Type SDV7
distribution circuit breaker

Top performance - proven reliability

Answers for energy.
The SDV7 family is the latest generation of the successful SDV product line. Ratings have been expanded, and the highly reliable type 3AH operators are retained. With over 7,000 type SDV units and 350,000 type 3AH operators in service, you can rely on Siemens products to meet your distribution system demands.

The design of the type SDV7 features significant reduction in enclosure size; and, consequently, in the overall footprint.

The type SDV7 product line encompasses the voltage groups: 15.5 kV and 27.6 kV. Each group is specifically designed to optimize space and material for the voltage class while retaining common features across the entire product line.

### Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>2-3</td>
</tr>
<tr>
<td>Type 3AH3 vacuum circuit breaker and stored-energy operating mechanism</td>
<td>4-5</td>
</tr>
<tr>
<td>Vacuum interrupters</td>
<td>5</td>
</tr>
<tr>
<td>Technical ratings and control voltages</td>
<td>6</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7</td>
</tr>
</tbody>
</table>

**Ratings available:**

**15.5 kV**
- 20 kA or 25 kA
- 1,200 A or 2,000 A
- 110 kV BIL

**27.6 kV**
- 20 kA or 25 kA
- 1,200 A or 2,000 A
- 150 kV BIL
Standard features

- Type 3AH3 operating mechanism
- Trip and close coil
- Visual circuit breaker status window
- Operations counter
- Mechanical position indicator
- External manual trip handle
- Generous relay and metering space
- Hinged panel for relays or devices
- Necessary terminal blocks and wiring
- Fused knife-switch control voltage disconnects
- Porcelain dry-type roof bushings
- Bolted cabinet construction
- Permanent lifting eyes (2)
- Adjustable galvanized legs (4)
- Corrosion resistant powder paint finish (ANSI-61 light gray)
- Stainless steel external ground pads (2)
- Stainless steel external hardware
- Cabinet heaters to prevent condensation
- Filtered ventilation
- ANSI rain-tested design (per ANSI C37.20.2-1999)
- Reduced footprint from previous models.

Options

- Terminal connectors for bushings
- Terminal connectors for ground
- Current transformers (up to 2/bushing)
- Capacitor trip unit for alternating current (ac) tripping supply
- Second trip coil
- Undervoltage trip device
- Additional auxiliary switch contacts
- Siemens protective relays
- Other protective relays
- Circuit breaker control switch with indicating lights
- Local/remote or toggle switches
- Additional heaters for -40 °C application
- 1/2 voltage heaters
- Adjustable thermostat
- Seismic capability (IEEE 693 high level)
- Interior convenience outlet (GFCI)
- Interior light with switch
- Molded case circuit breakers in lieu of fused knife switches
- Wire markers.

Standards

The type SDV7 meets the following standards:

- IEEE C37.04-1999 rating structure for ac high-voltage circuit breakers
- IEEE C37.09-1999 test procedure for ac high-voltage circuit breakers
- IEEE C37-06-2009 preferred ratings ac high-voltage circuit breakers
- NEMA SG-4-2009 ac high-voltage circuit breakers.

Seismic

When specified, the type SDV7 distribution vacuum circuit breaker can be provided with the capability of maintaining structural integrity during and following a seismic disturbance, as appropriate for the specified UBC zones 1-4, IBC-2006 or IEEE 693 levels.

Maintenance interval

If applied under ANSI “usual service” conditions, maintenance is only needed at intervals of five years/10,000 operations on any circuit breaker in an outdoor application.
Type 3AH3 vacuum circuit breaker

Circuit breaker

Siemens has been manufacturing medium-voltage vacuum circuit breakers for over 30 years and has over 350,000 vacuum circuit breakers in service throughout the world. Siemens designs and develops circuit breaker operators and interrupters at its circuit breaker Center of Competence in Berlin, Germany. Design (type) short-circuit tests are performed at independent power test laboratories. Design configuration of the operating mechanism is controlled from Berlin to ensure that circuit breakers assembled at any of the regional manufacturing centers will meet the performance requirements of the design.

Operator

The type 3AHI circuit breaker operator is a durable and reliable stored-energy mechanism. This operator is designed to perform up to 10,000 operations before overhaul, and the basic operator in the 3A family has a mean time before failure (MTBF) of over 12,000 years (as of 2006).

