Medium Voltage Switchgear
Type SIMOSEC up to 27.6 kV, Extendable, Metal-Enclosed up to 1200 A

Order no.: SGiM-4008
(SWF 832-6058.0)
Important

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Siemens reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material or both, the latter shall take precedence.

Qualified Person

For the purpose of this manual and product labels a qualified person is one who is familiar with the installation, construction, or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

(a) is trained and authorized to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) is trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety practices.

(c) is trained in rendering first aid.

Note

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, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser’s purposes, the matters should be referred to the local sales office.

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 obligation of Siemens Power Transmission & Distribution, Inc. The warranty contained in the contract between the parties is the sole warranty of Siemens Power Transmission & Distribution, Inc. Any statements contained herein do not create new warranties or modify the existing warranty.
Safety instructions .....................................4
1 Introduction ............................................4
2 Qualified Person .......................................4
3 Signal Words ..........................................4
4 Dangerous Procedures ................................5
5 Field Service Operation ...............................5

Description .................................................6
6 Features ..................................................6
7 Panel versions ...........................................8
8 Components ............................................9
  8.1 Three-position switch-disconnector ..................9
  8.2 Operating mechanisms for the three-position switches.................10
  8.3 Current and voltage transformers ....................14
  8.4 Protection and control equipment ....................15
  8.5 HV HRC (current limiting) fuse assembly .............16
  8.6 Interlocks ............................................18
  8.7 Bus bars .............................................20
  8.8 Cable connection ....................................20
  8.9 Rating plates .......................................21
  8.10 "Ready-for-service" indicator for SF6-gas .............22
  8.11 Voltage detection systems ..........................23
  8.12 Accessories ........................................24

9 Technical data ..........................................26
  9.1 Electrical data, pressure values, temperature ......26
  9.2 Tightening torques ...................................27
  9.3 Protection against solid foreign bodies, electric shock and ingress of water ......28
  9.4 Standards and guidelines ............................29
  9.5 Type of service location ................................29
  9.6 Service conditions ....................................30
  9.7 Insulating capacity and site altitude .................31
  9.8 Three-position switch-disconnector ..................32
  9.9 Make-proof grounding switch (feeder grounding switch) ......32
  9.10 Selection of HV HRC (current limiting) fuses .......32
  9.11 Cable terminations ...................................33

Maintenance ...............................................34
10 Switchgear maintenance ..............................34
  10.1 Recommended Hand Tools ............................35
  10.2 Recommended Maintenance and Lubrication .........36
  10.3 Cleaning the switchgear .............................37
  10.4 Checking corrosion protection .......................38
  10.5 Returning SIMOSEC switchgear to service .........38

11 Access to the switchgear .............................38
  11.1 Identifying the panel ..................................38
  11.2 Removing the cable compartment cover ............39

11.3 Removing the cover of the compartment for customer low voltage equipment ......42
11.4 Removing the cover of the bus bar compartment ................................43

12 Testing ................................................43
  12.1 Verification of grounding ............................43
  12.2 Verification of correct terminal-phase connections .........44
  12.3 Cable testing .........................................44
  12.4 Cable sheath testing ..................................46

13 Replacing HV HRC (current limiting) fuses ..................46
  13.1 Preparing fuse replacement ..........................47
  13.2 Removing HV HRC (current limiting) fuse link ............47
  13.3 Checking the fuse tripping mechanism ..................47
  13.4 Installing the HV HRC (current limiting) fuses ..........49
  13.5 Completing fuse replacement ........................49

14 Switchgear recycling ..................................50
15 Help ...................................................50
16 Index ..................................................51
Safety instructions

1 Introduction

The SIMOSEC medium voltage metal-enclosed switchgear is designed to meet all the applicable ANSI, NEMA and IEEE standards, or the applicable IEC standards, as appropriate for the specific contract. Successful application and operation of this equipment depends as much upon proper installation and maintenance by the user as it does upon the careful design and manufacture by Siemens.

The purpose of this instruction manual is to assist the user in developing safe and efficient procedures for the installation, maintenance and use of the equipment.

Contact the nearest Siemens representative if any additional information is desired.

2 Qualified Person

For the purpose of this manual and product labels a Qualified Person is one who is familiar with the installation, construction or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

- Training and authorization to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Training in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses, face shields, flash clothing, etc., in accordance with established safety procedures.
- Training in rendering first aid.

3 Signal Words

The signal words “Danger”, “Warning” and “Caution” used in this manual indicate the degree of hazard that may be encountered by the user. These words are defined as:

- **Danger**: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
- **Warning**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
- **Caution**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
4 Dangerous Procedures

In addition to other procedures described in this manual as dangerous, user personnel must adhere to the following:

1. Always work only on de-energized equipment. Always de-energize and ground the equipment before performing any tests, maintenance, or repair.

2. Always perform maintenance on the switching device after the spring-charged mechanisms are discharged.

3. Always let an interlock device or safety mechanism perform its function without forcing or defeating the device.

5 Field Service Operation

Siemens can provide competent, well-trained Field Service Representatives to provide technical guidance and advisory assistance for the installation, overhaul, repair and maintenance of Siemens equipment, processes and systems. Contact regional service centers, sales offices or the factory for details, or telephone Siemens Field Service at 1-800-347-6659 (919-365-2200 outside the U.S.).
SIMOSEC is an extendable, three-phase, metal-enclosed indoor switchgear.

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

Security of operation and reliability due to:
- Type (design) and routine (production) 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 (all insulation phase-ground)
• Operating mechanisms outside switchgear vessel (gas compartment)
• Maintenance-free operating mechanism parts
• Mechanical switch position indication integrated in mimic diagram
• Switchgear interlocking system with logical mechanical interlocks
• Cable testing without the need to isolate the bus bar (see Maintenance, Page 44)

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

• Low-maintenance technology concept
• Climatic independence
• Minimum space requirement
• Provisions for 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
7 Panel versions

Fig. 2: Cable switch panel CS (shown with main bus in the middle)

1 Sockets for capacitive voltage detection system
2 Manual operation for the mechanism of the load-break / disconnecting function
3 Indicator „Fuse intact / Fuse blown“
4 Switch position indicator for load-break and for grounding function “CLOSED-OPEN-GROUNDED”
5 Manual operation for the mechanism of the grounding function
6 Sockets for capacitive voltage detection system
7 Insulating cap on bus bar (for > 15 kV)
8 Bus bar
9 Bushing-type insulator for bus bar
10 „Ready-for-service“ indicator for switching device
11 Interlocking lever of cable compartment cover (option)
12 Pressure relief device for switching device
13 Option: Locking device for three-position switch
14 Cable compartment cover/ door

Fig. 3: Fuse switch panel FS (shown with main bus on top)

15 Gas-insulated vessel for switching device
16 Bushing-type insulator for feeder
17 Cable connection
18 Cable termination (not in scope of supply)
19 Cable connection compartment
20 Three-position switch
21 Grounding bus bar
22 Spring-operated mechanism for three-position switch
23 Grounding connection (for location see dimension drawings)
24 Option: Local-remote switch for the motor operating of the three-position switch
25 Option: Momentary-contact rotary control switch “CLOSED - OPEN” for motor operating mechanism for three-position switch
26 Option: HV HRC (current limiting) fuse
27 Post insulator
28 Low voltage compartment
8 Components

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

8.1 Three-position switch-disconnector

The three-position switch-disconnector is designed to break normal currents of up to 600 A and to ground the feeder cables of the panel.

