Your safety first – always!

That’s why our instruction manual begins with these recommendations:

- Only install switchgear and switchboards in enclosed rooms suitable for electrical equipment.
- Ensure that installation, operation and maintenance are carried out by specialist electricians only.
- Comply in full with the legally recognized standards (DIN VDE / IEC), the connection conditions of the local electrical utility and the applicable safety at work regulations.
- Observe the relevant information in the instruction manual for all actions involving switchgear and switchboards.

⚠️ Danger!

Pay special attention to the hazard notes in the instruction manual marked with this warning symbol.

- Make sure that under operation condition of the switchgear or switchboard the specified data are not exceeded.
- Keep the instruction manual accessible to all persons concerned with installation, operation and maintenance.
- The user’s personnel are to act responsibly in all matters affecting safety at work and the correct handling of the switchgear.

If you have any further questions on this instruction manual, the members of our field organization will be pleased to provide the required information.
Contents  Page
1  Summary  5
   1.1  General  5
   1.2  Standards and specifications  5
      1.2.1  Switchgear manufacture  5
      1.2.2  Installation and operation  5
   1.3  Operating conditions  5
      1.3.1  Normal operating conditions  5
      1.3.2  Special operating conditions  5
2  Technical data  6
   2.1  Technical data
      Circuit-breakers  6
   2.2  Technical data
      Releases and blocking magnet  7
   2.3  Technical data
      Motor-operated mechanisms  7
   2.4  Permissible number of vacuum interrupter switching operations in relation to breaking current  8
3  Structure and function  12
   3.1  Structure of the breaker poles  12
   3.2  Structure of the breaker operating mechanism  12
      3.2.1  Releases, blocking magnet and auxiliary switches  12
      3.2.2  Mounting of the VD4 on trucks from other manufacturers  13
   3.3  Function  13
      3.3.1  Charging of the spring energy store  13
      3.3.2  Closing procedure  13
      3.3.3  Opening procedure  13
      3.3.4  Auto-reclosing sequence  13
      3.3.5  Quenching principle of the vacuum interrupter  13
4  Despatch and storage  16
   4.1  Condition on delivery  16
   4.2  Packaging  16
   4.3  Transport  16
   4.4  Delivery  16
   4.5  Intermediate storage  16
5  Installation  17
6  Commissioning / Operation  18
   6.1  Note on safety at work  18
   6.2  Preparatory activities  18
   6.3  Operation of the circuit-breaker  18
      6.3.1  Charging the spring energy store  18
      6.3.2  Closing and opening  18
      6.3.3  Run-on block  19
7  Maintenance  20
   7.1  General  20
      7.1.1  Service life  20
      7.2  Inspection and functional testing  20
      7.2.1  Switching device in general  20
      7.2.2  Stored-energy spring mechanism  20
      7.2.3  Breaker pole  21
      7.3  Servicing  21
      7.3.1  Switching devices in general  21
      7.3.2  Stored-energy spring mechanism  21
      7.3.3  Breaker pole  22
      7.4  Repair  22
      7.4.1  Replacement of circuit-breaker parts and accessories  22
      7.4.2  Touch up of surfaces  22
      7.5  Spare parts and auxiliary materials  23
      7.5.1  Spare parts  23
      7.5.2  Auxiliary materials  24
8  Application of the X-ray regulations  27
9  Comparision of designations to VDE-DIN 40719 Part 2 and IEC 61346-1/IEC 61346-2  27

We reserve all rights to this publication. Misuse, particularly including duplication and making available of this manual – or extracts – to third parties is prohibited. The information supplied is without liability. Subject to alteration.
© ABB AG, 2009
Summary

1.1 General
(Figures 2/1 and 2/2)

The vacuum circuit-breakers of type VD4 are intended for indoor installation in air-insulated switchgear systems. Their switching capacity is sufficient to handle any conditions arising from switching of equipment and system components under normal operating and fault conditions, particularly short-circuits, within the parameters of their technical data.

Vacuum circuit-breakers have particular advantages for use in networks where there is a high switching frequency in the working current range and/or where a certain number of short-circuit breaking operations are expected. Type VD4 vacuum circuit-breakers are suitable for autoreclosing, and have exceptionally high operating reliability and long life.

The vacuum circuit-breakers of type VD4, designed in column form, can be supplied both as individual units for fixed installation and mounted on chassis. Their basic structure is shown in figures 2/1 and 2/2.

1.2 Standards and specifications

1.2.1 Switchgear manufacture

The switchgear complies with the following specifications in accordance with DIN VDE and the relevant IEC publications:

- VDE 0670, part 1000/IEC 60694
- VDE 0671, part 100/IEC 62271-100.

1.2.2 Installation and operation

The relevant specifications are to be taken into account during installation and operation, particularly:

- DIN VDE 0101, Power installations exceeding AC 1 kV
- VDE 0105, Operation of electrical installations
- DIN VDE 0141, Earthing systems for special power installations with rated voltages above 1 kV
- Accident prevention regulations issued by the appropriate professional bodies or comparable organisations.

In Germany, these comprise the following safety regulations:

- Health and Safety at Work Standards BGV A1 and BGV A3
- Safety guidelines for auxiliary and operating materials
- Order-related details provided by ABB.

1.3 Operating conditions

1.3.1 Normal operating conditions

Design to VDE 0670, part 1000, “Common specifications for high-voltage switchgear and controlgear standards” and IEC publication 60694, with the following limit values:

- Ambient temperature:
  - Maximum +40 °C
  - Maximum 24 hour average +35 °C
  - Minimum (according to “minus 5 indoor class”) –5 °C
- Humidity:
  - the average value of the relative humidity, measured over a period of 24 h, does not exceed 95%
  - the average value of the water vapour pressure, over a period of 24 h, does not exceed 2,2 kPa
  - the average value of the relative humidity, over a period of one month, does not exceed 90%
  - the average value of the water vapour pressure, over a period of one month, does not exceed 1,8 kPa
- Maximum site altitude:
  ≤ 1000 m above sea level.

1.3.2 Special operating conditions

Special operating conditions are to be agreed on by the manufacturer and user. The manufacturer must be consulted in advance about each special operating condition:

- Site altitude over 1000 m:
  - Allow for the reduction in the dielectric strength of the air.
- Increased ambient temperature:
  - Current carrying capacity is reduced.
  - Provide additional ventilation for heat dissipation.
- Climate:
  - Avoid the risk of corrosion or other damage in areas:
    - with high humidity and/or
    - with major rapid temperature fluctuations.
  - Implement preventive measures (e.g. electric heaters) to preclude condensation phenomena.
## 2 Technical data

