature
### Contents of gas compartments and SF₆-gas weights per phase

<table>
<thead>
<tr>
<th>Gas compartment</th>
<th>Content of gas compartment 8DA10</th>
<th>SF₆-gas weight at rated operating pressure (relative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit-breaker housing with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) fully insulated plug-in connection for one cable 36 kV</td>
<td>87 l</td>
<td>0.8 kg, 0.9 kg, 1.0 kg, 1.17 kg</td>
</tr>
<tr>
<td>b) fully insulated plug-in connection for two to five cables 36 kV</td>
<td>120 l</td>
<td>1.1 kg, 1.2 kg, 1.4 kg, 1.6 kg</td>
</tr>
<tr>
<td>Busbar housing</td>
<td>87 l</td>
<td>0.8 kg, 0.9 kg, -</td>
</tr>
<tr>
<td>Housing of busbar earthing switch</td>
<td>12 l</td>
<td>0.11 kg, 0.12 kg, -</td>
</tr>
<tr>
<td>Inductive voltage transformer</td>
<td>45 l</td>
<td>0.4 kg, 0.45 kg, -</td>
</tr>
</tbody>
</table>

#### 15.4 Basic prescriptions and standards

The fixed-mounted circuit-breaker switchgear of the 8DA series for indoor installation corresponds to the following prescriptions and standards:

<table>
<thead>
<tr>
<th>IEC-Publ.</th>
<th>DIN-VDE Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>60094</td>
<td>0670, Part 1000</td>
</tr>
<tr>
<td>60056, 62271-100</td>
<td>0670, Part 101-107</td>
</tr>
<tr>
<td>60129</td>
<td>0670, Part 2</td>
</tr>
<tr>
<td>60298</td>
<td>0670, Part 6</td>
</tr>
<tr>
<td>61243-5</td>
<td>0682, Part 415 Draft</td>
</tr>
<tr>
<td>60529</td>
<td>0470, Part 1</td>
</tr>
<tr>
<td>60071-1 und -2</td>
<td>0111 Part 1 and 2</td>
</tr>
<tr>
<td>60376</td>
<td>0373 Part 1</td>
</tr>
<tr>
<td>60044-1 und -2</td>
<td>0414 Part 1 and 2</td>
</tr>
</tbody>
</table>

#### 15.5 Special standards for railway switchgear

The fixed-mounted circuit-breaker switchgear 8DA11 and 8DA12 also corresponds to the following prescriptions and standards for railway applications:

<table>
<thead>
<tr>
<th>IEC-Publ.</th>
<th>DIN-VDE Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 50163/IEC 60850</td>
<td>0115, Part 102</td>
</tr>
<tr>
<td>EN 50152</td>
<td>0115, Part 320</td>
</tr>
</tbody>
</table>

#### 15.6 Rating plates

**Switchpanel**

The rating plate contains all information that is binding for the panel. It is provided on the inside of the door of the low-voltage compartment and on the SF₆-housing.

---

**Fig. 17:** Rating plate of an 8DA10 panel (example)

1. Switchgear type
2. Order number
3. Panel number
4. Pressure test mark of the SF₆-gas compartment

**Circuit-breaker**

The circuit-breaker has its own rating plate provided at the front on the gear block of the circuit-breaker operating mechanism.
**Fig. 18:** Rating plate of a circuit-breaker operating mechanism (example)
Operation

16 Operating the circuit-breaker

16.1 Control board

Fig. 19: Control board of the circuit-breaker panel

1 Manometer and filling socket of the SF₆-gas compartments for busbars L1, L2 and L3
2 Low-voltage compartment
3 Control and indication board for three-position switch
4 Manometer of SF₆-gas compartment “Circuit-breaker feeder”
5 Filling socket of SF₆-gas compartment “Circuit-breaker feeder”
6 Opening for hand crank to charge the circuit-breaker closing spring
7 ON pushbutton (mechanical), sealable by the customer
8 Closing spring “charged”/“not charged” indicator
9 Switch position indicator “CLOSED/OPEN” for the circuit-breaker
10 Operating cycle counter
11 OFF pushbutton (mechanical), sealable by the customer
12 Locking device
13 Sockets for voltage detection system
16.2 Closing the circuit-breaker manually
(Item 7 in Fig. 19.; on Page 20)
If there is no lock active from the mechanical interlock, you can close the circuit-breaker electrically or mechanically.

Close the circuit-breaker manually as follows:
⇒ Operate the ON pushbutton in the mechanical or electrical control board.
   The circuit-breaker is closed.

16.3 Opening the circuit-breaker manually
(Item 11 in Fig. 19.; on Page 20)
You can open the circuit-breaker electrically or mechanically.
If the control voltage fails, you have to open the circuit-breaker manually.
If the feeder is earthed through the three-position switch and the circuit-breaker, all electrical OFF signals are ineffective.
If the locking device is padlocked, the circuit-breaker cannot be opened mechanically either. The locking device must only be locked when the feeder is earthed.