Mode of operation

The three-position switch-disconnector combines the functions of a switch-disconnector and a make-proof grounding switch. Make-proof grounding switches are grounding 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 “GROUNDED” 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 grounding switch
- Three-position switch-disconnector with air-insulated primary connections for bus bar and feeder
- Operation via pivoting-arm welded gas-tight in the front of the switchgear vessel
- Hermetically welded, gas-tight stainless-steel vessel
- Up to 600 A
Description

Equipment

- **Shunt (trip) 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 shunt release, e.g. transformer overtemperature tripping. 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 signalling switch.

- **Auxiliary switch (option)**
  Each operating mechanism of the three-position switch-disconnector can be optionally equipped with an auxiliary switch for the switch position indication.
  - 2NO + 1NC for “CLOSED/GROUNDED”
  - 2NO for “OPEN”

8.2 Operating mechanisms for the three-position switches

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 speed at which the operating lever is moved.

- **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 speed at which the operating lever is moved.
  Stored energy is available to trip the switch by means of a striker pin of an HV HRC (current limiting) fuse or a shunt release (F-release).
  The energy to trip the switch is stored when the switch is operated from the “OPEN” position to the “CLOSED” position.
  After tripping (e.g. by means of the striker pin of the HV HRC (current limiting) fuse or the shunt release) the switch position indicator of the switch-disconnector shows „TRIPPED.” Since tripping occurs only as a result of a protective device operation (e.g., operation of fuse), re-closing of the switch is not allowed. Before the switch can be re-closed, the switch must be operated to the “GROUNDED” position to allow for correction of the problem that led to the tripping action.
Motor operating mechanism (option)
- Remote operation applied to terminals (standard)
- Local operation by means of momentary-contact rotary control switch, spring return (option)
- Local-remote switch as maintained-contact rotary control switch, non-spring-return (option)
Switch positions of the three-position switch

Three-position switch-disconnector up to 600 A

Switch position

CLOSED

OPEN

GROUNDED

Fig. 8: Switch positions of the three-position switch

① Bus bar connection
② Feeder, e.g., for cable connection
Switch-positions of the make-proof grounding switch

Fig. 9: Switch-positions of the make-proof grounding switch

① Bus bar connection
② Feeder, e.g., for cable connection (option) or for metering (option)
8.3 Current and voltage transformers

**4MC70 33, 4MC70 31 toroidal-type current transformers and 4MC70 32 bus-type current transformer**
- Single-pole toroidal-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
- 1A or 5A CT secondary rating, to suit order requirements

**4MA7 block-type current transformer / 4MR voltage transformers**
- Dimensions according to DIN 42 600 Part 8
- Single-pole indoor block-type current transformer
- Single-pole indoor voltage transformer
- Cast-resin insulated
- Secondary connection by means of screw-type terminals
- 1A or 5A CT secondary rating, to suit order requirement
8.4 Protection and control equipment

Protection and control equipment is supplied according to the customer’s specifications. The devices are installed in the standard low voltage compartment (item 28, figures 2 and 3) and/or in the optional low voltage compartment (item 1, figures 2 and 3). For details please refer to the schematic diagrams for the switchgear.

**Mimic diagram**

The mimic diagram on the control panel corresponds with 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.

![Control panel section](image)

Fig. 12: Control panel section

The local-remote switch latches (non-spring-return) in the corresponding switch position.

<table>
<thead>
<tr>
<th>LOCAL position: Local operation</th>
<th>REMOTE position: Remote operation from the control room/monitoring station</th>
</tr>
</thead>
</table>
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 (option) is in the “LOCAL” position.

The momentary-contact rotary control switch is spring-return type and returns to the center position (M position) automatically.

Bay controller (option)

For information on the bay controller (e.g. SIPROTEC 4), please refer to the instruction manual for the protective device.

8.5 HV HRC (current limiting) fuse assembly

The HV HRC (current limiting) fuse assembly protects downstream cable runs and/or devices.

The fuses used in SIMOSEC switchgear are manufactured by Bussman. The fuses comply with IEC 60282-1 and ANSI/IEEE C37.41. They are a general purpose current limiting fuse. The time-current characteristics of the fuses comply with the parameters for E-rated fuses as defined by ANSI C37.46.

The three-position switch-disconnector in the transformer feeder in combination with Bussmann HV HRC (current limiting) fuses was tested according to ANSI/IEEE C37.20.4.
Features

- HV HRC (current limiting) fuses according to DIN 43625 (main dimensions) with striker pin in “medium” version
- Thermal striker pin tripping when the corresponding Bussmann HV HRC (current limiting) fuse is used.
- Dimension e=21.14 in. (537 mm) up to 27.6 kV preset at the factory
- Option: Dimension e=17.4 in. (442 mm) possible with extension tube (95 mm)
- Open the cover for fuse replacement is only possible when:
  - the feeder is grounded, so you can open the door
  - the compartment cover is unscrewed
- Option: When the cable compartment door is opened, the switch cannot be operated from the “GROUNDED” position to the “OPEN” position
- Option: Shunt release on the operating mechanism of the three-position switch-disconnector
- Option: “TRIPPED indication” of the fuse in the fuse switch panel switch at a remote electrical indication with a normally-open contact (1NO)
- Option: “FUSE BLOWN” indication with a microswitch

Principle of fuse tripping

In the event that a HV HRC (current limiting) fuse has tripped (striker pin tripped), the three-position switch-disconnector of the transformer feeder is tripped via a time relay or via a linkage provided at the fuse contact.

Fig. 14: Principle of fuse tripping

1. Striker pin not tripped (fuse intact)
2. Striker pin tripped (fuse blown)
8.6 Interlocks

Control gate of the three-position switch
The control gate of the three-position switch prevents switching directly from “CLOSED” to “GROUNDED” or from “GROUNDED” to “CLOSED”, as the operating lever must be re-inserted in the “OPEN” position.

