Fixed-Mounted Circuit-Breaker Switchgear
Type 8DA and 8DB up to 40.5 kV,
Gas-Insulated

Medium-Voltage Switchgear
Application Public power supply system

Application Offshore and industry

Application Traction power supply

Application Industry

Application Offshore and industry
Fixed-Mounted Circuit-Breaker Switchgear
Type 8DA and 8DB up to 40.5 kV, Gas-Insulated

Medium-Voltage Switchgear
Catalog HA 35.11 · September 2017

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).

<table>
<thead>
<tr>
<th>Application</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Versions, typical uses, ratings</td>
<td>4 and 5</td>
</tr>
<tr>
<td>Requirements</td>
<td></td>
</tr>
<tr>
<td>Features, safety, technology</td>
<td>6 and 7</td>
</tr>
<tr>
<td>Technical data</td>
<td></td>
</tr>
<tr>
<td>Electrical data</td>
<td>8 and 9</td>
</tr>
<tr>
<td>Room planning</td>
<td>10 and 11</td>
</tr>
<tr>
<td>Shipping data</td>
<td>12</td>
</tr>
<tr>
<td>Classification</td>
<td>13</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>Front views, sections, floor openings, fixing points</td>
<td>14 to 21</td>
</tr>
<tr>
<td>Product range</td>
<td></td>
</tr>
<tr>
<td>Single-busbar panels</td>
<td>22 and 23</td>
</tr>
<tr>
<td>Double-busbar panels</td>
<td>24 to 30</td>
</tr>
<tr>
<td>Single-pole and double-pole single-busbar panels 8DA11/12</td>
<td>31</td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
<tr>
<td>Basic panel design</td>
<td>32 and 33</td>
</tr>
<tr>
<td>Gas compartment scheme</td>
<td>34 and 35</td>
</tr>
<tr>
<td>Components</td>
<td></td>
</tr>
<tr>
<td>Vacuum circuit-breaker</td>
<td>36 and 37</td>
</tr>
<tr>
<td>Three-position disconnecter</td>
<td>38 and 39</td>
</tr>
<tr>
<td>Control board</td>
<td>40</td>
</tr>
<tr>
<td>Busbar, busbar components</td>
<td>41</td>
</tr>
<tr>
<td>Current and voltage transformers</td>
<td>42 and 43</td>
</tr>
<tr>
<td>Panel connection</td>
<td>44 and 45</td>
</tr>
<tr>
<td>Panel connection (commercially available cable plugs and bar connections)</td>
<td>46</td>
</tr>
<tr>
<td>Indicating and measuring equipment</td>
<td>47 to 50</td>
</tr>
<tr>
<td>Protection, control, measuring and monitoring equipment</td>
<td>51 to 53</td>
</tr>
<tr>
<td>ANSI design</td>
<td>54 to 57</td>
</tr>
<tr>
<td>Standards</td>
<td></td>
</tr>
<tr>
<td>Standards, specifications, guidelines</td>
<td>58 and 59</td>
</tr>
<tr>
<td>First 8DA10 – Year of manufacture 1982</td>
<td>60</td>
</tr>
</tbody>
</table>
Application

Versions

Circuit-breaker panel 8DA10

Circuit-breaker panel 8DB10

Circuit-breaker panel 8DA11/12
Fixed-mounted circuit-breaker switchgear 8DA and 8DB is indoor, factory-assembled, type-tested, single-pole metal-enclosed, gas-insulated switchgear with metallic partitions 3), for single-busbar and double-busbar applications, as well as for traction power supply systems.

It is used in transformer and switching substations, e.g., in:
- Power supply companies
- Power stations
- Cement industry
- Automobile industry
- Iron and steel works
- Rolling mills
- Mining industry
- Textile, paper and food industries
- Chemical industry
- Petroleum industry
- Pipeline installations
- Offshore installations
- Electrochemical plants
- Petrochemical plants
- Shipbuilding industry
- Diesel power plants
- Emergency power supply installations
- Lignite open-cast mines
- Traction power supply systems.

### Electrical data (maximum values) and dimensions

#### Single-busbar and double-busbar switchgear

<table>
<thead>
<tr>
<th>Parameter</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage kV</td>
<td>28</td>
<td>50</td>
<td>70</td>
<td>85</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage kV</td>
<td>1) 42 kV / 70 kV according to some national requirements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
<td>185</td>
</tr>
<tr>
<td>Rated peak withstand current kA</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit making current kA</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-time withstand current 3 s kA</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Rated short-circuit breaking current kA</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Rated normal current of the busbar A</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>Rated normal current of feeders A</td>
<td>2750</td>
<td>2750</td>
<td>2750</td>
<td>2750</td>
</tr>
<tr>
<td>Width mm</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Depth (wall-standing arrangement) mm</td>
<td>1625</td>
<td>1625</td>
<td>1625</td>
<td>1625</td>
</tr>
<tr>
<td>Height mm</td>
<td>2350</td>
<td>2350</td>
<td>2350</td>
<td>2350</td>
</tr>
</tbody>
</table>

#### Single-pole and double-pole traction power supply switchgear

<table>
<thead>
<tr>
<th>Parameter</th>
<th>17.25</th>
<th>27.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage kV</td>
<td>16.7</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage kV</td>
<td>50</td>
<td>95</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>125</td>
<td>200</td>
</tr>
<tr>
<td>Rated peak withstand current kA</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Rated short-circuit making current kA</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Rated short-time withstand current 3 s kA</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated short-circuit breaking current kA</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Rated normal current of the busbar A</td>
<td>3150</td>
<td>3150</td>
</tr>
<tr>
<td>Rated normal current of feeders A</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>Width mm</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Depth (wall-standing arrangement) mm</td>
<td>865</td>
<td>865</td>
</tr>
<tr>
<td>Height mm</td>
<td>2350</td>
<td>2350</td>
</tr>
</tbody>
</table>

1) 42 kV / 70 kV according to some national requirements
2) 95 kV / 190 kV according to some national requirements
3) Corresponds to "metal-clad" according to former standard IEC 60298
4) 2750 A without forced ventilation (8DB10 on request)
5) 3150 A with forced ventilation (8DB10 on request)
Environmental independence
The enclosed high-voltage part of 8DA and 8DB switchgear is suitable for applications under aggressive ambient conditions, such as:
- Saline air
- Air humidity
- Dust
- Condensation.
It is tight to ingress of foreign objects, such as:
- Dust
- Pollution
- Small animals.
The application is independent of the site altitude.

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

Maintenance-free design
Switchgear housings designed as sealed pressure systems, maintenance-free switching devices and enclosed cable plugs ensure:
- Maximum supply reliability
- Personnel safety
- Sealed-for-life design according to IEC 62271-200 (sealed pressure system)
- Reduced operating costs
- Cost-efficient investment.

Innovation
The use of digital secondary systems and combined protection and control devices ensures:
- Clear integration in process control systems
- Flexible and highly simplified adaptation to new system conditions and thus to cost-efficient operation.

Service life
Under normal operating conditions, the expected service life of gas-insulated switchgear 8DA and 8DB is at least 35 years, probably 40 to 50 years, taking the tightness of the enclosed high-voltage part into account. The service life is limited by the maximum number of operating cycles of the switching 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.

Personal safety
- Safe-to-touch and hermetically sealed primary enclosure
- All high-voltage parts including the cable terminations, busbars and voltage transformers are metal-enclosed
- Capacitive voltage detecting system to verify safe isolation from supply
- Operating mechanisms and auxiliary switches safely accessible outside the primary enclosure (switchgear housings)
- Due to the system design, operation is only possible with closed switchgear enclosure
- Standard degree of protection IP 65 for all high-voltage parts of the primary circuit, IP 3XD for the switchgear enclosure according to IEC 60529
- High resistance to internal arcs by logical mechanical interlocks and tested switchgear enclosure
- Panels tested for resistance to internal faults up to 40 kA
- Logical mechanical interlocks prevent maloperation
- Make-proof earthing by means of the vacuum circuit-breaker.

Security of operation
- Hermetically sealed primary enclosure independent of environmental effects (pollution, humidity and small animals)
- Maintenance-free in an indoor environment according to IEC 62271-1
- Two-phase and three-phase short-circuits between the primary conductors are excluded by the single-pole primary enclosure
- In isolated or compensated systems, low-current earth-fault currents are self-extinguishing
- Operating mechanisms of switching devices accessible outside the primary enclosure (switchgear housings)
- Metal-enclosed, plug-in inductive voltage transformers mounted outside the switchgear housings
- Current transformers as ring-core current transformers mounted outside the switchgear housings
- Complete switchgear interlocking system with logical mechanical interlocks
- Bolted switchgear housings sealed for life
- Minimum fire load
- Option: Aseismic design.

Reliability
- Type and routine-tested
- Standardized, NC production processes
- Quality assurance in accordance with DIN EN ISO 9001, DIN EN ISO 14001 and BS OHSAS 18001
- More than 100,000 switchgear panels of Siemens in operation worldwide for many years.
General
- Single-pole enclosure of the primary part by modular switchgear housings made of corrosion-resistant aluminum alloy
- Insulating gas $\text{SF}_6$ (fluorinated greenhouse gas in sealed pressure system according to IEC 62271-1)
- Three-position disconnector as busbar disconnector and feeder earthing switch
- Make-proof earthing by means of the vacuum circuit-breaker
- Compact dimensions due to gas insulation
- Hermetically bolted switchgear housings made of corrosion-resistant aluminum alloy
- Single-pole metal-enclosed, gas-insulated busbars
- Cable connection with inside-cone plug-in system, or for connection of gas-insulated and solid-insulated bars
- Wall-standing or free-standing arrangement
- Installation and extension of existing switchgear at both ends without modification of existing panels.

Interlocks
- According to IEC 62271-200
- Logical mechanical interlocks prevent maloperation
- Three-position disconnector can only be operated with circuit-breaker in OPEN position
- Circuit-breaker can only be operated with three-position disconnector in end position and operating lever removed
- Locking device for circuit-breaker
- Locking device for three-position disconnector
- “Feeder earthed” locking device
- Option: Electromagnetic interlocks.

Modular design
- Replacement of the panel connection housings or the circuit-breaker possible without interrupting busbar operation
- Low-voltage compartment removable, plug-in bus wires
- Extension of double-busbar switchgear 8DB10 possible without interrupting operation
- Option: Extension of single-busbar switchgear 8DA10 possible without interrupting operation.

Instrument transformers
- Current transformers not subjected to dielectric stress
- Metal-enclosed, plug-in and disconnectable voltage transformers.

Vacuum circuit-breaker
- Maintenance-free under normal ambient conditions according to IEC 62271-1
- No relubrication or readjustment
- Vacuum interrupters sealed for life
- Up to 10,000 operating cycles (maintenance-free)
- Option: Up to 30,000 operating cycles (maintenance required).

