Powerbloc 36/40.5 kV

Air-insulated medium voltage switchgear module

Instruction manual BA 441/03E
That's why our instruction manual begins with these recommendations:

- Only install switchgear and/or 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.
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Summary

1.1 General
The Powerbloc 36/40.5 kV (in the following named: Powerbloc) forms the noble part of an air insulated switchgear. The metal-clad, three pole switchgear unit without disconnectors is factory-assembled, type-tested for a rated voltage of 36/40.5 kV and consists of the circuit-breaker compartment with the withdrawable part with circuit-breaker type VD4. All other compartments with the equipment to be installed like the busbar compartment with the busbar system, the cable compartment with the current transformers and earthing switch as well as the low voltage compartment will be provided by the customer.

Details of the technical design and configuration of individual switchgears, such as the technical data, detailed equipment lists for the individual panels and comprehensive circuit documentation, etc., can be found in the relevant order documents.

Technical Data and instructions stated in this manual refer to the Powerbloc only.

1.2 Standards and specifications
Powerbloc comply with the standards and specifications for factory-assembled, metal-clad and type tested high voltage switchgears to VDE 0670 and the relevant IEC publications 60298 and 60694. In addition, in accordance with VDE 0470 and the equivalent IEC 60529, the Powerbloc has the degree of protection:

IP 4X for the enclosure.

All other relevant VDE specifications, especially DIN VDE 0101, VDE 0105 and DIN VDE 0141, the corresponding IEC publications, the national or local safety at work regulations and the safety regulations for production materials are to be followed during erection and operation of these systems. Above and beyond this, the order-related data from ABB Calor Emag are to be taken into account.

1.3 Operating conditions
1.3.1 Normal operating conditions
The powerbloc modules are fundamentally designed for the normal operating conditions for indoor installation to VDE 0670 part 1000/IEC Publication 60694. The following limit values, among others, apply:

Ambient temperature:
- Maximum: + 40 °C
- Maximum 24 h average: + 35 °C
- Minimum (according to "minus 5 indoor class") -5 °C

VDE 0670 part 6 amends the content of VDE 0670 part 1000 "Common specifications for high-voltage switchgear and controlgear standards" with respect to humidity as follows: With indoor installation, it is assumed that the humidity within the enclosure can reach high values, but that there is normally no condensation on the installed equipment. Condensation can be prevented by appropriate configuration of the station building or switchgear room.

The maximum site altitude is 1000 m above sea level.

1.3.2 Special operating conditions
According to VDE 0670 part 1000, the manufacturer and user may agree on special operating conditions which deviate from the normal operating conditions. The manufacturer must be consulted in advance about each special operating condition. Examples are as follows:

- At site attitudes above 1000 m, the effects of the reduction in dielectric strength of the air on the insulation level are to be taken into account. (Figure 1/1)

- Increased ambient temperatures must be compensated for in the design of the busbars and tee-off conductors, or the current carrying capacity will be limited. Heat dissipation in the switchgear module can be assisted by fitting additional ventilation facilities.

Note on any special climatic operating conditions:
When switchgears are operated in areas with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits which must remain an exception in normal operating conditions for indoor switchgears. Preventive action (e.g. fitting electric heaters) must be taken in consultation with the manufacturer to avoid such condensation phenomena and the possibly resulting corrosion and other adverse effects.

![Figure 1/1](Source: ABB switchgear manual, 9th Edition, 1992)
2 Technical data

2.1 Electrical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit</th>
<th>38</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>38</td>
<td>40.5</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>kV</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>kV</td>
<td>170</td>
<td>200</td>
</tr>
<tr>
<td>Insulation to:</td>
<td></td>
<td>DIN VDE/IEC list 2</td>
<td></td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>50/60</td>
<td>50/60</td>
</tr>
<tr>
<td>Rated current of tee-offs, circuit-breaker</td>
<td>A</td>
<td>...3150(a)</td>
<td>...3150(a)</td>
</tr>
<tr>
<td>Rated peak withstand current(\text{\textsuperscript{1}})</td>
<td>kA</td>
<td>...80(\text{\textsuperscript{2}})</td>
<td>...80(\text{\textsuperscript{2}})</td>
</tr>
<tr>
<td>Rated short-circuit breaking current of circuit-breaker</td>
<td>kA</td>
<td>...31.5(\text{\textsuperscript{3}})</td>
<td>...31.5(\text{\textsuperscript{3}})</td>
</tr>
<tr>
<td>Rated short-time current 3 s(\text{\textsuperscript{1}})</td>
<td>kA</td>
<td>...31.5(\text{\textsuperscript{4}})</td>
<td>...31.5(\text{\textsuperscript{4}})</td>
</tr>
<tr>
<td>Auxiliary voltage</td>
<td>V</td>
<td>DC(^\text{\textsuperscript{5}}) 60, 110, 120; AC 110, 220</td>
<td></td>
</tr>
</tbody>
</table>

\(\text{\textsuperscript{1}}\) Take the short-circuit withstand capability of the instrument transformers into account separately.

\(\text{\textsuperscript{2}}\) Special DC voltages on request.

\(\text{\textsuperscript{3}}\) Up to 3150 A at 40°C and 2500 A at 55°C with forced ventilation.

\(\text{\textsuperscript{4}}\) 40 kA on request for circuit-breaker ≥ 2000 A.

\(\text{\textsuperscript{5}}\) 100 kA on request for circuit-breaker ≥ 2000 A.

2.2 Resistance to internal arc faults

The fault withstand capacity for the Powerbloc can only be considered in the context with the remaining components of the switchgear panel. With regards to the Powerbloc 36/40.5 kV as a single component no data can be given for the fault withstand capacity. As a part of the switchgear panel ZS3.2 the fault withstand capacity for the Powerbloc will be 31.5 kA, 1 s.

2.3 Dimensions and weights

Dimensions according to Figures 2/1 and 2/2

Weight: 870-950 kg, depending on the equipment installed.

<table>
<thead>
<tr>
<th>Dimensions:</th>
<th>Unit</th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>mm</td>
<td>2350</td>
<td>2350</td>
</tr>
<tr>
<td>Width</td>
<td>mm</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>Depth of the C.B. compartment</td>
<td>mm</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Depth of the connection block(\text{\textsuperscript{1}})</td>
<td>mm</td>
<td>466</td>
<td>466</td>
</tr>
</tbody>
</table>

\(\text{\textsuperscript{1}}\) Total depth of the Powerbloc is 1466 mm.
Figure 2/1: Dimensions, Powerbloc 36/40.5 kV, front view.