Cable compartment cover, screwed on

![DANGER]

Hazardous voltage.
Will cause death, serious injury and equipment damage.
De-energize and ground high voltage conductors within switchgear before working on or near the conductors.

De-grounding lock-out at the three-position switch
If the cable compartment cover is removed, the three-position switch-disconnector of the transformer panel cannot be “DE-GROUNDED”.

Note: The cable compartment cover can only be removed when the three-position switch is in “GROUNDED” position.

Closing lock-out (option)
If the cable compartment door is opened, the three-position switch cannot be switched to the “CLOSED” position.

Locking device
The control gate of the three-position switch-disconnector and the three-position disconnector can be locked in all three switch positions.
FII-Protection-System (option)
The Fuse-Installed-Intact-Protection-System (FII-Protection-System) prevents to switch the three-position switch to CLOSED position if only one fuse is blown or not installed.

Fig. 15: Shutter of FII-Protection-System
8.7 Bus bars

Fig. 16: Bus bar compartment (bus with heatshrink and insulating caps for >15 kV)

Features
- Metal-enclosed bus bar compartment
- Bus bars bolted from panel to panel
- Versions:
  - 1200 A
  - heatshrink insulation (option)
  - insulating caps (standard over 15 kV)

8.8 Cable connection

Features
- Cable termination points are arranged one behind the other
- Uniform cable connection height per panel (see dimension drawings)
- With cable bracket or cable clamps and grounding points for cable shields
- Access to the cable connection compartment only when feeder has been grounded

Features for cable terminal
- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables
- For connection cross-sections (cable size)* up to 300 mm² (600 kcmil)
- Cable bottom entry (from below) - standard
- Cable top entry (from above) - optional

Applicable cable types are described in Section "Cable terminations" (see Description, Page 33).

Installation of high voltage cables is described specifically for each panel in the operating Instructions (see Installation, Page 22).

* Larger connection cross-sections on request.
8.9 Rating plates

The rating plate identifies the components and the technical data.

Rating plate are provided as follows:
- bottom-right on the control panel
- in the operating mechanism box (inside cover)

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**Fig. 17:** Rating plate on the control panel

**Fig. 18:** Rating plate in the operating mechanism box
8.10  “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.

If a three-position switch filled with SF₆-gas is not ready for operation, then:
• Do not energize the switchgear
• Do not operate the switchgear
• Contact the Siemens Field Service, as indicated on page 4.

Features
• Easy to read
• Self-monitoring
• Independent of temperature and pressure variations
• Option: Alarm switch 1NO + 1NC for remote electrical indication
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-magnetic 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 determines the dielectric capability, are displayed, changes in the gas pressure due to 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.

8.11 Voltage detection systems

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

Regular tests of the voltage detection systems must be performed by the user and documented.

Voltage detection systems according to IEC 61243-5 and EN 61243-5 (VDE 0682-415) with:
- HR system (standard)
- LRM system (option)
- Integrated voltage detection system CAPDIS-S1/-S2 (option)

Fig. 21: Voltage detection system via capacitive voltage divider (phase L3 shown)

1 HR indicator, plug-in type

- C1: capacitance integrated into bushing or post insulator
- C2: capacitance of the connection leads and of the voltage indicator to ground
The control panel section of the three-position switch contains:

Features of HR system

- Verification of safe isolation from supply phase by phase by insertion in each socket pair
- Voltage indicator flashes if high voltage is present
- Measuring system and voltage indicator can be tested
- Does not require auxiliary power

8.12 Accessories

Standard accessories:

- SIMOSEC documentation (operating and installation instructions)
- Operating lever for three-position switch/grounding switch (black grip)

Further accessories according to order documentation/purchase order (selection):

- Operating lever for three-position switch (black grip)
- Operating lever for grounding switch (red grip)
- Double-bit key
- HV HRC (current limiting) fuses
- Surge arresters
- Test fuses for mechanical simulation of the striker pin of HV HRC (current limiting) fuses in transformer feeders

Fig. 22: Control board section: Sockets for capacitive voltage detection system

Fig. 23: Test fuse for striker pin function tests

- HR/LRM voltage indicators
- Test units to check the capacitive interface and the voltage indicators
Description

Fig. 24: Functional tester (Horstmann type HO-ST)

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

Fig. 25: Electronic phase comparer
## 9 Technical data

### 9.1 Electrical data, pressure values, temperature

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

#### Complete switchgear

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation level</td>
<td>8.25 15 27.6</td>
</tr>
<tr>
<td>Rated voltage $U_r [kV]$</td>
<td></td>
</tr>
<tr>
<td>Rated short-duration (one minute) power-frequency withstand voltage $U_{dp}$</td>
<td>36 60</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage $U_p$ peak</td>
<td>95 125</td>
</tr>
<tr>
<td>Rated frequency $f_r [Hz]$</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated continuous current $I_r [A]$</td>
<td>600 1200</td>
</tr>
<tr>
<td>Rated short-time withstand current $I_k$</td>
<td>20 25 20 25 20</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$</td>
<td>52 65 52 65 52</td>
</tr>
<tr>
<td>Rated filling pressure $p_{ref} [PSI(kPa)]$</td>
<td>21.8 (150)</td>
</tr>
<tr>
<td>Min. operating pressure $p_{me} [PSI(kPa)]$</td>
<td>18.9 (130)</td>
</tr>
<tr>
<td>Ambient temperature $T$ for panels without secondary equipment [°C]</td>
<td>-30 to +40</td>
</tr>
</tbody>
</table>

#### Cable-switch panel type CS; cable connection panel type CC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r [kV]$</td>
<td>8.25 15 27.6</td>
</tr>
<tr>
<td>Rated continuous current $I_r [A]$</td>
<td>600 600 - 1200</td>
</tr>
<tr>
<td>Rated fault closing current, $I_{ma} [kA]$</td>
<td>32 40 32 40 32</td>
</tr>
</tbody>
</table>

#### Transformer panel type FS, FU

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r [kV]$</td>
<td>8.25 15 27.6</td>
</tr>
<tr>
<td>Rated continuous current $I_r [A]$</td>
<td>200, 600, 1200</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$</td>
<td>52 65 52 65 52</td>
</tr>
<tr>
<td>Rated fault closing current, $I_{ma} [kA]$</td>
<td>52 65 52 65 52</td>
</tr>
<tr>
<td>Reference dimension &quot;e&quot; for HV HRC (current limiting) fuses [mm]</td>
<td>537</td>
</tr>
</tbody>
</table>

#### Bus bar grounding panel type BG

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r [kV]$</td>
<td>8.25 15 27.6</td>
</tr>
<tr>
<td>Rated fault closing current, $I_{ma} [kA]$</td>
<td>52 65 52 65 52</td>
</tr>
</tbody>
</table>

#### Bus bar voltage metering switch panel types MS3

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r [kV]$</td>
<td>8.25 15 27.6</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$</td>
<td>52 65 52 65 52</td>
</tr>
<tr>
<td>Rated fault closing current, $I_{ma} [kA]$</td>
<td>52 65 52 65 52</td>
</tr>
</tbody>
</table>
1) The rated continuous currents apply to ambient temperatures of 40 °C.