### 2.1 Technical data Circuit-breakers

<table>
<thead>
<tr>
<th>Breaker type</th>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Rated short-circuit breaking current</th>
<th>Rated short-circuit making current</th>
<th>Rated short-circuit duration</th>
<th>Poles</th>
<th>Weight</th>
<th>Permissible number of vacuum interrupter switching operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kV</td>
<td>A</td>
<td>symmetrical</td>
<td>asymmetrical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VD4-..</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1231-25</td>
<td>12</td>
<td>3150</td>
<td>25</td>
<td>27.3</td>
<td>63</td>
<td>3</td>
<td>275</td>
<td>260 Diagram B</td>
</tr>
<tr>
<td>1240-25a</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1231-31</td>
<td>3150</td>
<td></td>
<td>31.5</td>
<td>34.3</td>
<td>80</td>
<td>3</td>
<td>275</td>
<td>260 Diagram B</td>
</tr>
<tr>
<td>1240-31h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1231-40h</td>
<td>3150</td>
<td></td>
<td>40</td>
<td>43.6</td>
<td>100</td>
<td>3</td>
<td>275</td>
<td>260 Diagram D</td>
</tr>
<tr>
<td>1240-40h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1212-50</td>
<td>1250</td>
<td></td>
<td>50</td>
<td>54.4</td>
<td>125</td>
<td>3</td>
<td>275/275 147/155 Diagram D</td>
<td></td>
</tr>
<tr>
<td>1216-50</td>
<td>1600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1220-50</td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1225-50</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1231-50</td>
<td>3150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1240-50h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1212-63</td>
<td>1250</td>
<td></td>
<td>63</td>
<td>65.5</td>
<td>158</td>
<td>3</td>
<td>275</td>
<td>265 Diagram F</td>
</tr>
<tr>
<td>1216-63</td>
<td>1600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1220-63</td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1225-63</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1231-63</td>
<td>3150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1240-63h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1731-20</td>
<td>17.5</td>
<td>3150</td>
<td>20</td>
<td>21.8</td>
<td>50</td>
<td>3</td>
<td>275</td>
<td>260 Diagram A</td>
</tr>
<tr>
<td>1740-20h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1731-25</td>
<td>3150</td>
<td></td>
<td>25</td>
<td>27.3</td>
<td>63</td>
<td>3</td>
<td>275</td>
<td>260 Diagram B</td>
</tr>
<tr>
<td>1740-25h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1731-31</td>
<td>3150</td>
<td></td>
<td>31.5</td>
<td>34.3</td>
<td>80</td>
<td>3</td>
<td>275</td>
<td>260 Diagram C</td>
</tr>
<tr>
<td>1740-31h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1712-40</td>
<td>1250</td>
<td></td>
<td>40</td>
<td>43.6</td>
<td>100</td>
<td>3</td>
<td>275/275 147/155 Diagram D</td>
<td></td>
</tr>
<tr>
<td>1716-40</td>
<td>1600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1720-40</td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1725-40</td>
<td>2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1731-40</td>
<td>3150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1740-40h</td>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) 75…100 ms for generator breakers  
2) 90…115 ms for generator breakers  
3) Individual unit (without chassis) with motor-operated mechanism and basic release equipment.  
4) 60 ms for generator breakers  
5) 120 ms for generator breakers  
6) When the operating voltage is lower than the rated voltage, the same values apply as for rated voltage. Higher values on request.
7) 4000 A with fan cooling only  
8) Available in a special version as a generator breaker.  
9) 135 kA possible

---

Guideline values for function times at the rated supply voltage:

- **Closing time**: approx. 60 ms
- **Opening time**: \( \leq 45 \text{ ms} \)
- **Arcing time (at 50 Hz)**: \( \leq 15 \text{ ms} \)
- **Break time**: \( \leq 60 \text{ ms} \)
- **Minimum command time on closing**: 20 ms (120 ms)
- **Minimum command time on opening**: 20 ms (80 ms)

---

**Rated values**

- **Rated voltage (kV)**: 12, 17.5
- **Rated frequency (Hz)**: 50/60
- **Rated lightning impulse withstand voltage (kV)**: 75, 95
- **Rated power frequency withstand voltage (kV)**: 28, 38
- **Rate of rise of transient recovery voltage (kV/μs)**: 0.34, 0.42
- **Peak of transient recovery voltage (kV)**: 20.6, 30
- **Rated operating sequence**: O-3 min-CO-3 min-CO
- **Rated operating sequence with auto-reclosing**: O-0.3 s-CO-3 min-CO

---

Guideline values for function times at the rated supply voltage:

- **Closing time**: approx. 60 ms
- **Opening time**: \( \leq 45 \text{ ms} \)
- **Arcing time (at 50 Hz)**: \( \leq 15 \text{ ms} \)
- **Break time**: \( \leq 60 \text{ ms} \)
- **Minimum command time on closing**: 20 ms (120 ms)
- **Minimum command time on opening**: 20 ms (80 ms)

---

**Breaker Rated Rated Rated Short-circuit Rated Rated Poles Weight 7) Permissible number of**

- **Breaker type**
- **Rated voltage**
- **Rated current**
- **Rated short-circuit breaking current (kA)**
- **Rated short-circuit breaking current (asymmetrical kA)**
- **Rated short-circuit making current (peak kA)**
- **Rated short-circuit duration (s)**
- **Poles centres**
- **Weight (c. kg)**
- **Permissible number of vacuum interrupter switching operations**

Page 8 and 9
### 2.2 Technical data
#### Releases and blocking magnet

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Power consumption&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td>Shunt release OFF</td>
<td>250</td>
</tr>
<tr>
<td>Shunt release ON</td>
<td>310</td>
</tr>
<tr>
<td>Blocking magnet</td>
<td>10</td>
</tr>
<tr>
<td>Undervoltage release:</td>
<td></td>
</tr>
<tr>
<td>• undelayed&lt;sup&gt;3,5&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>• delayed&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Indirect overcurrent release with intermediate current transformer:</td>
<td></td>
</tr>
<tr>
<td>• two-phase</td>
<td></td>
</tr>
<tr>
<td>• three-phase</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Approximate values

### 2.3 Technical data
#### Motor-operated mechanisms

<table>
<thead>
<tr>
<th>Gefeg-Motor&lt;sup&gt;7&lt;/sup&gt;</th>
<th>Power consumption&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Motor protection (ABB-Stotz m.c.b.)</th>
<th>Charging time (maximum)&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage V</td>
<td>VA/W A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>150</td>
<td>1.6 S 281UC-K</td>
<td>15</td>
</tr>
<tr>
<td>220</td>
<td>150</td>
<td>0.75</td>
<td>15</td>
</tr>
<tr>
<td>240</td>
<td>170</td>
<td>0.75</td>
<td>15</td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>130</td>
<td>4.0 S 282UC-K</td>
<td>15</td>
</tr>
<tr>
<td>48</td>
<td>130</td>
<td>3.0</td>
<td>15</td>
</tr>
<tr>
<td>60</td>
<td>130</td>
<td>2.0</td>
<td>15</td>
</tr>
<tr>
<td>110</td>
<td>140</td>
<td>1.0</td>
<td>15</td>
</tr>
<tr>
<td>125</td>
<td>160</td>
<td>1.0</td>
<td>15</td>
</tr>
<tr>
<td>220</td>
<td>140</td>
<td>0.75</td>
<td>15</td>
</tr>
<tr>
<td>240</td>
<td>150</td>
<td>0.75</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groshopp-Motor</th>
<th>Power consumption&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Motor protection (ABB-Stotz m.c.b.)</th>
<th>Charging time (maximum)&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage V</td>
<td>VA/W A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>260</td>
<td>1.6 S 281UC-K</td>
<td>10</td>
</tr>
<tr>
<td>220</td>
<td>260</td>
<td>0.75</td>
<td>10</td>
</tr>
<tr>
<td>240</td>
<td>260</td>
<td>0.75</td>
<td>10</td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>260</td>
<td>3.0 S 282UC-K</td>
<td>10</td>
</tr>
<tr>
<td>48</td>
<td>230</td>
<td>1.6</td>
<td>10</td>
</tr>
<tr>
<td>110</td>
<td>260</td>
<td>1.6</td>
<td>10</td>
</tr>
<tr>
<td>125</td>
<td>260</td>
<td>0.75</td>
<td>10</td>
</tr>
<tr>
<td>220</td>
<td>260</td>
<td>0.75</td>
<td>10</td>
</tr>
<tr>
<td>240</td>
<td>260</td>
<td>0.75</td>
<td>10</td>
</tr>
</tbody>
</table>