Secondary systems
- Protection, measuring and control equipment
- Option: Numerical multifunction protection relay with integrated protection, control, communication, operating and monitoring functions
- Can be integrated in process control systems.
### Technical data

#### Electrical data, functional level, temperature for single-busbar and double-busbar switchgear

<table>
<thead>
<tr>
<th>Common electrical data, functional level and temperature</th>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$ [kV]</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Rated short-duration power-frequency withstand voltage $U_{rd}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>28</td>
<td>50</td>
<td>70</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>- across the isolating distance</td>
<td>kV</td>
<td>32</td>
<td>60</td>
<td>80</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>- Rated lightning impulse withstand voltage $U_{up}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>- across the isolating distance</td>
<td>kV</td>
<td>85</td>
<td>145</td>
<td>195</td>
<td>220</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rated short-duration power-frequency withstand voltage $U_{rd}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>28</td>
<td>1)</td>
<td>32</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td>- across the isolating distance</td>
<td>kV</td>
<td>32</td>
<td>1)</td>
<td>60</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td>Rated lightning impulse withstand voltage $U_{up}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td>- across the isolating distance</td>
<td>kV</td>
<td>85</td>
<td>145</td>
<td>195</td>
<td>220</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage $U_{rd}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>28</td>
<td>1)</td>
<td>32</td>
<td>1)</td>
<td>50</td>
</tr>
<tr>
<td>- across the isolating distance</td>
<td>kV</td>
<td>32</td>
<td>1)</td>
<td>60</td>
<td>1)</td>
<td>80</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage $U_{up}$:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- phase-to-earth, open contact gap</td>
<td>kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>- across the isolating distance</td>
<td>kV</td>
<td>85</td>
<td>145</td>
<td>195</td>
<td>220</td>
<td></td>
</tr>
</tbody>
</table>

### Data of the switchgear panels

#### Circuit-breaker panel, disconnector panel

<table>
<thead>
<tr>
<th>Rated normal current $I_r$ [A]</th>
<th>1250</th>
<th>1600</th>
<th>2000</th>
<th>2500</th>
<th>2750</th>
<th>3150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current $I_{kt}$ $t_k = 3$ s [kA]</td>
<td>up to</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit breaking current $I_{sc}$ [kA]</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
| Electrical endurance of vacuum circuit-breakers | at rated normal current | 10,000 operating cycles (12)
| at rated short-circuit breaking current | 50 breaking operations |
| Rated functional level $p_r$ (relative for feeders) | 70/120 kPa at 20 °C |
| Minimum functional level $p_m$ [kPa] | 50/100 kPa at 20 °C |

#### Bus section-alizer, bus coupler

<table>
<thead>
<tr>
<th>Rated normal current $I_r$ [A]</th>
<th>1250</th>
<th>1600</th>
<th>2000</th>
<th>2500</th>
<th>2750</th>
<th>3150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current $I_{kt}$ $t_k = 3$ s [kA]</td>
<td>up to</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit breaking current $I_{sc}$ [kA]</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
| Electrical endurance of vacuum circuit-breakers | at rated normal current | 10,000 operating cycles (12)
| at rated short-circuit breaking current | 50 breaking operations |
| Rated functional level $p_r$ (relative for feeders) | 70/120 kPa at 20 °C |
| Minimum functional level $p_m$ [kPa] | 50/100 kPa at 20 °C |

#### Cable connection panel, metering panel

<table>
<thead>
<tr>
<th>Rated normal current $I_r$ [A]</th>
<th>1250</th>
<th>1600</th>
<th>2000</th>
<th>2500</th>
<th>2750</th>
<th>3150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current $I_{kt}$ $t_k = 3$ s [kA]</td>
<td>up to</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Rated peak withstand current $I_p$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit making current $I_{ma}$ [kA]</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
<td>100/104</td>
</tr>
<tr>
<td>Rated short-circuit breaking current $I_{sc}$ [kA]</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
| Electrical endurance of vacuum circuit-breakers | at rated normal current | 10,000 operating cycles (12)
| at rated short-circuit breaking current | 50 breaking operations |
| Rated functional level $p_r$ (relative for feeders) | 70/120 kPa at 20 °C |
| Minimum functional level $p_m$ [kPa] | 50/100 kPa at 20 °C |
## Technical data

### Electrical data, functional level, temperature for single-pole and double-pole traction power supply switchgear

<table>
<thead>
<tr>
<th>Common electrical data, functional level and temperature</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated insulation level</strong></td>
<td><strong>Rated voltage ( U_r )</strong></td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td>17.25</td>
<td>27.5</td>
</tr>
<tr>
<td><strong>Nominal voltage according to IEC 60850/EN 50163</strong></td>
<td>kV</td>
<td>15</td>
</tr>
<tr>
<td><strong>Rated short-duration power-frequency withstand voltage ( U_{dc} ):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-earth, open contact gap</td>
<td>kV</td>
<td>50</td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>kV</td>
<td>60</td>
</tr>
<tr>
<td><strong>Rated lightning impulse withstand voltage ( U_{pd} ):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-earth, open contact gap</td>
<td>kV</td>
<td>125</td>
</tr>
<tr>
<td>– across the isolating distance</td>
<td>kV</td>
<td>145</td>
</tr>
<tr>
<td><strong>Rated frequency ( f ),</strong></td>
<td>Hz</td>
<td>16.7</td>
</tr>
<tr>
<td><strong>Rated normal current ( I_r ) of the busbar</strong></td>
<td>A</td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3150</td>
</tr>
<tr>
<td><strong>Rated functional level ( \rho_{re} ) (relative) of the busbar</strong></td>
<td></td>
<td>120 kPa at 20 °C</td>
</tr>
<tr>
<td><strong>Minimum functional level ( \rho_{me} )</strong></td>
<td></td>
<td>100 kPa at 20 °C</td>
</tr>
<tr>
<td><strong>Ambient air temperature</strong></td>
<td></td>
<td>–5 °C to +55 °C 13)</td>
</tr>
</tbody>
</table>

### Data of the switchgear panels

<table>
<thead>
<tr>
<th>Circuit-breaker panel, disconnector panel</th>
<th><strong>Rated normal current ( I_r )</strong></th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1250</td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td><strong>Rated short-time withstand current ( I_{tk} ) ( t_k = 3 ) s</strong> up to kA</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Rated peak withstand current ( I_{tp} )</strong></td>
<td>up to kA</td>
<td>80</td>
</tr>
<tr>
<td><strong>Rated short-circuit making current ( I_{ima} )</strong></td>
<td>up to kA</td>
<td>80</td>
</tr>
<tr>
<td><strong>Rated short-circuit breaking current ( I_{isc} )</strong></td>
<td>up to kA</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Electrical endurance of vacuum circuit-breakers</strong> at rated normal current</td>
<td>20,000 operating cycles</td>
<td></td>
</tr>
<tr>
<td><strong>Rated functional level ( \rho_{re} ) (relative) for feeders</strong></td>
<td>120 kPa at 20 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Minimum functional level ( \rho_{me} )</strong></td>
<td>100 kPa at 20 °C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bus sectionalizer</th>
<th><strong>Rated normal current ( I_r )</strong></th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1250</td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td><strong>Rated short-time withstand current ( I_{tk} ) ( t_k = 3 ) s</strong> up to kA</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Rated peak withstand current ( I_{tp} )</strong></td>
<td>up to kA</td>
<td>80</td>
</tr>
<tr>
<td><strong>Rated short-circuit making current ( I_{ima} )</strong></td>
<td>up to kA</td>
<td>80</td>
</tr>
<tr>
<td><strong>Rated short-circuit breaking current ( I_{isc} )</strong></td>
<td>up to kA</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Electrical endurance of vacuum circuit-breakers</strong> at rated normal current</td>
<td>20,000 operating cycles</td>
<td></td>
</tr>
<tr>
<td><strong>Rated functional level ( \rho_{re} ) (relative) for feeders</strong></td>
<td>120 kPa at 20 °C</td>
<td></td>
</tr>
<tr>
<td><strong>Minimum functional level ( \rho_{me} )</strong></td>
<td>100 kPa at 20 °C</td>
<td></td>
</tr>
</tbody>
</table>

### Footnotes for pages 8 and 9

1) Higher values of the rated short-duration power-frequency withstand voltage available with:
- 42 kV for phase-to-earth and open contact gap, as well as
- 48 kV across the isolating distance

2) Higher values of the rated short-duration power-frequency withstand voltage available with:
- 65 kV for phase-to-earth and open contact gap, as well as
- 75 kV across the isolating distance

3) Higher values of the rated short-duration power-frequency withstand voltage available with:
- 95 kV for phase-to-earth and open contact gap, as well as
- 120 kV across the isolating distance

4) Higher values of the rated lightning impulse withstand voltage available with:
- 190 kV for phase-to-earth and open contact gap, as well as
- 230 kV across the isolating distance

5) Higher value applies to 60 Hz

6) Disconnector panel available for single-busbar switchgear 8DA10

7) Bus coupler available for double-busbar switchgear 8DB10

8) Rated normal current \( I_r \) for cable connection panels

9) Maximum permissible normal current dependent on ambient air temperature

10) 2750 A without forced ventilation (8DB10 on request)

11) 3150 A with forced ventilation (8DB10 on request)

12) **Option:** 30,000 operating cycles

13) **Option:** Ambient air temperature –25 °C to +55 °C
### Technical data

#### Room planning

<table>
<thead>
<tr>
<th>Wall-standing arrangement (top view)</th>
<th>Free-standing arrangement (top view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room planning for single-busbar switchgear 8DA10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wall-standing arrangement (top view)</th>
<th>Free-standing arrangement (top view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room planning for traction power supply switchgear 8DA11</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wall-standing arrangement (top view)</th>
<th>Free-standing arrangement (top view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room planning for traction power supply switchgear 8DA12</td>
<td></td>
</tr>
</tbody>
</table>
Switchgear installation
• Wall-standing arrangement without rear wall (IAC AFL)
• Free-standing arrangement without rear wall (IAC AFL)
• Free-standing arrangement with rear wall (IAC AFLR).

Room dimensions
See dimension drawings above.
Room height: ≥ switchgear height + 200 mm.
If there are any busbar components, the minimum room height may have to be higher.
For switchable busbar components in 8DB10, free-standing arrangement is required.

Door dimensions
The door dimensions depend on the dimensions of the individual panels (see pages 14 to 21).

Switchgear fixing
• For floor openings and fixing points of the switchgear, see pages 14 to 21
• Foundations:
  – Steel girder construction
  – Steel-reinforced concrete with foundation rails, welded or bolted on.

Panel dimensions
See pages 14 to 21.

*) Depending on national requirements
**) Lateral wall distance ≥ 500 mm optionally required on the left or on the right
***) Lateral minimum wall distance ≥ 100 mm optionally possible on the left or on the right
Transport
Single-busbar switchgear 8DA10 and traction power supply switchgear 8DA11/12 is delivered in transport units comprising up to four panels. Double-busbar switchgear 8DB10 is delivered in transport units comprising up to three panels.
Please observe the following:
• Transport facilities on site
• Transport dimensions and transport weights
• Size of door openings in building.