2) Pressure values for SF₆-insulated vessels.

3) The fuse assembly is designed for a reference dimension “e” = 537 mm. With reference dimension “e” = 442 mm, an extension tube (95 mm long) is required.

9.2 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: steel-steel e. g.: front plates, top plates, etc.</td>
<td>M6 (self-cutting) M8</td>
<td>9 lbf.ft (12 Nm) 16 lbf.ft (21 Nm)</td>
</tr>
<tr>
<td>Grounding bus bar: steel/copper copper/copper steel/copper</td>
<td>M8 M8 M10</td>
<td>16 lbf.ft (21 Nm) 16 lbf.ft (21 Nm) 23 lbf.ft (30 Nm)</td>
</tr>
<tr>
<td>Current conductor joint: copper/copper copper/copper</td>
<td>M8 M10</td>
<td>16 lbf.ft (21 Nm) 23 lbf.ft (30 Nm)</td>
</tr>
<tr>
<td>Switchgear grounding: steel/cable lug</td>
<td>M12</td>
<td>37 lbf.ft (50 Nm)*</td>
</tr>
<tr>
<td>Cable shield grounding</td>
<td>M10 M12 (all other cable panels)</td>
<td>23 lbf.ft (30 Nm)* max. 37 lbf.ft (50 Nm)*</td>
</tr>
</tbody>
</table>

* The tightening torque at the cable lug joint depends on:
  - material of cable lug
  - instructions of termination manufacturer
  - instructions of cable manufacturer
9.3 Protection against solid foreign bodies, electric shock and ingress of water

The medium voltage switchgear SIMOSEC complies with the following degrees of protection:

<table>
<thead>
<tr>
<th>Degree of protection</th>
<th>Type of protection</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP2X</strong></td>
<td>Protection against solid foreign bodies: Protected against the penetration of solid foreign bodies; diameter 0.5 in. (12.5 mm). Protection against electric shock: Protected against access to dangerous parts by means of a finger (the distance between a test finger with a diameter of 12 mm to dangerous parts must be sufficient). Protection against the ingress of water: No definition.</td>
<td>Enclosure of live parts under high voltage Compartments</td>
</tr>
<tr>
<td><strong>IP3X</strong></td>
<td>Protection against solid foreign bodies: Protected against the penetration of solid foreign bodies; diameter 2.5 mm. Protection against the ingress of water: No definition. Protection against electric shock: Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 0.1 in. (2.5 mm) and a length of 3.94 in. (100 mm) to dangerous parts must be sufficient)</td>
<td>Enclosure of live parts under high voltage in switchgear with locking device</td>
</tr>
<tr>
<td><strong>IP3XD</strong> (on request)</td>
<td>Protection against solid foreign bodies: Protected against the penetration of solid foreign bodies; diameter 0.1 in. (2.5 mm). Protection against the ingress of water: No definition. Protection against electric shock: Protected against access to dangerous parts by means of a wire (the distance between a test rod with a diameter of 1 mm and a length of 3.94 in. (100 mm) to dangerous parts must be sufficient)</td>
<td>Enclosure of live parts under high voltage in switchgear with locking device</td>
</tr>
<tr>
<td><strong>IP65</strong></td>
<td>Protection against solid foreign bodies: Dust-proof; no penetration of dust. Protection against the ingress of water: Protected against water jets; water which is directed towards the enclosure from any direction may not have a damaging effect. Protection against electric shock: Protected against access to dangerous parts by means of a wire (test probe with a diameter of 0.04 in.(1 mm) may not penetrate)</td>
<td>Metal enclosure of gas-filled switchgear vessels</td>
</tr>
</tbody>
</table>
9.4 Standards and guidelines

SIMOSEC switchgear complies with the following relevant standards and specifications:

IEC-, ANSI-, IEEE-Standards
- IEC 62271 - 105
- ANSI/IEEE Std C37.20.3 - 2001
- ANSI/IEEE Std C37.20.4 - 2001
- ANSI/IEEE Std C37.57 - 2003
- ANSI/IEEE Std 1247 - 1998
- ANSI/IEEE Std C37.22 - 1997
- CSA C22.2 No. 193 - M 1983
- CSA C22.2 No. 31-04
- NEMA
- EEMAC G11-1 (Measurement of Corona)

Transport regulations

According to Annex A of the European agreement about international transport of hazardous materials (Anlage A des Europäischen Übereinkommens über die internationale Beförderung gefährlicher Güter auf der Straße (ADR)), SF₆-gas insulated medium voltage switchgear manufactured by Siemens is not categorized as hazardous materials with respect to transport procedures, and are exempt from special transport regulations according to ADR, Section 1.1.3.1 b.

9.5 Type of service location

SIMOSEC switchgear can be used in an indoor installation in accordance with IEC 61 936 (Power installations exceeding AC 1kV) and VDE 0101 and the NEC:
- Outside lockable electrical service locations at places which are not accessible to the public. The equipment enclosure in which the indoor SIMOSEC switchgear is installed must have doors that are lockable.
- 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 authorised personnel and persons who have been properly instructed in electrical engineering. Untrained or unskilled persons may only enter under the supervision of authorised personnel or properly instructed persons.
- In any event, access to the equipment must be restricted to authorized personnel.
9.6 Service conditions

SIMOSEC switchgear is intended for application under the “usual service conditions” defined in ANSI/IEEE C37.20.3, clauses 4 and 8.1.

Generally, “usual service conditions” are defined as an environment in which the equipment is not exposed to excessive dust, acid fumes, damaging chemicals, salt air, rapid or frequent changes in temperature, vibration, high humidity, and extremes of temperature.

For application is other than “usual service conditions” defined by ANSI/IEEE C37.20.3, Consult Siemens.