Figure 2/2: Dimensions, Powerbloc 36/40.5 kV, ...1600 A, section view.
3 Powerbloc 36/40.5 kV structure and fixing points for panel extension

3.1 Basic structure
(Figures 2/1, 3/1 to 3/19)
The basic structure of the Powerbloc comprises the circuit-breaker compartment, which is fixed in position, and the movable withdrawable part with vacuum circuit-breaker. Figures 3/1 to 3/19 show the structure of a panel and the electrical equipment fitted. Further details on the structure and equipment configuration of the Powerbloc can be taken from the order documents for the particular case.

3.2 Enclosure and partitions
(Figures 3/1 to 3/8)
The enclosure of the Powerbloc consists of high quality aluminium-zinc coated sheet steel, 2 mm thick. Secured pressure relief plates are located at the top of the high voltage compartment.

These open if internal arc faults result in overpressure. The front of the Powerbloc is closed off by flame-proof doors which open to an angle of almost 180°. Neighbouring Powerbloc modules are partitioned from one another by the side walls of each panel and the air cushion which remains between these walls as a result of the design when the Powerbloc modules are joined together. This method of construction prevents them from melting through if an arc fault should occur. Even with the withdrawable part with circuit-breaker removed (hinged shutters 35.1/35.2 in the closed position), there is protection against contact with live parts.

The necessary safety measures to counteract the effects of an internal arc fault must be ensured in connection with the ceiling height. This may in individual cases possibly necessitate additional operator protection measures on the switchgear panels.

The front door 30 of the Powerbloc and the partition plate 50.2 on the withdrawable part are thoroughly cleaned and thereafter protected against corrosion by an electrophoresis enamelling and then finally by a powder coating method in the colour RAL 7035 - light grey (or in a special colour as agreed).

3.3 Circuit-breaker compartment
(Figures 3/2, 3/3, 3/6 to 3/9, 3/11 and 6/6)
The circuit-breaker compartment A fitted with the necessary guide rails accommodates the withdrawable part with circuit-breaker type VD4, which can be moved between the service position and the test/disconnected position.

If the withdrawable part is moved from the service position into the test/disconnected position, the fixed contacts 25.1/25.2 located in the connection blocks 20.1/20.2 are automatically covered by hinged shutters 35.1/35.2. In the test/disconnected position, the withdrawable part is still completely inside the Powerbloc with the door closed. The mechanical indicators for ON/OFF and CHARGED/DISCHARGED can be observed through a sight glass.

The switching operations of the circuit-breaker are carried out with the doors closed.

Withdrawable circuit-breaker part
(Figures 3/2 to 3/4, 3/7 to 3/9, 3/12 to 3/15, 6/1 to 6/6)
The withdrawable part which can be moved manually consists of a robust sheet steel structure on which the circuit-breaker is mounted together with ancillary components.

Contact arms 57.1/57.2 with spring-loaded contact systems are fitted to the circuit-breaker poles. These create the electrical connection to the switchgear panel when the withdrawable part is inserted into the service position.

The signalling, protection and control wiring between the switchgear panel and the withdrawable part is coupled by a multiple pin control wiring plug connector 10.

As soon as withdrawable part 50 has been slid into the circuit-breaker compartment and the catch pin 51.1 of the interlock yoke has engaged in the test/disconnected position, it is positively connected to the switchgear panel. At the same time, it is earthed by the earthing contact 50.1 of the withdrawable part and via the earthing rail 19.1. The position of the withdrawable part can be checked on the electrical position indicator supplied by the customer or through the sight glass in the door at any time. The stored-energy spring mechanism of the circuit-breaker including controls and indicators is accessible at the front of the withdrawable part.

The control wiring in the Powerbloc area can be led through generously dimensioned and metal covered ducts. The left-hand duct is reserved for the incoming and outgoing control wires, and the internal wiring in the panel is located on the right hand side. The incoming control cables will be fixed on cable clamps located inside the cable ducts and then they will be led through reducer rings (sealing rings) into the low-voltage compartment.
3.4 Interlocks/protection against maloperation
(Figures 3/2, 3/6 to 3/9, 6/1 to 6/6, 6/8 and 6/9)

A series of interlocks are provided to prevent fundamentally hazardous situations and maloperation, thus protecting both personnel and the switchgear itself. The interlocks which are normally individually effective are as follows:

- The withdrawable part can only be moved from the test/disconnected position into the service position (and back) with the circuit-breaker open and the earthing switch open (between positions, the circuit-breaker is mechanically interlocked, and also electrically interlocked in the case of circuit-breakers with electrical releases/supplied by the customer).

- The circuit-breaker can only be closed when the withdrawable part is precisely in the defined test position or service position (between positions, the circuit-breaker is mechanically interlocked, and also electrically interlocked in the case of circuit-breakers with electrical releases).

- The circuit-breaker can only be opened manually in the service or test position when no control voltage is applied, and cannot be closed (electromechanical interlock).

- Control wiring plug 10.2 can only be inserted or removed when the the withdrawable part is in the test/disconnected position.

- Earthing switch (if supplied) can only be closed when the withdrawable part is in the test/disconnected position or the removed position (mechanical interlock).

- The withdrawable part cannot be moved from the test/disconnected position into the service position when the earthing switch is closed (mechanical interlock).

- Details of any additional interlocks, e.g. in connection with a blocking magnet on the withdrawable part and/or earthing switch operating mechanism, can be found in the order documents for each individual case (see also section 7.4.2).

- The hinged shutters 35.1/35.2 can be secured with padlocks in the closed position of the shutters when the withdrawable circuit-breaker part has been removed.

Figure 3/1: Powerbloc 36/40.5 kV, front view.

14 Earthing switch, operation mechanism
14.1 Driving shaft for the earthing switch, front part
14.2 Slide
52 Spindle
54 ON-OFF operating shaft
54.4 Label for operating advice
54.5 Sight glass
54.6 Ventilation grt, below (optional)
Figure 3/2: Powerbloc 36/40.5 kV, section view, basic structure.

Detail X: Figure 3/14.

A  Circuit-breaker compartment
B  Low-voltage compartment
C  Busbar compartment
D  Cable connection compartment

1  Enclosure
1.1 Pressure relief plate
1.2 Control wiring duct
3.1 Tee-off conductor, busbar side
3.2 Tee-off conductor, cable side
7  Separating plate, above
8  Separating plate, below
10 Control wiring plug connector
10.1 Control wiring socket
10.2 Control wiring plug

10.3 Interlocking arm for control wiring plug
11 Support profile, left
12 Support profile, right
14 Earthing switch operation mechanism
14.1 Driving shaft for the earthing switch, front part
19.1 Earthing rail
20.1 Connection block, above
20.2 Connection block, below
30 Front door for circuit-breaker compartment
35.1 Hinged shutter system, above
35.2 Hinged shutter system, below
50 Withdrawable part (with circuit-breaker, type VDK)
50.2 Front partition plate
51 Interlock yoke
52 Spindle

1) Customer components
2) The earthing rail in the Powerbloc must be connected with the earthing bar of the switchgear (customer component).
Figure 3/3: Powerbloc 36/40.5 kV, ...3150 A, section view.

