Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable
Medium-Voltage Switchgear
Application

Typical uses

Example
Transfer switchgear with integrated low-voltage niche

Utilities transfer substation for industrial plants
Contents

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Medium-Voltage Switchgear
Catalog HA 41.43 · 2018

Invalid: Catalog HA 41.43 · 2017

siemens.com/medium-voltage-switchgear
siemens.com/SIMOSEC

The products and systems described in this catalog are manufactured and sold according to a certified management system (acc. to ISO 9001, ISO 14001 and BS OHSAS 18001).
SIMOSEC switchgear is a factory-assembled, type-tested, three-phase, metal-enclosed, indoor switchgear according to IEC 62271-200 *) and GB 3906 *) for single busbars.

Typical uses
SIMOSEC switchgear is used for power distribution in distribution systems with busbar currents up to 1250 A. The modular, space saving design enables application in:
- Substations, customer transfer substations, distribution substations and switching substations of power supply and public utilities
- Public buildings, such as high-rise buildings, railway stations, hospitals
- Industrial plants.

Typical applications
- Wind power stations
- High-rise buildings
- Airports
- Underground railway stations
- Sewage treatment plants
- Port facilities
- Traction power supply systems
- Automobile industry
- Petroleum industry
- Chemical industry
- Unit-type heating power stations
- Textile, paper and food industries
- Emergency power supply installations
- Shopping centers and data centers.

Modular design
- Individual panels, for free combination and extension
- Option: Low-voltage compartments can be supplied in two overall heights
- Circuit-breaker panels for various applications.

Reliability
- Type and routine-tested *)
- No cross insulation between phases
- Standardized and manufactured using numerically controlled machines
- Quality management system according to DIN EN ISO 9001
- More than 100,000 switchgear components in operation worldwide for many years.

Personal safety
- All switching operations can be performed with closed panel front
- Metal-enclosed LSC 2 panels
- HV HRC fuses and cable sealing ends are only accessible when the outgoing feeders are earthed
- Logical mechanical interlocking
- Capacitive voltage detecting system for verification of safe isolation from supply
- Earthing of outgoing feeders by means of make-proof earthing switches
- Partition class: PM (metallic partition).

Compact design
Thanks to the use of gas-insulated switching-device vessel compact dimensions are possible. Thus:
- Existing switchgear rooms can be used effectively
- New constructions cost little
- Costly city-area space is saved.

Security of operation
- Components, e.g. operating mechanisms, three-position switches, vacuum circuit-breakers proven for years
- LSC 2 panels:
  - Panels with metallic partition (metal-clad) between busbar and switching device and between switching device and cable compartment (R, T, L)
  - Panels with metallic partition between switching device and busbar compartment
- Metal-enclosed switching-device vessel with three-position switch, gas-insulated
  - Welded sealed-for-life switching-device vessel
  - No cross insulation between phases
  - With welded-in rotary bushings for operation
  - Three-position switch-disconnector with gas-insulated switching functions
  - Three-position disconnector, gas-insulated
  - Switching functions CLOSE-OPEN-EARTH
- Operating mechanisms of switching devices accessible outside the switching-device vessel
- Maintenance-free operating mechanism parts (IEC 62271-1/VDE 0671-1 *) and GB 11022 *)
- Mechanical position indication integrated in mimic diagram
- Switchgear interlocking system with logical mechanical interlocks
- Partition class: PM (metallic partition).

Reavailability
- Three-position switch-disconnector with gas-insulated, maintenance-free quenching principle
- Metallic partition between busbar compartment, switching devices and cable compartment
- Separate pressure relief for each compartment
- Cable testing without the need to isolate the busbar
- Mounting location of three-phase current transformer for selective disconnection of circuit-breaker feeders.

*) For standards, see page 72
Cost-efficiency
Low “lifecycle costs” and high availability throughout the entire product service lifecycle as a result of:
• Minimum space requirement
• Easy switchgear extension, without gas work
• Maintenance-free gas-insulated switching functions of the three-position switch (gas-insulated quenching principle)
• Vacuum circuit-breaker
• Modular product range and design, e.g. circuit-breaker panels
• Low maintenance
• Option: Numerical multifunction protection relay (SIPROTEC protection device family, optionally external makes).

Quality and environment
• Quality and environmental management system according to DIN EN ISO 9001 and DIN EN ISO 14001
• Easy switchgear extension, without gas work on site
• Minimum space requirements.

Service life
Under normal operating conditions, the expected service life of air-insulated switchgear SIMOSEC is at least 35 years, probably 40 to 50 years, taking the tightness of the hermetically welded switching-device vessel into account. The service life is limited by the maximum number of operating cycles of the switchgear devices installed:
• For circuit-breakers, according to the endurance class defined in IEC 62271-100
• For three-position disconnectors and earthing switches, according to the endurance class defined in IEC 62271-102
• For three-position switch-disconnectors, according to the endurance class defined in IEC 62271-103.

Technology
• Air-insulated indoor switchgear
• Gas-insulated, maintenance-free switching functions for the three-position switch as switch-disconnector
• Partition class: PM (metallic partition)
• Three-pole primary enclosure
• Phases arranged one behind the other
• No cross insulation between phases
• Busbar system at the top
• Air-insulated busbar and cable connection system
• Three-position switch, metal-enclosed, with air-insulated primary terminals and gas-insulated switching functions
• Vacuum circuit-breaker, metal-enclosed, up to 1250 A, fixed-mounted in gas-insulated switching-device vessel
• Option: Vacuum circuit-breaker (type 3A_), air-insulated, up to 1250 A, removable design: Easy to remove after loosening the fixing bolts
• Hermetically-sealed by welded, stainless-steel switching-device vessel
  – For switching devices
  – With insulating gas SF₆ (fluorinated greenhouse gas).

Insulating system
• Switching-device vessel filled with SF₆ gas
• Features of SF₆ gas:
  – Non-toxic
  – Odorless and colorless
  – Non-inflammable
  – Chemically neutral
  – Heavier than air
  – Electronegative (high-quality insulator)
  – Global Warming Potential GWP = 22,800
• Pressure of SF₆ gas in the switching-device vessel (absolute values at 20 °C):
  – Rated filling level: 140 kPa
  – Design pressure: 180 kPa
  – Design temperature of the SF₆ gas: 80 °C
  – Operating pressure of bursting disc: ≥ 270 kPa
  – Bursting pressure: ≥ 550 kPa
  – Gas leakage rate: < 0.1 % per year.

Panel design
• Factory-assembled, type-tested
• Metal-enclosed, with metallic partitions
• LSC 2 panels, LSC 1 panels (without isolating distance)
• Pressure relief
  – To the rear and upwards
  – Separately for each compartment
• Air-insulated cable connection system for conventional cable sealing ends
• Option: Three-phase current transformer, factory-assembled on the feeder bushings
• Integrated low-voltage niche (standard) for installation of, e.g.
  – Terminals, MCBs, pushbuttons
  – Protection devices
• Option: Top-mounted low-voltage compartment
• Option: Panel heating for severe ambient conditions, e.g. condensation.

Standards (see page 72)
Electrical features
- Rated voltages up to 24 kV
- Rated short-time withstand current up to 25 kA
- Rated normal current of feeders
  - Up to 800 A, e.g. for ring-main, metering panels
  - Up to 1250 A, for circuit-breaker panels
  - Up to 1250 A, for bus sectionalizer panels
- Rated normal current of busbar up to 1250 A.

SIMOSEC switchgear is a factory-assembled, type-tested, metal-enclosed switchgear for indoor installation. SIMOSEC switchgear is classified according to IEC 62271-200 / VDE 0671-200.

Design and construction

<table>
<thead>
<tr>
<th>Partition class</th>
<th>PM (metallic partition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of service continuity category Panels</td>
<td></td>
</tr>
<tr>
<td>– With HV HRC fuses [T, M(VT-F), …]</td>
<td>LSC 2</td>
</tr>
<tr>
<td>– Without HV HRC fuses (R, L, D, …)</td>
<td>LSC 2</td>
</tr>
<tr>
<td>– Metering panels type M or H1 or bus riser panel type H</td>
<td>LSC 1</td>
</tr>
</tbody>
</table>

| Accessibility to compartments (enclosure) | |
| – Busbar compartment | Tool-based |
| – Switching-device compartment | Non-accessible |
| – Switching-device compartment with removable circuit-breaker | Interclock-controlled |
| – Low-voltage compartment (Option) | Tool-based |
| – Cable compartment for panels: | |
| – Without HV HRC fuses (R, L, …) | Interclock-controlled |
| – With HV HRC fuses (T, …) | Interclock-controlled |
| – Cable feeder (K) | Tool-based |
| – Metering panel (air-insulated) (M, …H) | Tool-based |

Internal arc classification (option)

| The following internal arc classifications are fulfilled: | |
| IAC A FL(R), I_{SC}, t | |

| IAC = Internal arc classification | |
| Type of accessibility: A | |
| – F | Switchgear in closed electrical service location, access “for authorized personnel only” (according to IEC 62271-200) |
| – L | Front |
| – R | Lateral Rear (for free-standing arrangement) |

| Arc test current I_{SC} | Up to 21 kA |
| Test duration t | 1 s |
### Common electrical data

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$ kV</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-dur. power-frequency withstand voltage $U_d$ kV</td>
<td>20</td>
<td>28, 42 *)</td>
<td>38</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td>23</td>
<td>32, 48 *)</td>
<td>45</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>60</td>
<td>75</td>
<td>95</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current $I_{k}$ up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
<td>16</td>
</tr>
<tr>
<td>for rated duration of short-circuit $t_k = 1$ s, $2$ s *)</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>21</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$ up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
</tr>
<tr>
<td>for rated duration of short-circuit $t_k = 3$ s (20 kA/4 s *)</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>21</td>
</tr>
<tr>
<td>for rated duration of short-circuit $t_k = 3$ s</td>
<td>55</td>
<td>65</td>
<td>55</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Rated frequency $f_r$ Hz</td>
<td>50/60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated normal current $I_{n}$ ***) for busbar Standard</td>
<td>A</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>A</td>
<td>800, 1250</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Pressure values, temperature

| Pressure in gas-insulated switching-device vessel for SF6 gas-insulated switching devices (pressure values at 20 °C) | Rated filling level for insulation $p_{re}$ (absolute) kPa | 140 |
| Minimum functional level for insulation $p_{me}$ (absolute) kPa | 120 |
| Signal of filling level for insulation $p_{ae}$ (absolute) kPa | 120 |
| Minimum functional level for switching $p_{sw}$ (absolute) kPa | 120 |
| Ambient air temperature $T$ (minimum/maximum air temperature depends on the secondary equipment used) | Operation: Standard °C | –5 to +55 1) |
| | Option °C | –25, –25 1) |
| Storage/transport | Standard °C | –5 to +55 1) |
| | Option °C | –25, +70 1) |
| | Option *) °C | –40 |

#### Degree of protection

- for gas-filled switching-device vessel IP65
- for switchgear enclosure IP2X/IP3X  *)
- for low-voltage compartment IP3X/IP4X  *)

*) As design option, according to some national requirements (e.g.: GOST, GB, ...)

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.
The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

1) Depending on the secondary equipment used

△) If panel heating available
### Common electrical data of the switchgear panels

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$</th>
<th>kV</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
</table>

### Ring-main panel types R, R1, R(T), R1(T), cable panel types K and K1 ³)

<table>
<thead>
<tr>
<th>Rated normal current $I_n$ **</th>
<th>Standard</th>
<th>A</th>
<th>630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option</td>
<td>A</td>
<td>800, 1250 for type K1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>Rated short-time withstand current $I_{k}$</th>
<th>for rated duration of short-circuit $t_k = 1 s, 2 s^*$</th>
<th>up to kA</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>25</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit $t_k = 3 s (4 s^*)$</td>
<td>up to kA</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>16</td>
<td>20</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{pk}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>40</td>
<td>50</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{max}$</td>
<td>for ring-main feeders</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>40</td>
<td>50</td>
<td>63</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>60 Hz</th>
<th>Rated short-time withstand current $I_{k}$</th>
<th>for rated duration of short-circuit $t_k = 1 s, 2 s^*$</th>
<th>up to kA</th>
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<th>25</th>
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<th>16</th>
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<td></td>
<td>for rated duration of short-circuit $t_k = 3 s (4 s^*)$</td>
<td>up to kA</td>
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<td>–</td>
<td>16</td>
<td>20</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{pk}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>42</td>
<td>52</td>
<td>65</td>
<td></td>
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<td>65</td>
<td>65</td>
<td>42</td>
<td>52</td>
<td>65</td>
</tr>
</tbody>
</table>

### Transformer panel types T, T1, T(T) as switch-fuse combination according to IEC 62271-105

<table>
<thead>
<tr>
<th>Rated normal current $I_n$ **³)</th>
<th>Standard</th>
<th>A</th>
<th>200</th>
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<tr>
<td>Option</td>
<td>A</td>
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</table>

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>Rated short-time withstand current $I_{k}$</th>
<th>for rated duration of short-circuit $t_k = 1 s, 2 s^*$</th>
<th>up to kA</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>25</th>
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<th>20</th>
<th>25</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit $t_k = 3 s (4 s^*)$</td>
<td>up to kA</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
<td>16</td>
<td>20</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{pk}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
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<td>63</td>
<td></td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{max}$</td>
<td>for transformer feeders</td>
<td>up to kA</td>
<td>52.5</td>
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<tr>
<th>60 Hz</th>
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<th>up to kA</th>
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<td>21</td>
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<td>20</td>
<td>–</td>
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<td>65</td>
<td>65</td>
<td>42</td>
<td>52</td>
<td>65</td>
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</table>

### Disconnector panel types D1, D1(T)

<table>
<thead>
<tr>
<th>Rated normal current $I_n$ **</th>
<th>Standard</th>
<th>A</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option</td>
<td>A</td>
<td>630</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>Rated short-time withstand current $I_{k}$</th>
<th>for rated duration of short-circuit $t_k = 1 s, 2 s^*$</th>
<th>up to kA</th>
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<td>21</td>
<td>–</td>
<td>16</td>
<td>20</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{pk}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
<td>40</td>
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<td>20</td>
<td>–</td>
</tr>
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<td>Rated peak withstand current $I_{pk}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
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<td>55</td>
<td>65</td>
<td>65</td>
<td>42</td>
<td>52</td>
<td>65</td>
<td></td>
</tr>
</tbody>
</table>

### Technical Data

- ***) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)
- **) The rated normal currents apply to ambient air temperatures of max. 40 °C.
- The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)

1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link), earthing switch at the feeder: see page 11
2) On request: Panel types K and K1, each with make-proof earthing switch
3) Busbar

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* • possible
  – not possible

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### Common electrical data of the switchgear panels

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage U_r (kV)</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
</table>

#### Circuit-breaker panel 2) types L, L1, L(T), L1(T)

<table>
<thead>
<tr>
<th>Rated normal current I_r (**)</th>
<th>Standard: L, L(T), L1, L1(T)</th>
<th>A 630</th>
<th>Option: L1, L1(T)</th>
<th>A 1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
</tbody>
</table>

#### Metering panel types M, bus riser panel types H, H1

<table>
<thead>
<tr>
<th>Rated normal current I_r (**) for:</th>
<th>Standard: M, M(-K), M(-B), M(-BK), H, M(KK), H1</th>
<th>A 630</th>
<th>Option: M, M(-K), M(-B), M(-BK), H, H1</th>
<th>A 800, 1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
</tbody>
</table>

#### Circuit-breaker panel types L1(r), L2(r), L1(r, T), L2(r, T)

<table>
<thead>
<tr>
<th>Rated normal current I_r (**)</th>
<th>Standard: L1(r), L1(r, T)</th>
<th>A 630</th>
<th>Option: L2(r), L2(r, T)</th>
<th>A 1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz</td>
<td>Rated short-time withstand current I_s</td>
<td>up to kA</td>
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<td>25</td>
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<tr>
<td></td>
<td>Rated peak withstand current I_p</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current I_{ma}</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit breaking current I_{sc}</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
</tr>
</tbody>
</table>

- possible
- not possible

*) As design option, on request according to some national requirements (e.g.: GOST, GB, …)
***) The rated normal currents apply to ambient air temperatures of max. 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62271 -1/VDE 0671 -1)

2) With vacuum circuit-breaker in gas-filled switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)

Δ) 1250 A in preparation
Common electrical data of the switchgear panels

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage U_r [kV]</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
</table>

**Busbar voltage metering panel types M(VT-F), M1(VT-F)**

<table>
<thead>
<tr>
<th>Rated normal current ( I_{r} ) <strong>(1)</strong></th>
<th>Standard</th>
<th>A</th>
<th>200</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>Rated short-time withstand current ( I_{t} )</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit ( t = 1 \text{ s}, 2 \text{ s} )</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current ( I_{p} )</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>60 Hz</th>
<th>Rated short-time withstand current ( I_{t} )</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit ( t = 1 \text{ s}, 2 \text{ s} )</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current ( I_{p} )</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>42</td>
</tr>
</tbody>
</table>

**Busbar earthing panel type E**

<table>
<thead>
<tr>
<th>Rated normal current ( I_{r} ) <strong>(1)</strong></th>
<th>Standard</th>
<th>A</th>
<th>200</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>Rated short-time withstand current ( I_{t} )</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit ( t = 1 \text{ s}, 2 \text{ s} )</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current ( I_{p} )</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current ( I_{ma} )</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>63</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>60 Hz</th>
<th>Rated short-time withstand current ( I_{t} )</th>
<th>21</th>
<th>25</th>
<th>21</th>
<th>25</th>
<th>16</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>for rated duration of short-circuit ( t = 1 \text{ s}, 2 \text{ s} )</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Rated peak withstand current ( I_{p} )</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Rated short-circuit making current ( I_{ma} )</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>42</td>
</tr>
</tbody>
</table>

**Technical Data**

Electrical data of the switchgear

<table>
<thead>
<tr>
<th>Dimension of HV HRC fuse-link</th>
<th>Standard: For HV HRC fuse-link</th>
<th>application of fuses for voltage transformer protection</th>
<th>e = 292 mm</th>
<th>•</th>
<th>•</th>
<th>•</th>
<th>•</th>
<th>•</th>
</tr>
</thead>
<tbody>
<tr>
<td>For HV HRC fuse-link according to IEC / EN 60282-1/VDE 0670-4 and DIN 43625</td>
<td>e = 442 mm</td>
<td>acceptance</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