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

• No cross insulation 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 current transformers
9.7 Insulating capacity and site altitude

**Insulating capacity**

- The insulating capacity is verified by testing the switchgear with rated values of short-duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 60 694 / VDE 0670 Part 1000, and ANSI/IEEE C37.20.3.
- The rated values are referred to sea level and to normal atmospheric conditions (14.7 PSI, 68 °F, 0.000687 lb/ft³ humidity in accordance with IEC 60 071 and VDE 0111) and ANSI/IEEE Std 4.
- The insulating capacity decreases with increasing altitude.

For site altitudes above 1000 m, the correction factor “a” is recommended, depending on the actual site altitude above sea level.

<table>
<thead>
<tr>
<th>Rated voltage (r.m.s. value) [kV]</th>
<th>8.25</th>
<th>15</th>
<th>27.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration (one minute) power-frequency withstand voltage (r.m.s. value) [kV]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Across isolating distance</td>
<td>39.6</td>
<td>39.6</td>
<td>66</td>
</tr>
<tr>
<td>- Between phases and to ground</td>
<td>36</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (peak value) [kV]</td>
<td>105</td>
<td>105</td>
<td>138</td>
</tr>
<tr>
<td>- Across isolating distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Between phases and to ground</td>
<td>95</td>
<td>95</td>
<td>125</td>
</tr>
</tbody>
</table>

**Fig. 26:** Correction factor “a” as a function of the site altitude in meters above sea level

**Table:**

<table>
<thead>
<tr>
<th>Rated short-duration power-frequency withstand voltage to be selected</th>
<th>Rated lightning impulse withstand voltage to be selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 kV</td>
<td>118 kV</td>
</tr>
</tbody>
</table>

**Example:**

<table>
<thead>
<tr>
<th>3000 m site altitude above sea level</th>
<th>15 kV switchgear rated voltage</th>
<th>95.0 kV rated lightning impulse withstand voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>95 kV</td>
<td>118 kV</td>
<td>118 kV</td>
</tr>
</tbody>
</table>

**Result:** According to the above table, switchgear for a rated voltage of 27.6 kV should be selected.
9.8 Three-position switch - disconnector

The three-position switch is tested in accordance with:
- IEC 62271 - 105
- ANSI/IEEE C37.20.4
- CAN/CSA C22.2 No. 193

9.9 Make-proof grounding switch (feeder grounding switch)

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>$U_t$</th>
<th>kV</th>
<th>8.25</th>
<th>15</th>
<th>27.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make-proof grounding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>function of the three-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>position switch-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>disconnector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated fault closing</td>
<td>$I_{ma}$</td>
<td>up to kA</td>
<td>40</td>
<td>40</td>
<td>32</td>
</tr>
<tr>
<td>current</td>
<td></td>
<td>(ASYM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-time</td>
<td>$I_k$</td>
<td>up to kA</td>
<td>25</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>withstand current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.10 Selection of HV HRC (current limiting) fuses

**Allocation of HV HRC fuses and transformers**

The fuses used in SIMOSEC switchgear are manufactured by Bussmann. The fuses comply with IEC 60282-1 and ANSI/IEEE C37.41. They are a general purpose current limiting fuse. The time-current characteristics of the fuses comply with the parameters for E-rated fuses as defined by ANSI C37.46. The fuse dimensions comply with the requirements of DIN 43625.

The three-position switch-disconnector in the transformer feeder of SIMOSEC switchgear in combination with Bussmann HV HRC (current limiting) fuses was tested in accordance with IEC 62 271-105 and ANSI/IEEE C37.20.3.

Please contact us for applications or HV HRC (current limiting) fuses from other manufacturers.
9.11 Cable terminations

Connection height

<table>
<thead>
<tr>
<th>Panel family</th>
<th>CS1+2</th>
<th>FS1+2+3</th>
<th>FU1+2+3</th>
<th>CC1+2</th>
<th>CG1+2</th>
<th>MC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top cable entry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main switch or vertical copper bar in upper position (fuse assembly in lower position)</td>
<td>490mm / 19.3&quot;</td>
<td>2550mm / 100.4&quot;</td>
<td>490mm / 19.3&quot;</td>
<td>2550mm / 100.4&quot;</td>
<td>490mm / 19.3&quot;</td>
<td>2550mm / 100.4&quot;</td>
</tr>
<tr>
<td>Main switch or vertical copper bar in lower position (fuse assembly in upper position)</td>
<td>not available</td>
<td>not available</td>
<td>490mm / 19.3&quot;</td>
<td>2550mm / 100.4&quot;</td>
<td>not available</td>
<td>not available</td>
</tr>
<tr>
<td><strong>Middle cable connection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to top</td>
<td>940mm / 37&quot; / 2250mm / 88.6&quot;</td>
<td>not available</td>
<td>940mm / 37&quot; / 2250mm / 88.6&quot;</td>
<td>940mm / 37&quot; / 2250mm / 88.6&quot;</td>
<td>940mm / 37&quot; / 2250mm / 88.6&quot;</td>
<td>not available</td>
</tr>
<tr>
<td>to bottom</td>
<td>1240mm / 49&quot; / 2250mm / 88.6&quot;</td>
<td>not available</td>
<td>1240mm / 49&quot; / 2250mm / 88.6&quot;</td>
<td>1240mm / 49&quot; / 2250mm / 88.6&quot;</td>
<td>1240mm / 49&quot; / 2250mm / 88.6&quot;</td>
<td>not available</td>
</tr>
<tr>
<td><strong>Bottom cable entry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main switch or vertical copper bar in upper position (fuse assembly in lower position)</td>
<td>not available</td>
<td>not available</td>
<td>490mm / 19.3&quot;</td>
<td>2250mm / 88.6&quot;</td>
<td>not available</td>
<td>not available</td>
</tr>
<tr>
<td>Main switch or vertical copper bar in lower position (fuse assembly in upper position)</td>
<td>490mm / 19.3&quot;</td>
<td>2250mm / 88.6&quot;</td>
<td>490mm / 19.3&quot;</td>
<td>2250mm / 88.6&quot;</td>
<td>not available</td>
<td>490mm / 19.3&quot;</td>
</tr>
</tbody>
</table>

For actual dimensions, please remark the dimension drawings.

Principle of cable connection

Fig. 27: Drawing of the principle of cable connections
Maintenance

10 Switchgear maintenance

Periodic inspections and maintenance are essential to obtain safe and reliable operation of the switchgear. When SIMOSEC switchgear is operated under "Usual Service Conditions", maintenance and lubrication is recommended at ten year intervals. The maintenance intervals of devices (e.g. relays, PLC’s, etc.) installed in the switchgear may differ. "Usual" and "Unusual" service conditions for Medium Voltage Metal-Enclosed Interrupter Switchgear are defined in ANSI/IEEE C37.20.3, clauses 4 and 8.1. Generally, "usual service conditions" are defined as an environment in which the equipment is not exposed to excessive dust, acid fumes, damaging chemicals, salt air, rapid or frequent changes in temperature, vibration, high humidity, and extremes of temperature.