<sup>1</sup> Approximate values

<sup>2</sup> With short-circuited intermediate current transformer

<sup>3</sup> Rated supply voltages AC: 110 and 220 V, DC: 24, 48, 60, 110 and 220 V

<sup>4</sup> See RN3U for supply voltage

<sup>5</sup> Rated supply voltage AC: 240 V, DC: 125 and 240 V

<sup>6</sup> At rated supply voltage

<sup>7</sup> With rated short-circuit breaking current 63 kA
2.4 Permissible number of vacuum interrupter switching operations in relation to breaking current

Figure 2/3: Permissible number of vacuum interrupter operating cycles \( n \) as a function of the breaking current \( I_b \)
(Reference see section 2.1 – Technical data page 6)
Figure 2/3: Permissible number of vacuum interrupter operating cycles $n$ as a function of the breaking current $I_a$.
(Reference see section 2.1 – Technical data page 6)
Figure 2/4: Dimensional drawing of a circuit-breaker, type VD4,

- 12 kV, 1250 ... 2500 A, 50 kA
- 17.5 kV, 1250 ... 2500 A, 40 kA

K = Cable entry
M = Minimum distance, corresponding to dimension a to DIN VDE 0101
T = Bore for handling, both sides
\( \varnothing \) = Earthing conductor connection - use contact washer

Note:
Lifting lug T only fitted for transport, remove prior to commissioning and store.

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated current</th>
<th>Rated short-circuit breaking current</th>
</tr>
</thead>
<tbody>
<tr>
<td>kV A</td>
<td>kA p a a_i</td>
<td>c d e f g h i k</td>
</tr>
<tr>
<td>12 1250/1600/ 2000</td>
<td>50 210</td>
<td>610 555 560 600 20 415 64 45 320 616</td>
</tr>
<tr>
<td></td>
<td>275 750 695 700 750 25 545 39 20 345 746</td>
<td></td>
</tr>
<tr>
<td>2500</td>
<td>50 275 750 695 700 750 25 545 39 20 345 746</td>
<td></td>
</tr>
<tr>
<td>17.5 1250</td>
<td>40 210</td>
<td>610 555 560 600 20 415 64 45 320 616</td>
</tr>
<tr>
<td></td>
<td>275 750 695 700 750 25 545 39 20 345 746</td>
<td></td>
</tr>
<tr>
<td>1600/2000 2500</td>
<td>40 275</td>
<td>750 695 700 750 25 545 39 20 345 746</td>
</tr>
</tbody>
</table>
Figure 2/5: Dimensional drawing of a circuit-breaker, type VD4,

- 12 kV, 3150/4000 A\(^1\), ...63 kA
- 12 kV, 1250 ...2500 A, 63 kA
- 17.5 kV, 3150/4000 A\(^1\), ...40 kA

\(^1\) with fan cooling

K = Cable entry
M = Minimum distance, corresponding to dimension a to DIN VDE 0101
T = Bore for handling, both sides
☆ = Earthing conductor connection - use contact washer

Note:
Lifting lug T only fitted for transport, remove prior to commissioning and store.
3 Structure and function

3.1 Structure of the breaker poles
(Figures 2/2, 3/2, 3/3 and 3/4)
The poles, which are constructed in column form, are mounted on the bracket-shaped rear part of the mechanism enclosure 1. The live parts of the breaker poles are located in the insulating material pole tubes 12 and protected from impacts and other external influences.

With the breaker closed, the current path leads from the upper breaker terminal 13 and a chamber holder fixed in the pole tube to the fixed contact 15.2 in the vacuum interrupter 15, then via the moving contact 15.3 and the roller contact 16.2, to the lower breaker terminal 14. The switching motion is effected by means of the insulated coupling rod 18 with internal contact force springs 17.

The basic structure of a vacuum interrupter is explained in figure 3/3.

3.2 Structure of the breaker operating mechanism
(Figures 3/1, 3/2, 3/4 and 3/5)
The operating mechanism is of the stored-energy spring type and acts on the three breaker poles. The necessary operating energy is stored ready for activation by charging the spring energy store.

The stored-energy spring mechanism essentially consists of drum 33 containing the spiral spring, the charging system, the latching and operating mechanism and the linkages which transmit the force to the breaker poles. In addition, there are supplementary components such as the charging motor, releases, auxiliary switches and the controls and instruments located on the front of the mechanism enclosure 1.

The operating mechanism is fundamentally suitable for auto-reclosing and, due to the short charging times, also for multi-shot auto-reclosing.

The generator breaker have a built-in mechanical delay system with which the opening time is prolonged by approx. 30 ms.

In the basic version of the circuit-breaker, the spring energy store is charged manually. The operating mechanism can optionally be fitted with a charging motor.

There is one rating plate with the main data of the switch equipment on front plate 1.1, and another at the lower front right in mechanism enclosure 1.

The basic version of the stored-energy spring mechanism is fitted with the following auxiliary equipment:

- Shunt release OFF -Y2
- Five-pole auxiliary switch -S4 for annunciation purposes
- Auxiliary switch -S7 for fault annunciation
- Mechanical ON push-button 2
- Mechanical OFF push-button 3
- Mechanical position indicator 4
- Charging condition indicator 8 for the spring energy store
- Mechanical operating cycle counter 5

The following additional equipment can be installed:

- Blocking magnet -Y1 with auxiliary switch -S2
- Shunt release ON -Y3
- Second shunt release OFF -Y9
- Indirect overcurrent release -Y7
- Undervoltage release -Y4
- Five-pole auxiliary switches -S3 and -S5
- Charging motor -M0
- Five-pole auxiliary switch -S1 to switch the charging motor.

3.2.1 Releases, blocking magnet and auxiliary switches
(Figures 3/1, 3/5, 7/1, 7/2, 7/3 and 7/5)

- The releases and the blocking magnet are mounted at the top left on the spring operating mechanism.
- The allocation of the auxiliary switches can be seen in the wiring diagram of figure 7/5.
- The five-pole auxiliary switch -S1 is operated by the charging condition indicator 8. It controls the charging motor -M0, serves as an electrical interlock for shunt release ON -Y3 when the spring mechanism is not sufficiently charged, and also provides an electrical switching readiness signal.
- Operation of the five-pole auxiliary switches -S3, -S4 and -S5 is dependent on the switching position of the circuit-breaker.
- Auxiliary switch -S3 interrupts the circuit of the optional additional shunt release OFF -Y9 with the circuit-breaker in the open position, and the circuits of shunt release ON -Y3 and the optional blocking magnet -Y1 with the circuit-breaker in the closed position. There is one further NOC for other purposes.
- On failure or absence of the control voltage, blocking magnet -Y1 mechanically locks the ON half shaft and simultaneously acts on the corresponding auxiliary switch -S2 to interrupt the circuit of shunt release ON -Y3.
- Blocking magnet -Y1 is accessible when front plate 1.1 is removed.
- Auxiliary switch -S4 interrupts the circuit of shunt release OFF -Y2 with the circuit-breaker in the open position. One further NOC and three NCCs are available for annunciation, control and interlock purposes.
- Auxiliary switch -S5 can be optionally designed with any possible combination of contacts from...
five NOCs to five NCCs. Its contacts are available for any required control, annunciation or interlock functions. The auxiliary switch is normally configured as shown in figure 7/5.