Open the circuit-breaker manually as follows:
⇒ Operate the OFF pushbutton in the mechanical or electrical control board.
   The circuit-breaker is open.

16.4 Recommendation for sealing the pushbuttons
With motor-operated switching operations, we recommend to seal the pushbuttons as follows (Item 7 and item 11 in Fig. 19.; on Page 20):

<table>
<thead>
<tr>
<th>Switching operation</th>
<th>Sealing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnecting and earthing</td>
<td>ON pushbutton for CLOSING the circuit-breaker</td>
</tr>
<tr>
<td>Coupling</td>
<td>ON and OFF pushbuttons for CLOSING and OPENING the circuit-breaker</td>
</tr>
</tbody>
</table>

16.5 Test operation without auxiliary voltage
Perform the following actions to test if the circuit-breaker is ready for operation:
⇒ Charge the closing spring manually (see Section 16.7, Page 22).
⇒ Operate the ON pushbutton in the mechanical control board.
   The circuit-breaker is closed.

⇒ Operate the OFF pushbutton in the mechanical control board.
   The circuit-breaker is open.

The circuit-breakers can be optionally equipped with undervoltage releases.

Caution!
If the retaining screw of the striker pin is not turned back from position B to position A after test operation without auxiliary voltage, the undervoltage release will not function.
⇒ After test operation without auxiliary voltage, turn the retaining screw of the striker pin back from position B to position A.

⇒ Turn the retaining screw of the striker pin from position A to position B.
16.6 Test operation with auxiliary voltage (motor operating mechanism)

(Item ⑧ in Fig. 19; on Page 20)

⇒ Switch on the supply voltage.
   The motor operating mechanism starts up and charges the closing spring.

⇒ Check if the spring charged indication appears.

Fig. 20: Symbol for “closing spring charged”

⇒ Close the circuit-breaker.
   The closing spring is recharged automatically.

⇒ Check if the switch position indication “circuit-breaker CLOSED” appears.

⇒ Open the circuit-breaker.
⇒ Check if the switch position indication “circuit-breaker OPEN” appears.

16.7 Charging the closing spring manually

(Item ⑧ in Fig. 19; on Page 20)

The closing spring is charged automatically after applying control voltage. The energy required for the switching sequence OPEN-CLOSED-OPEN (auto-reclosing) is stored in the closing spring 15 seconds after closing the circuit-breaker.

The hand crank is required to charge the closing spring manually if the control voltage fails. The hand crank has a freewheel, so that there is no risk of injury if the motor starts up with the crank inserted.

Fig. 22: Hand crank for charging the circuit-breaker closing spring

⚠️ Danger!
Risk of injury by sudden rotation of hand crank. If you use a hand crank without a freewheel for charging the closing spring, it will rotate when the control voltage is switched on again (motor starts up) and can cause injury.

⇒ Use special hand crank with freewheel from the accessories!

⇒ Remove cover from cutout.
⇒ Insert hand crank.
⇒ Turn hand crank clockwise (approx. 50 turns).
   The indication “Closing spring charged” appears in the inspection window.

⇒ Remove hand crank.
⇒ Close cutout with cover.
17 Operating the three-position switch

(Item 3 in Fig. 19, on Page 20)

17.1 Control elements

![Diagram of three-position switch]

**Fig. 23:** Three-position switch: Control and indication board

1. Switch position indicator for disconnector “CLOSED”/“OPEN”
2. Opening for mechanical operation of the earthing switch
3. Openings for mechanical operation of the disconnector
4. Opening for selector key
5. Switch position indicator for “OPEN”/“READY-TO-EARTH”
6. Switch position indicator for circuit-breaker

The manual switching operations DISCONNECTING or EARTHING without motor operation must be preselected with a double-bit key. Preselection is only possible if the associated switching operation is permissible.

The levers for operating the three-position switch are differentiated in colour and design as follows:

- Disconnector lever: passivated yellow, nose on the right, slot at the top
- Earthing switch lever: red, nose on the right, slot on the left
- Emergency operating lever (both functions): passivated yellow, without nose, slot marked

![Levers for operating the three-position switch]

**Fig. 25:** Levers for operating the three-position switch

1. Slot
2. Nose
3. Emergency operating lever
4. Earthing switch lever
5. Emergency operating lever

![Double-bit key]

**Fig. 24:** Double-bit key
17.2 Closing the disconnector manually

Caution!
A mechanical interlock prevents the three-position switch from being operated under load.

⇒ Switch the circuit-breaker to the "OPEN" position.

⇒ Turn the disconnector lever 180° clockwise (nose on the right).
   The disconnector is closed.

⇒ Remove the disconnector lever.

⇒ Turn double-bit key back counter-clockwise and remove it.
   The opening for the DISCONNECTOR function of the three-position switch is closed.
   The switch position indicator shows "CLOSED."

