For your safety!

- Make sure that the installation room (spaces, divisions and ambient) is suitable for the electrical apparatus.
- Check that all the installation, putting into service and maintenance operations are carried out by qualified personnel with suitable knowledge of the apparatus.
- To ensure that the installations are built in accordance with the rules of good working practice and safety in the work place, make sure that the regulatory and legal requirements are complied with during installation, putting into service and maintenance.
- Strictly follow the information given in this instruction manual.
- Check that the rated performance of the apparatus is not exceeded during service.
- Check that the personnel operating the apparatus have this instruction manual to hand as well as the necessary information for correct intervention.
- Pay special attention to the notes highlighted in the manual by the following symbol:

![Warning Symbol]

Responsible behavior safeguards your own and others' safety!
Please contact the ABB Assistance Service for any further requirements.
1. Foreword

This publication contains the information required to install DCBreak high speed DC circuit breakers and put them into service. Please read the manual carefully to ensure that the product is used correctly.

Similarly to all the apparatus we manufacture, DCBreak circuit breakers are designed for different configurations. They can also be used for special technical-construction solutions designed for the customer on request.

The manual may not contain instructions concerning these special customized configurations. Consequently, besides this manual, it is always necessary to consult the technical documentation of the specific job order (circuit diagrams, topographical diagrams, assembly and installation drawings, etc.) regarding any non-standard configurations requested.

Doubts concerning the interpretation of the contents of this document or the need for further information should be submitted to your ABB representative in order to obtain the necessary explanations before proceeding.

Only use original spare parts for maintenance work. Consult the list of spares enclosed with this manual and the spare parts catalog for further details.

All installation, putting into service, operation and maintenance work must be carried out by suitably qualified personnel with in-depth knowledge of the apparatus.

1.1. Environmental protection program

DCBreak circuit breakers are manufactured in accordance with ISO 14000 Standards (Guidelines for environmental management). Fully recyclable materials are used since particular care is paid to EoL management of the product.

Qualified personnel

All installation, putting into service, operation and maintenance work must be carried out by suitably qualified personnel with in-depth knowledge of the apparatus.

The tasks described in this manual must only be performed by qualified personnel who possess authorizations enabling them to work on electromechanical equipment and who are aware of the electrical hazards (dangerous voltage) and mechanical hazards (moving parts) relating to work on electric circuit breakers. The workers must also be familiar with the use of personal protective equipment.

1.2. Regulatory framework and applicable legislation

DCBreak circuit breakers conform to the requirements of the regulations applicable to the sector concerned. In detail:

- IEC 60077-1-2-3 Railway applications - Electric equipment for rolling stock: electrotechnical components
- IEC 61373 Railway applications - Electric equipment for rolling stock: shock and vibration tests
- EN 45545-2 Conformity of insulating parts to the reaction to fire and smoke classification

Installation and maintenance operations performed by the customer must comply with the local regulations and legislation governing labor safety and electrical installations with dangerous voltage.
DCBreak circuit breakers are high speed DC breakers for applications on rail rolling stock. They are available for 900 VDC and 1800 VDC voltage ratings with 1500 A rated thermal current. The contacts are opened and closed by means of an electromagnetic actuator which can be energized by a wide range of auxiliary voltages. The circuit breakers are equipped with an instantaneous release for bidirectional overcurrent that continuously adjusts to the trip value required by the specific application. DCBreak circuit breakers feature long mechanical and electrical life and comprise various subassemblies, which can be easily inspected during preventive maintenance work. The insulating materials used conform to the strictest international standards governing mass public transport as regards reaction to fire.

2. General description

1. Insulating structure
2. Arc-quenching chute
3. Main circuit connections
4. Overcurrent detecting system
5. Auxiliary contacts
6. Electromagnetic actuator
3. Operating principle

The operating principle of the DCBreak circuit breaker is described below.

When the electromagnetic actuator (7) is energized, the main lever (6) is first pushed forwards against the latching lever (5) and then turns, allowing the movable main contact (9) to advance until the circuit breaker closes. After about one second, the current required to keep the circuit breaker in the closed position is limited to the “closed position holding value” by limiting power consumption to about 5 W. When the electromagnetic actuator (7) is de-energized, its internal spring causes the main lever (6) to return, thereby separating the main contacts (9) until the circuit breaker reaches the open position.

When the value of the current through the circuit breaker exceeds the trip threshold setting in the instantaneous overcurrent release, the current that flows through the lower terminal (2) generates, by means of the magnetic circuit (3), sufficient force to overcome the corresponding latching force and to lower the trip lever (5), thereby releasing it. Once the trip lever (5) has been released, the return spring (8) separates the main contacts (9) while the main lever (6) meshes against the trip lever (5) again, ready for the next closing operation. The arc generated between the main contacts (9) runs along the arc ramps (1) before being pushed upwards towards the plates of the arc-quenching chute (10), where it is interrupted.