Powerbloc with ventilation and/or forced cooling:
In addition ventilation grills are installed in the front door and on the top of the Powerbloc.

Detail X: Figure 3/15

Figure 3/4: Powerbloc 36/40.5 kV, busbar metering, shown without withdrawable metering unit.
Figure 3/5: Power bloc 36/40.5 kV, front side, door closed.

Figure 3/6: Power bloc 36/40.5 kV, front side, door opened.

19.1 Earthing rail
35.1 Hinged shutter system, above
35.2 Hinged shutter system, below
44 Heater plate (non-standard)

Figure 3/7: Circuit-breaker compartment, door open, withdrawable part in isolated/disconnected position, control wiring plug connection engaged.

10 Control wiring plug connector
14 Earthing switch, operation mechanism
14.1 Driving shaft for the earthing switch, front part
14.2 Slide
50 Withdrawable part with circuit-breaker, type VD4
51 Interlock yoke

Figure 3/8: Circuit-breaker compartment, door open, withdrawable part in service position.

43.1 Duct cover for control cables
Figure 3/9: Circuit-breaker compartment, withdrawable part in service position, control wiring plug connection engaged, interlocking arm in blocking position.

10.1 Control wiring socket
10.2 Control wiring plug
10.3 Interlocking arm for control wiring plug (blocking position)

Figure 3/10: Powerbloc 36/40.5 kV, rear side.

12 Support profiles, right
20.1 Connection block, above
20.2 Connection block, below

Figure 3/11: View into circuit-breaker compartment withdrawable part removed, hinged shutters opened.

20.1 Connection block, above
20.2 Connection block, below
25.1 Contact pin, ...1600 A

Figure 3/12: Withdrawable part with circuit-breaker, type VCM, operator’s side, control wiring plug plugged to front partition plate.
**Figure 3/13:** Withdrawable part with circuit-breaker, type VD4, pole side.

- 50.1 Earthing contact
- 50.2 Front partition plate
- 50.8 Wheel
- 57.1 Upper contact arm, ...1600A
- 57.2 Lower contact arm, ...1600A
- 57.3 Contact system, ...1600A
- 57.8 Embedded pole

**Selection of the tee-off busbar**

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Tee-off bars</th>
<th>Ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1250 A</strong></td>
<td>1x80x10</td>
<td>40 °C</td>
</tr>
<tr>
<td><strong>1600 A</strong></td>
<td>1x100x10</td>
<td>40 °C</td>
</tr>
<tr>
<td><strong>1250 A</strong></td>
<td>1x80x10</td>
<td>55 °C</td>
</tr>
</tbody>
</table>

**Figure 3/14a:** Busbar connection and fitting of the contact pins.
Detail X: Figure 3/2.
Connection block with contact pins ...1600 A.

- 20.2 Connection block, below
- 25.1 Contact pin, ...1600 A
- 25.3 Threaded insert, M20/M10
- 25.6 Sealing
- 25.7 Dished washer 10
- 25.8 Cheese head bolt M10 x 120
- 57.2 Lower contact arm, ...1600 A
- 57.3 Contact system, ...1600 A

**Figure 3/14b:** Design of the tee-off busbars ≤ 1250A to 1600A.
Due to PD – tests round corners are required.
Selection of the tee-off busbars

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Tee-off bars</th>
<th>Ambient temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 A</td>
<td>2x100x10</td>
<td>40 °C</td>
</tr>
<tr>
<td>2500 A</td>
<td>2x100x10</td>
<td>40 °C</td>
</tr>
<tr>
<td>3150 A</td>
<td>2x100x10</td>
<td>40 °C</td>
</tr>
<tr>
<td>1600 A</td>
<td>2x100x10</td>
<td>55 °C</td>
</tr>
<tr>
<td>2000 A</td>
<td>2x100x10</td>
<td>55 °C</td>
</tr>
<tr>
<td>2500 A</td>
<td>2x100x10</td>
<td>55 °C</td>
</tr>
</tbody>
</table>

Figure 3/15a: Busbar connection and fitting of the contact pins. Detail X: Figure 3/3.
Connection block with contact pins 2000 A to 3150 A.

- 20.2 Connection block, below
- 25.2 Contact pin, 2000 A to 3150 A
- 25.4 Tightening jack
- 25.5 Sealing
- 25.6 Distance plate, 5 mm
- 25.7 Dished washer 10
- 25.9 Cheese head bolt M10 x 50
- 25.10 Hex bolt M20 x 90
- 25.11 Dished washer 20
- 57.12 Lower contact arm, 2000 A to 3150 A
- 57.13 Contact system, 2000 A to 3150 A

Tee-off bar ≤ 3150A (40/55°C)

Figure 3/15b: Design of the tee-off busbar (1600A), 2000A to 3150A. Due to PD – tests round corners are required.

Figure 3/16: For bolting together the Powerbloc 36/40.5 kV panels, threaded bushings are provided near to the front and rear edges of the side walls.

1.5 Lifting lug
1.9 Threaded bushing M10, for switchgear assembly
Figure 3/17: Extension of the shaft of the driving mechanism for the earthing switch type EK6.

6.6 Bevel gear mechanism
6.7 Operating shaft
6.11 Extension of driving shaft for earthing switch
6.12 Dowel pin 5 x 36 DIN EN 28748 ST
6.13 Dowel pin 8 x 36 DIN 1481- ST
6.14 End stud of the driving shaft (front part 14.1) for the earthing switch

<table>
<thead>
<tr>
<th>Length of the extension shaft</th>
<th>Depth of the panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>mm</td>
</tr>
<tr>
<td>1305</td>
<td>2500</td>
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<tr>
<td>bis</td>
<td>bis</td>
</tr>
<tr>
<td>1425</td>
<td>2620</td>
</tr>
</tbody>
</table>

The connection of the shaft (front part 14.1) and the extension shaft 6.11 is made by two sets of dowel pins (6.13 and 6.12).

There must be taken care for the position of the driving shaft (front part 14.1) and the extension shaft 6.11 to each other.

Figure 3/18: Driving shaft for the earthing switch, front part

14.1 Driving shaft for the earthing switch, front part
6.14 End stud of the driving shaft (front part 14.1) for the earthing switch
Figure 3/19: Fixing points for Powerblock 36/40.5 kV.
Busbar compartment and cable connection compartment.

a) Side view
b) Rear view
c) Section view A-A, base plate
d) Section view B-B, connection points for low voltage compartment
Dispatch and storage

4.1 Condition on delivery

The factory assembled Powerbloc modules are checked at the works for completeness in terms of the order and simultaneously subjected to routine testing to VDE 0670 part 6 or IEC publication 60298, and thus tested for correct structure and function.