- possible
- not possible

**Footnotes:**

- (*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)
- **) The rated normal currents apply to ambient air temperatures of max. 40 °C.
  1) Depending on HV HRC fuse-link (depending on the let-through current of the HV HRC fuse-link)
  2) Busbar

**Footnotes:**

- (*) As design option, on request according to some national requirements (e.g.: GOST, GB, \( i_{load} = 800 \text{ A} \), ...)
### Three-position switch-disconnector

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage $U_{rd}$</td>
<td>kV</td>
<td>20</td>
<td>23</td>
<td>28, 42 *)</td>
<td>32, 48 *)</td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td></td>
<td></td>
<td></td>
<td>38</td>
<td>45</td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td></td>
<td></td>
<td>50</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage $U_{ib}$</td>
<td>kV</td>
<td>60</td>
<td>70</td>
<td>75</td>
<td>85</td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated frequency $f_r$</td>
<td>Hz</td>
<td>50/60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated normal current $I_{r**}$</td>
<td>Standard:</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option:</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated short-time withstand current $I_t$ for rated duration of short-circuit $t_k = 1 s$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Rated short-time withstand current $I_t$ for rated duration of short-circuit $t_k = 3 s$</td>
<td>up to kA</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{p}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td>Rated short-time withstand current $I_t$ for rated duration of short-circuit $t_k = 1 s$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>Rated short-time withstand current $I_t$ for rated duration of short-circuit $t_k = 3 s$</td>
<td>up to kA</td>
<td>21</td>
<td>–</td>
<td>21</td>
<td>–</td>
</tr>
<tr>
<td>Rated peak withstand current $I_{p}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>55</td>
<td>65</td>
</tr>
</tbody>
</table>

### Switching capacity for general-purpose switches according to IEC/EN 62271-103

**Test duty $TD_{load}$**
- Rated mainly active load-breaking current $I_{load}$ 100 operations $I_{load} [I_1]^{*}$ A 630
- Rated mainly active load-breaking current $I_{load}$ 20 operations $0.05 I_{load} [I_1]^{*}$ A 31.5

**Test duty $TD_{loop}$**
- Rated closed-loop breaking current $I_{loop}$ $I_{loop} [I_2]$ A 630

**Test duty $TD_{lc}$**
- Rated cable-charging breaking current $I_{lc}$ $I_{lc} [I_4]$ A 68

**Test duty $TD_{ma}$**
- Rated short-circuit making current $I_{ma}$ 50 Hz up to kA 52.5 63 52.5 63 52.5 63 40 50 63 60 Hz up to kA 55 65 55 65 55 65 42 52 65

**Test duty $TD_{def}$**
- Rated earth-fault breaking current $I_{ef}$ $I_{ef} [I_6]$ A 200
- Rated earth-fault breaking current $I_{ef}$ $I_{ef} [I_6]$ A 115

**Number of mechanical operating cycles / M-classification**
- n 1000 / M1; 2000 *) / M1

**Number of electrical operating cycles with $I_{load} / Classification**
- n 100 / E3

**Number of short-circuit making operations with $I_{ma} / Classification**
- n 5 5 5 5 5 5 5 5 5 / 2/ E2

**Number of mechanical operating cycles / M-classification**
- n 1000 (2000 *)

**M-classification**
- M0 (M1 *)

### Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102

**Rated short-time withstand current $I_k$**
- 50 Hz up to kA 21 | 25 | 21 | 25 | 21 | 25 | 16 | 20 | 25
- 60 Hz up to kA 21 | 25 | 21 | 25 | 21 | 25 | 16 | 20 | 25

**Rated short-circuit making current $I_{ma}$**
- 50 Hz up to kA 5 | 8 | 5 | 8 | 5 | 8 | 5 | 8 | 5
- 60 Hz up to kA 5 | 8 | 5 | 8 | 5 | 8 | 5 | 8 | 5

**Number of mechanical operating cycles / M-classification**
- n 1000 / M0

**Number of short-circuit making operations with $I_{ma}$ / Classification**
- n 5 5 5 5 5 5 5 5 5 5 / 2/ E2

### Switch-disconnector/fuse combination according to IEC/EN 62271-105/VDE 0671-105

**Rated voltage $U_r$**
- kV 7.2 12 17.5 24

**Rated normal current $I_{r**}$**
- A 200

**Rated transfer current $I_{transfer}$**
- A 1750 1750 1500 1400

**Maximum transformer rating**
- kVA 800 1600 1600 2500

### Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018

For footnotes, see page 10
### Make-proof earthing switch

**Technical data and switching capacity for earthing switch according to IEC/EN 62271-102/VDE 0671-102**

<table>
<thead>
<tr>
<th>Rated voltage $U_r$ (kV)</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency $f_r$ (Hz)</td>
<td>50/60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated normal current $I_{n_{ma}}$ (**), Types</td>
<td>A</td>
<td>630 or request: 800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Types</td>
<td>L1(r), L1(T)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for panel types:</td>
<td>Type L2(r), L2(r), D1, D1(T)</td>
<td>A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rated short-time withstand current $I_k$**

| 50 Hz | for rated duration of short-circuit $t_k = 1 \text{s}$, $2 \text{s}$ (*) up to kA | 20 | 25 | 20 | 25 | 20 | 25 | 16 | 20 |
| 60 Hz | for rated duration of short-circuit $t_k = 3 \text{s}$ (4 s **) up to kA | 21 | – | 21 | – | 21 | – | 16 | 20 |

**Rated peak withstand current $I_p$**

| 50 Hz | up to kA | 52.5 | 63 |
| 60 Hz | up to kA | 55 |

**Number of short-circuit making operations with $I_{ma}$**

| n | 5 |

**Classification**

| E1 | E1 |

---

*) As design option, on request according to some national requirements (e.g.: GOST, GB, ...)

**) The rated normal currents apply to ambient air temperatures of max. 40 °C. The 24-hour mean value is max. 35 °C (according to IEC 62271-1/VDE 0671-1)
Vacuum circuit-breaker

Switching capacity according to IEC/EN 62271-100/VDE 0671-100

Type CB-f 1) 4), combined with three-position disconnector, in gas-insulated switching-device vessel 4)

Type CB-r / SION L (3AE6) 1)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>7.2</th>
<th>12</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_r$</td>
<td>kV</td>
<td>7.2</td>
<td>12</td>
<td>17.5</td>
<td>24</td>
</tr>
<tr>
<td>Rated normal current $I_r$</td>
<td>A</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for circuit-breaker type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_r$ for CB-f, CB-r (SION L)</td>
<td>A</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_r$ for CB-f, CB-r (SION L)</td>
<td>A</td>
<td>800</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Rated frequency $f_r$</td>
<td>Hz</td>
<td>50/60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Hz Rated short-time withstand current $I_{kr}$ for rated duration of short-circuit $t_k = 1\text{ s}, 2\text{ s}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>50 Hz Rated short-time withstand current $I_{kr}$ for rated duration of short-circuit $t_k = 3\text{ s}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>50 Hz Rated peak withstand current $I_{kp}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td>50 Hz Rated short-circuit breaking current $I_{sc}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>50 Hz Rated short-circuit making current $I_{ma}$</td>
<td>up to kA</td>
<td>52.5</td>
<td>63</td>
<td>52.5</td>
<td>63</td>
</tr>
<tr>
<td>60 Hz Rated short-time withstand current $I_{kr}$ for rated duration of short-circuit $t_k = 1\text{ s}, 2\text{ s}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz Rated short-time withstand current $I_{kr}$ for rated duration of short-circuit $t_k = 3\text{ s}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz Rated peak withstand current $I_{kp}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>60 Hz Rated short-circuit breaking current $I_{sc}$</td>
<td>up to kA</td>
<td>21</td>
<td>25</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>60 Hz Rated short-circuit making current $I_{ma}$</td>
<td>up to kA</td>
<td>55</td>
<td>65</td>
<td>55</td>
<td>65</td>
</tr>
</tbody>
</table>

Classification and number of operating cycles for circuit-breaker according to IEC/EN 62271-100/VDE 0671-100

Circuit-breaker: CB-f NAR 3)

| Mechanical | Number of operating cycles | 2000 |
| Class | | M1 |

Circuit-breaker: CB-f AR 1); CB-r AR 1) 3)

| Mechanical | Number of operating cycles | n 10000 |
| Class | | M2 |

Classification for disconnector according to IEC/EN 62271-102/VDE 0671-102 (for panel types L, L1, …)

| Number of mechanical operating cycles | n 1000 (2000 *) |
| M-classification | M0 (M1 *) |

Classification for earthing switch according to IEC/EN 62271-102/VDE 0671-102 (for panel types L, L1, …)

| Number of mechanical operating cycles/M-classification | n 1000/M0 |
| Number of short-circuit making operations with $I_{ma}$ | n 5 |
| Classification | E2 |

*) As design option, on request according to some national requirements (e.g.: GOST, GB, …)

**) The rated normal currents apply to ambient air temperatures of max. 40 °C.

The 24-hour mean value is max. 35 °C (acc. to IEC 62271-1/ VDE 0671-1)

1) Only for CB-f

1) Definition of the different types of vacuum circuit-breakers (= VCB):

<table>
<thead>
<tr>
<th>Panel type</th>
<th>VCB type</th>
<th>Vacuum circuit-breaker – Design:</th>
<th>VCB version:</th>
<th>without AR 3)</th>
<th>with AR 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L, L1</td>
<td>CB-f</td>
<td>fixed-mounted in gas-insulated switching-device vessel, combined with three-position disconnector</td>
<td>CB-f NAR, CB-f AR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1(t), L2(r)</td>
<td>CB-r (SION L)</td>
<td>air-insulated, removable, separate three-position disconnector</td>
<td>CB-r AR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3) AR = Automatic reclosing; NAR = Non-automatic reclosing

4) VCB in switching-device vessel (maintenance-free under normal ambient conditions according to IEC 62271-1)
### Standard panels (examples)

- **Ring-main panel, type R**
- **Transformer panel, type T**
- **Circuit-breaker panel**
  - Type L with CB type "CB-f NAR" (500 mm)

### Application as:

<table>
<thead>
<tr>
<th>Panel designation</th>
<th>Panel type</th>
<th>Panel width mm</th>
<th>Rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ring-main panel</strong></td>
<td>R</td>
<td>375</td>
<td>630 A, 800 A</td>
</tr>
<tr>
<td></td>
<td>R1</td>
<td>500</td>
<td>630 A, 800 A</td>
</tr>
<tr>
<td><strong>Transformer panel</strong></td>
<td>T</td>
<td>375</td>
<td>200 A</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>500</td>
<td>200 A</td>
</tr>
<tr>
<td><strong>Cable panel</strong></td>
<td>K</td>
<td>375</td>
<td>630 A</td>
</tr>
<tr>
<td></td>
<td>K1</td>
<td>500</td>
<td>630 A, 1250 A</td>
</tr>
<tr>
<td><strong>Circuit-breaker panel</strong></td>
<td>L</td>
<td>500</td>
<td>630 A</td>
</tr>
<tr>
<td>(fixed-mounted CB, gas-insul.)</td>
<td>L1</td>
<td>750</td>
<td>630 A, 1250 A</td>
</tr>
<tr>
<td><strong>Circuit-breaker panel</strong></td>
<td>L1</td>
<td>750</td>
<td>630 A</td>
</tr>
<tr>
<td>(removable CB) &quot;CB-r&quot;</td>
<td>L2(r)</td>
<td>875</td>
<td>1250 A</td>
</tr>
<tr>
<td><strong>Disconnector panel</strong></td>
<td>D1</td>
<td>500</td>
<td>1250 A</td>
</tr>
</tbody>
</table>

### Column No.

<table>
<thead>
<tr>
<th>Cable feeder panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
<tr>
<td>R1</td>
</tr>
<tr>
<td>T</td>
</tr>
<tr>
<td>T1</td>
</tr>
<tr>
<td>K</td>
</tr>
<tr>
<td>K1</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2(r)</td>
</tr>
<tr>
<td>D1</td>
</tr>
</tbody>
</table>

### Transfer panels

<table>
<thead>
<tr>
<th>Transfer panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(T)</td>
</tr>
<tr>
<td>R1(T)</td>
</tr>
<tr>
<td>L(T)</td>
</tr>
<tr>
<td>L1(T)</td>
</tr>
<tr>
<td>L1(r, T)</td>
</tr>
<tr>
<td>L2(r, T)</td>
</tr>
<tr>
<td>D1(T)</td>
</tr>
</tbody>
</table>

### Metering panels and other panel versions

<table>
<thead>
<tr>
<th>Metering panels and other panel versions</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
</tr>
<tr>
<td>M(K)</td>
</tr>
<tr>
<td>M(B)</td>
</tr>
<tr>
<td>M(BK)</td>
</tr>
<tr>
<td>M(KK)</td>
</tr>
<tr>
<td>M(VT)</td>
</tr>
<tr>
<td>M1(VT)</td>
</tr>
<tr>
<td>M2(VT)</td>
</tr>
<tr>
<td>M1(VT-F)</td>
</tr>
<tr>
<td>M2(VT-F)</td>
</tr>
<tr>
<td>H</td>
</tr>
<tr>
<td>H1</td>
</tr>
</tbody>
</table>

### Busbar earthing panel

<table>
<thead>
<tr>
<th>Busbar earthing panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
</tr>
<tr>
<td>375</td>
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</tbody>
</table>
# Product Range

Options for panels

<table>
<thead>
<tr>
<th>Column No.</th>
<th>Panel type</th>
<th>Cable feeder</th>
<th>Ring-main panel</th>
<th>Transformer panel</th>
<th>Cable panel</th>
<th>Circuit-breaker panel (fixed-mounted CB, gas-insul.)</th>
<th>Circuit-breaker panel (removable CB)</th>
<th>Disconnector panel</th>
<th>Transfer panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>--</td>
<td>--</td>
<td>1) R 375</td>
<td>1) T 375</td>
<td>1) K 375</td>
<td>1) L 500</td>
<td>1) L1(r)</td>
<td>1) D1</td>
<td>1) R(T)</td>
</tr>
<tr>
<td>2</td>
<td>--</td>
<td>--</td>
<td>630 A, 800 A</td>
<td>200 A</td>
<td>630 A, 1250 A</td>
<td>750 630 A</td>
<td>750 1250 A</td>
<td>500 1250 A</td>
<td>500 1250 A</td>
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</tr>
<tr>
<td>10</td>
<td>Panel type</td>
<td>Cable feeder</td>
<td>Ring-main panel</td>
<td>Transformer panel</td>
<td>Cable panel</td>
<td>Circuit-breaker panel (fixed-mounted CB, gas-insul.)</td>
<td>Circuit-breaker panel (removable CB)</td>
<td>Disconnector panel</td>
<td>Transfer panels</td>
</tr>
</tbody>
</table>

- Available
- Optionally available
- Not applicable

\(\triangleleft\) In preparation

1) Panel type:
   - Metal-clad
2) Type designation of vacuum circuit-breaker
Product Range
Product range overview

<table>
<thead>
<tr>
<th>Panel designation</th>
<th>Panel type</th>
<th>Panel width mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring-main panel 1)</td>
<td>as feeder</td>
<td>R</td>
</tr>
<tr>
<td></td>
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<td>375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>as transfer</td>
<td>R1(T)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Transformer panel 1)</td>
<td>as feeder</td>
<td>T</td>
</tr>
<tr>
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<td></td>
<td>375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Cable panel</td>
<td>as feeder</td>
<td>K</td>
</tr>
<tr>
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<td></td>
<td>375</td>
</tr>
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<td>500</td>
</tr>
<tr>
<td>Circuit-breaker panel 1)</td>
<td>as feeder</td>
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</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>750</td>
</tr>
<tr>
<td></td>
<td>as transfer</td>
<td>L1(T)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td></td>
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<td>750</td>
</tr>
<tr>
<td>Circuit-breaker panel 1)</td>
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<td>L1(r)</td>
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<td></td>
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<td>875</td>
</tr>
<tr>
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<td>as transfer</td>
<td>L1(r, T)</td>
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<td></td>
<td>750</td>
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<tr>
<td>Metering panels (as billing metering panel)</td>
<td>standard</td>
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</tr>
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<td>750</td>
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<tr>
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<td>as end panel</td>
<td>M1(BK)</td>
</tr>
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<td></td>
<td></td>
<td>750</td>
</tr>
<tr>
<td>Metering panel</td>
<td>as individual panel</td>
<td>M(KK)</td>
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<td>750</td>
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<tr>
<td>Busbar voltage metering panel 1)</td>
<td>as feeder</td>
<td>M(VT)</td>
</tr>
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<td>375</td>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>as feeder</td>
<td>M1(VT)</td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
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<td>500</td>
</tr>
<tr>
<td></td>
<td>as feeder</td>
<td>M1(VT-F)</td>
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<tr>
<td></td>
<td></td>
<td>375</td>
</tr>
<tr>
<td></td>
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<td>500</td>
</tr>
<tr>
<td>Bus riser panel</td>
<td>as feeder</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td></td>
<td>375</td>
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<tr>
<td>Metering panel / bus riser panel</td>
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<td>H1</td>
</tr>
<tr>
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<tr>
<td>Disconnector panel 1)</td>
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<td>D1</td>
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<tr>
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<td>500</td>
</tr>
<tr>
<td></td>
<td>as transfer</td>
<td>D1(T)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
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<td>Busbar earthing panel</td>
<td>as individual panel</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>375</td>
</tr>
</tbody>
</table>

1) Panel type: Metal-clad
2) Type designation of vacuum circuit-breaker

△) In preparation

Standard panels (examples)

- Cable panel type K
- Billing metering panel type M
- Bus riser panel type H
- Circuit-breaker panel, type L1 with CB type “CB-f” 2) (750 mm)

Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018
| Panel type | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| R          |   |   |   |   |   |   |   |   |   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| R(T)       |   |   |   |   |   |   |   |   |   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| T          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| T1         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| K          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| K1         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L1         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L(T)       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L(T)       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L(r)       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| L(r)       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M(-K)      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M(-B)      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M1(VT)     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M1(VT)     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M1(F)      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| M1(F)      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| H          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| H1         |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| D1 (T)     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| D1 (T)     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

**△** In preparation

1) Three-position switch as three-position switch-disconnector
2) Three-position switch as three-position disconnector
3) In special cases, deeper floor cover for panels with cable feeder required. Design of floor cover: Depending of direction of pressure relief
4) Not to be applied for versions with separate feeder earthing switch in panel types L1(r), L2(r)
5) Inspection window is a standard equipment in panel types L1(r), L2(r) for versions with separate earthing switch at the cable feeder
6) Or for earthing switch in panel type E
7) For panel type T with a rated voltage of 24 kV:
   Deeper cable fixing located underneath the panel

Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018
Product Range
Ring-main panels, cable panels, busbar earthing panels

Ring-main panels
as feeder panels

Type R
375 mm wide

Type R1
500 mm wide

Ring-main panel
as transfer panel for attachment to
panel
types M, M(-K), H
types L1(r, T)

Type R(T)
375 mm wide

Type R1(T)
500 mm wide

Cable panels
as feeder panels, 630 A

Type K
375 mm wide

Type K1
500 mm wide

Busbar earthing panel

Panel equipment with
devices and current
and voltage
transformers depends on
the rated voltage and
the panel type (e.g.
L1, R) as well as on
the panel combination (e.g. R(T))

Three-position
switch-disconnector

Make-proof
earthing switch

Capacitive voltage
detecting system

Fixed earthing point

Cable-type current
transformer, e.g.
4MC703 . . .