The rating plate (1) affixed to the side of the circuit breaker shows the settings of the release device in relation to the position of the adjustable screw (2). The range of values is established during the routine factory tests to which each circuit breaker produced is subjected and cannot be used for any other circuit breaker.
4. Identification and designation

The identification plate is affixed in a visible position at the side of the DCBreak circuit breaker or outside the protective enclosure on versions supplied in boxes. The data are given in the language requested when the order was placed. The relative denomination may vary from one DCBreak to the next. To find out the exact version of the product, refer to the Serial number, which must also be given in any query concerning technical or commercial issues or requests for spare parts. When ordering, the customer must specify a certain threshold range for the overcurrent releases, or a range of values for a successive adjustment to be performed at the customer’s charge. In this latter case, the circuit breaker leaves the factory set to the minimum value of the chosen range and the customer must adjust it to the required tripping value.
5. Factory test and accompanying documentation

The DCBreak circuit breaker family conforms to standard IEC 60077-3. After it has been assembled every circuit breaker produced is subjected to routine tests according to procedures derived from the ABB quality standards and type tests. These tests are reported in a test certificate, of which a hard copy is attached to each apparatus shipped along with a copy of this manual and the circuit diagram.
6. Characteristics

6.1. Main circuit

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Unit</th>
<th>DCBreak 915</th>
<th>DCBreak 1815</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated service voltage</td>
<td>Ue</td>
<td>900 V</td>
<td>1800 V</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>Ui</td>
<td>2300 V</td>
<td>2300 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage</td>
<td>UBIL</td>
<td>18 kV</td>
<td>18 kV</td>
</tr>
<tr>
<td>Rated service current</td>
<td>Ie</td>
<td>1500 A</td>
<td>1500 A</td>
</tr>
<tr>
<td>Conventional thermal current in free air</td>
<td>Ith</td>
<td>1500 A</td>
<td>1500 A</td>
</tr>
<tr>
<td>Rated duty short-circuit making and breaking capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nominal operating cycle: O - 20sec - CO - 60sec CJ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time constant T1</td>
<td></td>
<td>30 kA @ 0 ms</td>
<td>17 kA @ 0 ms</td>
</tr>
<tr>
<td>Time constant T2</td>
<td></td>
<td>30 kA @ 15 ms</td>
<td>30 kA @ 15 ms</td>
</tr>
<tr>
<td>Time constant T3</td>
<td></td>
<td>30 kA @ 50 ms</td>
<td>30 kA @ 40 ms</td>
</tr>
<tr>
<td>Time constant T4</td>
<td>Iss/T</td>
<td>30 kA @ 150 ms</td>
<td>30 kA @ 100 ms</td>
</tr>
<tr>
<td>Direct overcurrent release: possible setting ranges on request</td>
<td></td>
<td>0.9 + 1.3 kA</td>
<td>0.9 + 1.3 kA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 + 1.8 kA</td>
<td>1.3 + 1.8 kA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.8 + 2.5 kA</td>
<td>1.8 + 2.5 kA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5 + 3.6 kA</td>
<td>2.5 + 3.6 kA</td>
</tr>
<tr>
<td>Maximum arc voltage</td>
<td>Ũarc</td>
<td>2.5 x Ue</td>
<td>2.5 x Ue</td>
</tr>
<tr>
<td>Class of functional operations</td>
<td></td>
<td>C3</td>
<td>C3</td>
</tr>
</tbody>
</table>

6.2. Auxiliary control circuit

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Un</th>
<th>24, 36, 48, 72, 110 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage limits (-25 °C &lt; T.amb &lt; +70 °C)</td>
<td>0.7 x Un - 1.25 x Un</td>
<td></td>
</tr>
</tbody>
</table>

6.3. Standard duty conditions

<table>
<thead>
<tr>
<th>Ambient temperature (according to class T1 of IEC 60077-1 Table 2)</th>
<th>Amb.T.</th>
<th>Air temperature external to vehicle</th>
<th>-25°C to +40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>inside vehicle compartment temperature</td>
<td>-25°C to +50°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inside cubicle temperature</td>
<td>-25°C to +70°C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td></td>
<td></td>
<td>95% at 40 °C</td>
</tr>
<tr>
<td>Altitude</td>
<td></td>
<td></td>
<td>≤ 1400 m</td>
</tr>
</tbody>
</table>
6. Characteristics

6.4. Control circuit

The circuit breaker is kept in the closed position by a holding current of around 10% of the current absorbed during the closing operation. The circuit breaker opens automatically when the holding current is zeroed by the circuit having opened.