The definition of "usual service conditions" is subject to a variety of interpretations. Because of this, you are best served by adjusting maintenance and lubrication intervals based on your experience with the equipment in the actual service environment.

- 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 Siemens Service as described on page 4.

Introduction and Maintenance Intervals

Regardless of the length of the maintenance and lubrication interval, Siemens recommends that switching devices should be inspected and exercised annually.

Danger

Hazardous voltage and high speed moving parts.
Will cause death, serious injury and property damage.
De-energize and ground the equipment before working on the equipment.

For the safety of maintenance personnel as well as others who might be exposed to hazards associated with maintenance activities, the safety related work practices of NFPA 70E should always be followed when working on electrical equipment. Maintenance personnel should be trained in the safety practices, procedures and requirements that pertain to their respective job assignments. This manual should be reviewed and retained in a location readily accessible for reference during maintenance of this equipment.

The user must establish a periodic maintenance program to ensure trouble-free and safe operation. The frequency of inspection, periodic cleaning, and preventive maintenance schedule will depend upon the operation conditions. NFPA Publication 70B, "Electrical Equipment Maintenance" may be used as a guide to establish such a program.
A preventive maintenance program is not intended to cover reconditioning or major repair, but should be designed to reveal, if possible, the need for such actions in time to prevent malfunctions during operation.

Switchgear assemblies are enclosed on all sides and top with sheet metal. Access into the enclosure is provided by doors or removable covers. Although the bus and connections may be covered with insulating materials in metal-enclosed switchgear assemblies, it is a coordinated insulation system; insulation plus air or creep distance equals a given insulation level.

10.1 Recommended Hand Tools

SIMOSEC switchgear uses metric fasteners. For additional information call Siemens.
10.2 Recommended Maintenance and Lubrication

Periodic maintenance and lubrication should include all the tasks shown in the table below.

**WARNING**

Failure to properly maintain the equipment could result in death, serious injury and product failure, as well as prevent successful functioning of connected apparatus.

The instructions contained herein should be carefully reviewed, understood, and followed.

The maintenance tasks in the following table must be performed regularly.

1. Before any maintenance work is performed within primary compartments, make certain that the equipment is completely de-energized, tested, grounded, tagged or properly identified and released for work in an authorized manner.

2. Before starting work on the switchgear, the following should be completed on any equipment that will affect the area of the work:
   - Disable remote control and automatic transfer schemes.
   - De-energize all direct and back feed power and control sources, test and ground.
   - Disconnect all voltage and control power transformers.
   - Open all disconnects.
   - Ground outgoing circuits.

3. Include the following items in your inspection procedure:
   - Check general condition of switchgear installation.
   - Inspect switchgear interior for accumulation of dust, dirt or any foreign matter.
   - Examine indicating lamps and replace as required.
   - Check terminal block contacts for loose connections.
   - Check instrument and control switches and inspect their contacts.
   - Check for proper condition of instrument transformers. Replace burned out fuses, if any. Check primary and secondary connections.
   - Remove dust and other contaminants from all insulators and insulation.
   - Inspect bus bars and connections for proper condition. If bus bars are overheating check for poor or loose connections or for overload.
   - Examine all safety interlocks.
   - Check space heaters and thermostat (if equipped) for proper operation.
   - Maintain other equipment per their respective instruction book requirements.
   - Replace, reassemble, re-insulate, return all items to proper operating conditions and remove grounds prior to energization.

The list of tasks in the table does not represent an exhaustive survey of maintenance steps necessary to ensure safe operation of the equipment. Particular applications may require further procedures. Should further information be desired or should particular problems arise which are not covered sufficiently for the Purchaser's purposes, the matter should be referred to the local Siemens sales office.
10.3 Cleaning the switchgear

Most of the plastics and synthetics used in insulation systems are attacked by solvents containing aromatics or halogenated hydrocarbons. The use of these may cause crazing and deformation of the material reducing the dielectric strength. **Use only water and household cleaner to clean insulation.**

<table>
<thead>
<tr>
<th>Cleaning agents and cleaning aids</th>
<th>Contents</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>WD40</td>
<td>Water-resistant spray-oil</td>
<td>Corrosion protection for sliding parts</td>
</tr>
<tr>
<td>Household cleaner and water</td>
<td></td>
<td>Cast-resin parts, control panels, covers, transformers</td>
</tr>
<tr>
<td>Brush</td>
<td></td>
<td>Dust</td>
</tr>
<tr>
<td>Lint-free cleaning rag</td>
<td></td>
<td>Humid cleaning, drying</td>
</tr>
<tr>
<td>Vacuum cleaner</td>
<td></td>
<td>Drilling chips, rubble, dust</td>
</tr>
</tbody>
</table>

To clean the switchgear or single components please use the recommended cleaning agents and aids.
10.4 Checking corrosion protection
Scratches, impacts or bare spots in the surface painting of the switchgear enclosure can produce corrosion.

<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 “Light Basic SN700”</td>
<td>Scratches, impacts, bare spots</td>
</tr>
<tr>
<td>8DX2 012</td>
<td>Paint tin in color “Light Basic SN700”</td>
<td>Scratches, impacts, bare spots</td>
</tr>
<tr>
<td>on request</td>
<td>Paint pen in color “light gray No. 61 per ASTM D1535-97 (Munsell notation 8.3 G6.10V0.54)”</td>
<td>Scratches, impacts, bare spots</td>
</tr>
<tr>
<td>on request</td>
<td>Paint tin in color “light gray No. 61 per ASTM D1535-97 (Munsell notation 8.3 G6.10V0.54)”</td>
<td>Scratches, impacts, bare spots</td>
</tr>
</tbody>
</table>

10.5 Returning SIMOSEC switchgear to service
Follow the procedures given in “Placing SIMOSEC switchgear into service” (see Installation, Page 33).

11 Access to the switchgear

11.1 Identifying the panel
The accessibility, safety measures and work operations are dependent on the panel type. Identify the panel type and proceed accordingly.
11.2 Removing the cable compartment cover

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

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

Open interlocked cable compartment door

⇒ Check panel grounding (see Operation, Page 50).