Block-type current
transformer 4MA,
cast-resin insulated

Three-phase
current transformer 4MC63 . . .

Voltage transformer,
e.g. 4MR, 1-pole,
cast-resin insulated

2nd cable
(no scope of supply)

2nd cable, 3rd cable
(no scope of supply)

Surge arrester

*) Option: Up to $U_r=17.5$ kV

2) P1 and P2 are terminal
designations of the
current transformer
Transformer panels as feeder panels

- **Type T**
  - 375 mm wide

- **Type T1**
  - 500 mm wide

Disconnected panels as feeder panels

- **Type D1**
  - 500 mm wide

**Panel equipment with devices and current and voltage transformers** depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination (e.g. R(T)).

- Three-position switch-disconnector
- Three-position disconnector
- Discharge switch
- HV HRC fuse
- Capacitive voltage detecting system
- Cable-type current transformer, e.g. 4MC703 . . .
- On request: Three-phase current transformer 4MC63 . . .
- Cable (not included in the scope of supply)
- 2nd cable (not included in the scope of supply)
- Surge arrester

*) On request

△) In preparation
Product Range

Metering panels as billing metering panel

Billing metering panels 630 A, 800 A, 1250 A

**Standard**

Option

**Type M** 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A

for cable connection

Option

Panel design of M

Standard M

Type M(-B) 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A

for busbar connection

Option

Panel design of M(-BK)

Standard M

Type M(-BK) 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A

for busbar connection

Option

Panel design of M(-K)

Standard M

Type M(-K) 750 mm wide

Billing metering panels 630 A, 800 A, 1250 A

for busbar connection

Option

Panel design of M(K)

Standard M

Cable

(not included in the scope of supply)

2nd cable

(not included in the scope of supply)

Surge arrester

Individual metering panel type M(KK)

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]

Capacitive voltage detecting system

Fixed earthing point

Block-type current transformer 4MA, cast-resin insulated

Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated

Fixed earthing point for busbar earthing

Option

P1 and P2 are terminal designations of the current transformer
Product Range

Busbar voltage metering panels and bus riser panels

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]

- Three-position switch-disconnector
- Capacitive voltage detecting system
- Fixed earthing point
- HV HRC fuse
- Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated
- Discharge switch
- Block-type current transformer 4MA, cast-resin insulated
- Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated

Schemes 1 to 4 depend on:
- Rated voltage $U_r$
- Panel combinations (TC-xx) with the adjacent panel types

2) $P_1$ and $P_2$ are terminal designations of the current transformer

Busbar voltage metering panels

up to 17.5 kV

Type M(VT)
375 mm wide

Type M(VT-F)
375 mm wide

up to 24 kV

Type M1(VT)
500 mm wide

Type M1(VT-F)
500 mm wide

Metering panel and/or bus riser panels

Type H, 630 A, 800 A, 1250 A
375 mm wide

Type H1, 630 A, 1250 A
500 mm wide
Circuit-breaker panels 630 A
as feeder panels

Type L
500 mm wide

Type L1
750 mm wide

as transfer panel for attachment
to panel types M or H or R(T), D1(T)

Type L1(T)
750 mm wide
Type L(T): 500 mm wide

Circuit-breaker panels 630 A, 1250 A
as feeder panels

Type L1(r, T), 630 A
750 mm wide
Type L2(r), 1250 A
875 mm wide

as transfer panel for attachment
to panel types, see table below

Type L1(r, T), 630 A
750 mm wide
Type L2(r, T), 1250 A
875 mm wide

** Standard: Feeder earthing via the vacuum circuit-breaker type 3AE6 (with interlocks, without earthing switch)

Panel equipment with devices and current and voltage transformers depends on the rated voltage and the panel type (e.g. L1, R) as well as on the panel combination [e.g. R(T)]

Three-position disconnector
Vacuum circuit-breaker (type 3AE6 (CB-r) removable)
Make-proof earthing switch
Capacitive voltage detecting system
Fixed earthing point
Cable-type current transformer, e.g. 4MC703 . . .
Block-type current transformer 4MA, cast-resin insulated
Three-phase current transformer 4MC63 . . .
Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated
Cable (no scope of supply)
2nd cable (no scope of supply)
Surge arrester

P1 and P2 are terminal designations of the current transformer

Panel combinations
Design
Rated current
L1(r, T) + H1 Standard 630 A
L1(r, T) + R1(T) Standard 630 A
L2(r, T) + D1(T) Standard 1250 A
L2(r, T) + H1 Standard 1250 A

Product Range
Circuit-breaker panels

Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018
Switchgear Type SimoSec, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018

Panel design (examples)

Legend for pages 23 and 24 (contin. on page 24)
1 Option: Low-voltage compartment
2 Niche for optional low-voltage equipment, cover can be unscrewed
3 Option: CAPDIS-Sx voltage detecting system
4 Option: Short-circuit/earth-fault indicator
5 Option: Ready-for-service indicator for switching device
6 Position indication for load-break function "CLOSED – OPEN"
7 Position indication for earthing function "OPEN – EARTHED"
8 Feeder designation label
9 Mimic diagram
10 Option: Sockets for capacitive voltage detecting system (depending on arrangement)
10.1 for feeder
10.2 for busbar
11 Option: Momentary-contact rotary control switch "CLOSED – OPEN" for motor operating mechanism with local-remote switch for three-position switch-disconnector
12 Option: Locking device for three-position switch-disconnector
13 Pressure relief device for switching device
14 Manual operation for the mechanism of the earthing function
15 Manual operation for the mechanism of the load-break or disconnecting function in L panels
16 Rating and type plate
17 Gas-insulated vessel for switching device (contains fluorinated greenhouse gas SF₆)
18 Manual operation for mechanism "spring charging"
19 Bushing-type insulator for busbar
Legend for pages 23 and 24

20 Bushing-type insulator for feeder
21 Terminal for HV HRC fuse assembly (with tripping)
22 Cable bracket with cable clamps (option)
   for fastening cables
23 Busbar
24 "Spring charged" indicator for stored-energy "OPEN"
25 Spring-operated mechanism for three-position
   switch-disconnector
26 Spring-operated/stored-energy mechanism for
   three-position switch-disconnector
27 Three-position switch-disconnector
28 Cable connection
29 Cable compartment cover
30 Earthing connection (for location, see dimension
   drawings)
31 Earthing switch for cable connection
32 Inspection window
33 Post insulator
34 Operation for stored-energy mechanism
   – stored-energy "OPEN" (red)
   – stored-energy "CLOSED" (black)
35 Option: HV HRC fuse-link
   (e = 292 mm or 442 mm)
36 Option: Heating in the panel
37 Option: Secondary protection
   for voltage transformer
38 Cover, screwed on
39 4MR voltage transformer
40 4MA7 block-type current transformer

Vacuum circuit-breaker:

41 Vacuum circuit-breaker, (VCB) fixed-mounted
42 Operating mechanism box
43 Manual operation for "spring charging"
   – for closing with manual operating mechanism
   – for emergency operation with motor operating
   mechanism
44 Mechanical "OFF" pushbutton
45 Mechanical "ON" pushbutton
   (not supplied with spring-operated mechanism)
46 "Spring charged" indicator
47 Operations counter (option for
   VCB type: CB-f NAR)
48 Position indicator

49 Option: Three-phase current transformer 4MC63
50 Option: Overcurrent-time protection relay
   (type 7SR45 or similar)
51 Option: Multifunction protection relay
   SIPROTEC 5 7SJ82
52 Cable-type current transformer
53 Niche applicable for control cables and/or
   bus wires
54 Option: Additional earthing busbar
   for switching-device vessel
55 Metallic partition of busbar compartment
57 Busbar compartment cover for panel extension
58 Cable sealing end (not included in scope of supply)
59 Earthing busbar
60 Cover for transformer connection compartment
61 Insulating cap on the busbar (for $U_r > 17.5$ kV)
62 Insulating cap for cable connection
   (for $U_r > 17.5$ kV)
Control board
The control boards are function-related. They integrate operation, mimic diagram and position indication. Furthermore, the respective indicating, measuring and monitoring equipment as well as locking devices and control elements (e.g. local-remote switch) are arranged there according to the panel type and version. The ready-for-service indicator and rating plates are also located at the operating front. Operation is identical for transformer and circuit-breaker feeders. First, the operating mechanism must be charged; then, closing/opening is done through separate pushbuttons. The condition of the energy store is indicated. All actuating openings are functionally interlocked against each other, and are optionally lockable. The operating lever carries two plug inserts, separately for the disconnecting and earthing function.

1 Manual operation of load-break function (R, T) or disconnecting function (L)
2 Locking function (option for ring-main feeders)
3 Manual operation of earthing function
4 Panel designation label
5 Position indicator for switch-disconnector
6 Position indicator for earthing switch
7 Sockets of capacitive voltage detecting system
8 “Fuse tripped” indicator
9 ON pushbutton for transformer or circuit-breaker function
10 OFF pushbutton for transformer or circuit-breaker function
11 Manual operation for “spring charging”
12 “Spring charged” indicator
13 Position indicator for circuit-breaker
14 Ready-for-service indicator
15 Operations counter
16 Preselection for manual charging of circuit-breaker panels

*) AR = Automatic reclosing
    NAR = Non automatic reclosing
Components
Three-position switch-disconnector

Features
- Switch positions:
  CLOSED – OPEN – EARTHED
- Switching functions as general-purpose
  switch-disconnector (class E3) according to
  – IEC/EN 62271-103 / VDE 0671-103 *)
  – IEC/EN 62271-102 / VDE 0671-102 *)
- Designed as a three-position switch with the functions
  – Switch-disconnector and
  – Make-proof earthing switch
- Operation via rotary bushing welded gas-tight into the
  front of the switching-device vessel
- Climate-independent contact in the gas-filled
  switching-device vessel
- Maintenance-free according to IEC/EN 62271-1 / VDE 0671-1
- Individual secondary equipment
- No cross insulation between phases.

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

Closing operation
During the closing operation, the operating shaft with the moving contact blades changes from the “OPEN” to the “CLOSED” position.
The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.

Opening operation
During the opening operation, the arc is caused to rotate by the arc-suppression system. This rotation movement prevents the development of a fixed root.
The isolating distance in gas established after breaking fulfills the conditions applicable to isolating distances in accordance with
– IEC/EN 62271-102 / VDE 0671-102 *) and
– IEC/EN 62271-1 / VDE 0671-1 *).
Due to the arc rotation caused by the arc-suppression system, both load currents and minor no-load currents are safely interrupted.

Earthing operation
The EARTHING operation is implemented by changing from the “OPEN” to the “EARTHED” position.

*) For standards, see page 72
Features
• Mechanical endurance of more than 1000 operating cycles
• Parts subjected to mechanical stress are highly corrosion-proof
• Manual operation with the help of a slip-on operating lever
  Option: Motor operation
• Control board with accordingly cut-out switching gate prevents the three-position switch-disconnector from being switched directly from the “CLOSED” via the “OPEN” to the “EARTHED” position
• Two separate actuating openings are provided for unambiguous selection of the DISCONNECTING and EARTHING functions
• Operation via rotary movement, operating direction according to IEC / EN 60447/ VDE 0196 (recommendation of FNN *).

Spring-operated mechanism
The switching movements are performed independently of the operating speed.
Spring-operated / stored-energy mechanism
The switching movements are performed independently of the operating speed. During the charging process, the closing and opening springs are charged. This ensures that the switch-disconnector/fuse combination can switch off all types of faults reliably even during closing. Closing and opening is done via pushbuttons, and is therefore identical with the operation of circuit-breaker operating mechanisms. An energy store is available for tripping by means of an operating HV HRC fuse or via a shunt release (f-release). After tripping, a red bar appears on the position indicator.

Motor operating mechanism (option)
The manual operating mechanisms of SIMOSEC switchgear can be equipped with motor operating mechanisms for the three-position switch-disconnector. Retrofitting is possible. Operating voltages for motor operating mechanisms:
– 24, 48, 60, 110, 220 V DC
– 110 and 230 V AC, 50 / 60 Hz.
Operation:
• Local operation by momentary-contact rotary control switch (option)
• Remote operation (standard) applied to terminal.

Assignment of operating mechanism type of three-position switch to panel types

<table>
<thead>
<tr>
<th>Panel type</th>
<th>R, L, D1, L(r)</th>
<th>E</th>
<th>T, M(VT-F), M(VT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Switch-disconnector (R) Disconnector (L, D) Disconnector [L1(r), L2(r)]</td>
<td>Earthing switch</td>
<td>Switch-disconnector (T, T1) Disconnector [M(VT), M(VT-F)]</td>
</tr>
<tr>
<td>Type of operating mechanism</td>
<td>Spring-operated</td>
<td>Spring-operated</td>
<td>Stored-energy</td>
</tr>
</tbody>
</table>

Legend
D = Disconnector feeder
E = Earthing panel
L = Circuit-breaker feeder
R = Ring-main feeder
T = Transformer feeder
M(VT), M(VT-F) = Busbar voltage metering panel
*) FNN: Forum network technology/network operation of the VDE (FNN)
**Components**

**Equipment (optional)**

**Auxiliary switch (option)**

Each operating mechanism of the three-position switch-disconnector (or three-position disconnector) can be optionally equipped with an auxiliary switch for the position indication:

- Switch-disconnector function: **)**
  - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover (manually operated)
- Earthing switch function:
  - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover
  - Switch-disconnector function in T typicals:**)**
  - CLOSED and OPEN: 2 changeover (manually operated, motor-operated)
  - Earthing switch function:
    - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover.

**Technical data of the auxiliary switch**

**Breaking capacity**

<table>
<thead>
<tr>
<th>AC operation at 40 Hz up to 60 Hz</th>
<th>DC operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage V</td>
<td>Normal current A</td>
</tr>
<tr>
<td>up to 230</td>
<td>10</td>
</tr>
<tr>
<td>48</td>
<td>10</td>
</tr>
<tr>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td>110</td>
<td>5</td>
</tr>
<tr>
<td>240</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**Rated switching capacity**

<table>
<thead>
<tr>
<th>Rated insulation level</th>
<th>250 V AC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation group</td>
<td>C according to VDE 0110</td>
</tr>
<tr>
<td>Continuous current</td>
<td>10 A</td>
</tr>
<tr>
<td>Making capacity</td>
<td>50 A</td>
</tr>
</tbody>
</table>

**Abbreviations:**

NO = Normally open contact
NC = Normally closed contact
**)** Depending on the secondary equipment of the three-position switch.
Features

• According to IEC/EN 62271-100/VDE 0671-100/GB 1984 *)
• Application in hermetically welded switching-device vessel in conformity with the system
• Climate-independent vacuum interrupter poles in the gas-filled switching-device vessel
• Operating mechanism located outside the switching-device vessel in the front operating mechanism box
• Maintenance-free for indoor installation according to IEC/EN 62271-1/VDE 0671-1 *)
• Individual secondary equipment.

Operating mechanism functions

The closing spring is charged by means of the operating lever or the hand crank supplied, or by the motor (option), until the latching of the closing spring is indicated (“spring charged” indicator). Then, the vacuum circuit-breaker can be closed manually or electrically.

In operating mechanisms provided for automatic reclosing (AR), the closing spring can be recharged manually or automatically in case of motor operating mechanism. Thus, the “closing option” is available again.

Operating mechanism

The operating mechanism assigned to a circuit-breaker feeder consists of the following components:

• Operating mechanism for circuit-breaker
• Operating mechanism for three-position disconnector
• Motor operating mechanism (optional)
• Position indicators
• Pushbuttons for CLOSING and OPENING the circuit-breaker
• Operations counter (optional)
• Interlocking between circuit-breaker and disconnector.

Assignment of operating mechanism type

| Panel type | L, L1, L(T), L1(T), L1(r), L2(r) |
| Function | Circuit-breaker, Three-position disconnector, Disconnecter, Earthing switch |
| Type of operating mechanism | Stored-energy, Spring-operated, Spring-operated |

Trip-free mechanism

The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC/EN 62271-100/VDE 0671-100 *). In the event of an opening command being given after a closing operation has been initiated, the moving contacts return to the open position and remain there even if the closing command is sustained. This means that the contacts are momentarily in the closed position, which is permissible according to the mentioned standard.

*) For standards, see page 72

Technical data of the vacuum circuit-breaker

<table>
<thead>
<tr>
<th>Vacuum circuit-breaker</th>
<th>Type</th>
<th>CB-f AR *)</th>
<th>CB-f NAR *)</th>
<th>CB-r 3AE6 △</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-circuit breaking current</td>
<td>up to 25 kA</td>
<td>up to 25 kA</td>
<td>up to 25 kA</td>
<td></td>
</tr>
<tr>
<td>Rated operating sequence:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– O – 0.3 s – CO – 3 min – CO</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>– O – 0.3 s – CO – 15 s – CO</td>
<td>on request</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>– O – 0.3 s – CO – 30 s – CO</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>– O – 3 min – CO – 3 min – CO</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Number of breaking operations ( I_f )</td>
<td>10 000</td>
<td>2000</td>
<td>10 000</td>
<td></td>
</tr>
<tr>
<td>Number of short-circuit breaking operations ( I_{SC} )</td>
<td>30</td>
<td>Option: 50</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Individual panel type L...</td>
<td>500 mm L</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Individual panel type L1...</td>
<td>750 mm L1</td>
<td>L1</td>
<td>L1(r)</td>
<td></td>
</tr>
<tr>
<td>875 mm</td>
<td>–</td>
<td>–</td>
<td>L2(r)</td>
<td></td>
</tr>
</tbody>
</table>

Explanations:

• Design option
– Not available
*) AR = Automatic reclosing; NAR = Non automatic reclosing
△) In preparation; circuit-breaker design: • CB-r: removable

Vacuum circuit-breaker type CB-f

The vacuum circuit-breaker consists of a vacuum interrupter unit with integrated three-position disconnector located in the switching-device vessel, and the associated operating mechanisms.