**Closing**
The -SFC button closes the auxiliary switches -KFA1 and -KFA3. Closing contacts -KFA1 feeds the -MBC electromagnet and the main contacts of the high speed circuit breaker -QAB.

**Hold**
After about approximately 500 ms the delayed contact -KFA3 closes and feeds the contactor -KFA2. The contacts -KFA2 open by inserting the -RAR resistor: the current decreases to a proper value to maintain the circuit breaker in closed position.

**Opening**
Opening of the pushbutton -SFO causes the zeros of the current in the electromagnet -MBC and the opening of the main contacts of the high speed circuit breaker -QAB.
### Actuator characteristics

<table>
<thead>
<tr>
<th>U(tnom)</th>
<th>U(min)</th>
<th>U(max)</th>
<th>R(1nom)</th>
<th>I(min)</th>
<th>I(max)</th>
<th>R(1)</th>
<th>I(min)</th>
<th>I(max)</th>
<th>P(max)</th>
<th>R(1)</th>
<th>Microswitch to protect closing/opening control system of DCBreak circuit breaker (recommended)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[V]</td>
<td>[V]</td>
<td>[Ω]</td>
<td>[A]</td>
<td>[A]</td>
<td>[A]</td>
<td>[Ω]</td>
<td>[A]</td>
<td>[A]</td>
<td>[W]</td>
<td>[A]</td>
<td>[A]</td>
</tr>
<tr>
<td>24</td>
<td>16.8</td>
<td>30</td>
<td>0.55</td>
<td>43.6</td>
<td>25.1</td>
<td>71.3</td>
<td>7.5</td>
<td>3.0</td>
<td>2.1</td>
<td>3.8</td>
<td>107 S201-K10</td>
</tr>
<tr>
<td>36</td>
<td>25.2</td>
<td>45</td>
<td>1.39</td>
<td>25.9</td>
<td>14.9</td>
<td>42.3</td>
<td>18</td>
<td>1.9</td>
<td>1.3</td>
<td>2.37</td>
<td>98 S201-K6</td>
</tr>
<tr>
<td>48</td>
<td>33.6</td>
<td>60</td>
<td>1.8</td>
<td>26.7</td>
<td>15.4</td>
<td>43.6</td>
<td>28</td>
<td>1.6</td>
<td>1.1</td>
<td>2.1</td>
<td>118 S201-K6</td>
</tr>
<tr>
<td>72</td>
<td>50.4</td>
<td>90</td>
<td>4.9</td>
<td>14.7</td>
<td>8.5</td>
<td>24</td>
<td>68</td>
<td>1.0</td>
<td>0.7</td>
<td>1.25</td>
<td>107 S202-K4</td>
</tr>
<tr>
<td>110</td>
<td>77</td>
<td>137.5</td>
<td>12.25</td>
<td>9.0</td>
<td>5.2</td>
<td>12.8</td>
<td>160</td>
<td>0.6</td>
<td>0.4</td>
<td>0.8</td>
<td>105 S202-K2</td>
</tr>
</tbody>
</table>

| Power consumption (W) | 1060 | 430 | 2170 | 4.92 | 2.8 | 9.37 |

- (1) Coil temperature 20 °C
- (2) Coil temperature 70 °C and U(min)
- (3) Coil temperature -25 °C and U(max)
- (4) R1 = holding resistor (should be 200 W)

### 6.5. Auxiliary contacts

<table>
<thead>
<tr>
<th>Designation</th>
<th>Name</th>
<th>Unit</th>
<th>Value</th>
<th>Remarks / conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
<td>Screw with spring washer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>Ui</td>
<td>V</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>Rated impulse withstand voltage</td>
<td>Uimp</td>
<td>kV</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Thermal current</td>
<td>Ith</td>
<td>A</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Minimum current</td>
<td>I(min)</td>
<td>mA</td>
<td>5</td>
<td>If &lt; 5 mA, gold alloy (on request)</td>
</tr>
<tr>
<td>Contact material</td>
<td>Hard silver (AgCu3)</td>
<td>Gold alloy (AuAg26Ni3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact resistance</td>
<td>mΩ</td>
<td>10</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Mechanical life</td>
<td>10 x 106</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Max. breaking capacity

<table>
<thead>
<tr>
<th>Time constant UR</th>
<th>Switching voltage (U)</th>
<th>24 V DC</th>
<th>110 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ms</td>
<td>no</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
<tr>
<td>10 ms</td>
<td>yes</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
<tr>
<td>20 ms</td>
<td>yes</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
<tr>
<td>30 ms</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
<tr>
<td>40 ms</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
<tr>
<td>50 ms</td>
<td>10 A</td>
<td>&gt;16 A</td>
<td>&gt;16 A</td>
</tr>
</tbody>
</table>