- The single pole auxiliary switch -S7 (fleeting contact time ≥ 30 ms) serves to provide a fault signal ("breaker released"). With remote control, the auxiliary switch is necessarily operated by:
  - Shunt release OFF -Y2 or
  - Shunt release OFF -Y9 or
  - Undervoltage release -Y4 or
  - Indirect overcurrent release -Y7.

Note:
1. Shunt releases OFF (-Y2) and ON (-Y3) are exclusively provided for opening and closing in normal operation. For safety breaking operations, the second shunt release OFF (-Y9) must be used, in most cases with a separate control voltage supply. These three releases are of the solenoid type and suitable for a large number of operating cycles.
2. The undervoltage release (-Y4) and/or indirect overcurrent release (-Y7) are pure safety and protection releases and must not be used for switching in normal operation.

3.2.2 Mounting of the VD4 on trucks from other manufacturers

VD4 circuit-breakers which are not installed on ABB withdrawable parts must be fitted with one or two additional auxiliary switches which are dependent on the mechanical lock and release device. These must interrupt the circuit of shunt release ON -Y3. Similary to auxiliary switches -S8 and -S9 in ABB withdrawable parts, no electrical pulse may arise during and before mechanical blocking of the spindle mechanism, and may only be applied again after the end of mechanical blocking. This ensures that the shunt release ON cannot be loaded with an electrical ON pulse when the withdrawable part is in an intermediate position, which could burn out the coil.

3.3 Function

3.3.1 Charging of the spring energy store
(Figures 3/1 and 3/4)

To provide the necessary motive energy, the spring energy store, either charged automatically by a charging motor or manually in a vertical pumping action with charging lever 9, depending on the equipment fitted to the circuit-breaker. The current charging condition is shown at charging condition indicator 8.

As a precondition for an auto-reclosing sequence, the operating mechanism is either (re-)charged after a closing operation automatically by the charging motor, or it requires (re-)charging by hand if the operating mechanism is of the manual type.

3.3.2 Closing procedure
(Figures 3/1, 3/4 and 3/5)
The closing process is started by the mechanical ON push-button 2, or by activation of one of releases -Y2, -Y4, -Y7 or -Y9. Observe the notes in section 3.2.1 on control of the releases. Release mechanism 31 then permits drive shaft 30 to be rotated by the (previously) charged spiral spring. The moving contact 15.3 in vacuum interrupter 15 is moved until the contacts touch by cam disk 21 and further kinematic links. In the further sequence of motion, spring arrangement 17 is tensioned and the appropriate amount of contact force thus applied. The available overtravel is higher than the maximum value of contact erosion during lifetime of the interrupter. During the closing process, opening springs 19 are simultaneously tensioned.

3.3.3 Opening procedure
(Figures 3/1, 3/4 and 3/5)
The opening procedure is initiated by mechanical OFF push-button 3 or by activation of one of releases -Y2, -Y4, -Y7 or -Y9. Observe the notes in section 3.2.1 on control of the releases. Release mechanism 31 then permits drive shaft 30 to be turned further by the spring energy store, which is still sufficiently charged. Opening spring 19, which is thus released, moves contact 15.3 into the open position at a defined speed.

3.3.4 Auto-reclosing sequence

An OFF-ON or OFF-ON-OFF auto-reclosing sequence is activated and checked by the protection system. It is necessary for the spiral spring in the operating mechanism to be in the (re-)charged condition, with the circuit-breaker in the closed position. The (re-)charging process is carried out automatically after closing of the breaker on breakers with motor charging mechanisms, but must be carried out manually on breakers without charging motors (or when the charging motor has broken down). Opening of the breaker is also possible during the (re-)charging process, but subsequent closing of the breaker is however blocked until the charging process has been completed.

3.3.5 Quenching principle of the vacuum interrupter

Due to the extremely low static interrupter chamber pressure of 10⁻² to 10⁻⁶Pa, only a relatively small contact gap is required to achieve a high dielectric strength. The arc is extinguished on one of the first natural current zeros.

Due to the small contact gap and the high conductivity of the metal vapour plasma, the arc drop voltage, and additionally, due to the short arcing time, the associated arc energy, are extremely low, which has advantageous effects on the life of the contacts and thus on that of the vacuum interrupters.
Figure 3/1: Circuit-breaker front with controls and annunciations

1 Mechanism enclosure
1.1 Front plate
2 ON push-button
3 OFF push-button
4 Position indicator
5 Operating cycle counter
6 Recess for charging lever 9
7 Rating plate
8 Charging condition indicator
9 Charging lever

Figure 3/2: Sectional view of a vacuum circuit-breaker, type VD4, schematic diagram

1 Mechanism enclosure
1.1 Front plate, removable
12 Insulating material pole tube
13 Upper breaker terminal
14 Lower breaker terminal
15 Vacuum interrupter
16.2 Roller contact
17 Contact force spring
18 Insulated coupling rod
19 Opening spring
20 Shift lever pair

Figure 3/3: Partial section of a vacuum interrupter, simplified schematic diagram

(Details vary according to the specified switching duties)

15.1 Insulator
15.2 Fixed contact
15.3 Movable contact
15.4 Metal bellows
15.5 Screen
15.6 Guide
15.7 Interrupter lid
Figure 3/4: Basic structure of the stored-energy spring mechanism

6 Recess
9 Charging lever
15 Vacuum interrupter
15.3 Movable contact
16.2 Roller contact
17 Contact force spring
18 Insulated coupling rod
19 Opening spring
20 Shift lever pair
21 Cam disk
30 Drive shaft
31 Release mechanism
32 Stop disk
33 Drum with spiral spring
34 Chain drive
35 Ratchet wheel
50 Left-hand control cam

Figure 3/5: View of the stored-energy spring mechanism and auxiliary equipment with the front plate removed

6 Recess for charging lever 9
31 Release and control mechanism on the drive shaft
33 Drum with spiral spring
34 Chain drive
35 Ratchet wheel
36 Charging motor
37 Release and control mechanism area
38 Auxiliary switch block
Despatch and storage

4 Condition on delivery

• The factory-assembled switching devices are checked at the works for completeness of the equipment installed and simultaneously subjected to a routine test in accordance with VDE 0670, part 1000 or IEC publication 60694, thus verifying their correct structure and function.

4.2 Packaging

The switching devices are mounted individually on a wooden pallet and sealed in film and/or packed in cardboard for delivery.

Packaging for overseas shipment:
• Drying agent bags inserted in the film-sealed packaging
• Drying agent bags in accordance with DIN 55 473.

4.3 Transport

Loading of the package units must only be carried out with a
• crane,
• fork-lift truck and/or
• trolley jack.

Notes:
• Avoid impact during handling.
• Do not subject to other damaging mechanical stresses.
• Lifting gear must not be attached to the breaker poles or parts of the operating mechanism. Use the lifting lugs 1.3 for hoists (Figure 6/2).