![Fig 28: Position of grounding contacts with discharging switch in "CLOSED" position](image1)

![Fig 29: Position of grounding contacts with discharging switch in "OPEN" position](image2)

![Fig 30: Switch-disconnector positions using view port](image3)

**WARNING**

Risk of eye injury.

Eye protection required.

Do not look into viewport during switching operation. Arcing during switch operations may damage your eyes.
Verify that the grounding switch is closed—i.e., that the movable discharge switch contacts are touching the lower fuse contacts - through the inspection window of the cable compartment cover, or that the moving contacts of the switch-disconnector are in the “GRD” (“grounded”) position.

Push interlocking lever upwards and hold in this position.

Open the cable compartment door.

Release the interlocking lever.
Open screwed-on cable compartment door

LOBAL Check panel grounding (see Operation, Page 50).

LOCAL Remove the screw in the middle of the door handle securing the cable compartment door.

Fig 33: Screwed-on cable compartment door

LOCAL Open the screwed-on cable compartment door.

Close the cable compartment door
To close the cable compartment door, proceed in reverse order.

Remove the screwed-on cable compartment cover

LOBAL Check panel grounding (see Installation, Page 50).

LOCAL Remove the 4 screws in the corners of the cable compartment cover.

Fig 34: Screwed-on cable compartment cover

LOCAL Remove the screwed-on cable compartment cover.

Replace the screwed-on cable compartment cover
To replace the screwed-on cable compartment cover, proceed in reverse order.
11.3 Removing the cover of the compartment for customer low voltage equipment

Removing the compartment cover

⇒ Remove the screws that secure the compartment cover.
⇒ Remove the compartment cover.

Fig 35: Access to the compartment for customer low voltage equipment
11.4 Removing the cover of the bus bar compartment

**DANGER**

Hazardous voltage.
Will cause death, serious injury and equipment damage.

De-energize and ground high voltage conductors within switchgear before working on or near the conductors.

1. Remove the screws on the bus bar compartment cover.
2. Remove the bus bar compartment cover.

**Fig 36:** Access to bus bar compartment

- Remove the screws on the bus bar compartment cover.
- Remove the bus bar compartment cover.

12 Testing

12.1 Verification of grounding

The integrity of ground connections should be verified before performing any tests.

Check the following at each panel:

- All grounding connections properly made.
- Proper operation of grounding switches. Check that all three movable grounding contacts of the discharging switch touch the cable termination point as shown in figure 28, and that the moving contact of switch-disconnectors are in the “GRD” (“grounded”) position as shown in figure 30.
12.2 Verification of correct terminal-phase connections

The three-position switch-disconnector of the feeder to be tested must be in “OPEN” position. The switchgear main bus bar must be energized. The outgoing circuit must also be energized from the remote source (not by closing the three-position switch-disconnector).

Verify correct terminal-phase connections at the capacitive test sockets of the panel to be tested as compared to the test sockets of an adjacent panel connected to the same main bus bar, and whose three-position switch-disconnector is closed. The phase connections are verified 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.

Fig 37: Use of electronic phase comparer

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.

12.3 Cable testing

For cable testing, the operating and installation instructions of SIMOSEC switchgear must be observed as well as the specifications and recommendations of the cable and cable termination manufacturers.

Voltage transformers or surge arresters connected to the circuit to be tested must be removed or disconnected.
SIMOSEC switchgear is designed for rated voltages up to 27.6 kV and the connected cable can be tested with a DC test voltage of up to 72 kV for cable tests. During this test, the main bus bar voltage can be energized at normal system AC voltage up to 27.6 kV.

Do not exceed test voltage recommended by the cable manufacturer.

<p>| Rated voltage of | DC test voltage, | VLF* test voltage | VLF* test voltage |</p>
<table>
<thead>
<tr>
<th>switchgear</th>
<th>maximum value</th>
<th>cosine-rectangular waveform rms (peak) voltage</th>
<th>sinusoidal waveform rms (peak) voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 kV</td>
<td>55 kV</td>
<td>22 (22) kV</td>
<td>16 (22) kV</td>
</tr>
<tr>
<td>27.6 kV</td>
<td>72 kV</td>
<td>33 (33) kV</td>
<td>23 (33) kV</td>
</tr>
</tbody>
</table>

* Very Low Frequency. Refer to IEEE Std. 400.2-2004, "IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF).* For cosine-rectangular waveform, the rms value is taken as equal to the peak value. For sinusoidal waveform, the rms value is 0.707 times the peak value if distortion is less than 5%.

“IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF).” For cosine-rectangular waveform, the rms value is taken as equal to the peak value. For sinusoidal waveform, the rms value is 0.707 times the peak value if distortion is less than 5%.

Preconditions for testing:

- Three-position switch in "OPEN" position

Procedure to be followed for cable testing:

- Isolate the panel feeder to be tested.
- Isolate all sources of voltage from the cable circuit to be tested, and lockout switching devices to prevent re-energization.
- Verify safe isolation from sources of voltage.
- Ground the cable to be tested.
- OPEN compartment coverdoor (see Maintenance, Page 39).
- Connect source of test voltage to the cable connection point of cable to be tested.
- Switch switching devices of panel to be tested to test position (OPEN position).
- Test cable in accordance with instructions of the test equipment manufacturer.
- Do not exceed test voltage recommended by the cable manufacturer.
- After test is complete, ground the cable that was tested.
- Remove test connections from the cable connection point.
- Reinstall the cable compartment cover.

The cable has been tested. Other panels can be tested, or the panel can be put into operation again.
12.4 Cable sheath testing

-generic DANGER

Hazardous voltage.
Will cause death, serious injury and equipment damage.
De-energize and ground high voltage conductors within switchgear before working on or near the conductors.

¬ Isolate the panel feeder to be tested.
¬ Isolate all sources of voltage from the cable circuit to be tested, and lockout switching devices to prevent re-energization.
¬ Verify safe isolation from sources of voltage.
¬ Ground the cable to be tested.
¬ Remove the cable compartment cover (see Maintenance, Page 39).
¬ Isolate the cable shield from the ground connection.
¬ Perform cable shield test in accordance with cable manufacturer’s recommendations.
¬ Reconnect the cable shield to ground.
¬ Reinstall the cable compartment cover.

The cable shield has been tested. Other cable shields can be tested, or the panel can be put into operation again.

13 Replacing HV HRC (current limiting) fuses

Always replace the HV HRC (current limiting) fuses in 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 here.

-generic DANGER

Hazardous voltage.
Will cause death, serious injury and equipment damage.
De-energize and ground high voltage conductors within switchgear before working on or near the conductors.