### Direct current electric power
6. Characteristics

6.6. Operating sequences and durations

A: Coil current
B: Main contact
C: Auxiliary contact a (NO)
D: Auxiliary contact b (NC)

* Duration: min. 0.3 s, max. 1 s

Opening / closing sequence

![Closing time](image)

- Time in ms
- Ue (% of the nominal battery voltage)

- Main contact
- A 12
- A 34

![Opening time](image)

- Time in ms
- Ue (% of the nominal battery voltage)

- Main contact
- A 12
- A 34
7. Installation

7.1. General information
Correct installation is of primary importance. The manufacturer’s instructions must be carefully studied and followed. It is good practice to wear gloves, protection for the eyes, head and lower limbs when handling the components during the installation work.

7.2. Recommendations used in this manual
It is absolutely essential to comply with the following recommendations when mentioned in the text.

DANGER! Failure to comply with the tasks or procedures highlighted by this symbol could result in personal injuries!

IMPORTANT! Failure to comply with the tasks or procedures highlighted by this symbol could result in material damage or faulty operation!

7.3. Staff requirements
DANGER! This document describes the sole official procedure approved by ABB SpA for performance of the operations described below. ABB SpA declines all liability for failure to comply with the indicated procedures.

Throughout all operations, e.g. detailed planning, installation, disassembly, maintenance and putting into service of the apparatus, the workers are responsible:
• for correct and adequate execution of the operations
• for the apparatus and surrounding workplace
• for all persons present in the work area
• for safety, before the restarting and re-connection operations

The personnel assigned the tasks described above must be qualified in accordance with the regulations concerning this type of equipment in force in the country in which the equipment itself is installed, and must be familiar with similar types of apparatus. They must also be able to understand and comply with the indications in the corresponding circuit diagram and cable specifications during work. A working knowledge of the local regulations concerning safety for electrical installations and monitoring systems is also required.

All work on the apparatus and on the installation to which it is connected must be performed exclusively by properly trained personnel, in accordance with the laws governing safety in the workplace in force in the various different countries.
7. Installation

7.4. Overall dimensions

<table>
<thead>
<tr>
<th>Designation</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCBreak 915 Free Standing</td>
<td>28</td>
</tr>
<tr>
<td>DCBreak 1815 Free Standing</td>
<td>38</td>
</tr>
</tbody>
</table>

7.4.1. DCBreak 915 Free Standing

<table>
<thead>
<tr>
<th>Minimum distances from:</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulating panel</td>
<td>90</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Earth (solid or slatted metal panel)</td>
<td>300</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

Key:
1. Main connections
2. Fixing points
3. Earthing point
4. Actuator supply point
5. Auxiliary contacts
6. Adhesive rating plate
7. Aluminum rating plate (on request)
7.4.2. DCBreak 1815 Free Standing

<table>
<thead>
<tr>
<th>Minimum distances from:</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulating panel</td>
<td>90</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Earth (solid or slatted metal</td>
<td>300</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>panel)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key:
1. Main connections
2. Fixing points
3. Earthing point
4. Actuator supply point
5. Auxiliary contacts
6. Adhesive rating plate
7. Aluminum rating plate (on request)
7. **Installation**

7.5. **Transport and storage**

7.5.1. **Damage due to transport**
As soon as the apparatus is delivered, it must be visually inspected before being unpacked. Take note if the packaging is damaged or if there are signs that the apparatus has been transported in a negligent way by writing “possible internal damage. Subject to inspection” on the transport document, and have this signed by the carrier.

If ABB SpA is responsible for transport, the customer is obliged to report any damage to ABB SpA in writing within 7 days of receipt of the goods.

Also check:
- for the presence of damage on the outside of the apparatus
- for the presence of internal damage
- compliance with the order, the identification plates, the identification numbers and the quantity of components supplied.

If the apparatus is to be stored for a long period of time, seal it in its original packing so as to protect it against environmental influences.

7.5.2. **Storage**

*IMPORTANT!* The apparatus, accessories and spare parts must remain in their respective original packaging during the storage period.

Make sure that the apparatus, accessories and spare parts are stored in a clean, dry place, protected against the weather conditions such as dust, direct sunlight, rain, moisture and condensation. Comply with the storage conditions, as specified below.

**Storage temperature:**
The apparatus, accessories and spare parts must be stored at a temperature between -5 °C and +40 °C. Before putting the apparatus into service, allow it to fully adjust to the normal environmental conditions, especially as regards cleanliness and the degree of humidity of the insulating components.

**Position:**
The apparatus must be stored in its normal position.
7.5.3. Handling
Never lift the apparatus by the roof of its arc-quenching chute or by the side deflectors. The circuit breaker must be lifted by its upper terminal (1) and arc chute base (2), or by the two openings on each side (3).