Circuit-breaker secondary equipment

<table>
<thead>
<tr>
<th>Circuit-breaker</th>
<th>Type</th>
<th>CB-f AR</th>
<th>Type</th>
<th>CB-f NAR</th>
<th>Type</th>
<th>CB-r AR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor operating mechanism</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closing solenoid</td>
<td>●</td>
<td>o</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shunt release</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.t.-operated release</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-energy magnetic release</td>
<td>–</td>
<td>o</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undervoltage release</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-pumping</td>
<td>●</td>
<td>o.r.</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit-breaker tripping signal</td>
<td>●</td>
<td>o</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varistor module</td>
<td>for ≥ 60 V DC</td>
<td>for ≥ 60 V DC</td>
<td>for ≥ 60 V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary switch 6 NO + 6 NC</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>free contacts thereof 1)</td>
<td>1 NO + 2 NC + 2 change-over</td>
<td>1 NO + 1 NC + 2 change-over</td>
<td>2 NO + 2 NC + 2 change-over</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 NO + 11 NC</td>
<td>o</td>
<td>o</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>free contacts thereof 1)</td>
<td>6 NO + 7 NC + 2 change-over</td>
<td>–</td>
<td>7 NO + 2 NC + 2 change-over</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position switch</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical interlocking</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations counter</td>
<td>●</td>
<td>o</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

● = Standard
O = Option
o.r. = on request

Abbreviations:
NO = Normally open contact
NC = Normally closed contact

1) Depending on the selected secondary components
Components
Secondary equipment of the vacuum circuit-breaker

Motor operating mechanism (option)
Operating voltages for motor operating mechanisms:
• 24, 48, 60, 110, 220 V DC
• 110 and 230 V AC, 50/60 Hz.
Further values on request.
Motor rating for circuit-breaker operating mechanism at:
CB-f AR: *)
– Maximum 500 W
– Maximum 650 VA
CB-f NAR: *)
– Maximum 80 W
– Maximum 80 VA.

Secondary components
The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application and offers a wide range of possible variations, allowing almost every requirement to be satisfied.

Closing solenoid
• For electrical closing.

Shunt release
• Standard: Magnet coil
• Option: Magnet coil with energy store
• Tripping by protection relay or electrical actuation.

C.t.-operated release
• For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, make Woodward/SEG type WIC; other designs on request
• Used if external auxiliary voltage is missing, tripping via protection relay.

Low-energy magnetic release (for CB-f NAR)
• For tripping pulse 0.02 Ws, tripping via transformer monitor (KI-30).

Undervoltage release
• Comprising:
  – Energy store and unlatching mechanism
  – Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
• Connection to voltage transformers possible.

Anti-pumping (standard for CB-f AR) *)
(mechanical and electrical)
Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing. It remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.

Circuit-breaker tripping signal
• For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
• Via limit switch and cutout switch.

Varistor module
• To limit overvoltages to approx. 500 V for protection devices (when inductive components are mounted in the vacuum circuit-breaker)
• For auxiliary voltages ≥ 60 V DC.

Auxiliary switch
• For electrical position indication.

Position switch
• For signaling "closing spring charged".

Mechanical interlocking
• Dependent on the type of operating mechanism
• Logical mechanical interlock between the three-position disconnector and the circuit-breaker (option: Closing lock-out for the three-position disconnector in circuit-breaker panels)
• Option: Operating mechanism with mechanical interlocking as
  – Spring-operated mechanism: Opening for operating crank is blocked
  – Stored-energy mechanism with closing solenoid and pushbutton: The pushbutton operated by the mechanical interlock prevents a continuous command to the closing solenoid
• During operation of the three-position disconnector from CLOSED to OPEN, the vacuum circuit-breaker cannot be in CLOSED position.

Operations counter
• As numeric indicator, 5 digits, mechanical.

*) AR = Automatic reclosing
   NAR = Non automatic reclosing
Electrical service life

Vacuum circuit-breaker type CB-f AR *)

Rated short-circuit breaking current 20 kA

Max. number of short-circuit breaking operations: ① n = 30, ② n = 50

Vacuum circuit-breaker type CB-f NAR *)

Rated short-circuit breaking current 20 kA

Max. number of short-circuit breaking operations: ③ n = 20

Vacuum circuit-breaker type 3AE6, for switchgear type SIMOSEC as CB-r AR *)

Rated short-circuit breaking current 25 kA

Max. number of short-circuit breaking operations: ④ n = 30

*) AR = Automatic reclosing
NAR = Non automatic reclosing
Busbars

- Safe-to-touch due to metallic enclosure
- Metal-clad busbar compartment
- Three-pole design, bolted from panel to panel
- Easy switchgear extension
- Made of copper: Round E-Cu.

Maximum secondary equipment

1. Auxiliary switch at the circuit-breaker
2. Position switch "spring charged"
3. 2nd release
4. Operations counter
5. 1st release
6. Motor operating mechanism, circuit-breaker
7. Auxiliary switch at the three-position disconnector
8. Motor operating mechanism, three-position disconnector
9. Closing solenoid, circuit-breaker

*) AR: Automatic reclosing
General features
• Connecting lugs for sealing ends arranged one behind the other
• Uniform cable connection height for the respective panel types
• With cable bracket, e.g. type C40 according to DIN EN 50024
• Access to the cable compartment only if feeder has been isolated and earthed.

Special features
– In cable panels (type K)
– In ring-main panels (type R)
– In circuit-breaker panels (type L)
• For thermoplastic-insulated cables
• For paper-insulated mass-impregnated cables with adapter systems
• For connection cross-sections up to 300 mm²
• Cable routing downwards.
– In transformer panels (type T)
• For thermoplastic-insulated cables
• For connection cross-sections up to 120 mm²: Cable lug max. 32 mm wide
• For rated normal currents of 200 A.

Cable connection (examples)

Ring-main panel type R
Cable compartment as delivered

Transformer panel type T
Cable compartment as delivered

Cable compartment with cable sealing ends (options: A, B, C ¹) and D ¹, see below)

Options
A Mounted cable clamps ²)
B Short-circuit / earth-fault indicator
C Double cable connection
D Suitable for connection of surge arresters ³)

Cable sealing ends (examples)
1 As-delivered condition
2 Connection for cable
3 Phase L1:
   Make Lovink-Enertech, type IAEM 20, 240 mm² (20 kV)
4 Phase L2:
   Make Prysmian Kabel und Systeme (Pirelli Elektrik) type ELTI mb-1C-2h-C-T3, 240 mm² (24 kV)
5 Phase L3:
   Make Tyco Electronics Raychem, type EPKT 24 C / 1X, 185 mm² (24 kV), as shrink-on sealing end, for severe ambient conditions
6 As-delivered condition, prepared for cable sealing end
7 Phase L1:
   Make Lovink-Enertech, type IAEM 20, 95 mm² (20 kV)
8 Phase L2:
   Make Tyco Electronics Raychem, type TFTI / 5131, 95 mm² (24 kV), as push-on sealing end
9 Phase L3:
   Make Euromold, type ITK, 95 mm² (24 kV)

Note:
– Cable sealing ends and cable clamps are not included in the scope of supply

For options, see figures:
1) Only with ring-main panel
2) Cable clamps in transformer panels type T... partly mounted underneath the panel in the cable basement (for 24 kV = standard)
3) Make Siemens, type 3EK, other makes on request
Components

Selection data for various cable sealing ends 1)

<table>
<thead>
<tr>
<th>Make</th>
<th>Type</th>
<th>Cross-section in mm²</th>
</tr>
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<tbody>
<tr>
<td>Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard 2)</td>
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<tr>
<td>Euromold</td>
<td>AIN 10, AFN 10</td>
<td>25–300 (500 *)</td>
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<td>AIS, AIP</td>
<td>150–300; 25–300</td>
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<td>12 MONOi</td>
<td>25–300 (500 *)</td>
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<tr>
<td></td>
<td>ITK-212</td>
<td>50–300 (400 *)</td>
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<td>ELTI mb-IC-12</td>
<td>35–240</td>
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<td>ELTI-IC-12</td>
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</tr>
<tr>
<td>TE Connectivity</td>
<td>IXSU-F</td>
<td>16–300 (500 *)</td>
</tr>
<tr>
<td></td>
<td>MVTI-31xx-</td>
<td>25–240 (300 *)</td>
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<tr>
<td></td>
<td>EPKT</td>
<td>16–300</td>
</tr>
<tr>
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<td>25–300</td>
</tr>
<tr>
<td></td>
<td>IAES 10</td>
<td>25–300 (500 *)</td>
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<td></td>
<td>3M</td>
<td>92-EB 6x-1</td>
</tr>
<tr>
<td></td>
<td>SEHDI 10.2</td>
<td>35–300 (500 *)</td>
</tr>
<tr>
<td></td>
<td>TI 12</td>
<td>25–240</td>
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<tr>
<td></td>
<td>TO 12</td>
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<tr>
<td>Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard 2)</td>
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<td></td>
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<tr>
<td>Euromold</td>
<td>AIN 10, AFN 10</td>
<td>25–300 (500 *)</td>
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<tr>
<td></td>
<td>12 MONOi</td>
<td>35–300 (500 *)</td>
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<td>25–300</td>
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<tr>
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<td>IXSU-F</td>
<td>16–300 (500 *)</td>
</tr>
<tr>
<td>Lovink-Enertech</td>
<td>IAES 10</td>
<td>25–300</td>
</tr>
<tr>
<td></td>
<td>GHKI</td>
<td>16–300 (400 *)</td>
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<td>Single-core thermoplastic-insulated cables for &gt; 12 kV to ≤ 24 kV (12/20 kV) 2)</td>
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<td>Euromold</td>
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<tr>
<td></td>
<td>AIS, AIP</td>
<td>70–300; 25–300</td>
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<td>24 MONOi</td>
<td>25–300 (500 *)</td>
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<td>36 MSC 3)</td>
<td>95–300 (500 *)</td>
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<td>25–300</td>
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<td>25–300 (500 *)</td>
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<td>3M</td>
<td>93-EB 6x-1</td>
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<td>SEHDI 20.2</td>
<td>35–300 (500 *)</td>
</tr>
<tr>
<td></td>
<td>SEI 24</td>
<td>25–240</td>
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<tr>
<td></td>
<td>TI 24</td>
<td>25–240</td>
</tr>
<tr>
<td></td>
<td>TO 24</td>
<td>25–300 (500 *)</td>
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<td>Three-core thermoplastic-insulated cables for &gt; 12 kV to ≤ 24 kV (12/20 kV) 2)</td>
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<td></td>
</tr>
<tr>
<td>Euromold</td>
<td>24 MONOi</td>
<td>35–300 (500 *)</td>
</tr>
<tr>
<td></td>
<td>AFN 20, AIN 20</td>
<td>35–300</td>
</tr>
<tr>
<td>Lovink-Enertech</td>
<td>GHKI</td>
<td>25–300 (500 *)</td>
</tr>
<tr>
<td>TE Connectivity</td>
<td>on request</td>
<td>on request</td>
</tr>
</tbody>
</table>

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

**) Due to the installation of 4MA cast-resin insulated block-type current transformers, the connection height of the cables is reduced in the corresponding panel types [e.g.: L, L1, M (-K), …]

1) Note:
For cable connections, the manufacturer information about the sealing end and the design of the cable must be taken into account (e.g., operating voltage, rated power-frequency withstand voltage, cable type, core material)

2) Transformer panels type T:...
– Lower edge of sealing end partly underneath the panel (depending on type of sealing end)
– Cable lugs of sealing ends up to 32 mm width
– Owing to the various lengths of the sealing ends, mounted cable clamps are partly underneath the panel

3) Circuit-breaker panel types L:...
Lower edge of sealing end below panel

4) Cable sealing end type with insulation shields

*) Remark concerning applications with requirements according to the GB standard (China): Type suitable for rated short-duration power-frequency withstand voltage U₟ₛ = 42 kV according to IEC 62271-1 and U₟ₘ = 42 kV according to EN/HD 629
Cable cross-sections

<table>
<thead>
<tr>
<th>Panel type</th>
<th>Panel width</th>
<th>Version</th>
<th>Connected cables x connection cross-section number x mm² for rated voltage</th>
<th>Transformer combination in the connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>12 kV</td>
<td>17.5 kV</td>
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<td>K</td>
<td>375</td>
<td>Standard</td>
<td>1 x 300</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On request</td>
<td>2 x 300</td>
<td>2 x 300</td>
</tr>
<tr>
<td>K1</td>
<td>500</td>
<td>Standard</td>
<td>1 x 300</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option</td>
<td>2 x 400</td>
<td>2 x 300</td>
</tr>
<tr>
<td>R</td>
<td>375</td>
<td>Standard</td>
<td>1 x 300</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On request</td>
<td>2 x 300</td>
<td>2 x 300</td>
</tr>
<tr>
<td>R1, D1</td>
<td>500</td>
<td>Standard</td>
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<tr>
<td>L</td>
<td>500</td>
<td>Standard</td>
<td>1 x 300</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option</td>
<td>2 x 240</td>
<td>2 x 240</td>
</tr>
<tr>
<td>L1</td>
<td>750</td>
<td>Standard</td>
<td>1 x 300</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option</td>
<td>2 x 300</td>
<td>2 x 300</td>
</tr>
<tr>
<td>M(-K), M(-BK)</td>
<td>750</td>
<td>Standard</td>
<td>1 x 400</td>
<td>1 x 300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Option</td>
<td>3 x 400</td>
<td>3 x 300</td>
</tr>
<tr>
<td>M(KK)</td>
<td>750</td>
<td>Standard</td>
<td>1 x 400</td>
<td>1 x 300</td>
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<td></td>
<td></td>
<td>Option</td>
<td>3 x 300</td>
<td>3 x 300</td>
</tr>
</tbody>
</table>

○ possible - not possible

Cable fixing: Depending on the cable type (1-core cable, 3-core cable) or the associated panel type △ and its components, the cable may also be fixed in the cable basement (for local installation):

- 1-core cable
- 3-core cable

Optionally, a deep floor cover is also possible:

1) CT as an option (cable-type current transformer)
2) CT as an option (zero-sequence current transformer for earth-fault detection)
3) Deep floor cover
4) Cable fixing bar, additionally movable downwards
5) Option: Cable clamp

H₀ = Height of cable connection in the panel

* Extendable up to 600 mm

△ For panel types T and T1 with a rated voltage of 24 kV: Deeper cable fixing located underneath the panel

Max. dimensions H₀ in mm
<table>
<thead>
<tr>
<th>Cable version</th>
<th>1-core</th>
<th>3-core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>435</td>
<td>425</td>
</tr>
<tr>
<td>Option: Weichfuss</td>
<td>469</td>
<td>459</td>
</tr>
</tbody>
</table>

H₀ = Available height for cable connection: From the mounted cable clamp 5)
HV HRC fuse assembly

Features

- Application for
  - Transformer panel types T (375 mm) and T1 (500 mm)
  - Busbar voltage metering panel type M(VT-F), M1(VT-F)
- HV HRC fuse-links acc. to DIN 43625 (main dimensions) with striker version “medium” acc. to IEC 60282 / VDE 0670-4 *)
- As short-circuit protection before transformers
- With selectivity (depending on correct selection) to upstream and downstream connected equipment
- Requirements according IEC 62271-105 fulfilled as HV alternating current switch-fuse combination
- Selection of HV HRC fuses for transformers
- Fuse replacement possible only when feeder is earthed
- Option: Shunt release on operating mechanism of three-position switch-disconnector
- Option: “Tripped indication” of three-position switch-disconnector in transformer feeder (transformer switch) for remote electrical indication with one normally-open contact (1 NO).

Mode of operation

“HV HRC fuse tripped”

Following the tripping of an HV HRC fuse-link, the mechanism for charging the spring must be set to the “OPEN” position.

Subsequently, earthing can be implemented by means of the three-position switch-disconnector and e.g. the fuse can be replaced.

Replacement of HV HRC fuse-links (without any tools)

- Isolating and earthing of the transformer feeder
- Opening the connection compartment cover
- Subsequent manual replacement of the HV HRC fuse-link.

Note to HV HRC fuse-links

According to IEC 60282-1 (2009) Clause 6.6, the breaking capacity of HV HRC fuses is tested within the scope of the type test at 87% of their rated voltage.

In three-phase systems with resonance-earthed or isolated neutral, under double earth fault and other conditions, the full phase-to-phase voltage may be available at the HV HRC fuse during breaking. Depending on the size of the operating voltage of such a system, this applied voltage may then exceed 87% of the rated voltage.

It must therefore already be ensured during configuration of the switching devices and selection of the HV HRC fuse that only such fuse-links are used, which either satisfy the above operating conditions, or whose breaking capacity was tested at least with the maximum system voltage. In case of doubt, a suitable HV HRC fuse must be selected together with the fuse manufacturer.

*) For standards, see page 72
**Fuse protection table**

The following table shows the recommended HV HRC fuse-links make SIBA (electrical data valid for ambient air temperatures of up to 40 °C) for fuse protection of transformers. The three-position switch-disconnector in the transformer feeder in panel type "T" was combined and tested according to IEC 62271-103.

<table>
<thead>
<tr>
<th>Operating voltage $U_{\text{in}}$ (kV)</th>
<th>Transformer Rated power $S_t$ (kVA)</th>
<th>Relative impedance voltage $U_k$ (%)</th>
<th>Rated current $I_r$ A</th>
<th>Rated current $I_t$ A</th>
<th>Min. operating / rated voltage $U_{\text{in}}$ (kV)</th>
<th>Dimension $e$ (mm)</th>
<th>Outside diameter $d$ (mm)</th>
<th>Order No. Make SIBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3 to 3.6</td>
<td>20 4</td>
<td>3.5</td>
<td>6.3</td>
<td>10</td>
<td>3 to 7.2</td>
<td>292</td>
<td>53</td>
<td>30 098 13.6,3</td>
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<td>50 4</td>
<td>8.75</td>
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<td>20</td>
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<td></td>
<td>75 4</td>
<td>13.1</td>
<td>20</td>
<td>25</td>
<td>3 to 7.2</td>
<td>292</td>
<td>53</td>
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<td>100 4</td>
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**Standards**

- HV HRC fuse-links "medium" version with striker and for tripping energy $1 \pm 0.5$ Joule according to:
  - IEC/EN 60282-1/VDE 0670-4
  - IEC/EN 60787/VDE 0670-402
  - DIN 43625 main dimensions.
### Components

**Allocation of HV HRC fuses and transformers**

**Recommended HV HRC fuses for switchgear type SIMOSEC**

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<th>Transformer</th>
<th>HV HRC Fuse-link</th>
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## Components

Allocation of HV HRC fuses and transformers

Recommended HV HRC fuses for switchgear type SIMOSEC

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<td>1000</td>
<td>5 to 6</td>
<td>72.2</td>
<td>140</td>
<td>10 to 24</td>
<td>442</td>
<td>292</td>
<td>53</td>
<td>30 006 13.16</td>
<td></td>
</tr>
</tbody>
</table>

Note: All values are approximate and may vary slightly.
Features

- According to IEC 61869-2 / DIN EN 61869-2 *
- Designed as a three-pole ring-core current transformer
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip in the panel.