17.3 Opening the disconnector manually

⇒ Insert the double-bit key.

⇒ Turn the double-bit key clockwise as far as it will go.
   The opening for the DISCONNECTOR function of the three-position switch is released.

⇒ Hold the disconnector lever in horizontal position (nose on the right) and push it onto the hexagonal shaft as far as it will go.

⇒ Turn disconnector lever 180° counter-clockwise (nose on the left).
   The disconnector is open.

⇒ Remove the disconnector lever

⇒ Turn double-bit key back counter-clockwise and remove it.
   The opening for the DISCONNECTOR function of the three-position switch is closed.
   The switch position indicator shows "OPEN."

Fig. 26: Closing the disconnector

⇒ Insert the double-bit key.

⇒ Turn the double-bit key clockwise as far as it will go.
   The opening for the DISCONNECTOR function of the three-position switch is released.

⇒ Hold the disconnector lever in horizontal position (nose on the left), and push it onto the hexagonal shaft as far as it will go.
17.4 Earthing manually

Caution!
Earthing under load will destroy three-position switch
⇒ Switch the circuit-breaker to the “OPEN” position
⇒ and isolate the feeder.

![Diagram](image)

Fig. 27: Closing the earthing switch

1. Earthing switch
2. Circuit-breaker
3. Disconnector

⇒ Insert the double-bit key and turn it counter-clockwise.
The opening for the EARTHING SWITCH function of the three-position switch is released.

⇒ Hold the earthing switch lever in horizontal position (nose on the left) and push it onto the hexagonal shaft as far as it will go.
⇒ Turn earthing switch lever 180° clockwise.

The nose of the earthing switch lever is on the right and the earthing switch is closed.

⇒ Remove the earthing switch lever.
⇒ Turn double-bit key back clockwise and remove it.
The opening for the EARTHING SWITCH function of the three-position switch is closed.
The switch position indicator shows: “READY-TO-EARTH”

Danger!
High voltage! Danger!
The earthing process is not completed until the circuit-breaker is closed.
⇒ After earthing with the three-position switch, close the circuit-breaker!

17.5 De-earthing manually

⇒ Switch the circuit-breaker to the “OPEN” position.
⇒ Insert the double-bit key.
⇒ Turn the double-bit key counter-clockwise as far as it will go.
The opening for the EARTHING SWITCH function of the three-position switch is released.

⇒ Hold the earthing switch lever in horizontal position (nose on the right) and push it onto the hexagonal shaft as far as it will go.
⇒ Turn earthing switch lever 180° counter-clockwise (nose on the left).
The earthing switch is open.

⇒ Remove the earthing switch lever.
⇒ Turn double-bit key back clockwise and remove it.
The opening for the EARTHING SWITCH function of the three-position switch is closed.
The switch position indicator shows: “EARTH OFF”

17.6 Three-position switch with auxiliary voltage (motor operating mechanism)

Three-position switches with motor operating mechanism can also be operated from remote according to the switchgear design.
**17.7 Emergency operation of the three-position switch**

If the motor voltage fails in switchgear with motor operating three-position switches and the three-position switch is in no defined switch position, you must operate the three-position switch manually with the emergency operating lever.

---

**Caution!**

The emergency operating lever does not have a stop. Switching beyond the stops will damage the three-position switch.

⇒ Do not turn the emergency operating lever beyond the horizontal position.

---

The opening for the DISCONNECTOR function of the three-position switch is released.

⇒ Push the emergency operating lever (without nose, slot marked) onto the hexagonal shaft for the disconnector so that the pin of the hexagonal shaft fits in the slot of the operating lever.

To switch the disconnector to the desired position (“CLOSED” or “OPEN”), perform the following actions:

⇒ Turn the emergency operating lever until it is in the “CLOSED” or “OPEN” position.

If the disconnector is closed, the following applies:

The emergency operating lever is in horizontal position and the slot is at the bottom.

If the disconnector is open, the following applies:

The emergency operating lever is in horizontal position and the slot is at the top.

⇒ Remove the emergency operating lever.

⇒ Turn double-bit key back counter-clockwise and remove it.

The opening for the DISCONNECTOR function of the three-position switch is closed.

**Emergency operation of the earthing switch**

⇒ Insert the double-bit key.

⇒ Turn the double-bit key counter-clockwise as far as it will go.

The opening for the EARTHING SWITCH function of the three-position switch is released.

⇒ Push the emergency operating lever (without nose, slot marked) onto the hexagonal shaft for the earthing switch so that the pin of the hexagonal shaft fits in the slot of the operating lever.

To bring the three-position switch to the desired end position “EARTH” or “OPEN,” perform the following actions:

⇒ Turn the emergency operating lever until it is in the “EARTH” or “OPEN” position.

---

**Fig. 28:** Emergency operation of the disconnector

⇒ Insert the double-bit key.