4.4 Delivery

The duties of the consignee on receipt of the switching devices at site include the following:
• Checking the delivery for completeness and freedom from damage (e.g. moisture and its adverse effects).
• Any short quantities, defects or damage in transit:
  – Must be precisely documented on the consignment note.
  – The shipper/carrier is to be notified immediately in accordance with the liability provisions of the German general conditions for forwarders (ADSp/KVO).

Note:
Always take photographs to document any major damage.

4.5 Intermediate storage

Intermediate storage of the switchgear in the switch position OFF and the stored-energy spring mechanisms discharged

(Indicator DISCHARGED: 😞).

Conditions for optimum intermediate storage:
1. Devices with basic packaging or unpacked:
• A dry and well ventilated storeroom with climate in accordance with VDE 0670, part 1000 / IEC 60694.
• Room temperature which does not fall below –5 °C.
• Do not remove or damage the packaging.
• Unpackaged devices:
  – Are to be loosely covered with protective sheeting.
  – Sufficient air circulation must be maintained.
• Check regularly for any condensation.

2. Devices with seaworthy or similar packaging with internal protective sheeting:
• Store the transport units:
  – protected from the weather,
  – dry,
  – safe from damage.
• Check the packaging for damage.
• If the maximum storage period starting from the date of packaging has been exceeded:
  – The protective function of the packaging is no longer guaranteed.
  – Suitable action must be taken if intermediate storage is to continue.
Installation

Careful and professional installation of the switchgear is one of the fundamental conditions of trouble-free circuit-breaker operation.

- Install the mechanism enclosure in the panel without tension or distortion, inserting dished washers below the nuts or bolt heads at each of the four mounting points (dependent on the order).
- Connect the main terminals without any permanent tension or pressure forces, exerted for example by the conductor bars.
- When connecting the conductor bars, the bolts must be inserted to the depth shown on the dimensional drawing.
- Take account of any tested terminal zone.
- Use DIN bolts of tensile class 8.8, fastening conductor bars together with dished washers.
- Make a short-circuit proof connection between the PE conductor and the main earthing bar in the switchgear, using contact washers.
- Remove any dirt. See also section 7.3.1.

<table>
<thead>
<tr>
<th>Thread size</th>
<th>Recommended rated tightening torque (^1) (\text{Nm})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>without (dry)</td>
</tr>
<tr>
<td>M 6</td>
<td>10.5</td>
</tr>
<tr>
<td>M 8</td>
<td>26</td>
</tr>
<tr>
<td>M 10</td>
<td>50</td>
</tr>
<tr>
<td>M 12</td>
<td>86</td>
</tr>
<tr>
<td>M 16</td>
<td>200</td>
</tr>
</tbody>
</table>

\(^1\) Rated tightening torques for fasteners without lubrication are based on the thread friction coefficient 0.14 (the actual values of which are subject to unavoidable, in some cases not insignificant, spread).

\(^2\) Thread and contact face of head lubricated.

Take account of any tightening torques which deviate from the general table (e.g. for contact systems or device terminals) as stated in the detailed technical documentation.

It is recommended that the threads or head contact surfaces of the bolts be lightly oiled or greased, so as to achieve a precisely defined rated tightening torque.
Commissioning / Operation

6.1 Note on safety at work

- This switchgear may only be operated by specially trained personnel who are familiar with the characteristics of the particular device.
- Observe the relevant instructions in section 1.2.

6.2 Preparatory activities

(Prior to application of primary voltage)

- Check the circuit-breaker for any kind of damage or other injurious environmental influence, and restore to the proper condition where necessary.
- Remove any contamination, particularly on insulating parts, which has occurred during transit, storage or installation.
- Check the primary and secondary connections and the protective conductor terminal.
- Charge the spring energy store by hand (see section 6.3.1).
- Perform a trial opening or closing operation of the circuit-breaker using push-button 2 or 3 (taking into account any required supply voltage and any relevant interlocks).
- Check the charging motor on circuit-breakers with motor-operated mechanisms by applying supply voltage.
- Remove the transport caps 11 from the poles. They are marked accordingly.
- Ensure that the Instruction Manual is available to the operators at all times.
- Remove the lifting lugs 1.3 for hoists (Figures 2/5, 2/6 and 6/2).

6.3 Operation of the circuit-breaker

(Figures 3/1 and 6/1)

6.3.1 Charging the spring energy store

Circuit-breakers with charging motors:

- Charging takes place automatically.
- If the charging motor breaks down, the charging process can be carried out or completed manually.

Circuit-breakers with manual charging mechanisms:

- Insert charging lever 9 into recess 6 and pump up and down for approx. 25 strokes until the charged condition is displayed.
- When the charged condition is reached, the charging mechanism automatically disengages, and further strokes of the charging lever have no effect.

Key to the charging condition indications:

Discharged 🀄 Charged 🀃

As a precondition for an auto-reclosing sequence, the operating mechanism is either (re-)charged after a closing operation automatically by the charging motor, or it requires (re-)charging by hand if the operating mechanism is of the manual type.

6.3.2 Closing and opening

- Closing:
  Press mechanical ON push-button 2, or operate the electrical control unit.

- Opening:
  Press mechanical OFF push-button 3, or operate the electrical control unit.

Observe the notes in section 3.2.1.

The operating cycle counter 5 is automatically incremented by one complete figure with each switching cycle. On completion of a switching operation the position indicator 4 in the window of front plate 1.1 shows the appropriate position of the circuit-breaker.

- Anti-pumping relay:
  The anti-pumping relay -K0 (wiring diagram in figure 7/5) prevents repeated ON-OFF switching operations if, for example, the breaker is tripped by a protection relay in response to a primary side fault while a permanent electrical closing command is simultaneously applied. The circuit-breaker can then only be closed after the closing command has been interrupted.

- Closing on failure of supply voltage:
  - With standard equipment:
    On failure of the control voltage, mechanical closing by means of ON push-button 2 is possible at any time.
  - With blocking magnet -Y1 fitted:
    On failure of the control voltage, blocking magnet -Y1 mechanically locks the ON halfshaft and simultaneously interrupts the circuit shunt release ON -Y3 via the corresponding auxiliary switch -S2.

Closing with the blocking magnet de-energised requires manipulation of the circuit-breaker operating mechanism:

- Remove front plate 1.1.

- Take care to avoid rotating parts!

- Opening on failure of supply voltage:
  On failure of the supply voltage, mechanical opening by means of OFF push-button 3 is possible at any time.
6.3.3 Run-on block

When any irregularities occur in the internal control mechanism or with the charging function of the spring energy store, the run-on stop blocks the next closing operation.

This is a protective function to prevent damage to the circuit-breaker. Release of the run-on block is described in Instruction Manual BA 383/E.

Figure 6/1: Operation
2 Mechanical ON push-button
3 Mechanical OFF push-button
4 Mechanical position indicator
5 Mechanical operating cycle counter
8 Charging condition indicator
9 Charging lever

Figure 6/2: Transport view
1.3 Lifting lug (remove prior to commissioning)
11 Transport cap (remove prior to commissioning)
Maintenance

Maintenance serves to ensure trouble-free operation and achieve the longest possible working life of the switchgear. In accordance with DIN 31 051 / IEC 61208 it comprises the following closely related activities:

**Inspection:** Determination of the actual condition

**Servicing:** Preservation of a functional condition

**Repair:** Measures to restore the functional condition.

7.1 General

Vacuum circuit-breakers are characterized by their simple and robust construction. They have a long life expectancy. Their operating mechanisms have a low maintenance requirement, and the interrupters are maintenance-free during their working life. There is no adverse effect on the vacuum, even from frequent switching of operating and short-circuit currents.