The arc-quenching chute must be lifted two spans from the top or at the sides. Make sure you have a firm grip on the arc before lifting.

7.5.4. Packaging
DCBreak circuit breakers must always be packed with the arc-quenching chute assembled and protected against moisture, dust and shocks. Make sure that it is fastened to its support so as to prevent it from falling during transport.

7.5.5. Transport
The apparatus and components can only be transported in their original packaging and by adequate means of transport. Avoid shocks and jolts. Prevent dust, liquids and moisture from penetrating as they would damage the apparatus.

The photo below shows how DCBreak circuit breakers must be mounted on a pallet. A wooden cover and a frame must also be mounted on the pallet to protect the apparatus. Packing for ship transport can also be provided on request. Never leave the packs where they can be exposed to rain.
8. Putting into service

8.1. Special requirements
DCBreak circuit breakers have been designed by ABB for the standard uses defined by the IEC standards. Special requirements concerning the environment in which the circuit breaker must be used (altitude exceeding 1400 m, minimum operating temperature less than -25 °C, presence of large amounts of conductive polluting dust, etc.) can be considered and purpose-made solutions can be defined between the customer and ABB.

8.2. Assembly
DANGER! The DCBreak circuit breaker can be installed either inside the vehicle in a special ventilated cubicle or outside the vehicle (under-floor or on-floor assembly) in the dedicated metal enclosure. An enclosure with an adequate class of protection must be used for assembly outside the vehicle, so as to protect the circuit breaker components from polluting dust and water jets. The enclosures supplied by ABB for DCBreak circuit breakers are in the IP65 protection class, in accordance with the test requirements specified by standard IEC 60529. The minimum overall dimensions are determined by the distances from the insulating panels (7.4 - Dielectric dimensions). An opening flap measuring at least 40 cm² must be integrated above the enclosure. DCBreak circuit breakers must be fixed to a flat surface by means of four 146x130 mm holes.

8.3. Tightening torque values
The tightening torque values given in the table below must be applied using an adequate torque wrench (with reference to class 8.8 screws)

<table>
<thead>
<tr>
<th>Screw</th>
<th>Tightening torque [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>3</td>
</tr>
<tr>
<td>M5</td>
<td>6</td>
</tr>
<tr>
<td>M6</td>
<td>10</td>
</tr>
<tr>
<td>M8</td>
<td>25</td>
</tr>
<tr>
<td>M10</td>
<td>48</td>
</tr>
<tr>
<td>M12</td>
<td>84</td>
</tr>
</tbody>
</table>

8.4. Mechanical interface
IMPORTANT! Remember to fix the DCBreak circuit breaker to an insulated surface. If this is not possible, use 20 mm spacers to raise the fixing points. DCBreak circuit breakers must be installed in the horizontal position and fastened by four M8 screws (10) tightened to 25 Nm torque value.
8.5. Main connections

The main connections are made by cables or busbars (depending on the type of application and the customer’s requirements). The number of cables and their section must be chosen to suit the operating current required by the application and to not exceed current density of 1 A/mm².

Clean the contact surface using a non-abrasive cloth of the Scotch Brite type so as to ensure optimum contact resistance. Take care not to damage the silver plating on the terminals. After this, connect the cables or busbars (13) to each terminal (11, 12) using M12 nuts and screws (14). Remember to insert the locking washers as shown in the drawing. Tighten the screws (14) to 84 Nm tightening torque. Take care to position the cable terminals correctly so as to maintain the required dielectric clearance between the upper and lower terminals. Use screws long enough to project 3-4 threads from their nuts, but make sure that the screws are not too long, otherwise the clearance will be unnecessarily reduced.

IMPORTANT! In the case of busbar connections and to avoid excessive mechanical stress on the terminals due to the weight on the actual busbars (11, 12), the maximum distance between the connection and the first support of the busbar itself must not be more than 400 mm. Also take great care when aligning the terminals-busbars, so as to avoid creating mechanical stress on the circuit breaker terminals.

Polarity of main circuit connection to circuit breaker

The DCBreak circuit breaker has a bidirectional symmetric release. The forward biased normal connection direction of the main circuit is as follows:

+ connected to upper busbar (11)
– connected to lower busbar (12)
8. Putting into service

8.6. Auxiliary connections

The auxiliary contacts (19) are connected by 1 mm² crimped cables to terminals (17) and are fastened by M2.5 screws. The following can be used for wiring each block of auxiliary contacts (1 NO + 1 NC):

- four cables (x): two for the open contact and two for the closed contact
- or three cables and a bridge, as reverser.