4.2 Packaging

The Powerbloc modules are despatched in appropriate packaging for the prevailing conditions, e.g. "seaworthy packaging", or also without packaging, as required in individual cases. Particularly for overseas transport, even in containers, they are sealed in air-tight plastic sheeting with an appropriate quantity of drying agent to protect them from damage due to moisture, and in many cases fitted with a separate moisture indicator. When aluminum composite sheeting is used, a window has to be fitted for observation of the moisture indicator. The drying agent is active as long as the coloured indicator remains blue. When the colour changes to pink, the relative humidity stated on the bag (e.g. 40%) has been exceeded inside the packaging (possibly as a result of damage). Suitable action including replacement of the drying agent bags is then necessary if the packaging condition is to be maintained. The instructions for use of the drying agent bags to DIN 55 473 are to be followed carefully.

4.3 Transport

(Figure 4/1)

The transport units are individual modules.

The Powerbloc is fitted with four lifting lugs.

Transport Powerbloc upright. Only ever carry out loading operations when it has been ensured that all precautionary measures to protect personnel and materials have been taken and using a

- crane,
- fork-lift truck and/or
- manual trolley jack.

Loading by crane:

- Fit lifting ropes of appropriate load capacity with shackles (opening width ≥ 30 mm, fastening bore diameter 30 mm).
- Maintain an angle of ≥ 60° from the horizontal for the ropes leading to the crane hook.
- Withdrawable parts to be handled with special care.

4.4 Delivery and intermediate storage

The responsibilities of the consignee when the switchgear arrives at site include, but are not limited to the following:

- Checking the consignment for completeness and freedom from damage (e.g. also for moisture and its detrimental effects). In cases of doubt, the packaging must be opened and then properly resealed, fitting new drying agent bags, when intermediate storage is necessary.
- Precisely documenting any short quantities, defects or transport damage on the consignment note and notifying the shipper or carrier immediately in accordance with the liability provisions of the German General Conditions for Forwarders (GDP)/KVO.

Note:

Considerable damages should be documented by photographs.

Optimum intermediate storage – as far as this is necessary at all – without detrimental consequences depends on compliance with a number of minimum conditions for the switchgear panels and assembly materials.

Powerbloc modules with simple packaging or no packaging:

- A dry and well-ventilated store-room, atmosphere in accordance with VDE 0670 part 1000/IEC 60694.
- Room temperature which does not fall below -5 °C.
- No other detrimental environmental influences.
- Store Powerbloc modules standing upright.
- Do not stack Powerbloc modules.
- Do not remove or damage the packaging.
- Loosely cover unpackaged Powerbloc modules with plastic film to prevent dirt ingress. Sufficient air circulation must be maintained to prevent corrosion.
- Carry out regular checks for any condensation until erection starts.
Powerbloc modules with seaworthy or similar packaging and internal protective films:

- Store the transport units in a dry place, protected from the weather and from damage.
- Check the packaging for undamaged condition.
- Check the indicator for correct function of the drying agent on arrival of the consignment and at appropriate intervals, see also the details in section 4.2.
- When the maximum storage life after the date of packaging is exceeded, the protective function of the packaging including its anti-corrosion effects will cease to be effective sooner or later, depending on local conditions. If intermediate storage has to be prolonged, suitable action must be taken.

Note:

⚠️ Do not walk on the roof of the panels (rupture points in pressure relief devices)!

![Diagram]

**Figure 4/1:** Handling by crane
1.5 Lifting lug
1.10 Marking of the centre of gravity
5 Assembly of the Powerbloc (switchgear) at site

In the interests of an optimum installation sequence and the assurance of a high quality standard, site installation of the switchgear should only be carried out by specially trained skilled personnel, or at least supervised and monitored by responsible persons. In addition to this manual the instruction manual of the supplier of the switchgear must be considered.

5.1 General site requirements

On commencement of installation at site, the switchroom must be completely finished, provided with lighting and site electricity supply, lockable, dry and with facilities for ventilation. All the necessary preparations such as wall openings, ducts, etc., for laying of the power and control cables up to the switchgear must already be complete.

Compliance with the conditions for indoor switchgear to VDE 0670 part 1000, IEC 60694 including the conditions for the “minus 6 indoor” temperature class must be insured.

5.2 Foundations
(Figures 5/1 to 5/3)

The Powerbloc (switchgear) is preferably to be erected on a foundation frame set into the switchroom floor. When the final construction documents are compiled, the binding data supplied by ABB (or supplier of the complete switchgear) must always be taken into account!

The stipulations of DIN 43 661 are also to be complied with when the foundation is laid. This particularly applies to the evenness and straightness tolerances as a precondition for perfect installation of the switchgear.

5.2.1 Foundation frame on a concrete floor

The foundation frame, consisting of one or more parts depending on the size of the switchgear is usually laid by site personnel and should if possible be aligned and inspected under the supervision of a specialist.

Installation of the foundation frame:
(Sample for information only)

- Enter jacking screws 60.8 and place steel strips 60.4 below them.
- Carefully align the foundation frame horizontally along the entire surface and to the correct height by screwing the jacking crews down by an appropriate amount and using a levelling instrument. The top edge of the foundation frame should be 2 mm above the finished floor surface. This facilitates erection and alignment of the complete switchgear panels. In some cases, this means that the material thickness of an additional floor covering to be fitted later must be taken into account separately. Tolerances for laying of the frame to DIN 43 661:
  e.g. evenness tolerance:
  ±1 mm within a measuring length of 1 m,
  e.g. straightness tolerance:
  maximum 1 mm per m, but not more than 2 mm over the entire length of the frame.
- Slide brackets 60.5 against the frame at two points – for each 3 m of frame length – secure them to the concrete floor with plugs 60.6 and bolts 60.7; and weld them to the frame. The set position of the frame on the concrete floor must not be altered during this operation!
- Weld the foundation frame parts together. Grind projecting parts and weld seams on the top of the frame flat.
- Make the necessary preparations for perfect earthling of the foundation frame with 30 x 4 mm galvanized steel strip. Two connectors are necessary for long switchgears.
- When the floor topping is applied, carefully backfill the foundation frame, leaving no gaps.
- The foundation frame must not be subjected to any injurious impacts or pressures, particularly during the installation phase.