⇒ Turn the double-bit key clockwise as far as it will go.
If the earthing switch is **closed**, the following applies: The emergency operating lever is in vertical position and the **marking is on the left**.

If the earthing switch is **open**, the following applies: The emergency operating lever is in vertical position and the **marking is on the right**.

- Remove the emergency operating lever.
- Turn double-bit key back **clockwise** and remove it.
  The opening for the EARTHING SWITCH function of the three-position switch is closed.

**Switching operations after emergency operation**

- Perform further manual switching operations with the associated disconnector or earthing switch levers only.

### 17.8 Switch position indication of the three-position switch at the rear

The position of the three-position switch is shown both at the front and at the rear of the switchgear. The following two illustrations show the location of the switch position indication at the rear

---

**Fig. 29:** Switch position indication at the rear (1)

**Fig. 30:** Switch position indication at the rear (2)
Operation

18 Feeder earthing and de-earthing

18.1 Feeder earthing
Do always observe the Five Safety Rules:

 Danger!
High voltage! Danger!
⇒ Isolate the switchgear.
⇒ Secure against reclosing.
⇒ Verify safe isolation from supply.
⇒ Earth and short-circuit.
⇒ Cover or disconnect adjacent live parts.

Earthing the three-position switch and closing the circuit-breaker
⇒ Switch the three-position switch to the “EARTH” position.
⇒ Switch the circuit-breaker to the “CLOSED” position.

Securing the circuit-breaker against opening
⇒ Pull the locking device of the circuit-breaker upwards.
⇒ Fit the padlock.

18.2 De-earthing
⇒ Remove the padlock.
   The locking device folds downwards automatically.
⇒ Switch the circuit-breaker to the “OPEN” position.
⇒ Switch the earthing switch to the “OPEN” position.
19 Busbar make-proof earthing switch

19.1 Control elements and indicators

Fig. 31: Manual operating mechanism for the earthing switch

1 Operating spindle
2 Setscrew

The busbar earthing switch is equipped with a fast-closing manual operating mechanism for make-proof earthing.
The operating lever for this manual operating mechanism can only be pushed on or removed when the busbar make-proof earthing switch is in one of its end positions.

If there isn’t much space available (e.g. due to a wall next to an end panel), you can place the operating spindle on the operating lever shifted by 45°. To do this, undo the setscrew.

19.2 Closing

**Danger!**
High voltage! Danger!
By no means may the busbar make-proof earthing switch be operated under load, as it will be destroyed in case of repetition.

⇒ Observe the Five Safety Rules
⇒ Disconnect the incoming and outgoing feeders in all panels

⇒ Hold the operating lever in horizontal position.
⇒ Push it onto the hexagonal shaft as far as it will go.
Operation

⇒ Keep the operating lever pressed on over the operating spindle with the left hand, and move it clockwise downwards by 90° with the right hand until it reaches the vertical position.
⇒ Remove the operating lever.

19.3 Opening

⚠️ Caution!
Avoid any intermediate position of the busbar make-proof earthing switch during the opening process, as reversal will not be possible.
⇒ Complete the opening operation
⇒ Do not use force. (Tightening torque approx. 140 Nm)

⇒ Hold the operating lever in vertical position, with the ball handle pointing at the bottom.
⇒ Push it onto the hexagonal shaft as far as it will go.
⇒ Keep the operating lever pressed on over the operating spindle with the left hand, and move it clockwise upwards by 90° with the right hand until it reaches the horizontal position.
⇒ Remove the operating lever.
20 Interlocks

Switching devices must only be operated in logical dependence on the switch position of other devices. Unpermissible switching operations must be blocked in order to

- prevent switchgear damages and power failures.
- provide full protection for the personnel

**Feeder and circuit-breaker panel of bus sectionaliser**

<table>
<thead>
<tr>
<th>Switching operation</th>
<th>Switching operation only possible if</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnector CLOSED/OPEN</td>
<td>circuit-breaker OPEN, earthing switch OPEN</td>
<td>mechanical</td>
</tr>
<tr>
<td>Earthing switch CLOSED/OPEN</td>
<td>circuit-breaker OPEN, disconnector OPEN</td>
<td>mechanical</td>
</tr>
<tr>
<td>Circuit-breaker CLOSED</td>
<td>disconnector or earthing switch not in intermediate position (shutter closed)</td>
<td>mechanical</td>
</tr>
<tr>
<td>Circuit-breaker OPEN</td>
<td>not locked by a locking device</td>
<td>mechanical</td>
</tr>
</tbody>
</table>

Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.