Packing
• Means of transport: Truck
  – Panels on pallets
  – Open packing with PE protective foil.
• Means of transport: Ship and airplane
  – Panels on pallets
  – In closed crates with sealed upper and lower PE protective foil
  – With desiccant bags
  – With sealed wooden base
  – Max. storage time: 6 months.
• Long-time packing
  – Panels on pallets
  – In closed crates with sealed, aluminum-coated PE protective foil
  – With desiccant bags
  – With sealed wooden base
  – Max. storage time: 12 months.

### Transport dimensions, transport weights

<table>
<thead>
<tr>
<th>Panel widths</th>
<th>Transport dimensions Width × Height × Depth</th>
<th>Transport weight with packing approx. kg</th>
<th>Transport weight without packing approx. kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm × mm × mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Single-busbar switchgear 8DA10

**Means of transport: Truck**

| 1 × 600 | 1370 × 2550 × 1888 | 850 | 750 |
| 2 × 600 | 1764 × 2550 × 1870 | 1700 | 1500 |
| 3 × 600 | 2400 × 2550 × 1870 | 2550 | 2250 |
| 4 × 600 | 2964 × 2550 × 1870 | 3400 | 3000 |

**Means of transport: Ship and airplane**

| 1 × 600 | 1388 × 2700 × 1888 | 850 | 750 |
| 2 × 600 | 1764 × 2700 × 1888 | 1700 | 1500 |
| 3 × 600 | 2400 × 2700 × 1888 | 2550 | 2250 |
| 4 × 600 | 2964 × 2700 × 1888 | 3400 | 3000 |

#### Double-busbar switchgear 8DB10

**Means of transport: Truck**

| 1 × 600 | 1370 × 2550 × 3124 | 1300 | 1200 |
| 2 × 600 | 1870 × 2550 × 3124 | 2600 | 2400 |
| 3 × 600 | 2416 × 2550 × 3124 | 3900 | 3600 |

**Means of transport: Ship and airplane**

| 1 × 600 | 1388 × 2850 × 3124 | 1300 | 1200 |
| 2 × 600 | 1888 × 2850 × 3124 | 2600 | 2400 |
| 3 × 600 | 2440 × 2850 × 3124 | 3900 | 3600 |

#### Traction power supply switchgear 8DA11/12

**Means of transport: Truck**

| 1 × 600 | 1370 × 2550 × 1888 | 600 | 500 |
| 2 × 600 | 1764 × 2550 × 1870 | 1200 | 1000 |
| 3 × 600 | 2400 × 2550 × 1870 | 1800 | 1500 |
| 4 × 600 | 2964 × 2550 × 1870 | 2400 | 2000 |

**Means of transport: Ship and airplane**

| 1 × 600 | 1388 × 2700 × 1888 | 600 | 500 |
| 2 × 600 | 1764 × 2700 × 1888 | 1200 | 1000 |
| 3 × 600 | 2400 × 2700 × 1888 | 1800 | 1500 |
| 4 × 600 | 2964 × 2700 × 1888 | 2400 | 2000 |

1) Average values based on standard subframe with LV compartment 850 mm depending on the degree to which panels are equipped
### Design and construction

<table>
<thead>
<tr>
<th>Partition class</th>
<th>PM (metallic partition) 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of service continuity category</td>
<td>LSC2</td>
</tr>
<tr>
<td>Accessibility to compartments (enclosure)</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Busbar compartment</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Switching-device compartment</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Low-voltage compartment</td>
<td>Tool-based</td>
</tr>
<tr>
<td>Cable compartment</td>
<td>Tool-based</td>
</tr>
</tbody>
</table>

### Classification of 8DA and 8DB switchgear according to IEC 62271-200

#### Internal arc classification

- **Designation of the internal arc classification IAC**
  - Wall-standing arrangement: IAC AFL 40 kA, 1 s
  - Free-standing arrangement: IAC AFLR 40 kA, 1 s

- **Type of accessibility A**
  - F
  - L
  - R
  - Tool-based

- **Rated short-time withstand current** 40 kA
- **Rated duration of short-circuit** 1 s

### Classification of 8DA and 8DB switchgear according to IEEE Std C37.20.7™-2007

#### Internal arc classification

- **Designation of the internal arc classification IAC**
  - Wall-standing arrangement: Type 1B 40 kA, 0.5 s
  - Free-standing arrangement: Type 2B 40 kA, 0.5 s

- **Type of accessibility**
  - Type 1B
  - Type 2B
  - Type BC

- **Rated short-time withstand current** 40 kA
- **Rated duration of short-circuit** 0.5 s

---

1) Corresponds to "metal-clad" according to former standard IEC 60298
Dimensions
Front views, sections, floor openings, fixing points for 8DA10

Circuit-breaker panel up to 3150 A

Bus sectionalizer up to 3150 A
Legend and footnotes for pages 14 and 15
1 Fixing hole for 26 mm × 45 mm
2 Base frame
3 Floor opening for high-voltage cables
4 Area for floor openings for control cables
Dimensions
Front views, sections, floor openings, fixing points for 8DB10

Circuit-breaker panel up to 2500 A

Bus coupler up to 2500 A
Bus sectionalizer with panel connection up to 2500 A (busbar system 1 and 2)

Legend and footnotes for pages 16 and 17
1 Fixing hole for 26 mm × 45 mm
2 Base frame
3 Floor opening for high-voltage cables
4 Area for floor openings for control cables
Dimensions
Front views, sections, floor openings, fixing points for 8DB10

Bus sectionalizer up to 2500 A (busbar system 1)

Bus sectionalizer up to 2500 A (busbar system 2)
Cable connection panel up 2500 A

Dimensions
Front views, sections, floor openings, fixing points for 8DB10

Legend and footnotes for pages 18 and 19
1 Fixing hole for 26 mm × 45 mm
2 Base frame
3 Floor opening for high-voltage cables
4 Area for floor openings for control cables
Dimensions
Front views, sections, floor openings, fixing points for 8DB10 ANSI

Example: Circuit-breaker panel with three-position disconnector at the feeder (option)

Example: Circuit-breaker panel with disconnector bypass
Dimensions
Front views, sections, floor openings, fixing points for 8DA11/12

Legend and footnotes for pages 20 and 21
1 Fixing hole for 26 mm × 45 mm
2 Base frame
3 Floor opening for high-voltage cables
4 Area for floor openings for control cables
Product range
Single-busbar panels 8DA10

Circuit-breaker panel

Disconnected
Three-position disconnector
Vacuum circuit-breaker
Plug-in voltage transformer (directly plugged or with cable connection)
Plug-in voltage transformer with or without three-position disconnector
Current transformer
Capacitive voltage detecting system
Busbar
- earthing switch
- make-proof earthing switch
Busbar connection with or without three-position disconnector
Surge arrester
Panel connection with inside-cone plug or bar connection
Zero-sequence current transformer
Top-mounted bus sectionalizer

Disconnector panel

Vacuum circuit-breaker
Plug-in voltage transformer (directly plugged or with cable connection)
Plug-in voltage transformer with or without three-position disconnector
Current transformer
Capacitive voltage detecting system
Busbar
- earthing switch
- make-proof earthing switch
Busbar connection with or without three-position disconnector
Surge arrester
Panel connection with inside-cone plug or bar connection
Zero-sequence current transformer
Top-mounted bus sectionalizer

Bus sectionalizer (2 panels)

Panel connection with inside-cone plug or bar connection
Zero-sequence current transformer
Top-mounted bus sectionalizer
### Product range

**Single-busbar panels 8DA10**

<table>
<thead>
<tr>
<th>Metering panel</th>
<th>Cable connection panel</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- **Three-position disconnector**
- **Vacuum circuit-breaker**
- **Plug-in voltage transformer (directly plugged or with cable connection)**
- **Voltage transformer with or without three-position disconnector**
- **Current transformer**
- **Capacitive voltage detecting system**
- **Busbar** — earthing switch and make-proof earthing switch
- **Busbar connection with or without three-position disconnector**
- **Panel connection with inside-cone plug or bar connection**

---

**Fixed-Mounted Circuit-Breaker Switchgear Type 8DA and 8DB up to 40.5 kV, Gas-Insulated · Siemens HA 35.11 · September 2017**

23
Product range
Double-busbar panels 8DB10
Product range
Double-busbar panels 8DB10

Metering panel

Cable connection panel

- Three-position disconnector
- Plug-in voltage transformer (directly plugged)
- Voltage transformer with or without three-position disconnector
- Current transformer
- Capacitive voltage detecting system
- Busbar – earthing switch and – make-proof earthing switch
- Busbar connection with or without three-position disconnector
- Panel connection with inside-cone plug or bar connection
Product range
Double-busbar panels 8DB10

Bus sectionalizer (busbar system 1)

- Three-position disconnector
- Vacuum circuit-breaker
- Voltage transformer with or without three-position disconnector
- Current transformer
- Capacitive voltage detecting system
- Busbar
  - earthing switch and
  - make-proof earthing switch
- Busbar connection with or without three-position disconnector
Bus sectionalizer (busbar system 2)

Three-position disconnector

Vacuum circuit-breaker

Voltage transformer with or without three-position disconnector

Current transformer

Capacitive voltage detecting system

Busbar – earthing switch and – make-proof earthing switch

Busbar connection with or without three-position disconnector
Bus sectionalizer (busbar system 1 and 2)

Three-position disconnector

Vacuum circuit-breaker

Voltage transformer with or without three-position disconnector

Current transformer

Capacitive voltage detecting system

Busbar – earthing switch and – make-proof earthing switch

Busbar connection with or without three-position disconnector
Bus sectionalizer (busbar system 1 and 2)

- Three-position disconnector
- Voltage transformer with or without three-position disconnector
- Current transformer
- Capacitive voltage detecting system
- Busbar – earthing switch and – make-proof earthing switch
- Busbar connection with or without three-position disconnector

Product range
Double-busbar panels 8DB10
Product range
Single-pole and double-pole single-busbar panels 8DA1/12

Single-pole circuit-breaker panel

Double-pole circuit-breaker panel

- Three-position disconnector
- Vacuum circuit-breaker
- Plug-in voltage transformer (directly plugged or with cable connection)
- Voltage transformer with or without three-position disconnector
- Current transformer
- Capacitive voltage detecting system
- Busbar – earthing switch and – make-proof earthing switch
- Busbar connection with or without three-position disconnector
- Surge arrester
- Panel connection with inside-cone plug or bar connection
- Zero-sequence current transformer
- Top-mounted bus sectionalizer
Insulating system
- Switchgear housing filled with SF₆ gas
- Features of SF₆ gas:
  - Non-toxic
  - Odorless and colorless
  - Non-inflammable
  - Chemically neutral
  - Heavier than air
  - Electronegative (high-quality insulator)
  - GWP (Global Warming Potential) = 22,800
- Pressure of the SF₆ gas in the switchgear housing dependent on the electrical ratings (relative pressure at 20 °C):
  - Rated functional level (relative):
    - 70 kPa to 120 kPa
  - Design pressure: 190 kPa
  - Design temperature of the SF₆ gas: 90 °C
  - Operating pressure of bursting disc:
    - ≥ 300 kPa
  - Bursting pressure: ≥ 600 kPa
  - Gas leakage rate: < 0.1 % per year.