If these conditions are not fulfilled, problems during assembly of the switchgear and possibly with movement of the withdrawable parts and opening and closing of the doors cannot be ruled out.
### Table for figures 5/1 and 5/2

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>36</th>
<th>40.5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong></td>
<td>kV</td>
<td></td>
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<tr>
<td><strong>System type</strong></td>
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<td>Powerbloc</td>
<td>Powerbloc</td>
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<tr>
<td><strong>Panel equipment</strong></td>
<td></td>
<td>Withdrawable</td>
<td>Withdrawable</td>
</tr>
<tr>
<td><strong>Width of the powerbloc</strong></td>
<td>mm</td>
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<td>1200</td>
</tr>
<tr>
<td><strong>Aisle width (front of panel)</strong></td>
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<td>2000</td>
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<tr>
<td><strong>Aisle width (rear side of panel)</strong></td>
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<td><strong>Assembly openings in ceilings:</strong></td>
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</tr>
<tr>
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<td>mm</td>
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<td>2</td>
</tr>
<tr>
<td>Length:</td>
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<tr>
<td><strong>in doors:</strong></td>
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<tr>
<td>Width:</td>
<td>mm</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Height:</td>
<td>mm</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Weight of the Powerbloc 38/40.5 kV</strong></td>
<td>kg</td>
<td>870-950</td>
<td>870-950</td>
</tr>
<tr>
<td><strong>Ceiling load (for Powerbloc 38/40.5 kV)</strong></td>
<td>kg/m²</td>
<td>900</td>
<td>900</td>
</tr>
</tbody>
</table>

1) Determined by VDE 0101 and the data for maximum panel width.
2) Dimensions determined by the supplier of the switchgear.

### 5.3 Assembly of the Powerbloc (switchgear panels)
(Figures 3/1 to 3/4, 3/14 to 3/19, 5/1 to 5/3)

Use DIN screws of tensile class 8.8. The tightening torques for the busbar screw connections with dished washers are as follows:

<table>
<thead>
<tr>
<th>Thread</th>
<th>Nm</th>
<th>Recommended tightening torque [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 6</td>
<td>10,5</td>
<td>4,5</td>
</tr>
<tr>
<td>M 8</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>M 10</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>M 12</td>
<td>86</td>
<td>40</td>
</tr>
<tr>
<td>M 18</td>
<td>200</td>
<td>80</td>
</tr>
</tbody>
</table>

[1] The rated tightening torques for fasteners without lubrication are based on a coefficient of friction for the thread of 0.14 (the actual values are subject to an unavoidable, partly not inconsiderable spread).
[2] Rated tightening torques for fasteners with lubrication in accordance with DIN 43 673.

Consult the detailed technical documentation for any tightening torques which deviate from the general table (e.g. for contact systems or switch terminals).

The individual installation stages are as follows:

- Transport the switchgear panels to the prepared installation point in the sequence shown on the switchgear plan.
- Dismantle lifting lugs.
- Removedrawable parts from the switchgear panels and store them with suitable protection.
- Remove cover 43.1 from the vertical control wiring ducts at the front right and left of the Powerbloc modules.
- Align the switchgear panels on the foundation one after another for correct position and vertical alignment (deviations of the panel edges from the vertical must not exceed 2 mm, particularly at the front) and bolt the panels together. It is advisable to start from the centre when assembling switchgear with more than ten panels.
- When the switchgear has been properly assembled weld or adequately bolt them to the foundation frame.
5.4 **Earthing the Powerbloc 36/40.5 kV**  
(Figures 3/2 and 3/8)  
An earthing rail 19.1 is located at the bottom of the circuit-breaker compartment and this rail must be connected to the earthing bar of the switchgear (supplied by the customer).

5.5 **Concluding installation work**
- Check the paintwork of the switchgear for any damage, and touch up where necessary (see also section 7.3.1).
- Check bolted connections, especially all those made during on-site assembly in the busbar and earthing system, and tighten where necessary.
- Carefully clean the switchgear.
- Remove all foreign bodies from the switchgear panels.
- Properly refit all covers etc. removed during installation and connection.
- Close off any openings remaining in the enclosure as a result of the particular design, but which are no longer required.
- Insert the withdrawable parts into the switchgear panels.
- Check the isolating contacts and interlock mechanisms for smooth function, and relubricate with Isoflex Topas NB52 (section 7.6.2) where necessary.
Figure 5/1:  Guideline construction data for a foundation frame on a concrete floor (for information only). See figure 5/2 for section view.

Dimensions not indicated are to be determined by the supplier of the switchgear.

1) Minimum dimensions

1  Operator axle
2  Inspection axle
3  Opening for control cables (instead of individual openings, continuous openings or drilled holes are possible)
4  Points for fixing the Powerbloc 36/40.5 kV on the floor frame
6.1 Door opening: Panel width plus 200 mm
Figure 5/2: Section view for figure 5/1.

Dimensions not indicated are to be determined by the supplier of the switchgear.

1) Minimum dimensions
2) Dimension refers to the height of the Powerbloc

1. Operator aisle
2. Inspection aisle
3. Opening for control cables (instead of individual openings, continuous openings or drilled holes are possible)
6. Door
6.1. Door opening: Panel width plus 200 mm
6.2. Door opening: Panel height plus 200 mm
7. Powerbloc 38/40.5 kV, ...31.5 kA
9. Projecting of floor frame:
   - > 0 mm and < 3 mm above finished floor level
11. Screen 50 mm to 60 mm
12. Height of the cable cellar, to be determined by the client
13. Ventilation
Figure 5/3: Assembly of the foundation frame, for figure 5/1, 5/2.

60.1 Foundation frame part
60.2 Foundation frame part
60.3 Link
60.4 Steel strip
60.5 Bracket
60.6 Plug
60.7 Bolt
60.8 Jacking screw
Operation of the Powerbloc 36/40.5 kV

Note:
The instructions under this section are only valid as far as they refer to the Powerbloc 36/40.5 kV. Further information especially for the complete switchgear may differ from the instruction in this manual. In this case is valid the instruction supplied from the manufacturer of the complete switchgear.

Note on safety at work

The relevant work and operating procedures are to be carried out carefully by trained specialists familiar with the installation, taking into account all the relevant safety regulations to DIN VDE/IEC and the other relevant professional bodies, and also local and works regulations and instructions. Special attention is also to be paid to VDE 0105 (Operation of electrical installations).

Note:

⚠️ Do not walk on the top surfaces of the Powerbloc panels, rupture points for pressure relief.