Type 3AH3 stored-energy operating mechanism

The type SDV7 outdoor distribution circuit breaker utilizes the type 3AH3 stored-energy operating mechanism. The type 3AH3 is the latest member of the type 3A operator family, of which over 350,000 units are in service worldwide in vacuum circuit breakers. Over 60,000 type 3AH3 operators are in service. The type 3AH3 operator builds on the vast experience with the type 3A family of operating mechanisms. Improvements in the operator have been incorporated to enhance service life and simplify maintenance. Newer lubricants and alternative bearing materials have been selected to reduce the chance for interaction between the lubricants and the metals to ensure long service life. Mounting provisions for devices, such as the opening latch, closing latch and similar items, are designed for one-person removal and installation.
Reusable spring clips are used for pivot pins, avoiding the need for special removal tools or a supply of special purpose retainers during maintenance.

The type SDV7 circuit breaker now is provided with a 3-cycle rated interrupting time as standard for control voltage ratings of 48 Vdc and higher and for units equipped for capacitor tripping. Optionally, slower trip coils for 5-cycle interrupting time can be provided.

The type 3AH3 operator is a true stored-energy operating mechanism. Closing springs are charged electrically immediately following a closing operation, and the opening spring is charged by the rotation of the circuit breaker main shaft during the closing operation.

The spring charging mechanism is a gear-drive design. Compared to a ratchet-and-pawl mechanism, the type 3AH3 operator is quieter and exhibits longer mechanical life. The estimated total mechanical endurance of the operator is 60,000 operations with overhaul and vacuum interrupter replacement at 10,000 operations.

The recommended maintenance interval for the operating mechanism is five years or 10,000 operations, whichever occurs first, when used in the ANSI/IEEE “usual service conditions.”

The entire type SDV7 family, from 15.5 kV through 27.6 kV, uses the same basic type 3AH3 operating mechanism. The operators differ only in elements related to the design voltage or interrupting rating of the circuit breaker. The components that differ according to rating include: the main rotating shaft, contact pressure springs, closing spring, opening spring and pushrods, as well as the high voltage elements, such as the interrupter, standoff insulators and similar items.

The type SDV7 circuit breaker family is now provided with a 3-cycle rated interrupting time as standard for control voltage ratings of 48 Vdc and higher and for units equipped for capacitor tripping. Optionally, slower trip coils for 5-cycle interrupting time can be provided.

The type 3AH3 operator is a true stored-energy operating mechanism. Closing springs are charged electrically immediately following a closing operation, and the opening spring is charged by the rotation of the circuit breaker main shaft during the closing operation.

The spring charging mechanism is a gear-drive design. Compared to a ratchet-and-pawl mechanism, the type 3AH3 operator is quieter and exhibits longer mechanical life. The estimated total mechanical endurance of the operator is 60,000 operations with overhaul and vacuum interrupter replacement at 10,000 operations.

The recommended maintenance interval for the operating mechanism is five years or 10,000 operations, whichever occurs first, when used in the ANSI/IEEE “usual service conditions.”

The entire type SDV7 family, from 15.5 kV through 27.6 kV, uses the same basic type 3AH3 operating mechanism. The operators differ only in elements related to the design voltage or interrupting rating of the circuit breaker. The components that differ according to rating include: the main rotating shaft, contact pressure springs, closing spring, opening spring and pushrods, as well as the high voltage elements, such as the interrupter, standoff insulators and similar items.

Vacuum Interrupters

At the heart of the medium-voltage circuit breaker are the vacuum interrupters. Siemens vacuum interrupters use chrome-copper contact material, which keeps the chopping current to 5 amperes or less and thereby keeps overvoltages to a minimum.

For 15.5 kV and 27.6 kV circuit breakers up to 25 kA, radial magnetic field contacts are used to force high current (>10 kA) arcs to rotate rapidly around the contact surfaces to reduce contact erosion.

The Siemens vacuum interrupter is designed to interrupt up to 100 full-rated faults (depending on rating) before replacement is necessary. A contact-wear indicator is provided to directly determine the wear of the contacts within the vacuum interrupter.
## Technical ratings