Panel design
- Factory-assembled, type-tested
- Single-pole metal-enclosed, with metallic partitions
- Hermetically bolted switchgear housings made of corrosion-resistant aluminum alloy
- Switchpanel poles arranged one behind the other
- Maintenance-free in an indoor environment (IEC 62271-1)
- Degree of protection:
  - IP 65 for all high-voltage parts of the primary circuit
  - IP 3XD for the switchgear enclosure
- Option: IP 31D for the switchgear enclosure
- Option: IP 41 for the low-voltage compartment
- Vacuum circuit-breaker
- Three-position disconnector for disconnecting and earthing
- Make-proof earthing by means of the vacuum circuit-breaker
- Cable connection with inside-cone plug-in system according to EN 50181
- Wall-standing or free-standing arrangement
- Instrument transformers removable, located outside the gas compartments
- Subframe, front cover, rear cover and end walls powder-coated in color “light basic” (SN 700)
- Low-voltage compartment removable, plug-in bus wires
- Standardized production processes and certified quality and environmental management system according to ISO 9001 and ISO 14001.

Legend for 8DA10 and 8DB10
1 Low-voltage compartment
2 Electronic control board, e.g. multifunction protection
3 Operating mechanism and interlock for three-position disconnector, as well as mechanical position indicators for three-position disconnector and circuit-breaker
4 Manometer for gas monitoring of feeder gas compartments
5 Circuit-breaker operating mechanism
6 Voltage detecting system
Single-pole and double-pole design for AC traction power supply

Typical uses
• Single-pole and double-pole panels 8DA11/12 for the supply of overhead contact line sections in AC traction power supply systems
• Double-pole panels 8DA12 for application in traction power supply systems with autotransformers, e.g. for high-speed railway traffic.

Panel design
• Panel design based on standard version of single-busbar switchgear 8DA10.

8DA11
Single-pole switchgear panel for traction power supply.

8DA12
Double-pole switchgear panel for traction power supply.

Panel design (examples)

Legend for 8DA11 and 8DA12
1 Low-voltage compartment
2 Electronic control board, e.g. multifunction protection
3 Operating mechanism and interlock for three-position disconnector, as well as mechanical position indicators for three-position disconnector and circuit-breaker
4 Manometer for gas monitoring of feeder gas compartments
5 Circuit-breaker operating mechanism
6 Voltage detecting system
**Gas compartment scheme**

- Sealed pressure system (according to IEC 62271-1)
- No refilling required throughout the entire service life
- Gas compartments distributed to several areas
- Simple, visual check of the ready-for-service indicator by red/green indication areas
- Indication of gas pressure also guaranteed without auxiliary voltage supply
- Gas pressure manometers arranged at the switchgear front
- Gas filling equipment with non-return valve arranged at the switchgear front beside the associated gas pressure manometer
- Gas pressure manometers with two signaling contacts for "gas pressure too low / gas pressure too high" indication
- **Option:** Gas pressure manometers with three signaling contacts for "gas pressure too low / very low" and "gas pressure too high" indication
- **Option:** Gas pressure manometers with temperature and pressure compensation.

Example: Gas quantity circuit-breaker panel (36 kV, 40 kA, 1250 A, cable connection 1 × plug size S2)

- 8DA10:
  - \( SF_6 = 2.5 \text{ kg} \)
  - \( CO_2e = 57 \text{ t} \)
- 8DB10:
  - \( SF_6 = 4.5 \text{ kg} \)
  - \( CO_2e = 105 \text{ t} \).

---

**Legend for 8DA10**

1. Busbar L1 (manometer B11)
2. Busbar L2 (manometer B12)
3. Busbar L3 (manometer B13)
4. Circuit-breaker L1, L2, L3 (manometer B0)
5. Top-mounted bus sectionalizer L1, L2, L3 (manometer B15)
Double-busbar switchgear 8DB10

Legend for 8DB10
1 Busbar system 1, L1 (manometer B11)
2 Busbar system 1, L2 (manometer B12)
3 Busbar system 1, L3 (manometer B13)
4 Busbar system 2, L1 (manometer B21)
5 Busbar system 2, L2 (manometer B22)
6 Busbar system 2, L3 (manometer B23)
7 Three-position disconnector, busbar system 1, L1, L2, L3 (manometer B1)
8 Disconnector, busbar system 2, L1, L2, L3 (manometer B2)
9 Circuit-breaker L1, L2, L3 (manometer B0)
10 Top-mounted bus sectionalizer, busbar system 1, L1, L2, L3 (manometer B15)
11 Top-mounted bus sectionalizer, busbar system 2, L1, L2, L3 (manometer B25)
Features
- According to IEC 62271-100 (for standards, see page 58)
- Application in hermetically bolted switchgear housings in conformity with the system
- Vacuum interrupter in gas-filled switchgear housing
- Maintenance-free for indoor installation according to IEC 62271-1
- Individual secondary equipment
- A metal bellows is used for gasketless separation between the gas insulation and the vacuum (already used with success for over 5 million vacuum interrupters).

Trip-free mechanism
The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC 62271-100.

Switching duties and operating mechanisms
The switching duties of the vacuum circuit-breaker are dependent, among other factors, on its type of operating mechanism.

Motor operating mechanism
- Motor-operating stored-energy mechanism
  - For auto-reclosing (K)
  - For synchronization and rapid load transfer (U)

Further operating mechanism features
- Located outside the switchgear housings in the operating mechanism box and behind the control board
- Stored-energy spring mechanism for 10,000 operating cycles
- Optional: Stored-energy spring mechanism for 30,000 operating cycles.

Operating mechanism functions
Motor operating mechanism 1) (M1 *)
In the case of motor operating mechanism, the closing spring is charged by means of a motor and latched in the charged position (“spring charged” indication is visible). Closing is effected either by means of an ON pushbutton or a closing solenoid. The closing spring is recharged automatically (for auto-reclosing).

Endurance class of circuit-breaker

<table>
<thead>
<tr>
<th>Function</th>
<th>Class</th>
<th>Standard</th>
<th>Property of 8DA and 8DB</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREAKING</td>
<td>M2</td>
<td>IEC 62271-100</td>
<td>10,000 times mechanically without maintenance</td>
</tr>
<tr>
<td>E2</td>
<td>IEC 62271-100</td>
<td>10,000 times rated normal current without maintenance</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>IEC 62271-100</td>
<td>Very low probability of restrikes</td>
<td></td>
</tr>
</tbody>
</table>

Operating times

<table>
<thead>
<tr>
<th>Function</th>
<th>Time</th>
<th>50 Hz</th>
<th>60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closing time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening time</td>
<td>1st shunt release</td>
<td>&lt;65 ms</td>
<td>&lt;55 ms</td>
</tr>
<tr>
<td></td>
<td>2nd shunt release</td>
<td>&lt;65 ms</td>
<td>&lt;55 ms</td>
</tr>
<tr>
<td></td>
<td>Undervoltage release</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arcing time</td>
<td>at 50 Hz</td>
<td>&lt;15 ms</td>
<td>&lt;12 ms</td>
</tr>
<tr>
<td></td>
<td>at 60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Break time</td>
<td>at 50 Hz</td>
<td>&lt;15 ms</td>
<td>&lt;12 ms</td>
</tr>
<tr>
<td></td>
<td>at 60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead time</td>
<td></td>
<td>300 ms</td>
<td></td>
</tr>
<tr>
<td>Total charging time</td>
<td></td>
<td>&lt;15 s</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations for switching duties:
U = Synchronization and rapid load transfer
K = Auto-reclosing

1) Motor rating at
24 V to 250 V DC: max. 500 W
110 V and 240 V AC: max. 650 VA

* Item designation

For further technical data and description of typical applications, please refer also to Catalog HG 11.04 “3AH4 Vacuum Circuit-Breakers”
Secondary equipment
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
• Type 3AY15 10 (Y9 *)
• For electrical closing.

Shunt releases
• Types:
  – Standard: 3AY15 10 (Y1 *)
  – Option: 3AX11 01 (Y2 *), with energy store
• Tripping by protection relay or electrical actuation.

Undervoltage release
• Type 3AX11 03 (Y7 *)
• 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
• 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 (S6 *) and cutout switch (S7 *).

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
• Type 3SV9 (S1 *)
• Standard: Up to 22 NO + 22 NC.

Position switch
• Type 3SE4 (S4 *)
• For signaling “closing spring charged”.

Mechanical interlock
• Mechanical interlocking to the three-position disconnector
• During operation of the three-position disconnector, the vacuum circuit-breaker cannot be operated.

Abbreviations: NO = normally open contact,
NC = normally closed contact
* Item designation

Components
Vacuum circuit-breaker

Operating cycle diagram

Examples
Electrical data (curve 1)
Rated short-circuit breaking current 25 kA
Rated normal current 1250 A

Electrical data (curve 2)
Rated short-circuit breaking current 31.5 kA
Rated normal current 2000 A

Electrical data (curve 3)
Rated short-circuit breaking current 40 kA
Rated normal current 2500 A

Rated operating sequences
Rapid load transfer (U): O-t-CO-t'-CO (t = 0.3 s, t' = 3 min)
Auto-reclosing (K): O-t-CO-t'-CO (t = 0.3 s, t' = 3 min)
Auto-reclosing (K): O-t-CO-t'-CO (t = 0.3 s, t' = 15 s)
O = OPEN operation
CO = CLOSE operation with subsequent OPEN operation at the shortest internal close-open time of the vacuum circuit-breaker

Possible release combinations

<table>
<thead>
<tr>
<th>Release</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st shunt release type 3AY15 10</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2nd shunt release type 3AX11 01</td>
<td>–</td>
<td>*</td>
<td>*</td>
<td>–</td>
<td>*</td>
</tr>
<tr>
<td>3rd shunt release type 3AX11 01</td>
<td>–</td>
<td>–</td>
<td>*</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Undervoltage release type 3AX11 03</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>
Components

Three-position disconnector

Features

• Rated normal currents up to 3150 A
• 2000 operating cycles for the disconnector (higher operating cycles on request)
• 1000 operating cycles for the earthing switch (higher operating cycles on request)
• Option: Up to 2000 operating cycles for the earthing switch
• Operating shaft and contact blades with common center of rotation and reliable switch position up to the operating front of the panel
• Gas-tight bushings separate the busbar and circuit-breaker housings underneath the busbar disconnector contacts
• Cable connection and circuit-breaker housings can be removed without interrupting busbar operation
• Maintenance-free.

Switch positions

• CLOSED, OPEN, EARTHED or READY-TO-EARTH
• CLOSED: Contact blades connected with the busbar: Main circuit closed between busbar and circuit-breaker
• OPEN: Main circuit open between busbar and circuit-breaker: Test voltages for isolating distances are withstood
• READY-TO-EARTH: Contact blades connected with the earthing contact
• EARTHED: Feeder earthed and short-circuited by closing the circuit-breaker.

Operating mechanism

• Only permissible operations possible due to logical mechanical interlocks
• Mechanically coupled position indicator
• Separate operating shafts for the “DISCONNECTING”, “EARTHING” and “READY-TO-EARTH” functions
• With manual operating mechanism
• Option: With motor operating mechanism
  Motor rating at 24 V to 250 V DC: max. 100 W
  110 V to 240 V AC: max. 130 VA
• Same sense of rotation for the switching operations of the “CLOSE” or “OPEN” functions.