The servicing intervals and scope are determined by environmental influences, the switching sequences and number of short-circuit breaking operations.

**Note:**
The following must be observed for all maintenance work:
- The relevant specifications in section 1.2.2
- Notes on safety at work in section 6.1
- Standards and specifications in the country of installation.

Maintenance work may only be performed by fully trained personnel, observing all the relevant safety regulations. It is recommended that ABB after-sales service personnel should be called in, at least during the performance of servicing and repair work.

While the work is in progress, all supply voltage sources must also be disconnected and secured to prevent reconnection.

**Note:**
In order to prevent accidents (particularly injury to hands!) extreme care should be taken during all repair work on the operating mechanism, especially with front plate removed.

The spiral spring in the spring energy store, for instance, retains a basic tension which is independent of the charging and discharging processes during switching, so as to ensure correct function. This spring energy can be inadvertently released if work is performed incorrectly on the spring mechanism!

7.1.1 Service life

Typical life expectancies for VD4 circuit-breakers:

- Breakers with rated short-circuit breaking currents up to 50 kA:
  - The maintenance-free vacuum interrupters up to 30,000 operating cycles (see section 2.4).
  - The breaker itself, depending on type and presupposing carefully performed inspection and servicing work and normal operating conditions, up to 30,000 operating cycles.
- Breakers rated short-circuit breaking currents 63 kA:
  - Vacuum interrupters and breakers up to 10,000 operating cycles.

7.2 Inspection and functional testing

7.2.1 Switching devices in general

- The proper condition of the switching device is to be verified by regular inspection.
- The checks are to be performed in accordance with BGV A2 standard.
- Inspection at fixed intervals may be waived if the switchgear is permanently monitored by a qualified personnel.
- The checks first and foremost comprise visual examination for contamination, corrosion, moisture and discharge phenomena.
- In unusual operating conditions (including adverse climatic conditions) and/or special environmental pollutions (e.g. heavy contamination and aggressive atmosphere), inspection may also be necessary at shorter intervals.
- If an incorrect condition is found, appropriate servicing measures are to be initiated.

7.2.2 Stored-energy spring mechanism

(Figures 7/1 to 7/4)

Functional testing of the operating mechanism is to be performed:

Breakers with rated short-circuit breaking current with 50 kA:
- after 5,000 operating cycles or
- during servicing work as set out in 7.2.1.

Breakers with rated short-circuit breaking current with 63 kA:
- after 2,000 operating cycles or
- during servicing work as set out in 7.2.1.
Prior to functional testing, switch the breaker off and
- move it into the test position (withdrawable breaker) or
- isolate the outgoing feeder (with stationary mounted breakers).

**Note:**
Isolate and secure the working area in accordance with the safety regulations specified by DIN VDE/IEC.

**Scope of functional testing:**
- Perform several switching operations under no load, above all with circuit-breakers seldom operated in normal service.
- Switch off the charging motor (if fitted) and discharge the spring energy store by ON/OFF switching operations.
- Examine visual the condition of the lubrication on rotary bearings, sliding surfaces, etc.
- Check the proper mechanical/electrical sequence of the individual functions.

7.2.3 **Breaker pole**
No inspection of the breaker pole above and beyond the stipulations of section 7.2.1 is necessary.

7.3 **Servicing**

7.3.1 **Switching devices in general**
If cleaning is found to be necessary during inspections as set out in 7.2.1, the following procedure is to be adopted:
- Prior to cleaning, the working area is to be isolated and secured against reclosing where necessary in accordance with the safety regulations of DIN VDE/IEC.
- Cleaning of surfaces in general:
  - Dry, lightly adhering dust deposits with a soft, dry cloth.
  - More strongly adhering contamination with slightly alkaline household cleanser or Rivolta BWR 210.
- Cleaning of the insulating material surfaces and conductive components:
  - Strongly adhering contamination: with cold cleanser 716.
- Wipe down after cleaning, using clean water, and dry properly.
- Observe the manufacturer’s instructions and the special ABB Instruction Manuals BA 1002/E or BA 1006/E on safety at work.

**Note:**
Use only halogen free cleansers, and in no case 1,1,1-trichloroethane, trichloroethylene or carbon tetrachloride!

**Stored-energy spring mechanism**
(Figures 7/1 to 7/4)
Servicing of the operating mechanism is to be performed after the following number of operating cycles:
- Breakers with rated short-circuit breaking currents up to 50 kA after 10,000 operating cycles.
- Breakers with 63 kA rated short-circuit breaking current after 5,000 operating cycles.
Prior to servicing, switch the breaker off, and
- move it out of the panel (with withdrawable breakers) or
- isolate the outgoing feeder (with stationary mounted breakers).

Observe the safety regulations.

**Details of the servicing:**
- Switch off the charging motor (if fitted), and discharge the spring energy store by closing and opening the breaker once.
- Replace parts subject to high climatic and mechanical stresses as a precaution.
- For replacing highly stressed parts neutralize basic tension of the spiral spring, state the rate. Be careful when carrying out!
- Relubricate pawls, support shafts, sliding and rotating bearing surfaces. Lubricant: Isoflex Topas NB 52.
- Check the fit of fasteners (e.g. locking pins) in cranks, pins, bolts etc. Check the tightness of fastening bolts.
- Always replace any spring lock washers, split pins and other fasteners removed during the work with new parts when reassembling the equipment.
- Check the general condition of the operating mechanism and recharge the spring energy store.
- Perform comprehensive mechanical and electrical functional tests.
- Observe the instructions on setting.
- Ensure that the bolted joints at the contact locations of the conductor bar system and the earthing connections are tight.

**Note:**
Above mentioned work may only be performed by the after-sales service personnel of ABB or adequately qualified personnel.
7.3.3 **Breaker pole**

The breaker pole with the vacuum interrupter is maintenance-free up to reaching the permissible number of vacuum interrupter operating cycles in accordance with section 2.4.

Checking of the vacuum is only necessary when there is good cause to suspect that force applied externally to a pole tube has caused damage to the vacuum interrupter inside.

If the pole tube is damaged or destroyed, it may be necessary to replace the complete breaker pole.

The working life of the vacuum interrupter is defined by the sum current limit corresponding to the equipment data in individual cases in accordance with section 2.4:

- When the sum current limit is reached, the complete breaker poles are to be replaced.

**Note:**
Dismantling and Replacement of the complete breaker poles should only be carried out by ABB after-sales service personnel or by specially trained personnel, particularly as proper adjustment is necessary.

For testing the vacuum without dismantling the circuit-breaker you may use:

- Vacuum tester VIDAR, from Programma Electric GmbH, Bad Homberg v.d.H.

The following test values have to be set for checking of the internal interrupter chamber pressure with the VIDAR vacuum tester:

<table>
<thead>
<tr>
<th>Rated voltage of the circuit-breaker</th>
<th>DC test voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 kV</td>
<td>40 kV</td>
</tr>
<tr>
<td>17.5 kV</td>
<td>40 kV</td>
</tr>
<tr>
<td>24 kV</td>
<td>60 kV</td>
</tr>
</tbody>
</table>

Testing is to be performed at the rated contact distance in the OFF condition.