Installation

- Arranged outside the switching-device vessel on the bushings
- Factory-assembled
- Mounting location:
  - For circuit-breaker panels type L...
  - For bus sectionalizer panels type L(T)
  - Option: On request for ring-main-panels type R...

Other designs (option)

For protection equipment based on the current-transformer operation principle:
- Three-phase current transformer type 4MC63 60 for
- Protection relay 7SR45 (7SJ46) as definite-time overcurrent protection
- Definite-time overcurrent protection relay, make Woodward / SEG, type WIP-1.

Three-phase current transformer 4MC63 64 for
- Definite-time overcurrent protection relay, make Woodward / SEG, type WIC.

Technical data

<table>
<thead>
<tr>
<th>Three-phase current transformer 4MC63 60 (standard type)</th>
<th>Three-phase current transformer 4MC63 64 (option)</th>
</tr>
</thead>
<tbody>
<tr>
<td>for $I_N \leq 150$ A</td>
<td>for $I_D = 630$ A</td>
</tr>
<tr>
<td>$U_m = 0.72$ kV</td>
<td>$0.72$ kV</td>
</tr>
<tr>
<td>$I_N = 100$ A</td>
<td>$I_N = 300$ A</td>
</tr>
<tr>
<td>$I_N = 75$ A</td>
<td>$I_N = 200$ A</td>
</tr>
<tr>
<td>$I_N = 50$ A</td>
<td>$I_D = 1000$ A</td>
</tr>
<tr>
<td>$I_D = 630$ A</td>
<td>$I_D = 750$ A</td>
</tr>
<tr>
<td>$I_D = 400$ A</td>
<td>$I_D = 600$ A</td>
</tr>
<tr>
<td>$I_D = 300$ A</td>
<td>$I_D = 500$ A</td>
</tr>
</tbody>
</table>

Primary data

<table>
<thead>
<tr>
<th>Highest voltage for equipment $U_m$</th>
<th>Rated current $I_N$ (A)</th>
<th>Rated short-duration power-frequency withstand voltage (winding test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$150$</td>
<td>$3$ kV</td>
</tr>
<tr>
<td></td>
<td>$100$</td>
<td>$3$ kV</td>
</tr>
<tr>
<td></td>
<td>$75$</td>
<td>$3$ kV</td>
</tr>
<tr>
<td></td>
<td>$50$</td>
<td>$3$ kV</td>
</tr>
</tbody>
</table>

Rated short-time thermal current $I_{th}$

- $630$ A for $I_D = 630$ A
- $630$ A for $I_D = 1250$ A
- $2.5$ x $I_{th}$ for transient overload current
- $2.5$ x $I_{th}$ for rated dynamic current $I_{syn}$

Secondary data

<table>
<thead>
<tr>
<th>Rated current (A)</th>
<th>1</th>
<th>0.67</th>
<th>0.5</th>
<th>0.33</th>
<th>1</th>
<th>0.75</th>
<th>0.5</th>
<th>1</th>
<th>0.75</th>
<th>0.6</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating (VA)</td>
<td>5</td>
<td>3.33</td>
<td>2.5</td>
<td>1.67</td>
<td>5</td>
<td>3.75</td>
<td>2.5</td>
<td>5</td>
<td>3.75</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Rated current (5A)</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current at $I_D$</td>
<td>4.2 A</td>
<td>1.575 A</td>
<td>1.25 A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection core</td>
<td>Class 10 P</td>
<td>Class 10 P</td>
<td>Class 10 P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent factor</td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Other values on request, e.g. as additional type 4MC63 63 (complementary types)

*) For standards, see page 72
Features

- According to IEC 61869-2 / DIN EN 61869-2 *)
- Designed as a single-pole ring-core current transformer
- Climate-independent
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Secondary connection by means of a terminal strip inside the panel.

Application

- For circuit-breaker panels type L...
- For ring-main panels type R...
- For transformer panels type T...

Installation

- Cable-type current transformer 4MC70 33 for panel types: R..., K..., L...
- Cable-type current transformer 4MC70 31: E.g. for panel types R..., K... and T...
- Arranged on the cable at the panel connection
- For shielded cables
- Transformers mounted on a supporting plate at our factory; final assembly on the cables on site.

Technical data

<table>
<thead>
<tr>
<th></th>
<th>Cable-type current transformer 4MC70 33</th>
<th>Cable-type current transformer 4MC70 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest voltage</td>
<td>0.72 kV</td>
<td>0.72 kV</td>
</tr>
<tr>
<td>Rated current</td>
<td>20 A to 600 A</td>
<td>50 A to 600 A</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage (winding test)</td>
<td>3 kV</td>
<td>3 kV</td>
</tr>
<tr>
<td>Rated short-time thermal current ( I_{th} )</td>
<td>up to 25 kA/1 s or 25 kA/3 s or 20 kA/3 s</td>
<td>25 kA/1 s, or 14.5 kA/3 s</td>
</tr>
<tr>
<td>Rated continuous thermal current ( I_{D} )</td>
<td>1.0 x ( I_{N} ) option: 1.2 x ( I_{N} )</td>
<td>1.0 x ( I_{N} ) option: 1.2 x ( I_{N} )</td>
</tr>
<tr>
<td>Transient overload current</td>
<td>( 1.5 \times I_{D}/1 \text{ h} ) or ( 2 \times I_{D}/0.5 \text{ h} )</td>
<td>( 1.5 \times I_{D}/1 \text{ h} ) or ( 2 \times I_{D}/0.5 \text{ h} )</td>
</tr>
<tr>
<td>Rated dynamic current ( I_{dyn} )</td>
<td>( 2.5 \times I_{N} )</td>
<td>( 2.5 \times I_{h} )</td>
</tr>
<tr>
<td>Secondary data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current</td>
<td>1 A or 5 A</td>
<td>1 A or 5 A</td>
</tr>
<tr>
<td>Measuring core</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Overcurrent factor</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Without FS5</td>
<td>F55</td>
<td>F510</td>
</tr>
<tr>
<td>Rating</td>
<td>2.5 VA to 30 VA</td>
<td>2.5 VA to 10 VA</td>
</tr>
<tr>
<td>Protection core</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Overcurrent factor</td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Rating</td>
<td>2.5 VA to 10 VA</td>
<td>–</td>
</tr>
<tr>
<td>Option: Secondary tap</td>
<td>1 : 2 (e.g. 150 A – 300 A)</td>
<td>1 : 2</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall height ( H )</td>
<td>65 ( 1) )</td>
<td>110 ( 1) )</td>
</tr>
<tr>
<td></td>
<td>170 ( 1) )</td>
<td>285 ( 1) )</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>Outside diameter</td>
<td>150 mm</td>
<td>85 mm x 114 mm</td>
</tr>
<tr>
<td>Inside diameter</td>
<td>55 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td>For cable diameter</td>
<td>50 mm</td>
<td>36 mm</td>
</tr>
</tbody>
</table>

*) For standards, see page 72
1) Depending on the core data
2) Available installation space for cable-type current transformers inside the panels depends on make, type and cross-section of sealing end.
Example: Panel type R or K: Installation space approx. 285 mm
Features

Current transformer 4MA7
- According to IEC 61869-2 / DIN EN 61869-2 *)
- Dimensions according to DIN 42600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

Voltage transformer 4MR
- According to IEC 61869-3 / DIN EN 61869-3 *)
- Dimensions according to DIN 42600-9 (small model)
- Designed as an indoor voltage transformer:
  - Type 4MR, single-pole
  - Option: Type 4MR, two-pole
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

Technical data

Current transformer 4MA7, single-pole (other values on request)

| Primary data | | | | | |
| Highest voltage for equipment $U_m$ | kV | 3.6 | 7.2 | 12 | 12 | 17.5 | 24 |
| Rated short-duration power-frequency withstand voltage $U_d$ | kV | 10 | 20 | 28 | 42 | 38 | 50 |
| Rated lightning impulse withstand voltage $U_p$ | kV | 20 | 60 | 75 | 75 | 95 | 125 |
| Rated current $I_n$ | A | up to 20 kA |
| Rated short-time thermal current $I_{th}$ | kA | up to 20 kA/3 s, or up to 25 kA/1 s |
| Rated continuous thermal current $I_D$ | max. 2.5 × I_n |
| Rated dynamic current $I_{dyn}$ | max. 2.5 × I_{th} |

Secondary data

| Measuring core | | | | | |
| Measuring core | Class | 0.2 | 0.5 | 1 |
| Overcurrent factor | | |
| Rating VA | 2.5 to 30 |

| Protection core | | | | | |
| Protection core | Class | 5 P or 10 P |
| Overcurrent factor | | |
| Rating VA | 2.5 to 30 |

Voltage transformer 4MR, single-pole (other values on request)

| Primary data | | | | | |
| Highest voltage for equipment $U_m$ (= 1.2 × $U_N$) | kV | 3.6 | 7.2 | 12 | 12 | 17.5 | 24 |
| Rated short-duration power-frequency withstand voltage $U_d$ | kV | 10 | 20 | 28 | 42 | 38 | 50 |
| Rated lightning impulse withstand voltage $U_p$ | kV | 3.3√3 | 3.6/√3 | 4.2/√3 | 4.8/√3 | 5.0/√3 | 6.0/√3 | 6.3/√3 | 6.6/√3 |
| Rated voltage $U_N$ | kV | 7.2/√3 | 10.0/√3 | 11.0/√3 | 11.6/√3 | 10.0/√3 | 11.0/√3 | 10.0/√3 |
| Rated voltage factor (8 h) | 1.9 × U_N |

Secondary data

| Rated voltage V | | | | | |
| Rated voltage | 100/√3 |
| 110/√3 (option) |
| 120/√3 (option) |
| Rated voltage for auxiliary winding (option) V | | | | | |
| Rated voltage | 100/3 |
| 110/3 (option) |
| 120/3 (option) |
| Rating VA | 20 | 50 | 100 |
| Class | 0.2 | 0.5 | 1.0 |

*) For standards, see page 72
Ready-for-service indicator

Features
- Self-monitoring; easy to read
- Independent of temperature and pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Alarm switch “1 NO” for remote electrical indication.

Mode of operation
For the ready-for-service indicator, a gas-tight measurement box is installed inside the switching-device vessel. A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the non-magnetizable stainless-steel switching-device vessel. This armature moves the ready-for-service indicator of the switchgear. While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switching-device vessel. The temperature effect is compensated via the same pressure change in both gas volumes.

Components
Indicating and measuring equipment
Short-circuit/earth-fault indicators make Horstmann

Short-circuit/earth-fault indicator (option)

Ring-main, cable and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs. The equipment features are shown in the table on page 46.

Short-circuit and earth-fault indicators reduce the downtimes of a power system by delimiting the fault locations in medium-voltage systems.

Short-circuit/earth-fault indicators can be used in all kinds of power systems. In impedance-earthed and solidly earthed systems, as well as in isolated and compensated (resonantly-earthed) systems, earth-fault detection is also possible.

**SIGMA 2.0 with basic functions**
- Adjustable pickup values
- Phase-selective fault indication
- Reset of the fault indication: manually, automatically, from remote
- Earth-fault detection in impedance-earthed or solidly earthed systems
- Remote indication with relay contacts.

**SIGMA D++ with directional function**
- Directional short-circuit indication
- Directional earth-fault indication for all types of neutral treatment
- Unambiguous indication of the fault direction
- Monitoring with “SIGMA Explorer” software.

**ComPass B 2.0 with monitoring**
- Voltage detection via WEGA voltage detecting system and resistive sensor system for up to 4 devices
- High-precision current and voltage measurement up to 0.5 %
- Monitoring of the values: U, I, f, P, Q, S, E, cos ϕ, load flow direction, power meter with direction
- Temperature measurement with PT100
- Limit value recording for U, I, P, Q, T
- Transfer of measured values, fault indications and events via RS485/MODBUS.

**ComPass Bs 2.0 with control function**
- Remote control of a switch-disconnector or circuit-breaker
- Freely programmable logic to define the switching conditions
- 6 binary inputs for recording relevant state information from the switchgear/substation.

All indicators (except ALPHA) use the same phase current sensors.
### Components

**Indicating and measuring equipment**

<table>
<thead>
<tr>
<th>Short-circuit/earth-fault indicators from Horstmann</th>
<th>ALPHA</th>
<th>ALPHA E</th>
<th>SIGMA 2.0/AC</th>
<th>SIGMA 2.0/DC</th>
<th>SIGMA F/E 2.0/DC</th>
<th>SIGMA F/E 2.0/AC</th>
<th>SIGMA D</th>
<th>SIGMA D+</th>
<th>SIGMA D++</th>
<th>ComPass A 2.0</th>
<th>ComPass B 2.0</th>
<th>ComPass Bs 2.0</th>
<th>Earth Zero-EarthFlag</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short circuit/earth fault</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Direction indication</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Monitoring: U, I, F, P, Q, S, E, cos φ, load flow direction</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Control of a CB or SD</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Logic</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applicable for the following neutral treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impedance earthed</td>
</tr>
<tr>
<td>Solidly earthed</td>
</tr>
<tr>
<td>Isolated</td>
</tr>
<tr>
<td>Compensated</td>
</tr>
</tbody>
</table>

**Short-circuit pickup values**


| tI>> Pickup delay | 100 ms | 40, 80 ms | 40, 80, 200, 300 ms | DIP: 40, 80 ms, Software (SW): 40 ms – 60 s | 40 ms – 60 s | – |

**Earth-fault pickup values**

| IES> Short-circuit-to-earth current | – | – | 20, 40, 60, 80, 100, 120 or 160 A | DIP: off, 20, 40, 60, 80, 100, 120, 160 A, Software (SW): 20 – 1000 A | 20 – 1000 A | 25, 50, 75, 100 A |

| IET> Transient earth fault | – | – | – | – | – | 10 – 100 A | 10 – 500 A | 10 – 500 A | – |

| IEP> Active residual current cos φ | – | – | – | – | – | 5 – 200 A | 5 – 200 A | 1 – 200 A | – |

| IEQ> Reactive current sin φ | – | – | – | – | – | 5 – 200 A | 5 – 200 A | 1 – 200 A | – |

| UNE> Permanent earth fault | – | – | – | – | – | 1 – 100 A | 1 – 100 A | 1 – 200 A | – |

| DÆ> Pulse location (pulse amplitude) | – | – | – | – | – | 1 – 100 A | 1 – 100 A | 1 – 200 A | – |

| Pickup delay | – | – | 80, 200 ms | 60, 80, 200, 300 ms | DIP: 80, 160 ms, Software (SW): 40 ms – 60 s | 40 ms – 60 s | 80, 160 ms | – |

**Reset**

| Manually/from remote | ■ | (M) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

**Test**

| Manually/from remote | ■ | – | – | – | – | – | – | – | – | – | – | – | – |

**Communication**

| Relay contact | 1 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 1 |

| Maintained/passing contact | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable | adjustable |

| RS485/MODBUS-RTU | – | – | – | – | – | – | – | – | – | – | – | – | – |

| USB connection | – | – | – | – | – | – | – | – | – | – | – | – | – |

**Parameterizing**

| Manually/from remote | ■ | – | – | – | – | – | – | – | – | – | – | – | – |

**Supply**

| Lithium cell, ≥ 20 years | ■ (E) | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

| Current-transformer operated | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |


**Binary inputs**

| Number | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | – |

**Number of phase current/summation current sensors**

| Short circuit/earth fault | 3/0 | 3/0 | 3/0 | 3/0 | 3/0 or 3/1 for IET> | 3/0 or 3/1 | 3/0 | 3/0 or 3/1 or 2/1 | 0/1 |

**Voltage coupling**

| Capacitive | – | – | – | – | ■ | ■ | – | ■ | – |

| Resistive | – | – | – | – | – | – | – | – | – |

Switchgear Type SIMOSEC, up to 24 kV, Air-Insulated, Extendable · Siemens HA 41.43 · 2018
Short-circuit / short-circuit-to-earth and earth-fault indicators, make Kries

Ring-main, cable and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs. The equipment features are shown in the table on page 48.

The three most common types of faults in medium-voltage systems are earth faults in cables and switchgear, faults and overloads of distribution transformers, as well as short circuits in cables and switchgear. For fast fault location and minimization of downtimes, electronic fault indicators are used:

- Selective fault detection, and thus minimization of downtimes
- Reliable fault detection through electronic measured-value acquisition
- Remote indication of fault events and measured values.

1. **Short-circuit and short-circuit-to-earth indicator IKI-20**
   - Universally adjustable
   - Current-transformer supported battery version or auxiliary voltage versions available
   - Extended commissioning and testing functions.

2. **Short-circuit and earth-fault indicator IKI-20PULS**
   - Short-circuit detection same as IKI-20
   - Earth-fault detection via pulse location in compensated systems.

3. **Short-circuit and earth-fault indicator IKI-20C(PULS)**
   - Current-transformer operated (No battery, no auxiliary voltage)
   - Optionally with pulse location for earth-fault detection in compensated systems.

4. **Directional short-circuit and earth-fault indicator IKI-22**
   - Directional fault detection for all system types
   - Directional detection combined with the voltage detecting system CAPDIS-Sx+.

5. **Grid-Inspector IKI-50**
   - Directional measured-value acquisition
   - Monitoring of values U, I, f, P, Q, S, E, cos φ, power factor, load flow direction (momentary value, mean value and min/max value, directional)
   - Directional fault detection for all system types
   - Switchgear control or automation through an integrated, programmable logic component
   - Directional detection combined with the voltage detecting system CAPDIS-Sx+.