**Bus riser of bus sectionaliser / Disconnectable busbar connection / Top-mounted busbar sectionaliser**

<table>
<thead>
<tr>
<th>Switching operation</th>
<th>Switching operation only possible if</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnector CLOSED/OPEN</td>
<td>associated circuit-breaker OPEN, earthing switch OPEN</td>
<td>electromechanical, mechanical</td>
</tr>
<tr>
<td>Earthing switch CLOSED/OPEN</td>
<td>associated circuit-breaker OPEN, disconnector OPEN</td>
<td>electromechanical, mechanical</td>
</tr>
<tr>
<td>Circuit-breaker OPEN</td>
<td>not locked by a locking device</td>
<td>mechanical</td>
</tr>
</tbody>
</table>

Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.

**Disconnectable busbar voltage transformer**

<table>
<thead>
<tr>
<th>Switching operation</th>
<th>Switching operation only possible if</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnector CLOSED/OPEN</td>
<td>earthing switch OPEN</td>
<td>mechanical</td>
</tr>
<tr>
<td>Earthing switch CLOSED/OPEN</td>
<td>disconnector OPEN</td>
<td>mechanical</td>
</tr>
</tbody>
</table>

Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.

**Make-proof earthing switch**

<table>
<thead>
<tr>
<th>Switching operation</th>
<th>Switching operation only possible if</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthing switch CLOSED/OPEN</td>
<td>Opening for operating lever open</td>
<td>electromechanical</td>
</tr>
</tbody>
</table>

Additionally, electromechanical interlocks may be fitted for disconnectors and earthing switches or for earthing switches.
Operation

21 Safe isolation from supply and correct terminal-phase connections

The panels are equipped with test sockets for connection of voltage indication systems.

Fig. 34: Test socket symbol

Danger!

If safe isolation from supply is not verified correctly:

⇒ Check the perfect unction of the voltage indicator and the coupling section

• on live equipment
• with test unit according to IEC 61243-5 / DIN VDE 0682 Teil 415
• on all phases

21.1 Verification of safe isolation from supply

⇒ Remove the covers from the capacitive test sockets L1, L2, L3.
⇒ Plug the voltage indicator in all three phases L1, L2, L3 of the test sockets.

If the voltage indicator does not flash or light up in any of the three test sockets, the phases are not live.

⇒ Replace the covers on the test sockets to prevent pollution
21.2 Verifying correct terminal-phase connections

Observe the operating instructions of the phase comparator unit and test correct terminal-phase connections on a live cable before switching on for the first time.

⇒ Remove the covers from the capacitive test sockets L1, L2, L3.
⇒ Connect the test sockets L1, L2 und L3 of the feeders to be compared to the phase comparator unit.

⇒ Verify the correct terminal-phase connections.
⇒ Replace the covers on the test sockets.
### 22 Overview of switching operations

#### 22.1 Switching operations in the circuit-breaker panel

<table>
<thead>
<tr>
<th>Connecting incoming or outgoing feeder with busbar</th>
<th>Disconnecting incoming or outgoing feeder from busbar</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Initial situation" /></td>
<td><img src="image" alt="Initial situation" /></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><img src="image" alt="1" /> Insert double-bit key</td>
<td><img src="image" alt="1" /> Insert double-bit key</td>
</tr>
<tr>
<td><img src="image" alt="1" /> Turn clockwise</td>
<td><img src="image" alt="1" /> Open the circuit-breaker</td>
</tr>
<tr>
<td><img src="image" alt="Result: Opening for disconnector operation is released" /></td>
<td><img src="image" alt="Result: Opening for disconnector operation is released" /></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><img src="image" alt="1" /> Hold disconnector lever in horizontal position (nose on the left) and push it onto the hexagonal shaft as far as it will go</td>
<td><img src="image" alt="1" /> Hold disconnector lever in horizontal position (nose on the right) and push it onto the hexagonal shaft as far as it will go</td>
</tr>
<tr>
<td><img src="image" alt="2" /> Turn disconnector lever 180° clockwise</td>
<td><img src="image" alt="2" /> Turn disconnector lever 180° counter-clockwise</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><img src="image" alt="4" /> Remove disconnector lever</td>
<td><img src="image" alt="4" /> Remove disconnector lever</td>
</tr>
<tr>
<td><img src="image" alt="2" /> Turn double-bit key counter-clockwise and remove it</td>
<td><img src="image" alt="2" /> Turn double-bit key counter-clockwise and remove it</td>
</tr>
<tr>
<td><img src="image" alt="Result: Opening for disconnector operation is closed" /></td>
<td><img src="image" alt="Result: Opening for disconnector operation is closed" /></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td><img src="image" alt="5" /> Close the circuit-breaker</td>
<td><img src="image" alt="5" /> Close the circuit-breaker</td>
</tr>
<tr>
<td><img src="image" alt="5" /> Open the circuit-breaker</td>
<td><img src="image" alt="5" /> Open the circuit-breaker</td>
</tr>
<tr>
<td><img src="image" alt="Result: Opening for disconnector operation is closed" /></td>
<td><img src="image" alt="Result: Opening for disconnector operation is closed" /></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
**Feeder earthing**

1. Initial situation

2. ① Insert double-bit key  
   ② Turn counter-clockwise  
   Result: Opening for earthing switch operation is released