Endurance class of three-position disconnector

<table>
<thead>
<tr>
<th>Function</th>
<th>Class</th>
<th>Standard</th>
<th>Property of 8DA and 8DB</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISCONNECTING</td>
<td>M1</td>
<td>IEC 62271-102</td>
<td>2000 times mechanically without maintenance</td>
</tr>
<tr>
<td>READY-TO-EARTH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EARTHING</td>
<td>E2 1)</td>
<td>IEC 62271-102</td>
<td>50 times rated short-circuit making current I_{ma} without maintenance</td>
</tr>
</tbody>
</table>

Endurance class of make-proof earthing switch

<table>
<thead>
<tr>
<th>Function</th>
<th>Class</th>
<th>Standard</th>
<th>Property of 8DA and 8DB</th>
</tr>
</thead>
<tbody>
<tr>
<td>EARTHING</td>
<td>E1</td>
<td>IEC 62271-102</td>
<td>1000 times mechanically without maintenance</td>
</tr>
</tbody>
</table>

1) By closing the circuit-breaker
**Components**

**Three-position disconnector**

**Interlocks**

- Selection of permissible switching operations by means of a control gate with mechanically interlocked vacuum circuit-breaker
- Selection of permissible switching operations in double-busbar switchgear additionally by means of a control gate with mechanically interlocked vacuum circuit-breaker
- Corresponding operating shafts are not released at the operating front until they have been pre-selected with the control gate
- Operating lever cannot be removed until switching operation has been completed
- Circuit-breaker cannot be closed until the control gate is in neutral position again
- **Option:** Switchgear interlocking system with electromechanical interlocks (mechanical interlocking for manual operation remains).

**Position indicators of 8DB10**

- for three-position disconnector and vacuum circuit-breaker

---

**Feeder OPEN**

**Feeder busbar system 1 CLOSED**

**Feeder busbar system 2 CLOSED**

**Feeder READY-TO-EARTH**

**Feeder EARTHED**
Features

- Mechanical control board below the low-voltage compartment
- Actuations directly at the operating mechanisms
- Mechanical position indicators integrated in the switchgear front
- Unambiguous assignment of actuating openings and control elements to the corresponding position indicators
- Ergonomic height of all control elements.

Interlocking

- Panel-internal mechanical interlocks
- Operation of three-position disconnector (CLOSED, OPEN, EARTHED or READY-TO-EARTH)
- Vacuum circuit-breaker interlocked mechanically
- Control gate for opening the actuating openings (with single-busbar systems it can only be operated if the interrogation lever (4) is pushed downwards)
- Actuating openings (2, 3 and 8) cannot be opened as long as the vacuum circuit-breaker is in CLOSED position
- Operating lever can be inserted when the actuating openings are open
- Operating lever cannot be removed before the definite end position of the disconnecting or earthing function is reached
- Feeder de-earthing is secured by the vacuum circuit-breaker – electrically via the auxiliary switch – mechanically through the lever (14) of the mechanical circuit-breaker tripping block.

Components

Control board
Busbar features

- Single-pole enclosure with modular switchgear housings made of corrosion-resistant aluminum alloy
- Continuous gas insulation without plug-in connections or adapters
- No alteration of the insulating medium throughout the complete busbar assembly
- Up to 4000 A with copper bar connection in one busbar housing
- 5000 A with copper bar connection in two busbar housings (twin busbar).

Design of busbar components

The busbars of single-busbar switchgear 8DA and double-busbar switchgear 8DB can be equipped with the following busbar components:

- Plug-in, metal-enclosed busbar voltage transformers with or without three-position disconnector
- Busbar current transformers
- Busbar connection with cable plug, or with solid-insulated or gas-insulated bar connection, with or without three-position disconnector
- Busbar earthing switch or make-proof earthing switch
- Capacitive voltage detecting system according to IEC 61243-5 or IEC 61958
- Top-mounted bus sectionalizer for distribution into two busbar sections without additional switchgear panels and space requirements.
Components

Current transformers

Features

- According to IEC 61869-2
- Designed as ring-core current transformers, single-pole
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Certifiable
- Climate-independent
- Secondary connection by means of a terminal strip in the low-voltage compartment of the panel
- Cast-resin insulated.

Installation

- Arranged outside the primary enclosure (switchgear housing).

Current transformers installation (basic scheme)

Electrical data *

<table>
<thead>
<tr>
<th>Designation</th>
<th>Type 4MC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>max. 0.8 kV</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage (winding test)</td>
<td>3 kV</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Rated continuous thermal current</td>
<td>max. 1.2 × rated current (primary)</td>
</tr>
<tr>
<td>Rated thermal short-time current, max. 3 s</td>
<td>max. 40 kA</td>
</tr>
<tr>
<td>Rated current dynamic primary secondary</td>
<td>unlimited 40 A to 3150 A 1 A and 5 A</td>
</tr>
<tr>
<td>Designation</td>
<td>Type 4MC4</td>
</tr>
<tr>
<td>Multiratio (secondary)</td>
<td>200 A – 100 A up to 3150 A – 1575 A</td>
</tr>
<tr>
<td>Core data according to rated primary current: Measuring core</td>
<td>max. 3 cores</td>
</tr>
<tr>
<td>Rating Class Overcurrent factor</td>
<td>2.5 VA to 30 VA 0.2 to 1 FS 5, FS 10</td>
</tr>
<tr>
<td>Protection core</td>
<td>2.5 VA to 30 VA 5 P or 10 P 10 to 30</td>
</tr>
<tr>
<td>Permissible ambient air temperature</td>
<td>max. 60 °C</td>
</tr>
<tr>
<td>Insulation class</td>
<td>E</td>
</tr>
</tbody>
</table>

* Further electrical data on request
Features

- According to IEC 61869-3
- Single-pole, plug-in design
- Connection system with plug-in contact according to EN 50181
- Inductive type
- Safe-to-touch due to metal enclosure
- Certifiable
- Climate-independent
- Secondary connection by means of plugs in the low-voltage compartment of the panel
- Cast-resin insulated.

Installation

- Arranged outside the primary enclosure (switchgear housing).

Mounting locations

- On the busbar
- At the panel connection housing.

Voltage transformer types

Busbar voltage transformers 4MT3 and 4MU4
- Pluggable on the busbar with plug-in system according to EN 50181
- No separate metering panel required
- Option: Three-position disconnector for busbar voltage transformer CLOSED – OPEN – EARTHEDEDF
- Option 4MU4: Repeat test at 80 % of the rated short-duration power-frequency withstand voltage possible with mounted voltage transformer.

Feeder voltage transformers 4MT7 and 4MU3
- Pluggable at the feeder with plug-in system according to EN 50181
- Connection of 4MT7 directly at the panel connection housing
- Connection of 4MU3 via flexible cable with plug size S2 at the panel connection housing, and metal-enclosed voltage transformer.

Voltage transformer installation

Voltage transformers

1 Busbar voltage transformer 4MU4
2 Feeder voltage transformer 4MT7 (connection at panel connection housing)
3 Busbar voltage transformer 4MU4 with three-position disconnector
4 Feeder voltage transformer 4MU3 (not in the panel, connection via flexible cable with plug size S2 at the panel connection housing, and metal-enclosed voltage transformer)

Electrical data (maximum values)

<table>
<thead>
<tr>
<th>Designation</th>
<th>4MT3</th>
<th>4MU4</th>
<th>4MT7</th>
<th>4MU3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage kV</td>
<td>24.0</td>
<td>40.5</td>
<td>40.5</td>
<td>40.5</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage kV</td>
<td>65</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage kV</td>
<td>125</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Rated voltage factor $U_{n/8h} = 1.9$</td>
<td>$U_{n/8h} = 1.9$</td>
<td>$U_{n/8h} = 1.9$</td>
<td>$U_{n/8h} = 1.9$</td>
<td></td>
</tr>
<tr>
<td>$U_{n/continuous} = 1.2$</td>
<td>$U_{n/continuous} = 1.2$</td>
<td>$U_{n/continuous} = 1.2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>IEC</td>
<td>IEC</td>
<td>IEC</td>
<td>IEC</td>
</tr>
<tr>
<td>GOST</td>
<td>GOST</td>
<td>GOST</td>
<td>GOST</td>
<td></td>
</tr>
<tr>
<td>GB</td>
<td>GB</td>
<td>GB</td>
<td>GB</td>
<td></td>
</tr>
</tbody>
</table>
Features

- Bushings for plugs with inside-cone plug-in system according to EN 50181
- Inside-cone plug-in system for plug sizes 2, 3 and 4
- Single and multiple connections possible per phase
- Connection of several cables with different plug sizes possible per phase
- Connection of solid-insulated or gas-insulated bar possible
- Connection of 4MT7 voltage transformer plugged in at the panel connection housing version 3
- Connection of 4MU3 voltage transformer via flexible cable and plug size 2 at the panel connection housing
- For rated normal currents up to 3150 A.

Surge arresters

- Pluggable via inside-cone plug-in system size 2 or 3
- Surge arresters recommended if, at the same time,
  - the cable system is directly connected to the overhead line,
  - the protection zone of the surge arrester at the end tower of the overhead line does not cover the switchgear.

### Panel connection of 8DA10, 8DB10 and 8DA11/12 for cable plugs and bar systems

<table>
<thead>
<tr>
<th>Version 1</th>
<th>Version 2</th>
<th>Version 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>S3</td>
<td>S2 S3 4MT7 Solid-insulated bar connection</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1 1 – –</td>
</tr>
<tr>
<td>2 – – –</td>
<td></td>
<td>2 – 1 –</td>
</tr>
<tr>
<td>3 – – –</td>
<td></td>
<td>– 2 1 –</td>
</tr>
<tr>
<td>– 2 – –</td>
<td></td>
<td>– 3 1 –</td>
</tr>
<tr>
<td>1 2 – –</td>
<td></td>
<td>1 2 1 –</td>
</tr>
<tr>
<td>1 – 1 –</td>
<td></td>
<td>2 – 1 1</td>
</tr>
<tr>
<td>– 1 1 –</td>
<td></td>
<td>– 2 1 1</td>
</tr>
<tr>
<td>1 1 1 –</td>
<td></td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>– – 1 1</td>
<td></td>
<td>– – 1 1</td>
</tr>
<tr>
<td>1 – – 1</td>
<td></td>
<td>1 – – 1</td>
</tr>
<tr>
<td>2 1 – –</td>
<td></td>
<td>2 1 – –</td>
</tr>
</tbody>
</table>

### Components

#### Panel connection

<table>
<thead>
<tr>
<th>Switchgear type</th>
<th>Rated normal current [A]</th>
<th>Standard subframe</th>
<th>High subframe</th>
<th>Connection height of panel connection versions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8DA10</td>
<td>up to 3150</td>
<td>X</td>
<td></td>
<td>320 240 275 240.5</td>
</tr>
<tr>
<td>8DA11</td>
<td>X</td>
<td></td>
<td></td>
<td>540 460 495 460.5</td>
</tr>
<tr>
<td>8DA12</td>
<td>X</td>
<td></td>
<td></td>
<td>120 40 75 40.5</td>
</tr>
<tr>
<td>8DB10</td>
<td>up to 2500</td>
<td>X</td>
<td></td>
<td>540 460 495 460.5</td>
</tr>
</tbody>
</table>