**Options:**
- One device controls two cable panels and the load flow total
- Directional detection combined with resistor dividers (accuracy 1.0 %)
- Early fault detection and detection of intermittent earth faults
- Telecontrol interface according to IEC 60870-5-104.

6. **Short-circuit-to-earth indicator IKI-10light**
   - Earth-fault detection in systems with impedance-earthed neutral or temporarily impedance-earthed neutral
   - Adjustable.
## Components

### Indicating and measuring equipment

<table>
<thead>
<tr>
<th>Short-circuit/earth-fault indicators from Kries</th>
<th>IKI-20B</th>
<th>IKI-20T</th>
<th>IKI-20U</th>
<th>IKI-20PULS</th>
<th>IKI-20C</th>
<th>IKI-20CPULS</th>
<th>IKI-22</th>
<th>IKI-50_1F</th>
<th>IKI-50_1F_EW_PULS</th>
<th>IKI-50_2F</th>
<th>IKI-50_2F_EW_PULS</th>
<th>IKI-10-light-P</th>
</tr>
</thead>
</table>

### Function

- **Short-circuit indication**
- **Earth-fault indication**
- **Short-circuit-to-earth indication**
- **Direction indication**

### Short-circuit current

- 100, 200, 400, 600, 800, 1000, 2000 A
- 400, 600, 800, 1000 A
- 100, 200, 300, 400, 600, 800, 1000, 2000 A
- 100 ... 1000 A (steps of 100 A)

### Earth-fault current

- 4 ... 30 A (steps of 1 A)

### Short-circuit-to-earth current

- 40, 80, 100, 150 A
- 40, 80, 100, 200 A
- 40 ... 200 A (steps of 10 A)
- 20, 40, 60, 80 A

### Pickup time

- 60, 80, 150, 200 ms
- 60 – 1600 ms

- 60, 80, 150, 200 ms
- 60 – 1600 ms
- 70, 250 ms

### Pulse location

- Transient fault detection
- 400 – 3000 ms

### Remote indication

- Passing contact adjustable
- Maintained contact adjustable

### Interface

- RS485/MODBUS
- IEC 60870-5-104 (option)

### Power supply

- Lithium battery
- Buffered for 6 h by internal capacitor

### Current inputs

- Phase current
- Summation current

### Voltage inputs

- Via CAPDIS
- Via resistor divider (option)

### Release outputs

- Potential-free
- Supplied by internal capacitor (option)

### Binary inputs

- Number

---

1) Optional for wattmetric detection of earth-fault direction
2) Creation of sum signal via 3 transformers mounted around the conductor
3) 0.1 Ws, 24 V DC
4) Momentary value, mean value and min/max value, directional
5) Short-circuit to earth = Earth fault in impedance-earthed system
Components

On request: Indicating and measuring equipment

<table>
<thead>
<tr>
<th>Short-circuit/earth-fault indicator from Siemens</th>
<th>SICAM FCM</th>
<th>SICAM FPI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth-fault indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth-fault function (impedance-earthed system)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indication of direction, short-circuit/earth-fault</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undervoltage and overvoltage indication</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Applicable for the following neutral earthing options</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensated</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pickup current</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>50 ... 2000 A (steps of 1 A)</td>
<td></td>
</tr>
<tr>
<td>Earth-fault current</td>
<td>1 ... 1000 A (steps of 1 A)</td>
<td>Type 1: 10 – 100 A, type 2: 40 – 300 A (in 7 steps each)</td>
</tr>
<tr>
<td>Pulse location</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Reset</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual</td>
<td></td>
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</tr>
<tr>
<td>Automatic</td>
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<td></td>
</tr>
<tr>
<td>From remote</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Remote indication</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passing contact</td>
<td>adjustable</td>
<td>–</td>
</tr>
<tr>
<td>Maintained contact</td>
<td>adjustable</td>
<td>2 binary outputs</td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS485/MODBUS</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithium battery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External auxiliary voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase current</td>
<td>3 (2) 1)</td>
<td>3 optical</td>
</tr>
<tr>
<td>Summation current</td>
<td>0 (1) 1)</td>
<td>1 optical</td>
</tr>
<tr>
<td><strong>Voltage inputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Via resistor divider</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Via integrated capacitive voltage indicator (optional)</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td><strong>Relay outputs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential-free</td>
<td>2 2)</td>
<td>2</td>
</tr>
<tr>
<td>Binary inputs</td>
<td>1</td>
<td>–</td>
</tr>
</tbody>
</table>

1) Measuring sensor 3+0 (summation current is calculated), measuring sensor 2+1 (phase L2 is calculated)
2) Optional

1. **SICAM FCM**
   The short-circuit and earth-fault indicator SICAM FCM (Feeder Condition Monitor) with direction indication enables fast and precise fault location, thus reducing the downtimes in the power system. The possibility to determine and telecommunicate the values U, I, f, P, Q, S, E, cos ϕ and load flow direction supports efficient operational management and network planning.

• Usable in earthed, isolated and resonance-earthed systems
• Directional short-circuit and earth-fault detection
• Selective fault information with direction indication as a basis for “self-healing” applications
• Usable with current and voltage sensors according to IEC 60044 for precise measurement without calibration and adjustment to the primary values
• Alternatively usable with an integrated capacitive voltage detecting system
• Flexible earth-current detection as from 0.4 A
• Integrated MODBUS-RTU interface:
• Remote parameterization via SICAM A8000 and MODBUS
• Self-test function of the communication connection.

2. **SICAM FPI (Fault Passage Indicator)**
   • Detection of short circuits and earth faults
   • Indication of phase and earth faults via 4 separate LEDs
   • Enhanced diagnostics, self and sensor cable diagnostics is supported
   • Configurable binary outputs, for remote indication to SCADA via RTU for faults and for diagnostics.
Components
Indicating and measuring equipment, transformer monitor systems

For circuit-breaker panels (type L, L1 ...)
Protection of distribution transformers with ratings that cannot or should not be protected with HV HRC fuses:
- Tripping of the circuit-breaker in case of overload (delayed)
- Tripping of the circuit-breaker when the short-circuit current arises.

On request: Application with switch-fuse combination (panel type T...)
Monitoring of the overload range of distribution transformers with
- Tripping of the switch in case of overload (current smaller than the rated current of the switch)
- Blocking of the tripping function in the short-circuit range (here, the fuse takes over the disconnecting function).

Features
- Current-transformer operated (cable-type transformer), alternatively auxiliary voltage 24 ... 230 V AC/DC
- Instrument transformer
  - Special cable-type current transformer
  - No direction-dependent installation required
  - No earthing of a transformer pole required
  - No short-circuit terminals required for maintenance
- Low-energy magnetic release (0.02 Ws)
- Mounting location
  - In the low-voltage niche of the feeder panel
  - In the low-voltage compartment (option) of the circuit-breaker feeder
- Response performance
  - Definite-time overcurrent characteristic
  - Definite-time overcurrent characteristic for earth-fault protection (additional sensor required)
  - Inverse-time overcurrent characteristic
    - extremely inverse
    - normal inverse
  - Externally undelayed instantaneous tripping
- Self-test function
  - Display test LED (red)
  - Battery test (under load) LED (green)
  - Primary current test with tripping and with primary current injection into the transformers
- Indication
  - LED indication for tripping (single flash: Starting, double flash: Tripping)
  - Reset after 2 h, 4 h or automatically (after return of power) or manually with reset pushbutton

Example for selection of transformer protection

<table>
<thead>
<tr>
<th>Operating voltage (kV)</th>
<th>Transformer rating (kVA)</th>
<th>Make and type of the device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siemens</td>
<td>Woodward/SEG</td>
<td>Kries</td>
</tr>
<tr>
<td>7SJ45/7SJ46</td>
<td>WIC 1-2P</td>
<td>IKI-30</td>
</tr>
<tr>
<td>5</td>
<td>¥ 160</td>
<td>¥ 160</td>
</tr>
<tr>
<td>6</td>
<td>¥ 160</td>
<td>¥ 160</td>
</tr>
<tr>
<td>6.6</td>
<td>¥ 160</td>
<td>¥ 160</td>
</tr>
<tr>
<td>10</td>
<td>¥ 200</td>
<td>¥ 250</td>
</tr>
<tr>
<td>11</td>
<td>¥ 200</td>
<td>¥ 250</td>
</tr>
<tr>
<td>13.8</td>
<td>¥ 250</td>
<td>¥ 400</td>
</tr>
<tr>
<td>15</td>
<td>¥ 315</td>
<td>¥ 400</td>
</tr>
<tr>
<td>20</td>
<td>¥ 400</td>
<td>¥ 500</td>
</tr>
</tbody>
</table>

- Outputs
  - Tripping signal: 1 floating relay output (NC contact) for telecommunication as passing contact
  - Starting signal: 1 floating relay output (NC contact)
    - is activated as long as the starting criterion is reached, e.g. to block an upstream primary protection
  - 1 watchdog (relay)
  - 1 external tripping output for control of an existing release, e.g. via capacitor
  - Tripping output designed as impulse output for direct control of the low-energy release
- Input
  - Remote tripping signal, control via floating external contact
  - Instantaneous tripping.
Voltage detecting systems according to IEC 61243-5 or VDE 0682-415

- For verification of safe isolation from supply
- HR or LRM detecting systems with plug-in indicator
- LRM detecting systems with integrated indicator type VOIS+, VOIS R+, CAPDIS-S1+, CAPDIS-S2+, WEGA 1.2 C, WEGA 2.2 C or WEGA 3.

Plug-in voltage indicator

- Verification of safe isolation from supply phase by phase
- Indicator suitable for continuous operation
- Measuring system and voltage indicator can be tested, repeat test according to local specifications and standards
- Voltage indicator flashes if high voltage is present.

VOIS+, VOIS R+

- Without auxiliary power
- Display indication “A1” to “A3” (see legend)
- Repeat test according to local specifications and standards
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (only VOIS R+).

Common features of CAPDIS-Sx+

- Without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Test” button
- Adjustable for different operating voltages (adjustable capacitance C2)
- With integrated 3-phase LRM test socket for phase comparison
- With connectable signal-lead test
- With overvoltage monitoring and signaling (1.2 times operating voltage).

CAPDIS-S1+

- Without auxiliary power
- Display indication “A1” to “A7” (see legend)
- Without ready-for-service monitoring
- Without signaling relay (without auxiliary contacts).

CAPDIS-S2+

- Display indication “A0” to “A8” (see legend)
- Only by pressing the “Test” pushbutton: “ERROR” indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (auxiliary power required)
- With integrated signaling relay for signals (auxiliary power required).

Symbols shown

<table>
<thead>
<tr>
<th>VOIS+, VOIS R+</th>
<th>CAPDIS-S1+</th>
<th>CAPDIS-S2+</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CAPDIS S2+: The red and green LEDs show the state of the relay contacts

- LED doesn’t light up
- LED lights up
- U = Operating voltage

A0 CAPDIS-S2+: Operating voltage not present
A1 Operating voltage present
A2 – Operating voltage not present
  – For CAPDIS-S2+: Auxiliary power not present
A3 Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
A4 Voltage (not operating voltage) present
A5 Indication “Test” passed (lights up shortly)
A6 Indication “Test” not passed (lights up shortly)
A7 Overvoltage present (lights up permanently)
A8 “ERROR” indication, e.g. in case of missing auxiliary voltage

Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth
- \[ U_{LE} = \frac{U_A \sqrt{3}}{3} \] during rated operation in the three-phase system
- \[ U_L = U_A \] Voltage at the capacitive interface of the switchgear or at the voltage indicator.
Components

Indicating and measuring equipment

WEGA 3
- Display indication “A1” to “A5”
- Integrated repeat test of the interface (self-monitoring)
- With integrated 3-phase LRM test socket for phase comparison.

WEGA 1.2 C
- Display indication “A1” to “A6” (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” button
- With integrated 3-phase LRM test socket for phase comparison.

WEGA 2.2 C
- Display indication “A0” to “A7” (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” button
- With integrated 3-phase LRM test socket for phase comparison
- With two integrated signaling relays (auxiliary power required *).

Symbols shown

<table>
<thead>
<tr>
<th>WEGA 3</th>
<th>WEGA 1.2 C</th>
<th>WEGA 2.2 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
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<tr>
<td>A4</td>
<td></td>
<td></td>
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<tr>
<td>A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LC display gray: not illuminated
LC display white: illuminated
WEGA 2.2 C: The red and green LEDs show the state of the relay contacts
- LED doesn’t light up
- LED lights up
U = Operating voltage

A0 For WEGA 2.2 C:
Operating voltage not present, auxiliary power present, LCD illuminated

A1 Operating voltage present
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A2 Operating voltage not present
For WEGA 2.2 C: Auxiliary power not present, LCD not illuminated

A3 Failure in phase L1, operating voltage at L2 and L3
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A4 Voltage present, current monitoring of coupling section below limit value
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A5 Indication “Display-Test” passed
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A6 Indication “Display Test” passed
For WEGA 2.2 C: Auxiliary power present

A7 For WEGA 2.2 C: LCD for missing auxiliary voltage is not illuminated

*) Shows the function of the relay via the LED indications (U=0, U>0)

Symbols shown

WEGA 3
- Display indication “A1” to “A5”
- Integrated repeat test of the interface (self-monitoring)
- With integrated 3-phase LRM test socket for phase comparison.

WEGA 1.2 C
- Display indication “A1” to “A6” (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” button
- With integrated 3-phase LRM test socket for phase comparison.

WEGA 2.2 C
- Display indication “A0” to “A7” (see legend)
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” button
- With integrated 3-phase LRM test socket for phase comparison
- With two integrated signaling relays (auxiliary power required *).

Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth
- \( U_{LE} = U_L / \sqrt{3} \) during rated operation in the three-phase system
- \( U_2 = U_A \) Voltage at the capacitive interface of the switchgear or at the voltage indicator

*) Shows the function of the relay via the LED indications (U=0, U>0)
**Verification of correct terminal-phase connections**

- Verification of correct terminal-phase connections possible by means of a phase comparison test unit (can be ordered separately)
- Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear.

**Phase comparison test units according to IEC 61243-5 or VDE 0682-415**

- **Phase comparison test unit**
  - **make Pfisterer, type EPV**
  - as combined test unit (HR and LRM) for:
    - Voltage detection
    - Phase comparison
    - Interface test
    - Integrated self-test
    - Indication via LED.

- **Phase comparison test unit**
  - **make Kries, type CAP-Phase**
  - as combined test unit (HR and LRM) for:
    - Voltage detection
    - Phase comparison
    - Interface test
    - Voltage detection
    - Phase sequence test
    - Self-test.
  - The unit does not require a battery.

- **Phase comparison test unit**
  - **make Horstmann, type ORION M1**
  - as combined test unit (HR and LRM) for:
    - Voltage detection
    - Phase comparison
    - Interface testing at the switchgear
    - Integrated self-test
    - Indication via LED and acoustic alarm
    - Phase sequence indication.

- **Phase comparison test unit**
  - **make Horstmann, type ORION 3.1**
  - as combined test unit (HR and LRM) for:
    - Voltage detection
    - Phase comparison
    - Interface testing at the switchgear
    - Integrated self-test
    - Indication via display and acoustic alarm
    - Phase sequence indication.

The unit does not require a battery.
Simple protection systems
As a simple protection for distribution transformers and circuit-breaker feeders, standard protection systems are available, consisting of:
• Current-transformer operated protection device with c.t.-operated release (low-energy 0.1 Ws)
  – Siemens Reyrolle 7SR45
  – Woodward/SEG WIC 1-2P, WIC 1-3P, WIP-1
• Protection device with auxiliary voltage supply with shunt release (f)
  – Siemens Reyrolle 7SR10 (Siemens SIPROTEC 7SJ46)
• Instrument transformer as
  – Cable-type current transformer (standard)
  – Three-phase current transformer as option for SIMOSEC switchgear panels type L ...
Mounting location
• In 350 mm high low-voltage compartment (option) of the circuit-breaker feeder, or in the low-voltage niche.

Application of simple protection systems

<table>
<thead>
<tr>
<th>Operating voltage (kV)</th>
<th>Transformer rating (kVA)</th>
<th>7SJ45/7SJ46</th>
<th>WIC 1-2P</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>≥ 160</td>
<td>≥ 160</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>≥ 200</td>
<td>≥ 250</td>
<td></td>
</tr>
<tr>
<td>13.8</td>
<td>≥ 250</td>
<td>≥ 400</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>≥ 315</td>
<td>≥ 400</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>≥ 400</td>
<td>≥ 500</td>
<td></td>
</tr>
</tbody>
</table>

Multifunction protection (selection)
SIPROTEC Compact series
Overcurrent protection SIPROTEC 7SJ80
• 9 programmable function keys
• 6-line display
• USB port at the front
• 2 additional communication ports
• IEC 61850 with integrated redundancy (electrical or optical).

SIPROTEC 5 series, overcurrent protection SIPROTEC 7SJ82
• Directional and non-directional time-overcurrent protection with additional functions
• Time optimization of the tripping times by direction comparison and protection data communication
• Frequency protection and rate-of-frequency change protection for load shedding applications
• Overvoltage and undervoltage protection in all required variations
• Power protection, configurable as active or reactive power protection
• Control, synchrocheck and switchgear interlocking system
• Firmly integrated, electrical Ethernet port J for DIGSI
• Complete IEC 61850 (Reporting and GOOSE) via integrated port J
• Two optional, pluggable communication modules usable for different and redundant protocols (IEC 61850, IEC 60870-5-103, DNP3 (serial+TCP), MODBUS RTU Slave, protection data communication).

Other types and makes on request
Mounting location
• In the 350 mm or 550 mm high low-voltage compartment (option) of the circuit-breaker feeder.
Features of low-voltage compartment (option)

- Overall heights
  - 350 mm
  - 550 mm
- Partitioned safe-to-touch from the high-voltage part of the panel
- Installation on the panel:
  Possible per feeder
- Customer-specific equipment
  For accommodation of protection, control, measuring and metering equipment
- Overall height depends on the panel-specific configuration of primary and secondary equipment
- Door with hinge on the left (standard for heights of 350 and 550 mm)
  Option: Door with hinge on the right.