6.1 Commissioning

6.1.1 Preparatory work
(Figures 3/1 to 3/4, 3/6, 3/12, 3/13)

In preparation for commissioning, the following work should be carried out prior to connection with the high-voltage power supply:

- Check the general condition of the switchgear for detrimental circumstances of all kinds.
- Perform a visual examination of the switching devices, withdrawable parts, isolating contacts, insulating parts, etc.
- Check the connection of the main earthing bar to the earthing rail 19.1 of the Powerbloc (DIN VDE 0141).
- Check the paintwork for damage and touch up as described in section 7.3 where necessary.
- Remove all material residues, foreign bodies and tools from the switchgear.
- Clean the switchgear, rubbing down insulating parts with a clean, soft, non-fraying and dry cloth. Remove greasy or adhesive dirt as described in section 7.2.
- Properly refit all covers etc. removed during assembly and testing processes.
- Protective transport covers 57.5 on vacuum circuit-breaker poles – if still fitted – must be removed.
- Pole tube caps 57.4 may be fitted in certain systems and on certain circuit-breakers. Check their correct fit.
- Perform AC voltage testing on the main circuits to VDE 0670 part 6 (IEC 60298) as far as necessary. Pay special attention during this procedure to voltage transformers, cables, etc.
- Turn the auxiliary and control voltage on.
- Carry out test operations of switching devices manually or by electrical control, and simultaneously observe the relevant position indicators.
- Check mechanical and electrical interlocks for effectiveness, without using force.
- Set the protective devices in the switchgear to the required values and check their function with test equipment.
- Instruct the local operators in the fundamental details of regular handling of the switchgear.
- Check the readiness for operation and switching status of electrical systems upstream and downstream from the switchgear.

Depending on the allocation of responsibilities, it may also be necessary to check the following equipment in areas adjacent to the switchgear:

- power cables
- auxiliary cables
- auxiliary power source
- remote control system
- complete earthing system, to DIN VDE 0141
- switch-room equipment
- switch-room condition

6.1.2 Start-up

- Comply with all relevant safety regulations.
- Ensure that the circuit-breakers in the system are in the OFF position.
- Remove any existing earthing and short-circuiting connections in the critical switching area.
- Energize the feeder cables.
- Connect the switchgear step by step, observing the signals and indicators.
- Check that the relevant conductors are in phase, as far as necessary when several incoming feeder cables and switchgear sections are concerned.
- Carry out all measurements and check all functions dependent on the high-voltage power supply being connected.
- Watch out for irregularities of any kind.
6.2 Switching operations
Carry out switching operations with the front doors closed.

6.2.1 Withdrawable part with circuit-breaker, type VD4
(Figures 3/1 to 3/3, 3/5 to 3/8, 3/12, 3/13, 9/1 to 6/7)
Insertion from the test/disconnected position to the service position:
- Connect control wiring plug 10.2.
- Close the front door.
- Ensure that the circuit-breaker is in the OFF position.
- Fit hand crank 146 on square spigot 52.1 of the spindle mechanism 52.
- Turn the crank clockwise through approx. 45° until the stop is reached and the withdrawable part is in the service position.
- Observe the position indicator.
- Remove hand crank 146.

Manual withdrawal from the service position into the test/disconnected position:
- Ensure that the circuit-breaker is in the OFF position.
- Reverse the procedure described above for insertion into the service position.

Note:
Do not use force to move withdrawable parts with blocking magnet Y0 in the event of a voltage drop. If this occurs they are blocked along the whole travel range between the service position and test position. To remove the interlock, consult section 7.4.2.

Withdrawal of the circuit-breaker unit out of the panel:
- Open the door of the circuit-breaker compartment.
- Release control wiring plug 10.2 and engage it in the storage position of the withdrawable part.
- Move sliding handles 51.2 inwards against the springs to release withdrawable part.
- Move the withdrawable part out of the panel.
- Close panel door

Insertion into the test/disconnected position:
- Carry out the procedure as described above for withdrawal, changing the order accordingly.

6.2.2 Circuit-breaker

6.2.3 Earthing switch
(Figures 3/1, 6/3 and 6/9)
The earthing switch and the relevant driving mechanism (not part of the Powerbloc) are supplied loose and will be installed by the customer in the foreseen compartments. The driving mechanism will be installed at the right hand side of the Powerbloc module. The earthing switch type EK6 has a snap-action closing mechanism which is independent of the rotation of the drive shaft. An earthing switch allocated to a circuit-breaker is only enabled for switching when the withdrawable part 50 is in the test/disconnected position or removed from the switchgear panel. Only close the earthing switches when the doors are closed.

Manual opening and closing:
- Press slide 14.2 on the operating lever recess socket down. (When the earthing switch is closed, it is already in position!)
- Fit operating lever on the driving shaft 14.1, which is now released for operation.

Note:
Fit the operating lever in such a way to the driving shaft that the operation can be carried out at lateral limited space.
- Turn the lever clockwise through approx. 180° until the stop is reached to close the earthing switch, or anti-clockwise until the stop is reached to open the earthing switch.
- Observe the mechanical/electrical switch position indicator.
- Remove operating lever. Slide 14.2 remains open if the earthing switch is in the closed position.

Make sure that the operating lever is turned right up to the stop in the opening process, to ensure that the earthing switch is in its defined limit position.
The operating mechanism can also be fitted with a blocking magnet.
The following operation instructions must also be observed together with this instruction manual.
- Earthing switch EK6, instruction manual BA 444/E.
Figure 6/1: Withdrawable part with circuit-breaker, type VD4, control area.

- 50.4 Guide cam
- 50.6 Front cover plate, right hand side
- 50.7 Front cover plate, left hand side
- 51 Interlock yoke
- 51.1 Catch pin spring loaded
- 51.2 Sliding handle
- 52 Spindle
- 54.1 Link rod
- 55.4 Switch position indicator
- 55.5 Operating cycle counter
- 55.7 Rating plate

Figure 6/2: Charging the spring energy storage mechanism manually by moving the inserted lever up and down.

- 55.6 Socket for charging lever
- 55.8 Charging condition indicator
- 128 Charging lever

Figure 6/3: Fitting the hand crank (against spring-loaded intermediate plate) to move the truck inside the panel clockwise towards the service position, and anti-clockwise from the service position towards the test/disconnected position.

- 52 Spindle
- 52.1 Square splined
- 146 Hand crank

Figure 6/4: Manual operation of the circuit-breaker, by turning the double bit key approx. 15° clockwise (ON), or approx. 15° anti-clockwise (OFF).

- 54 ON-OFF operating shaft
- 145 Three bit key (ON-OFF operation)
Figure 6/5: Interlock yoke with sliding handles which will be moved inwards to release the withdrawable part for withdrawing from the panel.
51 Interlock yoke
51.1 Catch pin, spring loaded
51.2 Sliding handle
51.4 Blocking shaft (interlocking circuit-breaker and withdrawable part)

Figure 6/6: Withdrawable part in service position. Interlock yoke engaged, control wiring plugged-in and engaged.
10 Control wiring plug connector, (obscured)
10.1 Control wiring socket
10.2 Control wiring plug
10.4 S9, Limit switch for test position indicator
10.5 S9, Limit switch for service position indicator
51 Interlock yoke
51.3 Interlocking plate
54 ON-OFF operating shaft

Figure 6/7: Operating accessories.
122 Operating lever (for earthing switch)
128 Charging lever (for circuit-breaker)
145 Three bit key (ON-OFF operation)
146 Hand crank (for moving the withdrawable part)
Figure 6/8: Earthing switch operation mechanism (Power bloc front side) operation of the earthing switch blocked.