<table>
<thead>
<tr>
<th>Circuit breaker type</th>
<th>Rated maximum voltage</th>
<th>Rated withstand voltages</th>
<th>Rated short-circuit and short-time current</th>
<th>Rated interrupting time¹</th>
<th>Rated continuous current</th>
<th>Rated transient recovery voltage²</th>
<th>Rated permissible tripping delay time</th>
<th>Rated closing and latching current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kV, rms</td>
<td>kV¹</td>
<td>kA, rms</td>
<td>ms/cycles</td>
<td>A, rms</td>
<td>kV</td>
<td>μs</td>
<td>sec</td>
</tr>
<tr>
<td>15.5-20</td>
<td>15.5</td>
<td>110/142</td>
<td>50</td>
<td>20</td>
<td>50/3</td>
<td>1,200, 2,000</td>
<td>29.2</td>
<td>32</td>
</tr>
<tr>
<td>15.5-25</td>
<td>15.5</td>
<td>110/142</td>
<td>50</td>
<td>25</td>
<td>50/3</td>
<td>1,200, 2,000</td>
<td>29.2</td>
<td>32</td>
</tr>
<tr>
<td>27.6-20</td>
<td>27.6</td>
<td>150/194</td>
<td>60</td>
<td>20</td>
<td>50/3</td>
<td>1,200, 2,000</td>
<td>52.1</td>
<td>45</td>
</tr>
<tr>
<td>27.6-25</td>
<td>27.6</td>
<td>150/194</td>
<td>60</td>
<td>25</td>
<td>50/3</td>
<td>1,200, 2,000</td>
<td>52.1</td>
<td>45</td>
</tr>
</tbody>
</table>

### Type SDV7 circuit breaker control data

<table>
<thead>
<tr>
<th>Nominal</th>
<th>Range</th>
<th>Close coil</th>
<th>Trip coil⁴</th>
<th>Spring charging motor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Close</td>
<td>Trip</td>
<td>A</td>
</tr>
<tr>
<td>48 Vdc</td>
<td>36-56</td>
<td>28-56</td>
<td>11.4</td>
<td>30/11.4</td>
</tr>
<tr>
<td>125 Vdc</td>
<td>90-140</td>
<td>70-140</td>
<td>2.1</td>
<td>7.4/4.8</td>
</tr>
<tr>
<td>250 Vdc</td>
<td>180-280</td>
<td>140-280</td>
<td>2.1</td>
<td>9.6/4.2</td>
</tr>
<tr>
<td>120 Vac</td>
<td>104-127</td>
<td>104-127</td>
<td>2.0</td>
<td>---</td>
</tr>
<tr>
<td>240 Vac</td>
<td>208-254</td>
<td>208-254</td>
<td>2.0</td>
<td>---</td>
</tr>
</tbody>
</table>

### Footnotes:

¹ Standard 50 ms (3-cycle) with 48 Vdc, 125 Vdc or 250 Vdc trip voltage or capacitor trip with 83 ms (5-cycle) interrupting time optional. For 24 Vdc trip, interrupting time is 83 ms (5-cycle).
² TRV values are in accord with IEEE C37.06-2009. TRV peak value $u_c$ is roughly equal to historic $E_2$ value in ANSI C37.06-2000. Value $t_3$, time to voltage $u_c$, is approximately 1/1.138 times the $T_2$ value in ANSI C37.06-2000.
³ First value is full-wave impulse withstand circuit breaker open or closed. Second value is chopped-wave impulse withstand, applicable only with circuit breaker closed.
⁴ First value is for standard 50 ms/3-cycle interrupting time. Second value is for optional 83 ms/5-cycle interrupting time (see note 1).
### Dimensions

<table>
<thead>
<tr>
<th>Rating</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G Minimum</th>
<th>G Maximum</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.5 kV</td>
<td>10.7</td>
<td>13.0</td>
<td>47.2</td>
<td>44.5</td>
<td>12.4</td>
<td>19.8</td>
<td>92.0</td>
<td>113.0</td>
<td>38.8</td>
<td>31.4</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>(272)</td>
<td>(330)</td>
<td>(1,199)</td>
<td>(1,130)</td>
<td>(315)</td>
<td>(503)</td>
<td>(2,337)</td>
<td>(2,870)</td>
<td>(986)</td>
<td>(798)</td>
<td>(1,087)</td>
</tr>
<tr>
<td>27.6 kV</td>
<td>12.3</td>
<td>16.0</td>
<td>56.5</td>
<td>49.8</td>
<td>14.4</td>
<td>21.0</td>
<td>96.0</td>
<td>117.0</td>
<td>44.2</td>
<td>39.4</td>
<td>52.0</td>
</tr>
<tr>
<td></td>
<td>(312)</td>
<td>(406)</td>
<td>(1,435)</td>
<td>(1,265)</td>
<td>(366)</td>
<td>(533)</td>
<td>(2,438)</td>
<td>(2,972)</td>
<td>(1,123)</td>
<td>(1,001)</td>
<td>(1,321)</td>
</tr>
</tbody>
</table>

Footnote: 1 Dimensions in inches (mm).