**Procedure for vacuum interrupter testing for stationary mounted switching devices:**

- Isolate and secure the working area in accordance with the Safety Regulations to DIN VDE / IEC.
- Open the VD4 circuit-breaker.
- Earth all poles of the VD4 circuit-breaker on one side.
- Connect the earthed test lead of the the VIDAR vacuum checker conductively to the station earth.
- Connect the high voltage test lead of the VIDAR vacuum checker with phase L1 of the unearthed pole side and test the vacuum interrupter chamber with the circuit-breaker contact gap open. Repeat for phases L2 and L3.

**Note:**
Connected cables may lead to a “detective” indication on the vacuum checker as a result of their cable capacitance. In such cases, the cables are not be removed.

7.4 **Repair**

7.4.1 **Replacement of circuit-breaker parts and accessories**

Only remove and reassemble circuit-breaker parts and accessories when the breaker has been switched off and the working area is to be isolated and secured against reclosing. The spring energy store must be discharged.

All supply voltage sources must be disconnected and secured against reclosing during the removal and installation work.

7.4.2 **Touch up of surfaces**

- Sheet steel parts, painted:
  - Remove rust, e.g. with a wire brush.
  - Grind off paint coat and grease.
  - Apply anti-rust primer and top coat.
  - Use top coat paint in the standard colour RAL 7035.
- Sheet steel parts, with zinc surface and passivated functional parts:
  - Remove white rust with a wire brush or cleaning pad (e.g. Scotch-Brite white).
  - Remove loosely adhering particles with a dry cloth.
  - Apply zinc spray or zinc dust primer.
- Functional parts, phosphated:
  - Remove rust with a wire brush or cleaning pad (e.g. Scotch-Brite white).
  - Clean with a dry cloth.
  - Grease with Isoflex Topas NB 52.
### 7.5 Spare parts and auxiliary materials

#### 7.5.1 Spare parts

<table>
<thead>
<tr>
<th>Designation</th>
<th>Breaker type</th>
<th>Rated voltage, kV</th>
<th>Rated current, A</th>
<th>Rated short-circuit breaking current, symm., kA</th>
<th>Ident no.1,2 (order code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaker pole, complete</td>
<td>1231-25</td>
<td>12</td>
<td>≥ 3150</td>
<td>25</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1231-31</td>
<td></td>
<td>≥ 3150</td>
<td>31.5</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1231-40</td>
<td></td>
<td>≥ 3150</td>
<td>40</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1212-50</td>
<td>1250</td>
<td></td>
<td>50</td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1216-50</td>
<td>1600</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1220-50</td>
<td>2000</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1225-50</td>
<td>2500</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1231-50</td>
<td>≥ 3150</td>
<td></td>
<td></td>
<td>GCE 7179616 R0142</td>
</tr>
<tr>
<td></td>
<td>1212-63</td>
<td>1250</td>
<td></td>
<td>63</td>
<td>GCE 7179616 R0155</td>
</tr>
<tr>
<td></td>
<td>1216-63</td>
<td>1600</td>
<td></td>
<td></td>
<td>GCE 7179616 R0155</td>
</tr>
<tr>
<td></td>
<td>1220-63</td>
<td>2000</td>
<td></td>
<td></td>
<td>GCE 7179616 R0155</td>
</tr>
<tr>
<td></td>
<td>1225-63</td>
<td>2500</td>
<td></td>
<td></td>
<td>GCE 7179616 R0155</td>
</tr>
<tr>
<td></td>
<td>1231-63</td>
<td>≥ 3150</td>
<td></td>
<td></td>
<td>GCE 7179616 R0155</td>
</tr>
<tr>
<td>Breaker pole, complete</td>
<td>1731-20</td>
<td>17.5</td>
<td>≥ 3150</td>
<td>20</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1731-25</td>
<td></td>
<td>≥ 3150</td>
<td>25</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1731-31</td>
<td></td>
<td>≥ 3150</td>
<td>31.5</td>
<td>GCE 7179616 R0140</td>
</tr>
<tr>
<td></td>
<td>1712-40</td>
<td>1250</td>
<td></td>
<td>40</td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1716-40</td>
<td>1600</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1720-40</td>
<td>2000</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1725-40</td>
<td>2500</td>
<td></td>
<td></td>
<td>GCE 7179616 R0148</td>
</tr>
<tr>
<td></td>
<td>1731-40</td>
<td>≥ 3150</td>
<td></td>
<td></td>
<td>GCE 7179616 R0142</td>
</tr>
</tbody>
</table>

1) For circuit-breakers with additional equipment in withdrawable module design another ident nos. (order codes) corresponding to the cubicle types apply.

2) Always quote the serial number of the switchgear when ordering parts.
<table>
<thead>
<tr>
<th>Designation</th>
<th>Item no.</th>
<th>Rated supply voltage</th>
<th>Ident no. (order code)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary switch -S1</td>
<td></td>
<td></td>
<td>GCE7002397R0122</td>
</tr>
<tr>
<td>(with clamp-type terminal) -S3</td>
<td></td>
<td></td>
<td>GCE7002397R0121</td>
</tr>
<tr>
<td>-S4</td>
<td></td>
<td></td>
<td>GCE7002397R0122</td>
</tr>
<tr>
<td>-S5</td>
<td></td>
<td></td>
<td>GCE7002397R01.. 1)</td>
</tr>
<tr>
<td>Auxiliary switch on blocking magnet -S2</td>
<td></td>
<td></td>
<td>GCE7003022P0101</td>
</tr>
<tr>
<td>Auxiliary switch for fault annunciation -S7</td>
<td></td>
<td></td>
<td>GCE0905121P0100</td>
</tr>
<tr>
<td>1st shunt release OFF -Y2</td>
<td></td>
<td></td>
<td>GCE7004590P01.. 2)</td>
</tr>
<tr>
<td>2nd shunt release OFF -Y9</td>
<td></td>
<td></td>
<td>GCE7004590P01.. 2)</td>
</tr>
<tr>
<td>Shunt release ON -Y3</td>
<td></td>
<td></td>
<td>GCE7004590P01.. 2)</td>
</tr>
<tr>
<td>Blocking magnet -Y1</td>
<td></td>
<td></td>
<td>GCE9478103P01.. 2)</td>
</tr>
<tr>
<td>Undervoltage release -Y4</td>
<td></td>
<td></td>
<td>GCE9371466R01.. 2)</td>
</tr>
<tr>
<td>with spring mechanism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed undervoltage release with spring mechanism -Y4</td>
<td></td>
<td></td>
<td>GCE9371466R01.. 2)</td>
</tr>
<tr>
<td>Indirect overcurrent release with intermediate current transformer and spring mechanism -Y7</td>
<td></td>
<td></td>
<td>GCE9371466R0112</td>
</tr>
<tr>
<td>Intermediate current transformer for indirect overcurrent release</td>
<td></td>
<td></td>
<td>GCE9476148R0100</td>
</tr>
<tr>
<td>Magnet holder, complete (with integrated rectifiers -V1, -V2, -V3, -V9)</td>
<td></td>
<td></td>
<td>GCE7000880R0111</td>
</tr>
<tr>
<td>Series rectifier -V4/-V7</td>
<td></td>
<td></td>
<td>GCE7004046R0101</td>
</tr>
<tr>
<td>Charging motor -M0</td>
<td></td>
<td>24V...240V</td>
<td>GCE0940084P.... 3)</td>
</tr>
<tr>
<td>(with gearing)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.5.2 **Auxiliary materials**