14.1 Driving shaft for the earthing switch, front part
14.2 Slide

Figure 6/9: Earthing switch operation mechanism duct cover 43.1 removed (seen from inside panel).

14.3 Auxiliary switch Q8S1, earthing switch OFF
14.4 Auxiliary switch Q8S2, earthing switch ON
14.5 Interlocking rod (earthing switch — withdrawable part)
7 Maintenance

7.1 General

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

Inspection: Determination of the actual condition
Servicing: Measures to preserve the specified condition
Repair: Measures to restore the specified condition

Note:

When carrying out all maintenance work, the regulations in the country of installation must be strictly complied with. In Germany these comprise the following safety regulations and standards:

- Health and safety at work standard VBG 1
- Health and safety at work standard VBG 4
- VDE 0105,
  "Operation of electrical installations".

Maintenance work may only be performed in a careful manner by trained personnel familiar with the characteristics of the individual switchgear, in accordance with all relevant safety regulations to VDE/IEC and other technical authorities, and with other overriding instructions. With regards to the Powerbloc it is recommended that ABB service personnel will be called in to perform servicing and repair work, and this is necessary for some of the work detailed below.

The inspection and servicing intervals for some of the equipment/components (e.g. parts subject to wear) are determined by fixed criteria such as switching frequency, length of service and number of short-circuit breaking operations. For other parts, on the other hand, the length of the intervals may depend, for example, on the different modes of operation in individual cases, the degree of loading, and also environmental influences (including pollution and aggressive air).

The following operating instructions must also be observed together with this instruction manual in the individual cases concerned:

- Vacuum circuit-breaker type VD4 BA 442/E
- Earthing switch type EK6 BA 444/E

If necessary, further details can be taken from the technical documentation for the switchgear installation (including, for example, any agreed special operating conditions).

7.2 Inspection and servicing

Inspection

Inspection of the Powerbloc (switchgear) should be carried out approximately every two to four years, depending on the operating conditions and local environment in accordance with VBG 4 standard.

Isolate the area where work is to be performed in accordance with the relevant safety regulations to DIN VDE/IEC, and secure it against reconnection.

The inspection should include but not be limited to the following:

- Check the installation for abnormalities of any kind, dirt and the effects of other environmental influences.
- Check the function of the switching devices and the controls, interlocks, protection, annunciation and other devices.
- Check the surface condition of the isolating contact system (for visual examination of the contact pins with the withdrawable part removed). When the galvanic silver coating on the contact parts is worn to such an extent that the copper condenser metal below becomes visible, or when their surfaces are heavily corroded or show signs of other damage or overheating (discoloured surface), replace the contact parts. See also section 7.3.
- Check all switchgear accessories and the auxiliary equipment.
- No external discharge may occur on the surfaces of equipment at operating voltage. This can, for example, be detected by characteristic noises, a clearly perceptible smell of ozone, or visible glowing in the dark.

Servicing

Basic servicing activities, and those which may be found necessary during inspections, include the following:

- Carefully clean the unit, and in particular the insulating material surfaces, when they are found to be dirty (contamination may also be caused by salt, mould formations, insects or conductive materials in conjunction with frequent condensation when the switchgear is operated in a tropical climate). Remove dry dust deposits which do not adhere strongly using a soft dry cloth. Remove more strongly adhering, e.g. sticky/greasy dirt, with a cloth soaked in a slightly alkaline household cleaner. Wipe off with clear water and dry carefully.

Use halogen-free cleaners such as Rivolta BWR 210 and cold cleanser 716 (for components in insulating material and for major contamination). Observe the manufacturer’s instructions and the special ABB instruction manuals BA 1002E and BA 1006E respectively on safety at work.

Never use 1,1,1-trichloroethane, trichloroethylene or carbon tetrachloride!
• Should external discharges occur as a result of condensation, application of a thin silicone film on the surface concerned is often effective as a temporary remedy. It is advisable to request advice from the ABB after-sales service department on permanent solutions to such unusual problems.

• Check that the bolt connections at the connectionblock and the earth connections are tight, and that the isolating contact system functions correctly.

• Regrease the contact points and mechanism of the withdrawable part insertion system as necessary, or, when lubrication is inadequate or missing, thoroughly clean the areas concerned and regrease with Isoflex Topas NB52 lubricant.

• Top up the grease on sliding and bearing surfaces in the panels — for example on the hinged shutters, the interlock and guide systems, the spindle mechanism and the travel rollers of the withdrawable part — or thoroughly clean and regrease with Isoflex Topas NB52 lubricant where necessary.

• Observe the maintenance instructions in the manuals for the individual switch types.

7.3 Repair

7.3.1 Surface of the Powerbloc

• Carry out repair work immediately after a defect has been discovered.

• Completely remove all rust from damaged paintwork areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush.

Lightly grind the surrounding paint coat and carefully disgrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the top coat. The total dry film thickness should be approx. 60 μm. Only use suitable and compatible paint products.

Top coat in standard colour RAL 7035 or the relevant special colour.

• Carefully remove any white rust from aluminium/zinc surfaces with a wire brush or Scotch Brite, and remove loosely adhering particles with a dry, non-fraying cloth. Then treat the cleaned areas with zinc spray or zinc dust paint, and then with aluminium spray to match up the colour.

• Carefully remove any white rust on chromium plated functional parts and rust on phosphatized parts with a wire brush or Scotch Brite, and clean with a dry cloth. Then evenly grease the parts (with Isoflex Topas NB52).

7.3.2 Replacement of components

Replacement of the isolating contact systems:
(Figures 3/13, 7/1 to 7/4)

• Slide the two inner annular tension springs 57.6 facing the breaker pole to a position beside the two outer annular tension springs, thus releasing contact systems 57.7, and remove the contact system from isolating contact arm 57.1, 57.2.

• Fit a new contact system back to front on the thin end of arbor 127, and slide it forwards onto the thicker part of the shank.

• Fit arbor 127 onto the relevant contact arm 57.1 (57.2), slide the contact system 57.3 over onto the isolating contact arm, and withdraw the arbor.

• Check all contact fingers and annular tension springs for perfect fit.

Note:
The set installation position of isolating contact arms 57.1/57.2 must not be changed by the improper use of force.

Replacement of the contact pins:
(Figures 3/14 and 3/15)

After any required replacement of contact pins 25.1/25.2, these are to be retightened using hexagon socket head screws:

• Thread M10, non-greased: at 46 Nm

• Thread M20, non-greased, at 250 Nm.