3. ① Hold earthing switch lever in horizontal position (nose on the right) and push it onto the hexagonal shaft as far as it will go  
   ② Turn earthing switch lever 180° clockwise

4. ① Remove earthing switch lever  
   ② Turn double-bit key clockwise and remove  
   Result: Opening for disconnector operation is closed

5. ① Close the circuit-breaker  
   ② Pull locking device of circuit-breaker upwards and secure with padlock against OPENING

**Feeder de-earthing**

1. Initial situation

2. ① Take padlock out of locking device  
   ② Open the circuit-breaker

3. ① Insert double-bit key  
   ② Turn counter-clockwise  
   Result: Opening for earthing switch operation is released

4. ① Hold earthing switch lever in horizontal position (nose on the left) and push it onto the hexagonal shaft as far as it will go  
   ② Turn earthing switch lever 180° counter-clockwise

5. ① Remove disconnector lever  
   ② Turn double-bit key clockwise and remove  
   Result: Opening for earthing switch operation is closed
22.2 Switching operations in the bus sectionaliser

**Coupling busbar sections**

1. Initial situation

2. "CLOSE" disconnector in circuit-breaker panel
   "CLOSE" disconnector in bus riser panel
   "CLOSE" circuit-breaker in circuit-breaker panel

**Decoupling busbar sections**

1. Initial situation

2. "OPEN" circuit-breaker in circuit-breaker panel
   "OPEN" disconnector in circuit-breaker panel
   "OPEN" disconnector in bus riser panel

**Earthing busbar section 1**

1. Initial situation

2. "CLOSE" disconnector in circuit-breaker panel
   "CLOSE" earthing switch in bus riser panel
   "CLOSE" circuit-breaker in circuit-breaker panel
De-earthing busbar section 1

1

Initial situation

2

① “OPEN” circuit-breaker in circuit-breaker panel
② “OPEN” earthing switch in bus riser panel
③ “OPEN” disconnector in circuit-breaker panel

Earthing busbar section 2

1

Initial situation

2

① “CLOSE” disconnector in bus riser panel
② “CLOSE” earthing switch in circuit-breaker panel
③ “CLOSE” circuit-breaker in circuit-breaker panel

De-earthing busbar section 2

1

Initial situation

2

① “OPEN” circuit-breaker in circuit-breaker panel
② “OPEN” earthing switch in circuit-breaker panel
③ “OPEN” disconnector in bus riser panel
Operation

22.3 Switching operations for top-mounted busbar sectionaliser

Coupling busbar sections

1

Initial situation

2

① "CLOSE" disconnector in left-hand busbar section
② "CLOSE" disconnector in right-hand busbar section

Decoupling busbar sections

1

Initial situation

2

① "OPEN" disconnector in left-hand busbar section
② "OPEN" disconnector in right-hand busbar section

Earthing busbar section 1

1

Initial situation

2

① "CLOSE" disconnector in left-hand busbar section
② "CLOSE" earthing switch in right-hand busbar section
De-earthing busbar section 1

1

![Initial situation](image1)

2

① “OPEN” earthing switch in right-hand busbar section
② “OPEN” disconnector in left-hand busbar section

Earthing busbar section 2

1

![Initial situation](image2)

2

① “CLOSE” earthing switch in right-hand busbar section
② “CLOSE” disconnector in left-hand busbar section

De-earthing busbar section 1

1

![Initial situation](image3)

2

① “OPEN” earthing switch in left-hand busbar section
② “OPEN” disconnector in right-hand busbar section
Operation

22.4 Switching operations for disconnectable voltage transformers

Connecting voltage transformers with busbar 1

1  2  3  4

Disconnecting voltage transformers from busbar 1

1  2  3  4

Earthing voltage transformers

1  2  3  4

De-earthing voltage transformers

1  2  3  4
Servicing

23 Maintenance

23.1 Switchgear maintenance
The fixed-mounted circuit-breaker switchgear of the 8DA series is maintained according to an inspection schedule. To prevent any danger during maintenance, please observe the following safety instructions.

23.2 Safety instructions

Danger!
High-voltage! Danger!
Touching live parts will cause death or serious injuries. Observe the Five Safety Rules:
⇒ Isolate the switchgear.
⇒ Secure against reclosing.
⇒ Check safe isolation from supply.
⇒ Earth and short-circuit.
⇒ Cover or disconnect adjacent live parts.