- **Lubricants:**
  - Isoflex Topas NB 52 GCE0007249P0100
- **Cleaning agents for general cleaning:**
  - Rivolta BWR 210 GCE0007707P0100
  - Observe the relevant ABB instruction manual BA 1002/E GCEA901002P0102
- **Cleaning agent for conductive parts, insulating-material parts, and all parts with heavy contamination:**
  - Cold cleanser 716 GCE0007706P0100
  - Observe the relevant instruction manual BA 1006/E GCEA901006P0102
- **Touch-up paint:**
  - Standard colour Ral 7035
    - 1 kg-box GCE9014060R0103
    - Spray tin GCE0007895P0100
Figure 7/1: Auxiliary switch block, equipment example

- 41 Mounting plate
- 41.1 Upper (plug-in) fixing point
- 41.2 Lower fixing point
- 42 Auxiliary shaft
- 42.1 Crank
- 43 Fastening screw
- 45 Magnet holder, complete

Figure 7/2: Undervoltage release and operation area, equipment example

- -Y1 Blocking magnet
- -Y3 Shunt release ON
- -Y4 Undervoltage release
- 47 Interlock plate for -Y4

Figure 7/3: Indirect overcurrent release and operation area, equipment example

- 2.1 ON push-rod
- 3.1 OFF push-rod
- 5 Operating cycle counter
- -Y7 Indirect overcurrent release

Figure 7/4: Charging motor, charging system and spring energy store

- 33 Drum with spiral spring
- 34 Chain
- 35 Ratchet wheel
- 36 Charging motor with gearing
- 36.1 Fastening screw (gearbox)
– S1 Auxiliary switch on operating mechanism
– S2 Auxiliary switch on blocking magnet
– S3 Auxiliary switch on the breaker shaft
– S4 Auxiliary switch on the breaker shaft
– S5 Auxiliary switch on the breaker shaft
– S7 Auxiliary switch for fault annunciation
  (fleeting contact, time \( \geq 30 \text{ ms} \))

1) Only when \( Y_1 \) not fitted
2) External operation

See page 27 for comparison of VDE/IEC designations.

Note:
Shunt releases and blocking magnets are fundamentally wired with rectifiers (e.g. magnet holder 45 with integrated rectifiers \( -V_1 \), \( -V_2 \), \( -V_3 \) and \( -V_9 \)).
Rectifiers function as free-wheeling diodes if d.c.-supply.

Figure 7/5: Wiring diagram

Arrangement for DC 24, 48, 60, 110, 125, 220, 240 V; AC 110, 220, 240 V

Shown with the spring energy store in the discharged state.
The wiring diagram comprises the basic components and all further equipment options for the various VD4 types. The scope of equipment possible within an individual type series is listed in the relevant switchgear list, and the equipment fitted in each individual case can be found in the order documentation.
Application of the X-ray regulations

One of the physical properties of vacuum insulation is the possibility of X-ray emissions when the contact gap is open. The specified test performed by the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig demonstrates that the local dosage output of 1 μSv/h at a distance of 10 cm from the touchable surface is not exceeded when the rated voltage is applied.

The results are as follows:

- Testing of the switching device or the vacuum interrupter to VDE 0671 part 100 or IEC 62271-100 at the relevant rated power frequency withstand voltage may only be performed by trained personnel observing the stipulations of the EU basic standard (Directive 96/29/Euratom of the Council of 13 May 1996 (ABI.L 159 of 29 June 1996)).

Comparison of designations to VDE-DIN 40719 Part 2 and IEC 61346-1/IEC 61346-2

<table>
<thead>
<tr>
<th>VDE DIN 40719 Part 2</th>
<th>Description</th>
<th>IEC 61346-1/61346-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>-S1</td>
<td>Auxiliary switch on operating mechanism</td>
<td>-BS1</td>
</tr>
<tr>
<td>-S2</td>
<td>Auxiliary switch on blocking magnet -Y1</td>
<td>-BL1</td>
</tr>
<tr>
<td>-S3</td>
<td>Auxiliary switch on the breaker shaft</td>
<td>-BB1</td>
</tr>
<tr>
<td>-S4</td>
<td>Auxiliary switch on the breaker shaft</td>
<td>-BB2</td>
</tr>
<tr>
<td>-S5</td>
<td>Auxiliary switch on the breaker shaft</td>
<td>-BB3</td>
</tr>
<tr>
<td>-S7</td>
<td>Auxiliary switch for fault annunciation</td>
<td>-BB4S</td>
</tr>
<tr>
<td>-Y1</td>
<td>Blocking magnet</td>
<td>-RL1</td>
</tr>
<tr>
<td>-Y2</td>
<td>Shunt release OFF</td>
<td>-MO1</td>
</tr>
<tr>
<td>-Y3</td>
<td>Shunt release ON</td>
<td>-MC</td>
</tr>
<tr>
<td>-Y4</td>
<td>Undervoltage release</td>
<td>-MU</td>
</tr>
<tr>
<td>-Y7</td>
<td>Indirect overcurrent release</td>
<td>-MO3</td>
</tr>
<tr>
<td>-Y9</td>
<td>Second shunt release OFF</td>
<td>-MO2S</td>
</tr>
<tr>
<td>-V1</td>
<td>Series rectifier for -Y1</td>
<td>-TR4</td>
</tr>
<tr>
<td>-V2</td>
<td>Series rectifier for -Y2</td>
<td>-TR1</td>
</tr>
<tr>
<td>-V3</td>
<td>Series rectifier for -Y3 and -K0</td>
<td>-TR3</td>
</tr>
<tr>
<td>-V4</td>
<td>Series rectifier for -Y4</td>
<td>-TR6</td>
</tr>
<tr>
<td>-V9</td>
<td>Series rectifier for -Y9</td>
<td>-TR2</td>
</tr>
<tr>
<td>-M0</td>
<td>Charging motor for spring energy store</td>
<td>-MS</td>
</tr>
<tr>
<td>-K0</td>
<td>Antipumping relay</td>
<td>-KN</td>
</tr>
<tr>
<td>-R0</td>
<td>Series resistor</td>
<td>-RR</td>
</tr>
</tbody>
</table>
Contact us

ABB S.p.A.
Electrification Products Division
Medium Voltage Products
Via Friuli, 4
I-24044 Dalmine
Tel.: +39 035 6952 111
Fax: +39 035 6952 874
E-mail: info.mv@it.abb.com

ABB AG
Calor Emag Medium Voltage Products
Oberhausener Strasse 33  Petzower Strasse 8
40472 Ratingen 14542 Werder (Havel) OT Glindow
GERMANY  GERMANY
Tel.: 02102 12-0
Fax: 02102 12-17 77
E-Mail: powertech@de.abb.com

www.abb.com/mediumvoltage

The data and illustrations are not binding. We reserve the right to modify the contents of this document without prior notice following technical and product developments.

© Copyright 2016 ABB. All rights reserved.