The actuator is connected to terminals (x) by a crimped cable of at least 2.5 mm² and is fastened by M4 screws. The actuator functions correctly regardless of the polarity of its power supply. The section of the supply cables must be chosen to suit the power consumption during the circuit breaker closing operation and the voltage drop this causes must not be excessive (see 7.5 - Circuit breaker commands).

1. Remove the four screws (15) and extract the auxiliary contact box (16)
2. Crimp terminals (17) over cables (18)
3. Connect terminals to contact connections (19), as shown on circuit diagram
4. Connect cables (18) on both sides
5. Fit box (16) back into circuit breaker
6. Tighten the four screws (15)
7. Connect terminals (17) to terminal box
8.7. Earth connection
Make the earth connection and tighten to 10 Nm torque value

IMPORTANT! The section of the earth connection must be over 35 mm²

8.8. Final inspection

DANGER!
- Connect circuit breaker to auxiliary voltage supply for final inspection, with main circuit dead and without connecting terminals to main circuit.
- Never operate the energized circuit breaker without the arc-quenching chute completely assembled and fastened to the body of the circuit breaker by the 4 screws (electrical connection of the arc ramps on the circuit breaker body and the arc-quenching chute must be guaranteed).
- Make sure that the arc-quenching chute has been correctly fastened to the circuit breaker and that this latter is fastened to its support.
- Check that the earth connection has been assembled properly and screwed down in position.
- Check that the auxiliary connections are tight and that the cables are properly fixed.
- Make sure that the release settings conform to those required by the documents and specific application.
- Operate the DCBreak circuit breaker several times in the absence of voltage in the main circuit to check that it has been assembled correctly and that it performs the no-load closing-opening operations properly.
- Connect the cables and busbars to the main circuit as required by the specific application.
9. DCBreak version installed in a box

9.1. Description
The protective enclosure specifically designed for DCBreak circuit breakers is made of stainless steel and is pre-engineered to perform the following functions:
• Connection to the main circuit by means of sealed cable glands and cables (up to 6 cables)
• Connection of the signaling circuits and control circuit of the auxiliaries by means of a connector
• Mechanical fixing to the structure of the vehicle
• Protection against shocks and impact for underfloor applications and from the penetration of water and polluting dust.

9.2. Handling
IMPORTANT! Do not lift the whole enclosure by the handgrips (24). Use the handgrips (24) to lift the upper shell (25) and use two ropes (26) to lift the lower shell or the entire enclosure.

The dimensions of the enclosure have been optimized and checked during dedicated type tests to which the circuit breaker and enclosure assembly have been subjected. The enclosure is certified as able to withstand jets of water and dust (IP 65 protection class) and can be installed both on and under a vehicle.
9.3. Overall dimensions

DCBreak 915 B

DCBreak 1815 B

<table>
<thead>
<tr>
<th>Designation</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCCreak 915 B</td>
<td>68</td>
</tr>
<tr>
<td>DCCreak 1815 B</td>
<td>78</td>
</tr>
</tbody>
</table>

Caption:
1. Main cable connection cable glands
2. Harting-type auxiliary circuit connector plug (supplied loose)
3. Earthing connection point
4. Harting-type auxiliary circuit connector feeding socket
5. Aluminum nameplate
6. Lifting handles
7. Fixing points
X Minimum clearance for arc chute removal: 30 mm
9. DCBreak version installed in a box

9.4. Installation
The enclosure can be installed both on and under the vehicle. In both cases, the lower shell must first be positioned on a frame. After this, the upper shell is fixed from above or underneath the enclosure so as to facilitate the final assembly operations.

9.4.1. Removal of upper shell
Remove the six screws (27) to separate the upper shell (25) of the enclosure from the lower shell at the base (26). Raise the upper shell (25) using both handgrips (24) and set it down overturned so that the arc-quenching chute inside is visible.

9.4.2. Assembly of lower base
Lift the lower shell (26) and place it on its support so that the various connections can be accessed.
9.4.3. Main circuit connection
First route all the cables through the cable gland (28) before connecting the high voltage cables to the circuit breaker. After this, crimp the terminals (29) over each cable (30) according to the specifications (depending on the cable diameter and current). Before crimping, make sure that the size of the chosen terminals allows these latter to pass through the holes in the enclosure. First connect the lower cables to the busbar (31) and tighten them with M12 screws (32) and 84 Nm tightening torque. Now connect the upper cables to the busbar (33) and tighten them with M12 screws (34) and 84 Nm tightening torque. Lastly,

9.4.4. Auxiliary circuit connection
Each enclosure is equipped with a Harting-type connector (standard version). The enclosure can be equipped with circular-shaped connectors on request.
9. DCBreak version installed in a box

9.4.5. Earth connection
The earth connection (35) must be screwed onto a bolt (M12) to 84 Nm tightening torque. The section of the earth connection must be at least 35 mm².