Danger!
High-voltage! Danger!
Touching live parts will cause death or serious injuries.
⇒ Switchgear maintenance may be performed only by qualified personnel who are familiar with the danger associated with maintenance.
Servicing

23.3 Inspection schedule

Switchgear maintenance must be carried out at the following intervals:

<table>
<thead>
<tr>
<th></th>
<th>8DA10</th>
<th>8DA11/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual inspection</td>
<td>every 5 years</td>
<td>every 5 years</td>
</tr>
<tr>
<td>Minor inspection</td>
<td>every 10 years</td>
<td>every 10 years</td>
</tr>
<tr>
<td>Major inspection</td>
<td>every 20 years or after 1000 operating cycles of the earthing switches</td>
<td>every 20 years or after 3000 operating cycles of the earthing switches</td>
</tr>
</tbody>
</table>

These intervals are guidelines which have to be adapted to the different operating conditions. The inspection measures with the associated test and maintenance actions are shown on the following table.

<table>
<thead>
<tr>
<th>Every 5 years</th>
<th>Additionally every 10 years</th>
<th>Additionally every 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Check and document SF6-gas pressure (see &quot;Description&quot; 15.3, page 16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and document dew point (humidity content) ( $\leq -15^\circ$ C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and document gas quality (air content) ( $\geq 95$ %)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check mechanical interlocking system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check screw-type terminals of auxiliary circuits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and document dew point (humidity content) ( $\leq -15^\circ$ C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check and document gas quality (air content) ( $\geq 95$ %)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check operating mechanism of disconnector and earthing switch (if required, grease linkage and bearings)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Danger while working on gas compartments!</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observe the safety instructions given in the installation instructions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Before working with gas, generally check gas for re-applicability (check and document dew point and gas quality).</td>
</tr>
</tbody>
</table>

In all compartments with three-position switch:

- Evacuate SF6-gas.
- Operate disconnector and earthing switch for test and verify that the end positions are reached correctly.
- Check contact surfaces, rotary insulators and operating linkages for signs of wear.
- If required, clean the insulating bushings with a vacuum cleaner.
- Grease contact surfaces and joints of the operating linkage.
- Replace desiccant bags.
- Replace O-rings.
- Fill in SF6-gas.
- Check and document gas pressure.
- Check tightness.

In all other gas compartments: Check gas and refill or replace SF6-gas if required:

- Evacuate SF6-gas
- Replace O-rings.
- Fill in SF6-gas.
- Check and document gas pressure.
- Check tightness.

23.4 Procedure for bolted joints and seals

Please observe the following procedure for maintenance of switchgear parts with bolted joints:

- Always replace the spring elements on loosened bolted joints

Please observe the following procedure for maintenance of switchgear parts with seals:

42

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⇒ Always replace removed O-rings with new ones
  Note: O-rings are available at your Siemens Service Centre
⇒ Clean the surfaces and grooves in the flanges with a lint-free rag
⇒ Check the surfaces before installation
⇒ Fit new spring elements on loosened bolted joints
⇒ Grease the O-rings and place them in the grooves of the flanges.
⇒ Put the cover in position, placing a desiccant bag inside first, if applicable
⇒ Bolt the flanges cross-wise together with hexagonal bolts M8 and a tightening torque of 20 Nm.

23.5 Maintenance of the vacuum circuit-breaker operating mechanism

In case of adverse indoor conditions (heavy frequent condensation, dusty air, etc.) we recommend to renew the anticorrosion greasing of the circuit-breaker operating mechanism. Use only the following agents:

<table>
<thead>
<tr>
<th>Agent</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoflex Topas L32</td>
<td>Bearings</td>
</tr>
<tr>
<td>Sliding surfaces</td>
<td></td>
</tr>
<tr>
<td>Rizol Rostschutz 7/2</td>
<td>Points that are inaccessible for grease</td>
</tr>
<tr>
<td>Bearings of the auxiliary switch S1</td>
<td></td>
</tr>
</tbody>
</table>

1) For addresses of agent manufacturers (see 25.2, Page 45)
After treatment with the agent, operate the circuit-breaker mechanism mechanically several times for test.

23.6 Cleaning agents and cleaning aids

Caution!
For protection of personnel and environment
⇒ Read the instructions for use of cleaning agents carefully.
⇒ Observe the warnings (e.g. inflammable!, corrosive!, etc.)

Caution!
Chemical reaction between cleaning agent containing carbon hydrogen and insulating material.
⇒ For cleaning, use water with a household cleaner

| Table of cleaning agents and cleaning aids |
| Cleaning agent | HAKU 1025-920 | Contains carbon hydrogren! |
| Household cleaner and water | For cleaning electrostatically stressed insulation (e.g. epoxy resin) |
| Cleaning aid | Lint-free cleaning paper | For applying and cleaning liquid cleaning agent (single use) |
| Brush |
| Cleaning rag |
| Vacuum cleaner |

23.7 Lubricants

Table of lubricants

<table>
<thead>
<tr>
<th>Designation</th>
<th>Manufacturer</th>
<th>Application</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polylub GLY 801</td>
<td>Siemens</td>
<td>Current-carrying fixed-mounted connections (current conductors and earthing bars, connections)</td>
<td>No greasing effect; only corrosion protection; used as mounting aid for O-rings</td>
</tr>
<tr>
<td>Barrierta GTE 403</td>
<td>Klüber</td>
<td>Contact blades and contact pieces of the three-position switches</td>
<td>Observe the designation “GTE 403” in order to avoid mistakes with other Barrierta products</td>
</tr>
</tbody>
</table>

Ordering data for lubricants (see 25.3, Page 45)
Servicing

23.8 Switchgear extension and replacement of panels and components

For switchgear extension and replacement of components, please contact the local Siemens Service Centre.