#### Legend

1) 3150 A on request
Panel connection of 8DA10, 8DB10 and 8DA11/12 for cable plugs and bar systems

<table>
<thead>
<tr>
<th>Version 4</th>
<th>Version 5</th>
<th>Version 6</th>
<th>Version 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>S3</td>
<td>Solid-insulated bar connection</td>
<td>S2</td>
</tr>
<tr>
<td>4</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>5</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>–</td>
<td>4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Connection height of panel connection versions (mm)

| | | | | | |
|---|---|---|---|---|
| 222 | 219 | -15 | 290 | 327 |
| 442 | 439 | 205 | 510 | 547 |
| 22 | 19 | -215 | 90 | 127 |
| 442 | 439 | 205 | 510 | 547 |
## Components

### Panel connection (commercially available cable plugs and bar connections)

#### Busbar and panel connection (commercially available cable plugs)

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Diameter across cable insulation mm</th>
<th>Conductor cross-section mm²</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermoplastic-insulated cables ≤ 12 kV according to IEC 60502-2</td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>12.7 - 33.6</td>
<td>25 - 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tools</td>
</tr>
<tr>
<td></td>
<td>CPI 3</td>
<td>3</td>
<td>21.2 - 45.6</td>
<td>185 - 630</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>13.5 - 44.0</td>
<td>25 - 400</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>3</td>
<td>15.5 - 55.0</td>
<td>35 - 800</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>4</td>
<td>33.0 - 78.5</td>
<td>95 - 1600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Südkabel</td>
<td>SEIK 14</td>
<td>2</td>
<td>13.0 - 40.6</td>
<td>25 - 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEIK 15</td>
<td>3</td>
<td>19.3 - 50.6</td>
<td>120 - 630</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tyco Electronics</td>
<td>RPIT-321x</td>
<td>2</td>
<td>19.5 - 36.0</td>
<td>95 - 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPIT-331x</td>
<td>3</td>
<td>26.0 - 50.0</td>
<td>240 - 630</td>
<td></td>
</tr>
<tr>
<td>Thermoplastic-insulated cables ≤ 24 kV according to IEC 60502-2</td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>17.0 - 40.0</td>
<td>25 - 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tools</td>
</tr>
<tr>
<td></td>
<td>CPI 3</td>
<td>3</td>
<td>21.2 - 45.6</td>
<td>95 - 630</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>13.5 - 44.0</td>
<td>25 - 400</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>3</td>
<td>15.5 - 55.0</td>
<td>35 - 800</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>4</td>
<td>33.0 - 78.5</td>
<td>95 - 1600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Südkabel</td>
<td>SEIK 24</td>
<td>2</td>
<td>13.0 - 40.6</td>
<td>25 - 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEIK 25</td>
<td>3</td>
<td>19.3 - 50.6</td>
<td>50 - 630</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tyco Electronics</td>
<td>RPIT-521x</td>
<td>2</td>
<td>19.5 - 36.0</td>
<td>50 - 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPIT-531x</td>
<td>3</td>
<td>26.0 - 50.0</td>
<td>150 - 630</td>
<td></td>
</tr>
<tr>
<td>Thermoplastic-insulated cables ≤ 40.5 kV according to IEC 60502-2</td>
<td>nkt cables</td>
<td>CPI 2</td>
<td>2</td>
<td>17.0 - 40.0</td>
<td>25 - 300</td>
<td>Insulation material silicone rubber, with or without metal housing, installation without special tools</td>
</tr>
<tr>
<td></td>
<td>CPI 3</td>
<td>3</td>
<td>21.2 - 51.0</td>
<td>50 - 630</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pfisterer</td>
<td>CONNEX</td>
<td>2</td>
<td>13.5 - 44.0</td>
<td>25 - 400</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>3</td>
<td>15.5 - 55.0</td>
<td>35 - 800</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONNEX</td>
<td>4</td>
<td>33.0 - 78.5</td>
<td>95 - 1600</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Südkabel</td>
<td>SEIK 34</td>
<td>2</td>
<td>13.0 - 40.6</td>
<td>35 - 300</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEIK 35</td>
<td>3</td>
<td>19.3 - 50.6</td>
<td>50 - 630</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tyco Electronics</td>
<td>RPIT-621x</td>
<td>2</td>
<td>19.5 - 36.0</td>
<td>50 - 185</td>
<td>Insulation material silicone rubber, with metal housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RPIT-631x</td>
<td>3</td>
<td>26.0 - 50.0</td>
<td>95 - 630</td>
<td></td>
</tr>
</tbody>
</table>

#### Busbar and panel connection (commercially available bar systems)

<table>
<thead>
<tr>
<th>Bar type</th>
<th>Bar connection</th>
<th>Make</th>
<th>Type</th>
<th>Conductor material</th>
<th>Max. rated current ¹</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid-insulated bar</td>
<td>MGC Moser Glaser Duresca DE</td>
<td>Copper, aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of polyamide</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duresca DG</td>
<td>Copper, aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of CrNi steel or aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tefelen Preissinger ISOBUS MR</td>
<td>Copper, aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of heat shrinkable tube</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ritz SIS</td>
<td>Copper, aluminum</td>
<td>2500 A</td>
<td>Outer sheath made of heat shrinkable tube</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas-insulated bar</td>
<td>MGC Moser Glaser Gaslink</td>
<td>Copper</td>
<td>2500 A</td>
<td>Aluminum housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tefelen Preissinger ISOBUS MG</td>
<td>Copper</td>
<td>2500 A</td>
<td>Aluminum housing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Busbar and panel connection (commercially available dummy plugs)

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Dummy plug</th>
<th>Make</th>
<th>Type</th>
<th>Size</th>
<th>Rated voltage</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside-cone plug-in system according to EN 50181</td>
<td>nkt cables FPI 2</td>
<td>2</td>
<td>40.5 kV</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FPI 3</td>
<td>3</td>
<td>40.5 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pfisterer Blindstecker</td>
<td>2</td>
<td>40.5 kV</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>40.5 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>40.5 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Südkabel ISIK 14/24/34</td>
<td>2</td>
<td>12 / 24 / 40.5 kV</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISIK 15/25/35</td>
<td>3</td>
<td>12 / 24 / 40.5 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyco Electronics RPC-2</td>
<td>2</td>
<td>40.5 kV</td>
<td>Insulation material silicone rubber, with metal housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RPC-3</td>
<td>3</td>
<td>40.5 kV</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) Higher values on request
Voltage detecting systems according to IEC 61243-5 or VDE 0622-415, IEC 62271-206

- To verify safe isolation from supply
- LRM detecting systems
  - with plug-in indicator
  - with integrated indicator, type VOIS+, VOIS R+
  - with integrated indicator, with integrated repeat test of the interface, with integrated function test, type CAPDIS-S1+, WEGA 1.2 C, WEGA 1.2 C Vario, with integrated signaling relay, type CAPDIS-S2+, WEGA 2.2 C, 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+
- Integrated display, without auxiliary power
- With indication “A1” to “A3” (see legend)
- Maintenance-free, repeat test according to local specifications and standards required
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (only VOIS R+)
- Degree of protection IP54.

Common features of CAPDIS-Sx+
- Maintenance-free
- Integrated display, without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display-Test” pushbutton
- 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)
- Degree of protection IP54.

CAPDIS-S1+
- Without auxiliary power
- With indication “A1” to “A7” (see legend)
- Without ready-for-service-monitoring
- Without signaling relays (without auxiliary contacts).

CAPDIS-S2+
- With 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).

## Indicators and detecting systems

### Symbols shown

<table>
<thead>
<tr>
<th>VOIS+, VOIS R+</th>
<th>CAPDIS-S1+</th>
<th>CAPDIS-S2+</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1, L2, L3</td>
<td>L1, L2, L3</td>
<td>L1, L2, L3</td>
</tr>
</tbody>
</table>

**Indicators and detecting systems**

- **Plug-in voltage indicator per phase at the panel front**
- **Integrated voltage indicator VOIS+, VOIS R+**
- **Integrated voltage detecting system CAPDIS-S1+, -S2+**
- **CAPDIS S2+: The red and green LEDs show the state of the relay contacts**

### Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth

$U_{LE} = U_N\sqrt{3}$ during rated operation in the three-phase system

$U_2 = U_A = \text{Voltage at the capacitive interface of the switchgear or at the voltage indicator}$

**CAPDIS S2+**

**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 briefly)

**A6** Indication "Test" not passed (lights up briefly)

**A7** Overvoltage present (lights up permanently)

**A8** Indication "ERROR", e.g.: in case of missing auxiliary voltage
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, WEGA 1.2 C Vario
- Display indication “A1” to “A6” (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- Without integrated signaling relay
- Without auxiliary power
- Degree of protection IP54
- Adjustable for different operating voltages (adjustable capacitance C2) (only for WEGA 1.2 C Vario).

WEGA 2.2 C
- Display indication “A0” to “A7” (see legend)
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the “Display Test” pushbutton
- With integrated 3-phase LRM test socket for phase comparison
- With two integrated signaling relays (auxiliary power required)
- Degree of protection IP54.

Voltage indication
via capacitive voltage divider (principle)
- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth
- \[ U_{LE} = U_{N}/\sqrt{3} \] 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

Symbols shown

<table>
<thead>
<tr>
<th></th>
<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>
<td></td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td></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
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
– Repeat test
– Phase comparison
– Phase sequence test
– Self-test
The unit does not require a battery.

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

Phase comparison test unit
make Horstmann, type ORION M1
as combined test unit (HR and LRM) for:
– Phase comparison
– Interface testing at the switchgear
– Voltage detection
– Integrated self-test
– Indication via LED and acoustic alarm
– Phase sequence indicator.
– Measurement of interface current up to 25µA
– Measurement of phase angle from −180° to +180°
– Measurement of harmonics up to 40th harmonic
– Securing the measured values via PC software (ORION explorer) and USB.
Components
Indicating and measuring equipment

Ready-for-service indication

Features
- Simple, visual check of the ready-for-service indicator by red/green indication areas
- Indication of gas pressure also guaranteed without auxiliary voltage supply
- Gas pressure manometers arranged at the switchgear front
- Gas filling equipment with non-return valve arranged at the switchgear front beside the associated gas pressure manometer
- Gas pressure manometers with two signaling contacts for “gas pressure too low / gas pressure too high” indication
- Option: Gas pressure manometers with three signaling contacts for “gas pressure too low / very low” and “gas pressure too high” indication
- Option: Gas pressure manometers with temperature and pressure compensation.