13.1 Preparing fuse replacement

¬ Ground transformer panel (see Operation, Page 45).
¬ Remove cable compartment cover (see Maintenance, Page 39).

The cable connection compartment with the HV HRC (current limiting) fuse links is accessible.
13.2 Removing HV HRC (current limiting) fuse link

**Caution**

Burn Hazard
May cause skin burns

Allow fuse to cool before handling, or use appropriate protection while handling fuses which are at high temperature.

1. Grasp the HV HRC (current limiting) fuse in the lower portion of the fuse body.
2. Pull the HV HRC (current limiting) fuse towards the front of the panel to release the fuse from the fuse clips.

The HV HRC (current limiting) fuse has been removed.

13.3 Checking the fuse tripping mechanism

When first placing the SIMOSEC switchgear into service and before installing replacement HV HRC (current limiting) fuse, check the tripping behavior of the switch-disconnector in all three phases, preferably 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 and grounded, including the bus bars.
Install test fuse instead of the HV HRC (current limiting) fuse.

Close switch-disconnector.

Trip striker pin of test fuse.

Verify that the striker pin of the test fuse trips the switch-disconnector and that the switch-disconnector is in the “TRIPPED” position.

Open switch-disconnector.

Verify by control the movement of the switch position indication (see Fig. 5: Switch position indication, page 11) that the tripping mechanism is charged. While switching the three-position switch from CLOSED to OPEN position the switch position indicator changes from TRIPPED to OPEN. This means that the stored-energized mechanism is pre-charged.
13.4 Installing the HV HRC (current limiting) fuses

Caution

Use of incorrect fuses may cause damage to equipment.

Use only the make, model and rating of fuses for which the panel was designed. Fuses must have the correct dimensions and current ratings. Fuses must be installed with striker pin pointing upwards.

Select correct HV HRC fuse as shown on switchgear drawings.

Grasp HV HRC (current limiting) fuse in the middle of the fuse body, with the fuse striker pin upwards.

With the fuse tilted as needed, insert the upper end of the fuse in the upper clip, and then move the fuse to vertical and install the lower end of the fuse in the lower fuse clip.

Check that the fuse is installed uniformly into both the upper and lower fuse clips.

13.5 Completing fuse replacement

Install cable compartment cover (see Maintenance, Page 39).

Put fuse switch panel into operation (see Installation, Page 33).
14 Switchgear recycling

The switchgear is an environmentally compatible product.

The switchgear can be disposed of in an environmentally compatible manner in compliance with existing legislation. Always observe the local laws, regulations, guidelines and standards for work, health and environmental protection.

The components of the switchgear should be recycled in an environmentally compatible way by dismantling into sorted scrap and residual mixed scrap. For this purpose, evacuate the SF$_6$-gas professionally and have it recycled.

The switchgear mainly consists of the following materials:
- Galvanized steel (enclosure and operating mechanisms)
- Stainless steel (vessel)
- Copper (conductor bars)
- Silver (contacts)
- Cast-resin epoxy (bushings and post insulators)
- Plastic material (arching chamber and fuse tripping mechanism)
- Sulphur hexafluoride (SF$_6$)
- Silicone rubber

The switchgear does not contain hazardous materials.

Auxiliary devices such as short-circuit indicators, relays, instruments, etc., should be disposed of as electronic scrap.

Batteries have to be disposed of professionally.

As for disposal of SF$_6$ gas and further information, please contact Siemens Service as described on page 4.

15 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.

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 contact Siemens Service immediately as described on page 4.

Please provide the following data to help us in answering the issue.
- Type, serial and panel number of the switchgear (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).
Index

A
Accessories .................................................. 24

B
Bay controller - SIPROTEC 4 ............................. 16
Busbars ...................................................... 20
Bus-type current transformer ............................ 14

C
Cable compartment cover - removing .................. 39
Cable connection ........................................... 20
Cable sheath testing ........................................ 46
Cable terminations .......................................... 33
Cable testing ................................................ 44
Cable-type current transformer .......................... 14
Cleaning the switchgear .................................... 37
Closing lock-out ............................................. 18
Components .................................................. 9
Control equipment ......................................... 15
Control gate - three-position switch .................... 18
Correct terminal-phase connections - verification .... 44
Corrosion protection - ensuring ......................... 38
Cover of busbar compartment - removing .............. 43
Cover of compartment for customer low voltage
  equipment - removing ................................... 42
Current transformer ........................................ 14

D
De-grounding lock-out ..................................... 18
Description ................................................ 6
Disposal ..................................................... 50

E
Electrical data ............................................... 26
Environmental protection .................................. 50

F
Fuse - fitting ................................................ 49
Fuse - removing .......................................... 47
Fuse replacement - completing .......................... 49
Fuse replacement - preparing ............................ 46
Fuse tripping mechanism - checking ................... 47
Fuses - replacing ......................................... 46

H
Help ........................................................... 50
HR system .................................................. 24
HV HRC (current limiting) fuse - installing .......... 49
HV HRC (current limiting) fuse - removing .......... 47
HV HRC (current limiting) fuse - replacing .......... 46
HV HRC (current limiting) fuse assembly ............ 16

I
Instrument transformer ................................... 14
Insulating capacity ....................................... 31
Interlocked cable compartment door ..................... 39
Interlocks ................................................... 18

L
Local-remote switch ...................................... 15
Locking device ............................................ 18
LRM system .............................................. 24

M
Maintenance .............................................. 34
Maintenance - switchgear ................................ 34
Mimic diagram ............................................ 15

O
Operating mechanisms - three-position switches .... 10

P
Panel - identification .................................... 38
Panel versions ........................................... 8
Protection against electric shock ......................... 28
Protection against ingress of water ..................... 28
Protection against solid foreign bodies ................. 28
Protection equipment .................................... 15

R
Rating plate ............................................... 21
Ready-for-service indicator .............................. 22
Recycling - switchgear .................................. 50

S
Safety instructions ......................................... 4
Service conditions ....................................... 30
Service location .......................................... 29
SF6-gas ................................................... 22
SIPROTEC 4 ............................................. 16
Site altitude .............................................. 31
Standards ................................................ 29
Switchgear - cleaning ................................... 37
Switchgear access .......................................... 38
Switchgear features ...................................... 6

T
Technical data ............................................ 26
Testing .................................................... 43
Three-phase current transformer ......................... 14
Three-position switch-disconnector ...................... 9
Three-position switches - operating mechanisms .... 10
Tightening torques ....................................... 27
Torques .................................................... 27
Transformer protection .................................. 32
Transport regulations ..................................... 29

V
Voltage detection systems ................................ 23
Voltage transformer ...................................... 14