Information required for spare part orders of single components and devices:
- Type and serial number of the switchgear and the circuit-breaker (see rating plates)
- Precise designation of the device or component, if applicable on the basis of the information and illustrations in the associated instructions, a drawing, sketch or circuit diagram

23.9 Service life and disposal

Service life

The maximum permissible number of mechanical operating cycles is 30,000. After that, the panels must be replaced. The current number of operating cycles is shown on the mechanical operating cycle counter.

Disposal

The fixed-mounted circuit-breaker switchgear of the 8DA series is an environment-compatible product.

At the end of the service life, the switchgear material should be recycled. The switchgear can be disposed of in environment-compatible manner in compliance with existing legislation.

The components of the switchgear can be recycled as mixed scrap; however, dismantling as far as possible into sorted scrap is the more environment-compatible way.

The switchgear consists of the following materials:
- Steel
- Copper
- Aluminium
- PTFE
- Cast resin
- Fibre-reinforced plastics
- Rubber material
- Sulphur hexafluoride (SF₆)
- Ceramic materials
- Lubricants

The switchgear does not contain hazardous materials. As this is an SF₆-insulated switchgear, the gas enclosed in the gas compartment must be evacuated, collected and recycled. To do this, observe the necessary safety measures according to the instruction leaflet for accident prevention “SF₆-Switchgear” of the professional association for fine mechanics and electrical engineering. Outside Germany, the locally applicable regulations must be followed.

Should you require further information, please contact your Siemens Service Centre.

24 Cable testing

24.1 Function test

Before commissioning, the cables are exposed to a high DC voltage for test.

24.2 Safety instructions

Danger!

If the voltage transformer is connected, the test voltage can destroy the voltage transformer and cause personal injuries.
- Switch disconnectable voltage transformers to “EARTH” before testing the cables.
- Remove non-disconnectable voltage transformers.

Danger!

High voltage! Danger!
During cable testing there may be flashovers which can cause death or serious injuries.
- The test may be performed only by qualified personnel who are familiar with the danger associated with the test.
- The permissible test voltages must not be exceeded.
- Keep the safety distances.
- Provide barriers.
- Switch on warning signs.
24.3 Procedure

⇒ Earth the feeder.
⇒ Switch disconnectable voltage transformers to “EARTH” or remove non-disconnectable voltage transformers.
⇒ Remove the cable from the switchgear.
⇒ Screw the test adapter onto the cable termination.
⇒ Connect the test cable.
⇒ Short-circuit capacitive test sockets.
⇒ Switch the circuit-breaker to the “OPEN” position.
⇒ Switch the three-position switch to the “OPEN” position.
⇒ Switch the circuit-breaker to the “CLOSED” position.
⇒ Perform voltage test.
⇒ Proceed in reverse order to reach the initial state again.

25 Accessories and spare parts

25.1 Standard accessories

• Operating instructions
• Installation instructions
• Operating lever for three-position switch
• Operating lever for earthing switch
• Hand crank for circuit-breaker
• Socket spanner

Furthermore, the following standard tool is supplied for motor operating switchgear:

• Emergency operating lever

Put the operating tools back to the corresponding place in the switchgear room after use.

Replacement for standard accessories is available at the Siemens Service Centre.

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

25.2 Accessories for the circuit-breaker

The following accessories can be ordered directly at the manufacturer’s:

• Lubricant for bearings and sliding surfaces:
  Isoflex Topas L32
  Klüber Lubrication KG
  Geisenhausener-Str. 7
  D-81379 München 70

• Lubricant for bearings that are inaccessible for grease, and bearings of the auxiliary switch:
  Ritzol Rostschutz 7-2
  Valvoline (Deutschland) GmbH, Ritz & Co KG
  Am Sandtorkai 73
  D-20457 Hamburg

25.3 Ordering data for lubricants

<table>
<thead>
<tr>
<th>Designation</th>
<th>Manufacturer</th>
<th>Packing / Quantity</th>
<th>SWF Data</th>
<th>SWF No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyol GLY 8018</td>
<td>Siemens</td>
<td>Tube (0.19 kg)</td>
<td>FEVO 009</td>
<td>5.7234.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>/0004</td>
</tr>
<tr>
<td>Barierta GTE 403</td>
<td>Klüber</td>
<td>Tube (0.02 kg)</td>
<td>FEVO 577</td>
<td>5.7254.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>/0011</td>
</tr>
</tbody>
</table>
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