Low-voltage cables

- Control cables of the panel to the low-voltage compartment via multi-pole, coded module plug connectors
- Option: Plug-in bus wires from panel to panel inside the low-voltage niche, or optionally in the separate wiring duct on the panel.
Low-voltage niche (standard)

- Inside the panel
- Cover for low-voltage niche:
  - Standard: Screwed-on cover
  - With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
- Protection relays (with max. 75 mm wide mounting frame), e.g.
  - Type 7SR45, 7SR10:
    - For type L and L1
  - Make Woodward / SEG,
    - type WIC1: For type L and L1
  - On request:
    - 7SJ80
    - Make Woodward / SEG, WIP-1
- For bus wires and/or control cables; niche open at the side to the adjacent panel
- Safe-to-touch, separated from high-voltage part of the panel
- Degree of protection IP3X (standard).

Protection relay as option:
1 Protection relay type 7SR45
2 On request: Protection relay type 7SJ80 in LV niche
3 Protection relay make Woodward (SEG), type WIC
4 On request:
   Multifunction protection relay SIPROTEC 4 type 7SJ61 on swing-out frame

5 Option: Sockets for capacitive voltage detecting system for busbar
6 Short-circuit/earth-fault indicator
7 Frame cover of low-voltage niche (can be unscrewed)
   Option: as door
8 Option: Local-remote switch for three-position switch-disconnector
9 Option: Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
10 Panel front
11 Low-voltage niche open
12 Option:
   Installed equipment

*) AR = Automatic reclosing
NAR = Non automatic reclosing
Room planning

Switchgear installation
Wall-standing arrangement, free-standing arrangement
– 1 row
– 2 rows (for face-to-face arrangement).

Room dimensions
See opposite dimension drawings.

Door dimensions
The door dimensions depend on the
– Number of panels in a transport unit
– Design with or without low-voltage compartment.

Switchgear fastening
• For floor openings and fixing points of the switchgear, see pages 66 to 68
• Foundations:
  – Steel girder construction
  – Steel-reinforced concrete.

Panel dimensions
See pages 60 to 65

Weight
The weight of a panel depends on the extent to which it is equipped (e.g. with motor operating mechanism, voltage transformer). For details, please refer to page 69.

**Note:**
1) Floor opening
△) Panel type L, L1, L(T), L1(T) with VCB type 3AH569:
Panel depth: 1080 mm,
switchgear depth: 1230 mm
*) Switchgear height 2100 mm if height of low-voltage compartment 350 mm; switchgear height 2300 mm if height of low-voltage compartment 550 mm
**) Cable fixing in the panel,
  – without deep floor cover
  (for version without current transformer on the cable)
Dimensions
Switchgear installation

Wall-standing arrangement

Free-standing arrangement

Design of switchgear

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>IAC</th>
<th>Rear pressure relief duct</th>
<th>Switchgear height in mm</th>
<th>Recommended height for switchgear room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall-standing</td>
<td>–</td>
<td>–</td>
<td>1750</td>
<td>≥ 2400</td>
</tr>
<tr>
<td>Free-standing</td>
<td>–</td>
<td>△</td>
<td>1750</td>
<td>≥ 2400</td>
</tr>
</tbody>
</table>

Floor cover: Available as option

---

Continued from page 57

16 End wall
17 Depth of pressure relief duct
18 Option: Pressure relief duct for each panel, for wall-standing or free-standing arrangement
19 Option: Front cover (panel without low-voltage compartment)
20.1 Option: Low-voltage compartment: 350 mm high
20.2 Option: Low-voltage compartment: 550 mm high
21.1 End wall: 1750 mm high
21.2 End wall: 2100 mm high
   (standard for IAC design, option without IAC = 2100 mm high)
22 Earthing terminal
23 Cover for low-voltage niche
23.1 Standard: Cover screwed-on (panel depth: 998 mm)
23.2 Option: Door (= 45 mm, panel depth: 1041 mm)
25 Distance to rear wall:
   ≥ 800 mm (for free-standing arrangement)

△) Option: Rear pressure relief duct
   ● As standard
   *) Panel height: 2100 mm, height of low-voltage compartment: 350 mm
   **) Option: Panel height: 2300 mm, height of low-voltage compartment: 550 mm

For standard dimensions and IAC design, see also page 59
### Standard dimensions of switchgear

<table>
<thead>
<tr>
<th>IAC – Design of switchgear</th>
<th>Pressure relief duct (add to panel depth)</th>
<th>Direction of pressure relief</th>
<th>Panel depth *)</th>
<th>Switchgear depth</th>
<th>Switchgear height</th>
<th>Switchgear arrangement</th>
<th>Distance &quot;a&quot; from switchgear to rear wall of switchgear room</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC A FL or IAC A FLR</td>
<td>with (duct is standard)</td>
<td>upwards</td>
<td>1020, 1041</td>
<td>1170</td>
<td>≤ 16 kA: 2100</td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>≤ 21 kA: 2100</td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(incl. front cover or low-voltage compartment)</td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>free-standing</td>
<td>approx. ≥ 800 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>wall-standing</td>
<td>approx. ≥ 35 mm</td>
</tr>
</tbody>
</table>

*) Panel depth depends on panel type and panel design:
- Low-voltage niche with door (= option) (instead of screwed front cover): 1041 mm
- Low-voltage niche with door: 1041 mm

**) In addition, a low-voltage compartment can be selected optionally. The switchgear height is changed respectively.
Dimensions

Ring-main panels, transformer panels

**Ring-main panels**

Type R

Type R1

Type R(T)

Type R(T)

Type R(T)

Type T

Type T1

Transformer panels

*) Option:
  Low-voltage compartment

**) For panel design with 4MA block-type current transformer, the cable connection height is reduced

1) Location of voltage transformer in left-hand panel

Panel type T:

2) Dimension a
   - 384 mm: for fuses with e = 442 mm
   - 534 mm: for fuses with e = 292 mm

3) Panel types T and T1 with a rated voltage of 24 kV: deeper cable fixing underneath the panel

Dimensions x1 and x2:

See pages 59 and 66
Dimensions
Cable panels, disconnector panels, earthing panel

Type K
Type K1

Cable panels

Type D1
Disconnected panel type D1 for cable connection

Type D1(T)
Disconnected panel type D1(T)
for panel combinations [e.g. metering panel type M or L1(T)]

Type E
Earthing panel

*) Option:
Low-voltage compartment

**) For panel design with 4MA block-type current transformer, the cable connection height is reduced

Dimensions x1 and x2:
See pages 59 and 66
Dimensions
Circuit-breaker panels

Type L (500 mm)
Type L(T) as transfer panel to the right

Type L1 (750 mm)
Type L1(T) as transfer panel to the right

Circuit-breaker panel 630 A
Circuit-breaker panel 630 A, 1250 A

Position of L1, L2 and L3: See page 59
Dimensions x1 and x2: See pages 59 and 66

*) Option: Low-voltage compartment
**) For panel design with 4MA block-type current transformer, the cable connection height is reduced
△) Option: Protection relay
Dimensions

Metering panels, as billing metering panel

Type M

Metering panel type M (standard)

Type M(-B)

Metering panel type M(-B)
(for busbar connection)

<table>
<thead>
<tr>
<th>Ur</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x1</td>
</tr>
<tr>
<td>Up to 17.5 kV</td>
<td>187</td>
</tr>
<tr>
<td>24 kV</td>
<td>215</td>
</tr>
</tbody>
</table>

Dimensions x1 and x2 for cable connection: See pages 66 and 67

Type M(-K)

Metering panel type M(-K) (for cable connection)

+) Option: Low-voltage compartment

**) The cable connection height depends on the rated voltage, the transformer design and the number of cable connections
Dimensions

Metering/bus riser panels, busbar voltage metering panels

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Dimensions in mm</th>
<th>x1</th>
<th>x2</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(T) + H</td>
<td>Ring-main transfer panel type R(T) and bus riser panel type H without transformers</td>
<td>Up to 17.5 kV</td>
<td>187</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 kV</td>
<td>215</td>
<td>250</td>
</tr>
</tbody>
</table>

Options:

1) Low-voltage compartment
2) Fuses
Dimensions

Circuit-breaker panels (for removable circuit-breaker type CB-r), overview of panel combination “TC”

<table>
<thead>
<tr>
<th>Panel combination</th>
<th>Rated normal current of TC</th>
<th>Total width of TC (in mm)</th>
<th>Serial no. of TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(T) - H</td>
<td>630 A, 800 A</td>
<td>750</td>
<td>TC-1</td>
</tr>
<tr>
<td>H - R(T)</td>
<td>630 A</td>
<td>750</td>
<td>TC-2</td>
</tr>
<tr>
<td>R(T) - R(T)</td>
<td>630 A, 800 A</td>
<td>1125</td>
<td>TC-3</td>
</tr>
<tr>
<td>R(T) - M</td>
<td>630 A, 800 A</td>
<td>1125</td>
<td>TC-4</td>
</tr>
<tr>
<td>R(T) - M(-K)</td>
<td>630 A, 800 A</td>
<td>1125</td>
<td>TC-6</td>
</tr>
<tr>
<td>L(T) - H</td>
<td>630 A</td>
<td>875</td>
<td>TC-11</td>
</tr>
<tr>
<td>L(T) - M</td>
<td>630 A</td>
<td>1250</td>
<td>TC-13</td>
</tr>
<tr>
<td>L(T) - M(-K)</td>
<td>630 A</td>
<td>1250</td>
<td>TC-15</td>
</tr>
<tr>
<td>L(T) - R(T)</td>
<td>630 A</td>
<td>875</td>
<td>TC-17</td>
</tr>
<tr>
<td>L1(T) - H</td>
<td>630 A</td>
<td>1125</td>
<td>TC-21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel combination</th>
<th>Rated normal current of TC</th>
<th>Total width of TC (in mm)</th>
<th>Serial no. of TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1(T) - M</td>
<td>630 A</td>
<td>1500</td>
<td>TC-23</td>
</tr>
<tr>
<td>L1(T) - M(-K)</td>
<td>630 A</td>
<td>1500</td>
<td>TC-25</td>
</tr>
<tr>
<td>L1(T) - R(T)</td>
<td>630 A</td>
<td>1125</td>
<td>TC-27</td>
</tr>
<tr>
<td>D1(T) - H</td>
<td>1250 A</td>
<td>875</td>
<td>TC-45</td>
</tr>
<tr>
<td>L1(r,T) - H1</td>
<td>630 A</td>
<td>1250</td>
<td>TC-63</td>
</tr>
<tr>
<td>L1(r,T) - R1(T)</td>
<td>630 A</td>
<td>1250</td>
<td>TC-62</td>
</tr>
<tr>
<td>L2(r,T) - H1</td>
<td>1250 A</td>
<td>1375</td>
<td>TC-63</td>
</tr>
<tr>
<td>L2(r,T) - D1(T)</td>
<td>1250 A</td>
<td>1375</td>
<td>TC-64</td>
</tr>
<tr>
<td>R(TM) - L(TM)</td>
<td>630 A</td>
<td>1500</td>
<td>TC-57</td>
</tr>
<tr>
<td>R(TM) - L1(TM)</td>
<td>630 A</td>
<td>1750</td>
<td>TC-58</td>
</tr>
</tbody>
</table>

* Current and voltage transformer installation in the “TC”: Depending on the type of “TC” and the rated voltage (not possible everywhere)

TC = Typical combination
Dimensions
Floor openings (dimensions in red) and fixing points

For panel width 375 mm

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>x1</td>
</tr>
<tr>
<td>17.5 kV</td>
</tr>
<tr>
<td>R</td>
</tr>
<tr>
<td>K</td>
</tr>
<tr>
<td>T</td>
</tr>
</tbody>
</table>

For panel width 500 mm

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>x1</td>
</tr>
<tr>
<td>17.5 kV</td>
</tr>
<tr>
<td>R1, D1</td>
</tr>
<tr>
<td>K1</td>
</tr>
<tr>
<td>T1</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>L with CTs, VTs</td>
</tr>
</tbody>
</table>

For panel width 750 mm

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>Number of cables</td>
</tr>
<tr>
<td>17.5 kV</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>L1 with CTs, VTs</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm.

1) The position of the cables in the panel depends on the additional built-in panel components, e.g., current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.
Dimensions

Floor openings (dimensions in red) and fixing points

<table>
<thead>
<tr>
<th>Metering panels: Panel width 750 mm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>Number of cables</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>M(-K)</td>
</tr>
<tr>
<td>M(-BK)</td>
</tr>
</tbody>
</table>

| With cable connection |

<table>
<thead>
<tr>
<th>For panel type L1(r), width 750 mm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>Number of cables</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>L1(r)</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| With cable connection |

<table>
<thead>
<tr>
<th>For panel type L2(r), width 875 mm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Position of cables 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions in mm</td>
</tr>
<tr>
<td>Number of cables</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>L2(r)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| With cable connection (up to 3 cables) |

**Note:**
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm, or 100 mm.

**1 Wall distance (see page 59)**

**2 Fixing frame (base) of an individual panel or panel block**

**3 Floor opening for high-voltage cables and, where applicable, control cables**

**4 Position of the led-in cables for the feeder 1)**

**5 Fixing points**

**6 Floor opening if required for panels without cable connection**

**7 **Option: Pressure relief duct**

1*) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.
Dimensions
Floor openings (dimensions in red) and fixing points

For panel width 375 mm

For panel width 500 mm

For panel width 750 mm

For panel width L1(r, T), width 750 mm

For panel type L2(r, T), width 875 mm

1 Wall distance (see page 59)
2 Fixing frame (base) of an individual panel or panel block
3 Floor opening for high-voltage cables and, where applicable, control cables

Note:
Connection of double cables: Depending on the panel type and version of the sealing end, the cable distance is approx. 110 mm.

4 Position of the led-in cables for the feeder 1)
5 Fixing points
6 Floor opening if required for panels without cable connection
7 Option: Pressure relief duct

1) The position of the cables in the panel depends on the additional built-in panel components, e.g. current and voltage transformers. Therefore, the dimensions x1, x2, c1, c2 may be different.
### Individual panels or combinations thereof for standard switchgear

<table>
<thead>
<tr>
<th>Panel type</th>
<th>Panel or panel combination</th>
<th>Transport unit “TU” (including packing) for standard panels (without/with pressure relief duct, option)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B1</td>
<td>Net weight 1) approx. kg</td>
</tr>
<tr>
<td>Ring-main panel</td>
<td>R</td>
<td>375</td>
</tr>
<tr>
<td>Ring-main transfer panel</td>
<td>R(T)</td>
<td>375</td>
</tr>
<tr>
<td>Transformer panel</td>
<td>T</td>
<td>375</td>
</tr>
<tr>
<td>Cable panel</td>
<td>K</td>
<td>375</td>
</tr>
<tr>
<td>Cable panel with make-proof earthing switch</td>
<td>K</td>
<td>375</td>
</tr>
<tr>
<td>Circuit-breaker panel (fixed-mounted circuit-breaker type “CB-F)</td>
<td>L</td>
<td>500</td>
</tr>
<tr>
<td>Circuit-breaker panel (removable circuit-breaker)</td>
<td>L(T)</td>
<td>500</td>
</tr>
<tr>
<td>Circuit-breaker panel (removable circuit-breaker)</td>
<td>L1(r)</td>
<td>750</td>
</tr>
<tr>
<td>Disconnector panel</td>
<td>D1</td>
<td>500</td>
</tr>
<tr>
<td>Disconnector transfer panel</td>
<td>D1(T)</td>
<td>500</td>
</tr>
<tr>
<td>Metering panel</td>
<td>M; M(K); M(B); M(BK)</td>
<td>750</td>
</tr>
<tr>
<td>Metering panel</td>
<td>M(KK)</td>
<td>750</td>
</tr>
<tr>
<td>Busbar voltage metering panel</td>
<td>M(VT); M(VT-F); M1(VT); M1(VT-F)</td>
<td>375</td>
</tr>
<tr>
<td>Bus riser panel</td>
<td>H</td>
<td>375</td>
</tr>
<tr>
<td>Busbar earthing panel</td>
<td>E</td>
<td>375</td>
</tr>
</tbody>
</table>

### Panel combinations

### Pressure relief duct (option)

<table>
<thead>
<tr>
<th>Panel width mm</th>
<th>Additional weight per duct and per panel approx. kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>375</td>
<td>30</td>
</tr>
<tr>
<td>500</td>
<td>40</td>
</tr>
<tr>
<td>750</td>
<td>60</td>
</tr>
<tr>
<td>875</td>
<td>70</td>
</tr>
</tbody>
</table>

---

1) The net weight and the gross weight depend on the extent to which the panel is equipped (e.g. current transformers, motor operating mechanisms) and are therefore given as mean value.

2) Other heights “H” of “TU” possible (depending on the equipment of the panel type and the packing type).

4) Additional weight for pressure relief duct (according to table values).

---

*) Low-voltage compartment, 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped, or optionally 550 mm high

△) Other heights “H” of “TU” possible (depending on the equipment of the panel type and the packing type).

O) Depending on the delivering factory.
### Installation

**Shipping data, transport**

<table>
<thead>
<tr>
<th>Individual panels or combinations thereof for standard switchgear</th>
<th>Panel type</th>
<th>Panel or panel combination</th>
<th>Transport unit “TU” (including packing) for standard panels (without/with pressure relief duct, option)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Width $B_1$ mm</td>
<td>Net weight $w_1$ approx. kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transport dimensions</strong> $^{(\circledast)}$ for combinations of different individual panels</td>
<td></td>
<td>Max. width of switchgear unit “B3”</td>
<td>$B_2$</td>
</tr>
<tr>
<td>Transport unit “TU”:</td>
<td></td>
<td>On request</td>
<td>0.70</td>
</tr>
<tr>
<td>– Standard: As individual panels arranged side by side and not screwed together</td>
<td></td>
<td>$\leq 875$ mm</td>
<td>1.08</td>
</tr>
<tr>
<td>– $\circledast$ Option: As multi-panel transport unit, panels screwed together</td>
<td></td>
<td>$\leq 1000$ mm $^{***}$</td>
<td>1.20</td>
</tr>
<tr>
<td>Standard packing for:</td>
<td></td>
<td>$\leq 1500$ mm</td>
<td>1.78</td>
</tr>
<tr>
<td>– Truck</td>
<td></td>
<td>$\leq 2125$ mm</td>
<td>2.33</td>
</tr>
<tr>
<td></td>
<td>Container packing, standard (other dimensions on request)</td>
<td>$\leq 875$ mm</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\leq 2000$ mm</td>
<td>2.20</td>
</tr>
<tr>
<td>Transport unit “TU” (CN):</td>
<td></td>
<td>Max. width of switchgear unit “B3”</td>
<td>$B_2$</td>
</tr>
<tr>
<td>– Standard: As individual panels arranged side by side and not screwed together</td>
<td></td>
<td>On request</td>
<td>0.70</td>
</tr>
<tr>
<td>– $\circledast$ Option: As multi-panel transport unit, panels screwed together</td>
<td></td>
<td>$\leq 875$ mm</td>
<td>1.050</td>
</tr>
<tr>
<td>Standard packing for:</td>
<td></td>
<td>$\leq 1125$ mm</td>
<td>1.290</td>
</tr>
<tr>
<td>– Truck</td>
<td></td>
<td>$\leq 1500$ mm</td>
<td>1.680</td>
</tr>
<tr>
<td>– Sea transport</td>
<td></td>
<td>$\leq 2000$ mm</td>
<td>2.200</td>
</tr>
<tr>
<td>– Container transport (other packing on request)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Transport units (= TU) for shipping** (plan view)

1. $T_1$ = Depth of individual panel  
2. Individual panel dimension $B_1$ x $T_1$  
3. Transport unit, dimension $B_2$ x $T_2$  
4. $B_3$ = Overall width of combination of different individual panels  
5. $B_2$ = Width of the transport unit  
6. $T_2$ = Depth of the transport unit

---

*) Low-voltage compartment, 350 mm high, weight approx. 60 kg depending on the panel type and on the extent to which it is equipped, or optionally 550 mm high  
** Packing weight  
*** On request: Max. panel width “B3” $\leq 1125$ mm (e.g. for 3 x 375 mm)  
$\circledast$ Other heights “H” of “TU” possible (depending on the equipment of the panel type and the packing type)  
$\circledast$ Option: Depending on the delivering factory (CN, PT)

1) The net weight and the gross weight depend on the extent to which the panel is equipped (e.g. current transformers, motor operating mechanisms) and are therefore given as mean value  
2) Sum of the net weights of individual panels
Packing types (examples)
For size and weight of the transport units, see page 69.