9.4.6. Re-assembly of the upper shell
Place the upper shell on the lower shell in the correct direction. Insert six screws (27) and tighten them to 48 Nm tightening torque.
10. Disposal

If the apparatus is dismantled, the resulting materials can be disposed of in different ways according to their type:
- Stainless steel
- Copper and copper alloy
- Aluminum alloy
- Rubber (gaskets, etc.)
- Sintered material
- Cables
- Electrical components
- Glass-polyester
- Ceramic guides

All materials and components must be dismantled or recycled in accordance with the laws and regulations in force in the place of installation.

To ensure a high quality Customer Service, compliance with the following ABB SpA provisions and directives and, thus, the Quality Control regulations, is mandatory. This requirement applies to all cases of damage or repair, without exception.
11. Customer Service

11.1. Procedure
Before shipping materials for repair, please contact ABB SpA in order to establish all the details about the shipment, e.g. shipping method, address, etc.

To arrange for the repairs to be performed as rapidly as possible, please provide precise information about the cause of the damage and circumstances in which it occurred, as well as the following information:
- Production number of apparatus
- Order number
- Circuit diagram, drawing number with revision and date of issue
- Article number
- Description of fault and when it occurred (brief description!)

11.2. Packaging
To prevent damage during transport, the customer must ship the materials in adequate packaging.

11.3. Customer feedback
Our aim is to draw up this document as clearly and thoroughly as possible. To allow us to continually improve the quality of our documentation, we need to know your opinion, so feel free to send any suggestions for improvements you may have to your local ABB representative or to ABB SpA. Please use this form and send it to:

ABB SpA
Via Friuli, 4
24044 Dalmine BG Italy

Name of your company: .........................................................
Mailing address: ..........................................................
..........................................................
..........................................................
Contact person: ..........................................................
Tel.: ..........................................................
Fax: ..........................................................
e-mail address: ..........................................................

Notes and remarks:
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Date: .......................................................... Signature: ..........................................................

Acknowledgement of receipt of your feedback:
Thank you for your help. We acknowledge receipt of your remarks and suggestions and will forward them to the people concerned. After careful assessment, we will inform you about the actions that have been taken.

Name: ..........................................................
Date: .......................................................... Signature: ..........................................................
12. Maintenance

12.1. General information

Maintenance includes the following operations:

- **Routine inspection**: checks are performed to assess the effective conditions of the apparatus and whether dedicated maintenance work is required.
- **Preventive routine maintenance**: Tasks performed to preserve the required conditions.
- **Corrective maintenance**: Tasks performed to restore correct operation after faults.

All maintenance work must be performed in accordance with the regulations in force in the country where the apparatus is installed.

The maintenance operations must be performed by specialized personnel, who have been duly trained and informed about the characteristics of the apparatus in question.

Inspection and maintenance frequency for components subject to wear are established on the basis of the effective conditions in which the apparatus is used, i.e. operation frequency, length of time in service and number of short-circuit interruptions, environmental pollution conditions and presence of semi-conductive dust.

Since the real conditions of use vary to a great extent between one installation and the other, they cannot be known to ABB. The frequencies given are purely indicative since they are based on an average degree of use in subway and tramline installations. Users should acquire familiarity with the typical conditions of use in their installations and keep track of the observations reported in successive inspections so as to establish the best frequency with which inspections and preventive maintenance should be performed.

Instructions for replacing spare parts are supplied with the relative kits.

12.2. Routine inspections

12.2.1. Basic inspection

<table>
<thead>
<tr>
<th>Frequency in normal conditions</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The event that occurs first among those listed below:</td>
<td>Visual inspection</td>
</tr>
<tr>
<td>Every 18 months</td>
<td>Check safety rings.</td>
</tr>
<tr>
<td>- 25000 operations without load</td>
<td>Tighten screws.</td>
</tr>
<tr>
<td>- 400 operations up to rated load</td>
<td>Clean insulating parts</td>
</tr>
<tr>
<td>- 6 current interruptions due to overload</td>
<td>Inspect kinematic parts</td>
</tr>
<tr>
<td>- 25000 operations without load</td>
<td>Check main contacts and arc chute for wear.</td>
</tr>
<tr>
<td>Every 18 months</td>
<td></td>
</tr>
</tbody>
</table>

12.2.2. Main inspection

<table>
<thead>
<tr>
<th>Frequency in normal conditions</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The event that occurs first among those listed below:</td>
<td>Basic inspection</td>
</tr>
<tr>
<td>Every 18 months</td>
<td>Check pressure of contacts.</td>
</tr>
<tr>
<td>- 50000 operations without load</td>
<td>Carefully inspect the arc-quenching chute.</td>
</tr>
<tr>
<td>- 800 operations up to rated load</td>
<td>Check electric contact between circuit breaker and arc-quenching chute.</td>
</tr>
<tr>
<td>- 12 current interruptions due to overload</td>
<td></td>
</tr>
</tbody>
</table>