7.4 Tests on withdrawable parts with circuit-breakers, type VD4
(Figures 6/1 to 6/6)

When functional tests are carried out on withdrawable parts, compliance with the conditions listed below should also be checked.

7.4.1 Checking the auxiliary switch settings on withdrawable parts
(Figure 6/6)

Refer to manual BA 442/E; VD4 Vacuum circuit-breaker on withdrawable part.

Compliance with the interlock conditions in the areas of the test/disconnected position and the service position is ensured by position signalling switches 10.4 (S8) and 10.5 (S9) located on the withdrawable part and set at the works.

In the inspection and test operation, the withdrawable part is to be moved with the crank fitted.

1. Settings in the area of the test/disconnected position

• Move the withdrawable part out of the test/disconnected position towards the service position with a few turns of the crank.

• Slowly move the withdrawable part back to the stop.

Auxiliary switch 10.4 (S8) must then operate when the hand crank still has ≥ 90° of turn to reach the stop.
• Slowly insert the withdrawable part from the test/disconnected position towards the service position until auxiliary switch 10.4 (S8) just operates.

In this position, it must still just be possible to move the ON-OFF operating shaft 54. For this test, the function of the blocking magnet must be deactivated manually.

This condition ensures that the electrical interlock becomes active before the mechanical interlock in the motion sequence involved.

2. Settings in the area of the service position
• Move the withdrawable part out of the limit position towards the test/disconnected position with a few turns of the crank.
• Slowly move the withdrawable part forwards again up to the stop.

Auxiliary switch 10.5 (S9) must then operate when the hand crank has a remaining angle of ≥ 60° to turn up to the stop.

7.4.2 Testing of interlock conditions
(Figures 3/6 to 3/9, 6/1, 6/5 to 6/9)

1. The withdrawable part must only be movable from the test/disconnected into the service position when the circuit-breaker is open and the earthing switch is open.

Check the following conditions individually:
• With the circuit-breaker closed, insertion of the withdrawable part towards the service position must be blocked after only half a turn of the crank in the clockwise direction.
• With the earthing switch closed, insertion of the withdrawable part towards the service position must be blocked after only two clockwise turns of the crank.

2. The withdrawable part must only be movable from the service position into the test/disconnected position with the circuit-breaker open.

Check the condition as follows:
• With the circuit-breaker closed, withdrawal movement of the withdrawable part must be blocked after only half a turn of the crank in the anti-clockwise direction.

3. Closing of the circuit-breaker must only be possible when the withdrawable part is in the defined test/disconnected position or service position.

The control wiring plug 10.2 must previously have been inserted.

Check this condition as follows:
• It must not be possible to close the circuit-breaker with the withdrawable part in any position between the test/disconnected position and the service position.

Enabling of switching when the withdrawable part moves into the service position is effected electrically by operation of auxiliary switch 10.5 (S9), and mechanically slightly earlier; the latter corresponds to a position approximately half a turn of the crank before the stop.

• The enable conditions for movement into the test/disconnected position apply accordingly, in this case established by auxiliary switch 10.4 (S8).

4. It must only be possible to open the circuit-breaker (manually) when the withdrawable part is in the service position or test/disconnected position and the control voltage has failed.

Check this condition.

5. The withdrawable part with blocking magnet Y0 (if ordered) may not be moved if the control voltage fails or is not available. Do not use force to move the blocked withdrawable part!

Removing the block:
• Remove front cover plate 50.6 and 50.7.
• Release the blocking magnet Y0 by pressing the armature continuously when moving the withdrawable part by using the hand crank 146 for 1/2 turn right or left.
• The blocking magnet is effective only in the service and test/disconnected position and it is not effective in the intermediate position.

6. Removal of control wiring plug 10.2 and reinsertion of the plug must be blocked with the withdrawable part in the service position.

Check this condition.

7. Operation of the earthing switch must only be possible when the withdrawable part 50 is in the test/disconnected position or the removed position (subject to any additional electromagnetic interlocks in individual cases!)

Check these conditions as follows:
• With the withdrawable part in the test/disconnected position, it must be possible to press slide 14.2 in front of the earthing switch drive shaft 14.1 downwards to the opening position. The earthing switch can then be operated.
• When the withdrawable part is moved inwards towards the service position, pressing down of the slide 14.2 must be blocked after only one and a half clockwise turns on the crank.
7.5 Tests on Powerbloc 36/40.5 kV (with earthing switch in the panel)

7.5.1 Auxiliary switch setting on the earthing switch driving mechanism
(Figures 8/8 and 8/9)

1. There must be a run-on of 0.5 mm in the fully operated position before the plunger reaches the stop (for safety reasons).

2. Limit position auxiliary switch Q8S2 for earthing switch ON must be operated immediately after the dead centre position of the toggle spring mechanism is reached in the closing process and the automatic quick-closing process has started.

3. Limit position auxiliary switch Q8S1 for earthing switch OFF must be operated on earthing switches with manual mechanisms during the opening motion of the slide 14.2 before half of the hexagon shaft has become visible, or 1 mm before the tongue of the slide makes contact with the armature of the unexcited blocking magnet.

7.6 Spare parts, auxiliary materials and lubricants

7.6.1 Spare parts
A spare part list for the Powerbloc is available on request for procurement of spare parts. It fundamentally comprises moving parts and parts subject to wear. When parts are required, the serial number of the relevant Powerbloc unit or circuit-breaker should always be quoted.

7.6.2 Auxiliary materials and lubricants

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<td>• Rivolta BWR210,</td>
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<td>• Cold cleanser 716,</td>
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<td>• ABB directions for use BA 1006/E</td>
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Paint:
Standard colour
RAL 7035
• 1kg-box | GCE9014060P0103
• 1 Spray tin | GCE0007895P0100
Figure 7/1: Contact system sample for 2000 A to 3150 A.
- Left: front view
- Right: rear view

Figure 7/2: Sliding the contact system onto the auxiliary arbour with the rear end first, schematic representation here for 1600 A.
- 57.3 Contact system, 1600 A
- 127 Auxiliary arbour, 1600 A
- 127.1 Plug, 1600 A

Figure 7/3: Contact shift on auxiliary arbour for 2000 A to 3150 A.
- 57.6 Internal annular tension springs
- 57.7 External annular tension springs
- 57.13 Contact system, 2000 A to 3150 A
- 130 Auxiliary arbour, 2000 A to 3150 A
- 130.1 Plug, 2000 A to 3150 A

Figure 7/4: Sliding of the contact system onto the auxiliary arbour onto the contact arm and engaging it here.
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<td>ABB (Hong Kong) Limited</td>
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<td>Tel: (852) 2929 3638</td>
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