Low-voltage compartment
- For accommodation of protection, control, measuring and metering equipment
- Partitioned safe-to-touch from the high-voltage part of the panel
- Low-voltage compartment can be removed, bus wires and control cables are plugged in
- Option: Higher low-voltage compartment (1200 mm instead of 850 mm) possible.
Protecting, controlling and monitoring are the basic requirements placed on a complete bay controller across all technology generations. The properties the user expects from modern bay controllers are: multifunctionality, reliability, safety and communication capability. The increasing integration of many functions in one multifunctional device leads to an optimally supported engineering process, IT security, service and testability, or simple and safe operability of the devices and tools. On the following pages you will find functional descriptions for some selected devices. The low-voltage compartment can accommodate all customary protection, control, measuring and monitoring equipment available on the market.

### Overview of digital protection devices

<table>
<thead>
<tr>
<th>Main function</th>
<th>SIPROTEC 5</th>
<th>SIPROTEC Compact</th>
<th>SIPROTEC 4</th>
<th>Reyrolle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcurrent and feeder protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent protection with PMU(^1) and control</td>
<td>7SJ82/85</td>
<td>7SJ80/81</td>
<td>7SJ61/62/63/64/66</td>
<td>7SR10/11/12/21/22</td>
</tr>
<tr>
<td>Self powered overcurrent protection</td>
<td></td>
<td>7SJ45</td>
<td></td>
<td>7SR45</td>
</tr>
<tr>
<td>Line protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance protection with PMU(^1) and control</td>
<td>7SA82/86/87</td>
<td></td>
<td>7SA61/63/64</td>
<td></td>
</tr>
<tr>
<td>Line differential protection with PMU(^1) and control</td>
<td>7SD82/86/87</td>
<td>7SD80</td>
<td>7SD610, 7SD5</td>
<td>7SR18 Solkor</td>
</tr>
<tr>
<td>Combined line differential and distance protection with PMU(^1) and control</td>
<td>7SL82/86/87</td>
<td>7SD5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breaker management with PMU(^1) and control</td>
<td>7VK87</td>
<td></td>
<td>7VK61</td>
<td></td>
</tr>
<tr>
<td>Overcurrent protection for lines with PMU(^1)</td>
<td>7SJ86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformer differential protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformer differential protection with PMU(^1), control and monitoring</td>
<td>7UT82/85/86/87</td>
<td>7UT612/613/63</td>
<td>7SR242 Duobias</td>
<td></td>
</tr>
<tr>
<td>Motor- and generator protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor protection with PMU(^1) and control</td>
<td>7SK82/85</td>
<td>7SK80/81</td>
<td>7SJ61/62/63/64/66</td>
<td>7SR105 Argus, 7SR17 Argus</td>
</tr>
<tr>
<td>Generator protection with PMU(^1) and control</td>
<td>7UM85</td>
<td></td>
<td>7UM61/62</td>
<td></td>
</tr>
<tr>
<td>Busbar differential protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centralized busbar differential protection</td>
<td>7SS85</td>
<td></td>
<td>7SS52</td>
<td></td>
</tr>
<tr>
<td>Bay controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bay controller for control/interlocking tasks with PMU(^1), monitoring and protection functions(^1)</td>
<td>6MD85/86</td>
<td>6MD63/66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault recorder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault recorder, fault recorder with power quality recordings and fault recorder with PMU</td>
<td>7KE85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage and frequency protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicable for system decoupling, load shedding and load restoration</td>
<td>7RW80</td>
<td></td>
<td>7SR158 Argus</td>
<td></td>
</tr>
<tr>
<td>Synchronizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronizing</td>
<td></td>
<td>7VE61/63</td>
<td>7SR157 Argus</td>
<td></td>
</tr>
<tr>
<td>Distribution automation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection and automation for overhead lines</td>
<td>7SC80</td>
<td></td>
<td>7SR224 Argus</td>
<td></td>
</tr>
<tr>
<td>Capacitor bank protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitor bank protection</td>
<td>7SJ82/85</td>
<td></td>
<td>7SR191 Capa</td>
<td></td>
</tr>
<tr>
<td>High impedance protection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High impedance protection</td>
<td></td>
<td></td>
<td>7SR23 DAD</td>
<td></td>
</tr>
<tr>
<td>High speed busbar transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High speed busbar transfer</td>
<td></td>
<td></td>
<td></td>
<td>7VU68</td>
</tr>
</tbody>
</table>

\(^1\) Optional for SIPROTEC 5
Components
Protection, control, measuring and monitoring equipment

SIPROTEC 5 device series
- Powerful automation with graphical CFC (Continuous Function Chart)
- Secure serial protection data communication, also over large distances and all available physical media (fiber-optic cable, 2-wire connections and communication networks)
- Recognition of static and transient earth faults (passing contact function in resonant-earthed and isolated systems)
- Measurement of operational values
- Phasor Measurement Unit (PMU) for synchrophasor measured values and IEEE C37.118 protocol
- Powerful fault recording
- Control of switching devices.

Overcurrent protection device SIPROTEC 7SJ82
- Directional and non-directional time-overcurrent protection with additional functions
- Time optimization of the tripping times by directional 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 system interlocking
- 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).

Distance protection SIPROTEC 7SA86
- Line protection for all voltage levels with 3-pole tripping
- Very short tripping time
- Selective protection of overhead lines and cables with single- and multi-ended infeeds
- Time-graded backup protection to differential protection relays
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Main protection function: 6-system distance protection
- Detection of current transformer saturation for fast tripping with high accuracy at the same time.

Differential protection SIPROTEC 7SD86
- Line protection for all voltage levels with 3-pole tripping
- Phase-selective protection of overhead lines and cables with single- and multi-ended infeeds of all lengths with up to 6 line ends
- Transformers and shunt reactors within the protection zone are possible
- Suitable for radial, ring-shaped, or any type of meshed systems of any voltage level with earthed, resonant-earthed or isolated neutral point
- Protection of lines with capacitive series compensation
- Directional backup protection and various additional functions.
Transformer differential protection SIPROTEC 7UT85
- Transformer differential protection for two-winding transformers with versatile additional protection functions
- Universal utilization of the permissible measuring points
- Flexible adjustment to the transformer vector group, controlling of making and overexcitation processes, secure performance in case of current transformer saturation with different saturation degrees.
- Protection of standard power transformers and auto-transformers
- Increased sensitivity in case of earth short-circuits close to the neutral point by means of a separate earth-fault differential protection
- Additional current and voltage inputs can be provided for standard protection functions such as overcurrent, voltage, frequency, etc.
- In the standard version, two communication modules can be plugged in, and different protocols can be used (IEC 61850, IEC 60870-5-103, DNP3 (serial, TCP), Modbus RTU Slave).

Digital fault recorder SIPROTEC 7KE85
- Fast-scan recorder
- Up to 2 slow scan recorders
- Up to 5 continuous recorders
- Usable as Phasor Measurement Unit (PMU) according to IEEE C37.118 Standard
- Transfer of recordings and triggering via IEC 61850
- Variable sampling rates programmable between 1 kHz – 16 kHz
- No-loss data compression
- Time synchronization via IRIG-B, DCF77 and SNTP
- Free mapping of measured values to the individual recorders
- Free combination of measuring groups for power calculation
- Quality bits for displaying the momentary channel quality
- The trigger functions of a function block are the fundamental value, r.m.s. value, zero-sequence, positive-sequence, negative-sequence system, Σ active, Σ reactive and Σ apparent power
- Level trigger and gradient trigger for each trigger function
- Flexible cross and network trigger
- Creation of trigger functions with the graphical automation editor CFC (Continuous Function Chart)
- Trigger functions by combination of single signals, double signals, analog values, binary signals, Bool signals and GOOSE messages.

SIPROTEC Compact series
Overcurrent protection SIPROTEC 7SJ80
- Pluggable current and voltage terminals
- Binary input thresholds settable using DIGSI (3 stages)
- Secondary current transformer values (1A/5A) settable using DIGSI
- 9 programmable function keys
- 6-line display
- Buffer battery exchangeable from the front
- USB front port
- 2 additional communication ports
- IEC 61850 with integrated redundancy (electrical or optical)
- Relay-to-relay communication through Ethernet with IEC 61850 GOOSE
- Millisecond-accurate time synchronization through Ethernet with SNTP.
Components
ANSI design

Panel design
- Factory-assembled, type-tested according to IEC 62271
- Single-pole metal-enclosed, with metallic partitions ¹)
- Hermetically bolted switchgear housings made of corrosion-resistant aluminum alloy
- Switchpanel poles arranged one behind the other
- Maintenance-free in an indoor environment (IEC 62271-1)
- Cable connection with inside-cone plug-in system according to EN 50181
- Wall-standing or free-standing arrangement
- Subframe, front cover, rear cover and end walls powder-coated in color “light basic” (SN 700)
- Low-voltage compartment removable, plug-in bus wires
- Degree of protection
  - IP 65 for all high-voltage parts of the primary circuit
  - IP 3XD for the switchgear enclosure
- Option: IP 31D for the switchgear enclosure
- Option: IP 41 for the low-voltage compartment
- Vacuum circuit-breaker
- Three-position disconnector for disconnecting and earthing by means of the circuit-breaker
- Make-proof earthing by means of the vacuum circuit-breaker
- Option: Three-position disconnector for disconnecting and earthing at the feeder
- For further dimensions and product range, see pages 14 to 31.

Insulating system
- Switchgear housing filled with SF₆ gas
- Features of SF₆ gas:
  - Non-toxic
  - Odorless and colorless
  - Non-inflammable
  - Chemically neutral
  - Heavier than air
  - Electronegative (high-quality insulator)
  - GWP (Global Warming Potential) = 22,800
- Pressure of the SF₆ gas in the switchgear housing dependent on the electrical ratings (relative pressure at 20 °C):
  Rated functional level (relative): 120 kPa
  Gas leakage rate: < 0.1 % per year.

Camera system
- Camera system for visual monitoring of the switch positions of the disconnectors and earthing switches (see also page 54).

UL certification
- For 8DA and 8DB ANSI design options there is a UL or cUL certificate available.