12.2.3. Inspections of contacts after short-circuit interruption

<table>
<thead>
<tr>
<th>Frequency in normal conditions</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The event occurs in random way</td>
<td>Revamp the surface of fixed and mobile contacts with 150-grit emery cloth</td>
</tr>
<tr>
<td></td>
<td>Check the pressure of contacts measuring the resistance of main circuit that must not exceed 70 µOhm</td>
</tr>
<tr>
<td></td>
<td>Inspect accurately the arc-quenching chute</td>
</tr>
<tr>
<td></td>
<td>Verify the electrical contact between the circuit breaker the arc-quenching chute</td>
</tr>
</tbody>
</table>

12.3. When parts need to be replaced

<table>
<thead>
<tr>
<th>Kits</th>
<th>When parts need to be replaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main contacts kit</td>
<td>When wear on the contacts reaches 2 mm</td>
</tr>
<tr>
<td></td>
<td>When contact resistance exceeds 70 µOhm after trimming and cleaning</td>
</tr>
<tr>
<td></td>
<td>If guides have been perforated</td>
</tr>
<tr>
<td></td>
<td>If arc quenching path has been perforated</td>
</tr>
<tr>
<td>Arc chute kit</td>
<td>Every 800 operations under rated load</td>
</tr>
<tr>
<td></td>
<td>Every 12 current interruptions due to overload</td>
</tr>
<tr>
<td></td>
<td>If more than 6 plates touch each other</td>
</tr>
<tr>
<td></td>
<td>Presence of evident melting between plates</td>
</tr>
<tr>
<td>Ceramic guides kit</td>
<td>Every 800 operations under rated load</td>
</tr>
<tr>
<td></td>
<td>Every 12 current interruptions due to overload</td>
</tr>
<tr>
<td>Auxiliary contacts kit</td>
<td>If a fault occurs</td>
</tr>
<tr>
<td>Flexible connection kit</td>
<td>After 100000 mechanical operations</td>
</tr>
</tbody>
</table>
12. Maintenance

12.4. Inspection procedure

12.4.1. Inspection of quenching chute
- Remove the cover of the quenching chute from above.
- Eliminate dust and residues.
- Make sure there is no abnormal wear inside the quenching chute, such as extensive melting on the metal plates.
- Check for the presence of short-circuits between each pair of plates using an Ohmmeter.

12.4.2. Inspection of contact wear
- Perform a visual inspection to assess the thickness of the contact pads and whether they have been worn evenly (note: when new, the contact pads are 2.5 mm thick, measured from the copper support to which they are welded).
- Clean the surfaces of the contacts using a fine-grain file or abrasive cloth, as necessary.
- If wear has noticeably reduced the thickness of the pads, proceed with the inspection described in the next point.
- Connect the ohmmeter to terminals (1) (2) and set it to the sound mode.
- Close the circuit breaker.
- If there is no continuity, fully tighten an M8 x 60 screw (3) behind the actuator then unscrew it by one turn. If the ohmmeter fails to indicate electrical continuity, it means that the contacts have reached their wear limit and must be replaced.

12.4.3. Flexible movable part
Check whether the first copper blades of the movable part are undamaged. Replace the connection if the first layer is damaged. Replacement is not necessarily required in the presence of cracks. The operator must assess whether the crack is able to affect dielectric clearance, considering the forecast increase in wear until the next inspection.

12.4.4. Screws
Make sure that the screws are tight. Re-tighten them to the required tightening torque if necessary.
12.5. Spare parts kits

12.5.1. DCBreak 915 arc chute kit

12.5.2. DCBreak 1815 arc chute kit

12.5.3. Ceramic guides kit

12.5.4. Auxiliary contacts kit

12.5.5. Main contacts kit

12.5.6. Flexible connection kit

12.5.7. Set of bolts, screws and nuts
12. Maintenance

12.5.8. Cable gland kit

12.5.9. Closing cap kit

12.5.10. Handle kit

12.5.11. Plug kit (24pins - 28pins - 36pins) for auxiliary circuits

12.5.12. Socket kit (24pins - 28pins - 36pins) for auxiliary circuits

12.5.13. Set of insulating parts

12.6. Disposal

If the apparatus is dismantled, the resulting materials can be disposed of in different ways according to their type:

- Stainless steel
- Copper and copper alloy
- Aluminum alloy
- Rubber (gaskets, etc.)
- Sintered material
- Cables
- Ceramic guides
- Glass-polyester

All materials and components must be dismantled or recycled in accordance with the laws and regulations in force in the place of installation.