<table>
<thead>
<tr>
<th>Place of destination and means of transport</th>
<th>Examples for packing ((\text{O}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>China / Europe by rail and truck</td>
<td>Type: Open PE protective foil pulled over the switchgear, with wooden base</td>
</tr>
<tr>
<td>Overseas by seafreight</td>
<td>Type: Seaworthy crate (standard) PE protective foil, with closed wooden crate, with desiccant bag</td>
</tr>
<tr>
<td></td>
<td>Type: Open for container PE protective foil pulled over the switchgear, with wooden base</td>
</tr>
<tr>
<td>Overseas by airfreight</td>
<td>Type: Open PE protective foil pulled over the switchgear, with wooden base and lattice or cardboard cover</td>
</tr>
</tbody>
</table>

Transport
SIMOSEC switchgear is completely delivered in transport units. Please observe the following:
• Transport facilities on site
• Transport dimensions and weights
• Size of door openings in building
• Switchgear with low-voltage compartment: Please observe other transport dimensions and weights.

\(\text{O}\) Depending on the delivering factory
Standards

SIMOSEC switchgear complies with the relevant standards and specifications applicable at the time of type tests. In accordance with the harmonization agreement reached by the countries of the European Union, their national specifications conform to the IEC standard.

Overview of standards (2018)

<table>
<thead>
<tr>
<th></th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
<th>GB standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgear</td>
<td>SIMOSEC</td>
<td>IEC 62271-1</td>
<td>VDE 0671-1</td>
<td>EN 62271-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 62271-200</td>
<td>VDE 0671-200</td>
<td>EN 62271-200</td>
</tr>
<tr>
<td>Devices</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit-breakers</td>
<td>IEC 62271-100</td>
<td>VDE 0671-100</td>
<td>EN 62271-100</td>
<td>GB 1984</td>
</tr>
<tr>
<td>Disconnectors and earthing switches</td>
<td>IEC 62271-102</td>
<td>VDE 0671-102</td>
<td>EN 62271-102</td>
<td>GB 1985</td>
</tr>
<tr>
<td>Switch-disconnectors</td>
<td>IEC 62271-103</td>
<td>VDE 0671-103</td>
<td>EN 62271-103</td>
<td>GB 3804</td>
</tr>
<tr>
<td>Switch-disconnector/fuse combination</td>
<td>IEC 62271-105</td>
<td>VDE 0671-105</td>
<td>EN 62271-105</td>
<td>GB 16926</td>
</tr>
<tr>
<td>HV HRC fuses</td>
<td>IEC 60282-1</td>
<td>VDE 0670-4</td>
<td>EN 60282-1</td>
<td>GB 15166.2</td>
</tr>
<tr>
<td>Voltage detecting systems</td>
<td>IEC 61243-5</td>
<td>VDE 0682-415</td>
<td>EN 61243-5</td>
<td>DL/T 538-2006</td>
</tr>
<tr>
<td>Voltage presence indicating systems</td>
<td>IEC 62271-206</td>
<td>VDE 0671-206</td>
<td>EN 62271-206</td>
<td>similar to Chinese standard</td>
</tr>
<tr>
<td>Degree of protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP code</td>
<td>IEC 60529</td>
<td>VDE 0470-1</td>
<td>EN 60529</td>
<td>GB 4208</td>
</tr>
<tr>
<td>IK code</td>
<td>IEC 62262</td>
<td>VDE 0470-100</td>
<td>EN 50102</td>
<td></td>
</tr>
<tr>
<td>Insulation</td>
<td>–</td>
<td>VDE 0111</td>
<td>EN 60071</td>
<td>GB/T 311.2</td>
</tr>
<tr>
<td>Transformer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument transformers:</td>
<td>IEC 61869-1</td>
<td>VDE 0414-9-1</td>
<td>EN 61869-1</td>
<td></td>
</tr>
<tr>
<td>General requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current transformers</td>
<td>IEC 61869-2</td>
<td>VDE 0414-9-2</td>
<td>EN 61869-2</td>
<td>GB 1208</td>
</tr>
<tr>
<td>Voltage transformers</td>
<td>IEC 61869-3</td>
<td>VDE 0414-9-3</td>
<td>EN 61869-3</td>
<td>GB 1207</td>
</tr>
<tr>
<td>Power installations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common rules</td>
<td>IEC 61936-1</td>
<td>VDE 0101-1</td>
<td>EN 61936-1</td>
<td></td>
</tr>
<tr>
<td>Earthing of power installations</td>
<td>–</td>
<td>VDE 0101-2</td>
<td>EN 50522</td>
<td></td>
</tr>
<tr>
<td>Insulating gas SF6</td>
<td>Specification for sulfur hexafluoride (SF6)</td>
<td>IEC 60376</td>
<td>VDE 0373-1</td>
<td>EN 60376</td>
</tr>
</tbody>
</table>

Type of service location

SIMOSEC switchgear can be used as an indoor installation in accordance with IEC 61936 (Power installations exceeding 1 kV AC) and VDE 0101:

- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools.

- Inside lockable electrical service locations. A lockable electrical service location is a place outdoors or indoors that is reserved exclusively for housing electrical equipment and which is kept under lock and key. Access is restricted to authorized personnel and persons who have been properly instructed in electrical engineering. Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.
Dielectric strength

- The dielectric strength is verified by testing the switchgear with rated values of short duration power-frequency withstand voltage and lightning impulse withstand voltage according to IEC 62271-1/VDE 0671-1 and GB 11022 (see table "Dielectric strength").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11 g/m³ humidity in accordance with IEC 60071 and VDE 0111).
- The dielectric strength decreases with increasing altitude. For site altitudes above 1000 m (above sea level) the standards do not provide any guidelines for the insulation rating. Instead, special regulations apply to these altitudes.
- Site altitude
  - As the altitude increases, the dielectric strength of insulation in air decreases due to the decreasing air density. This reduction is permitted up to a site altitude of 1000 m according to IEC and VDE.
  - For site altitudes above 1000 m a higher insulation level must be selected. It results from the multiplication of the rated insulation level for 0 to 1000 m with the altitude correction factor Ka.

Table – Dielectric strength

<table>
<thead>
<tr>
<th>Rated voltage (r.m.s. value) kV</th>
<th>7.2</th>
<th>12</th>
<th>15</th>
<th>17.5</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage (r.m.s. value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across the isolating distances kV</td>
<td>23</td>
<td>32</td>
<td>48*</td>
<td>39</td>
<td>45</td>
</tr>
<tr>
<td>– Between phases and to earth kV</td>
<td>20</td>
<td>28</td>
<td>42*</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage (peak value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Across the isolating distances kV</td>
<td>70</td>
<td>85</td>
<td>105</td>
<td>110</td>
<td>145</td>
</tr>
<tr>
<td>– Between phases and to earth kV</td>
<td>60</td>
<td>75</td>
<td>95</td>
<td>95</td>
<td>125</td>
</tr>
</tbody>
</table>

Current carrying capacity

- According to IEC 62271-200 or IEC 62271-1, VDE 0671-200 or VDE 0671-1, the rated normal current refers to the following ambient air temperatures:
  - Maximum of 24-hour mean + 35 °C
  - Maximum + 40 °C
- The current carrying capacity of the panels and busbars depends on the ambient air temperature outside the enclosure.

Internal arc classification

- Protection of operating personnel by means of tests for verifying the internal arc classification
- Internal arcing tests must be performed in accordance with IEC 62271-200 or VDE 0671-200
- Definition of criteria:
  - Criterion 1:
    Correctly secured doors and covers do not open, limited deformations are accepted
  - Criterion 2:
    No fragmentation of the enclosure, no projection of small parts above 60 g
  - Criterion 3:
    No holes in accessible sides up to a height of 2 m
  - Criterion 4:
    No ignition of indicators due to hot gases
  - Criterion 5:
    The enclosure remains connected to its earthing point.

Resistance to internal faults (option)

In SIMOSEC switchgear, the appearance of internal faults (internal arcs) is less compared with earlier designs due to:
- Use of gas-insulated switching-device vessels
- Use of metal-enclosed switching-device vessels
- The fact that maloperation is practically excluded due to logical arrangement of operating elements and use of logical mechanical interlocks
- Short-circuit-proof feeder earthing by means of the three-position switch (make-proof earthing switch) or the circuit-breaker.

Altitude correction factor Ka

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

Example 1:
3000 m site altitude above sea level
17.5 kV switchgear rated voltage
95 kV rated lightning impulse withstand voltage
Rated lightning impulse withstand volt. to be selected 95 kV · 1.28 = 122 kV
Result:
According to the above table, a switchgear for a rated voltage of 24 kV with a rated lightning impulse withstand voltage of 125 kV is to be selected

Example 2:
2750 m site altitude above sea level
7.2 kV switchgear rated voltage
60 kV rated lightning impulse withstand voltage
Rated lightning impulse withstand volt. to be selected 60 kV · 1.25 = 75 kV
Result:
According to the above table, a switchgear for a rated voltage of 12 kV with a rated lightning impulse withstand voltage of 75 kV is to be selected.

*) Value according to GB standard
Cable testing

- For circuit-breaker and switch-disconnector feeders
- **DC voltage test**
  Before the test:
  - Remove or disconnect any voltage transformers at the cable connection in SIMOSEC switchgear
- SIMOSEC switchgear, e.g. for rated voltages up to 17.5 kV can be subjected to cable tests at a max. DC test voltage of 38 kV according to VDE. The voltage at the busbar may be 17.5 kV in this case.
- SIMOSEC switchgear for rated voltages up to 24 kV can be subjected to cable tests at a max. DC test voltage of 72 kV or according to VDE at 70 kV, 15 min. The voltage at the busbar may be 24 kV in this case.

- For cable testing
  - the installation and operating instructions of the switchgear
  - the standards IEC 62271-200 / VDE 0671-200 Clause 5.105 *)
  - the information on manufacturer-dependent cable sealing ends
  - the cable version (e.g. paper-insulated mass-impregnated cables, PVC cables or XLPE cables)
  must be observed.

Test voltages:

<table>
<thead>
<tr>
<th>Rated voltage (U0 / Um)</th>
<th>Max. test voltage applied to the connected cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLF 1), 0.1 Hz acc. to IEC VDE 0278</td>
<td>3 x U0 / U_{LF}</td>
</tr>
<tr>
<td></td>
<td>U = 6 x U0, 15 min max.</td>
</tr>
<tr>
<td>U (kV)</td>
<td>AC (kV)</td>
</tr>
<tr>
<td>12</td>
<td>6/10 (12)</td>
</tr>
<tr>
<td>24</td>
<td>12/20 (24)</td>
</tr>
</tbody>
</table>

Color of the switchgear

Panel front:
RAL 7035 (light grey)

End walls:
Standard: Steel (sendzimir galvanized)
Option: Painted, color according to panel front.

Terms
"Make-proof earthing switches" are earthing switches with short-circuit making capacity according to
- IEC 62271-102 and
- VDE 0671-102.

Climate and environmental influences

Indoor installation:
The SIMOSEC switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1:
- Temperature: –5 °C up to +55 °C
  –25 °C up to +55 °C 3)
  (optional, with panel heating)
- Relative air humidity: Mean value over 24 h 3): ≤ 95 %
  Mean value over 1 month: ≤ 90 %
- Condensation: Occasionally use a heater as anti-condensation protection (in the panel)
- Site altitude: Altitude correction to be considered (see page 73)

SIMOSEC switchgear is largely insensitive to climate and environmental influences by virtue of the following features:
- No cross insulation for isolating distances between phases
- Metal enclosure of switching devices (e.g. three-position switch) in gas-filled stainless-steel switching-device vessel
- Dry-type bearings in operating mechanism
- Essential parts of the operating mechanism made of corrosion-proof materials
- Use of climate-independent three-phase current transformers.

Climate classes:
- The climate classes are defined according to IEC 60721-3-3.
- The SIMOSEC switchgear has been subjected to a climatic test according to IEC 60932, Level 2, and is suitable for operating conditions according to “Design Class 1”. This test also meets the requirements of IEC 62271-304 for “Design Class 1”.

SIMOSEC switchgear may be used, subject to possible additional measures – e.g. panel heaters or floor covers – under the following environmental influences and climate classes:
- Environmental influences
  – Natural foreign materials
  – Chemically active pollutants
  – Small animals

Recycling

The switchgear can be recycled in ecological manner in compliance with existing legislation. Auxiliary devices such as short-circuit indicators have to be recycled as electronic scrap. Batteries have to be recycled professionally. Insulating gas SF₆ has to be evacuated professionally as a reusable material and recycled (SF₆ must not be released into the environment).

*) For standards, see page 72
1) VLF = very low frequency
2) Referred to: U₀ / U (Um = 6.35 / 11 (12) kV)
3) Secondary devices (e.g. protection devices, meters, measuring transducers, etc.) must be suitable for the given operating conditions.
Metallic partition according to IEC 62271-200 (3.109.1). Metallic partitions between open, accessible compartments and live parts. The SIMOSEC switchgear is suitable for application in indoor installations under normal operating conditions as defined in the standard IEC 62271-1.

Protection against solid foreign objects, electric shock and water

SIMOSEC switchgear fulfills according to the standards *)

<table>
<thead>
<tr>
<th>Standard</th>
<th>EN</th>
<th>VDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 62271-1</td>
<td>EN 62271-1</td>
<td>VDE 0671-1</td>
</tr>
<tr>
<td>IEC 62271-200</td>
<td>EN 62271-200</td>
<td>VDE 0671-200</td>
</tr>
<tr>
<td>IEC 60529</td>
<td>EN 60529</td>
<td>VDE 0470-1</td>
</tr>
<tr>
<td>IEC 62262</td>
<td>EN 50102</td>
<td>VDE 0470-100</td>
</tr>
</tbody>
</table>

* For standards, see page 72

The following degrees of protection (for explanations, see opposite table):

<table>
<thead>
<tr>
<th>Degree of protection &quot;IP&quot;</th>
<th>Type of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP2X (standard)</td>
<td>for switchgear enclosure</td>
</tr>
<tr>
<td>IP3X (option)</td>
<td>for switchgear enclosure (optional)</td>
</tr>
<tr>
<td>IP3XD (option on request)</td>
<td>for switchgear enclosure (on request)</td>
</tr>
<tr>
<td>IP65</td>
<td>for parts of the primary circuit of switching-device vessels under high voltage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of protection IK</th>
<th>Type of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>IK 07</td>
<td>for switchgear enclosure</td>
</tr>
</tbody>
</table>

For secondary devices in the low-voltage door, the stipulations of the IP degree of protection apply according to the definitions for the switchgear enclosure.

IEC/EN 60529:

<table>
<thead>
<tr>
<th>Type of protection</th>
<th>Degree of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard:</td>
<td>IP 2 X</td>
</tr>
<tr>
<td>Protection against solid foreign objects</td>
<td></td>
</tr>
<tr>
<td>Protected against solid foreign objects of 12.5 mm diameter and greater (the object probe, sphere of 12.5 mm diameter, shall not fully penetrate)</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access to hazardous parts with a finger (the jointed test finger of 12 mm diameter, 80 mm length, shall have adequate clearance from hazardous parts)</td>
<td></td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>No definition</td>
<td></td>
</tr>
<tr>
<td>Option:</td>
<td>IP 3 X</td>
</tr>
<tr>
<td>Protection against solid foreign objects</td>
<td></td>
</tr>
<tr>
<td>Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access to hazardous parts with a tool (the access probe of 2.5 mm diameter shall not penetrate)</td>
<td></td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>No definition</td>
<td></td>
</tr>
<tr>
<td>Option on request:</td>
<td>IP 3 XD</td>
</tr>
<tr>
<td>Protection against solid foreign objects</td>
<td></td>
</tr>
<tr>
<td>Protected against solid foreign objects of 2.5 mm diameter and greater (the object probe, sphere of 2.5 mm diameter, shall not penetrate at all)</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access with a wire (the access probe of 1.0 mm diameter, 100 mm length, shall have adequate clearance from hazardous parts)</td>
<td></td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>No definition</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access with a wire (the access probe of 1.0 mm diameter shall not penetrate)</td>
<td></td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>Dust-tight (No ingress of dust)</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter shall not penetrate)</td>
<td></td>
</tr>
<tr>
<td>Protection against water</td>
<td></td>
</tr>
<tr>
<td>Protected against water jets (water projected in jets against the enclosure from any direction shall have no harmful effects)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard:</th>
<th>IP 6 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection against solid foreign objects</td>
<td></td>
</tr>
<tr>
<td>Dust-tight (No ingress of dust)</td>
<td></td>
</tr>
<tr>
<td>Protection against access to hazardous parts</td>
<td></td>
</tr>
<tr>
<td>Protected against access to hazardous parts with a wire (the access probe of 1.0 mm diameter shall not penetrate)</td>
<td></td>
</tr>
</tbody>
</table>