¹) Corresponds to “metal-clad” according to former standard IEC 60298
### Electrical data, functional level, temperature for single-busbar and double-busbar switchgear according to ANSI

<table>
<thead>
<tr>
<th>Common electrical data, functional level and temperature</th>
<th>Rated insulation level</th>
<th>Rated voltage $U_r$ kV</th>
<th>4.76</th>
<th>8.25</th>
<th>15</th>
<th>27</th>
<th>38</th>
<th>40.5 (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated short-duration power-frequency withstand voltage $U_{dc}$:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap kV</td>
<td>19</td>
<td>21</td>
<td>36</td>
<td>36</td>
<td>70</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>– across the isolating distance kV</td>
<td>60</td>
<td>66</td>
<td>95</td>
<td>105</td>
<td>125</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>Rated lightning impulse withstand voltage $U_{ip}$:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– phase-to-phase, phase-to-earth, open contact gap kV</td>
<td>60</td>
<td>66</td>
<td>95</td>
<td>105</td>
<td>125</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>– across the isolating distance kV</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td><strong>Rated frequency $f_r$ Hz</strong></td>
<td></td>
<td></td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td><strong>Rated normal current $I_r$ of the busbar</strong> A</td>
<td>A</td>
<td></td>
<td>1250</td>
<td>1600</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
<td>5000</td>
</tr>
<tr>
<td><strong>Rated short-time withstand current $I_k$ $t_k=3\text{ s}$ bis kA</strong></td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Rated peak withstand current $I_p$</strong> bis kA**</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
</tr>
<tr>
<td><strong>Rated short-circuit making current $I_{ma}$</strong> bis kA**</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>104</td>
</tr>
<tr>
<td><strong>Rated short-circuit breaking current $I_{sc}$</strong> bis kA**</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Electrical endurance of vacuum circuit-breakers</strong> at rated normal current 10,000 operating cycles (^2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at rated short-circuit breaking current 50 breaking operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rated functional level $p_{re}$ (relative) for feeders</strong></td>
<td>120 kPa at 20 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minimum functional level $p_{me}$</strong></td>
<td>100 kPa at 20 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Components ANSI design**

---

1) Higher values of the rated voltage available with 42 kV
2) Disconnector panel available for single-busbar switchgear 8DA10
3) Bus coupler available for double-busbar switchgear 8DB10
4) Maximum permissible normal current dependent on ambient air temperature
5) 2700 A without forced ventilation (8DB10 on request)
6) 3000 A with forced ventilation (8DB10 on request)
7) **Option:** 30,000 operating cycles
8) **Option:** Ambient air temperature –30 °C to +55 °C
Components
ANSI design

Camera system
8DA and 8DB switchgear can be designed according to ANSI requirements. For this purpose, every three-position disconnector is equipped with a digital camera monitoring system VDMS (Visible Disconnect Monitoring System). The CLOSED - OPEN - EARTHED positions are transmitted per phase through a USB / RJ45 interface and signaled to a mobile computer.

Current transformer features
- Designed as ring-core current transformers, single-pole
- Free of dielectrically stressed cast-resin parts (due to design)
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip in the low-voltage compartment of the panel
- Cast-resin insulated.

Voltage transformer features
- Single-pole, plug-in design
- Connection system with plug-in contact according to EN 50181
- Inductive type
- Safe-to-touch due to metal enclosure
- Climate-independent
- Secondary connection by means of plugs in the low-voltage compartment of the panel
- Cast-resin insulated.

Installation
Arranged outside the primary enclosure (switchgear housing).

Internal arc classification
- Internal arcing test according to IEEE Std C37.20.7™-2007 (see also page 13).

Current transformer installation (basic scheme)
C  Feeder current transformer (type 4MC4_90)
D  Feeder current transformer (type 4MC4_10)
E  Busbar current transformer (type 4MC4_40)

Option:
A  Feeder current transformer between circuit-breaker and three-position disconnector on the busbar (type 4MC4_90)

Voltage transformer installation (basic scheme)
1  Busbar voltage transformer 4MU4_FUSE with primary fuses and three-position disconnector
2  Feeder voltage transformer 4MU3_FUSE with primary fuses (not in the panel, connection via flexible cable with plug size S2 at the panel connection housing and metal-enclosed voltage transformer)

USB and LAN interface for visual monitoring of the positions of the three-position disconnector
Option:
In accordance with ANSI requirements, 8DA and 8DB switchgear can be equipped with an additional three-position disconnector at the feeder.

Features
• Rated normal currents up to 2000 A
• 2000 operating cycles for the disconnector (higher operating cycles on request)
• 1000 operating cycles for the earthing switch (higher operating cycles on request)
• Operating shaft and disconnector contacts with common center of rotation and reliable switch position up to the operating front of the panel
• Gas-tight bushings separate the busbar and circuit-breaker housings underneath the busbar disconnector contacts
• Cable connection and circuit-breaker housings can be removed without interrupting busbar operation
• Maintenance-free.

Switch positions
• CLOSED, OPEN, EARTHED or READY-TO-EARTH
• CLOSED: Disconnector contact connected with the busbar: Main circuit closed between busbar, circuit-breaker and feeder
• OPEN: Main circuit open between busbar, circuit-breaker and feeder: Test voltages for isolating distances are withstood
• READY-TO-EARTH: Contact blades connected with the earthing contact
• EARTHED: Circuit-breaker closed. Three-position disconnector at the feeder connected with earthing contact

Operating mechanism
• Only permissible operations possible due to logical mechanical interlocks
• Mechanically coupled position indicators
• Separate operating shafts for the “DISCONNECTING”, “EARTHING” and “READY-TO-EARTH” functions
• With manual operating mechanism
• Option: With motor operating mechanism
  Motor rating at
  24 V to 250 V DC: max. 100 W
  110 V to 240 V AC: max. 130 VA
• Same sense of rotation for the switching operations of the “CLOSE” or “OPEN” functions.
Type of service location
The switchgear can be used as indoor installation according to IEC 61936 (Power installations exceeding 1 kV AC)
- Outside lockable electrical service locations at places which are not accessible to the public. Enclosures of switchgear can only be removed with tools
- In 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 engineering. Untrained or unskilled persons may only enter under the supervision of authorized personnel or properly instructed persons.

Terms
“Make-proof earthing switches” are earthing switches with short-circuit making capacity according to IEC 62271-102 and EN 62271-102.

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 (see table "Dielectric strength").
- The rated values are referred to sea level and to normal atmospheric conditions (1013 hPa, 20 °C, 11g/m3 humidity according to IEC 60071).
  The gas insulation at a relative gas pressure of > 50 kPa permits switchgear installation at any desired altitude above sea level without the dielectric strength being adversely affected.

Standards
8DA and 8DB 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 (September 2017)

<table>
<thead>
<tr>
<th>Overview of standards for traction applications</th>
<th>IEC standard</th>
<th>VDE standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>8DA11 and 8DA12</td>
<td>IEC 60850</td>
<td>VDE 0115-102</td>
</tr>
<tr>
<td>Switchgear</td>
<td>8DA11 and 8DA12</td>
<td>IEC 62505</td>
<td>VDE 0115-320</td>
</tr>
<tr>
<td>Insulation</td>
<td>8DA11 and 8DA12</td>
<td>–</td>
<td>VDE 0115-107</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table – Dielectric strength Single-busbar and double-busbar switchgear 8DA10 and 8DB10</th>
<th>Rated voltage</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>– Between phase and earth</td>
<td>kV</td>
<td>28</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>– Across isolating distance</td>
<td>kV</td>
<td>32</td>
<td>60</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>– Between phase and earth</td>
<td>kV</td>
<td>75</td>
<td>125</td>
<td>170</td>
</tr>
<tr>
<td>– Across isolating distance</td>
<td>kV</td>
<td>85</td>
<td>145</td>
<td>195</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table – Dielectric strength Traction power supply switchgear 8DA11/12</th>
<th>Rated voltage according to EN 50124-1</th>
<th>17.25</th>
<th>27.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage according to IEC 60850 / EN 50163</td>
<td>kV</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Rated short-duration power-frequency withstand voltage</td>
<td>– Between phase and earth</td>
<td>kV</td>
<td>50</td>
</tr>
<tr>
<td>– Across isolating distance</td>
<td>kV</td>
<td>60</td>
<td>110</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>– Between phase and earth</td>
<td>kV</td>
<td>125</td>
</tr>
<tr>
<td>– Across isolating distance</td>
<td>kV</td>
<td>145</td>
<td>220</td>
</tr>
</tbody>
</table>
Current carrying capacity
- According to IEC 62271-200 or IEC 62271-1, 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 classifications
- 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 and IEEE Std C37.20.7™-2007
- Definition of criteria according to IEC:
  - 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
Due to the single-pole enclosure and the gas insulation of the switchgear and the switching devices, the possibility of faults in gas-insulated switchgear is a mere fraction of that typical of other switchgear types:
- There are no effects due to external influences, such as:
  - Pollution layers
  - Humidity
  - Small animals and foreign objects
- Maloperation is practically excluded due to logical arrangement of operating elements
- Short-circuit-proof feeder earthing by means of the circuit-breaker.
In the unlikely event of a fault within the switchgear housing, the energy conversion in the case of an internal arc fault is minor thanks to the SF₆ insulation and the shorter length of the arc, approximately only ⅓ of the converted energy of an arc in air insulation.

Resistance to short circuits and earth faults
Two-phase and three-phase short circuits between the primary conductors are excluded by the single-pole primary enclosure.

Seismic withstand capability (optional)
8DA and 8DB switchgear can be upgraded for regions at risk from earthquakes.
For upgrading, earthquake qualification testing has been carried out in accordance with the following standards:
- IEC 60980-1989 “Recommended practices for seismic qualification of electrical equipment of the safety system for nuclear generating stations”.
For installation on even and rigid concrete or steel structure (without considering building influences), the tested ground accelerations meet the following requirements:
- Uniform Building Code 1997 (UBC) – Zone 4
- California Building Code 1998 (CBC) – Zone 4
- International Building Code 2006 (IBC) – 200 %
- American Society of Civil Engineers 2005 (ASCE) – 200 %
- IEEE 693-2005 – High required response spectrum (Figure A.1).

Color of the panel front
Siemens standard (SN) 47 030 G1, color “light basic” (SN700) (similar to RAL 7044 / silk grey).

Climate and environmental influences
8DA and 8DB switchgear is completely enclosed and insensitive to climatic influences.
- All medium-voltage devices are installed in gas-tight and bolted switchgear housings made of corrosion-resistant aluminum alloy and filled with SF₆ gas
- Live parts inside and outside the switchgear housing are provided with single-pole enclosure
- At no point can creepage currents flow from high-voltage potentials to earth
- Operating mechanism parts which are functionally important are made of corrosion-resistant materials
- Bearings in the operating mechanism are designed as dry-type bearings and do not require lubrication.

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).

Protection against solid foreign objects, electric shock and water
8DA and 8DB switchgear fulfills according to the standards

<table>
<thead>
<tr>
<th>Degree of protection</th>
<th>Type of protection</th>
<th>Standards</th>
<th>Specifications</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP 65</td>
<td>for parts of the primary circuit under high voltage</td>
<td>IEC 62271-1</td>
<td>EN 62271-1</td>
<td></td>
</tr>
<tr>
<td>IP 3XD</td>
<td>for switchgear enclosure</td>
<td>IEC 62271-200</td>
<td>EN 62271-200</td>
<td></td>
</tr>
<tr>
<td>IP 31D</td>
<td>for switchgear enclosure (optional)</td>
<td>IEC 60529</td>
<td>EN 60529</td>
<td></td>
</tr>
<tr>
<td>IP 41</td>
<td>for low-voltage compartment (optional)</td>
<td>IEC 62262</td>
<td>EN 50102</td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>Type of protection</td>
<td>Standards</td>
<td>Specifications</td>
<td>Guidelines</td>
</tr>
<tr>
<td>IK 07</td>
<td>for switchgear enclosure</td>
<td>IEC 344-2004</td>
<td>“IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations”</td>
<td></td>
</tr>
</tbody>
</table>
First circuit-breaker switchgear 8DA10 – 1982

Up to now, more than 100,000 8DA and 8DB switchgear panels successfully in operation worldwide.