HVX
Vacuum circuit-breaker - HVX ANSI

Assembly
Operation
Maintenance

No. AGS 531351-01
Edition 11/2018
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As our products are subject to continuous further development, we reserve the right to make changes regarding standards, illustrations and technical data. All dimensions specified in this manual are in millimeters.

Purpose and target group

This Technical Manual describes transport, assembly, operation and maintenance of the series HVX vacuum circuit-breakers. It is exclusively intended for specialist electricians who have been certified for the HVX series (training certificate).

This Technical Manual is an integral part of the product and must be kept accessible at all times to persons performing assembly, operation or maintenance on the circuit-breaker. If the circuit-breaker is sold to new owners, they must receive this document along with the switching device.

This Technical Manual cannot describe every imaginable individual case or every customer-specific version of the product. For information which is not included in this manual, please contact the manufacturer.

Reference documents

The following additional documents must be complied with:

- Purchase agreement with the stipulations regarding the switch-specific equipment and the legal details
- Switch-specific circuit diagrams and documentation
- Project notes regarding the HVX circuit breaker
- For assembly and operation of the circuit-breaker, the operating manual of the switchgear in which it is operated must be complied with.

Terms and symbols used

This manual uses certain terms and symbols. They warn about dangers or provide important information which must be complied with at all costs so as to avoid danger and damage:

The addition of this symbol either to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

INFORMATION-ADVICE
We draw your attention on this particular point.

Abbreviations used

HVX-E: HVX circuit-breaker for truck-mounting

\[ U_r \]: Rated voltage

\[ I_r \]: Rated current

\[ I_{sc} \]: Rated short-circuit breaking current
Remarks on this manual

Any questions or suggestions?

Do you have any questions or suggestions regarding this manual, or do you require further information?

We always strive to provide you with the best-possible information for optimum, safe use of our products. Thus, do not hesitate to contact us if you have any recommendations, amendments or proposals for improvement.
1 Safety Provisions

The work described in this manual may only be performed by specialist electricians who have proved their experience with the HVX series and the applicable safety provisions.

Please read the whole manual carefully before working on the circuit-breaker.

Applicable standards and regulations:

- High-voltage switchgear and control gear, part 100: AC circuit-breaker (IEC 62271-100)
- The locally applicable accident prevention, operating and work instructions must be complied with.
- Installation: IEC 61936-1

Before performing work on the circuit-breaker, it is essential that you comply with the following instructions:

⚠️ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠️ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠️ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Behaviour in case of incidents or accidents

In case of fire or of internal faults, toxic and caustic decomposition products may be produced. Comply with the locally applicable accident and safety provisions.

In case of personal injury, take first-aid measures or cause them to be taken.
2 Variants and technical details

2.1 Vacuum circuit-breaker HVX-E (truck-mounted version)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>$U_r$</td>
<td>[kV]</td>
<td>$\leq 27$</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>$U_p$</td>
<td>[kV]</td>
<td>125</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>$U_d$</td>
<td>[kV]</td>
<td>60</td>
</tr>
<tr>
<td>Rated normal current</td>
<td>$I_r$</td>
<td>[A]</td>
<td>$\leq 2000$</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>$I_{sc}$</td>
<td>[kA]</td>
<td>$\leq 31.5$</td>
</tr>
<tr>
<td>Rated short-time current (3 s)</td>
<td>$I_k$</td>
<td>[kA]</td>
<td>$\leq 31.5$</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>$f_r$</td>
<td>[Hz]</td>
<td>60</td>
</tr>
<tr>
<td>Weight (without packaging)</td>
<td></td>
<td>[kg]</td>
<td>approx. 160</td>
</tr>
</tbody>
</table>

Fig. 1 Schematic view of the vacuum circuit-breaker HVX-E for high rated voltage $U_r$ and low rated normal current $I_r$

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moving contacts</td>
</tr>
<tr>
<td>2</td>
<td>Vacuum interrupter chambers</td>
</tr>
<tr>
<td>3</td>
<td>Rollers</td>
</tr>
<tr>
<td>4</td>
<td>Truck for PIX panels</td>
</tr>
<tr>
<td>5</td>
<td>Insertion opening for crank to move the circuit-breaker into its disconnected/service position</td>
</tr>
<tr>
<td>6</td>
<td>Drive casing</td>
</tr>
<tr>
<td>7</td>
<td>Handles</td>
</tr>
<tr>
<td>8</td>
<td>Operator interface</td>
</tr>
<tr>
<td>9</td>
<td>Nameplate</td>
</tr>
<tr>
<td>10</td>
<td>Low-voltage connector for control lines</td>
</tr>
</tbody>
</table>

Rated voltage $U_r$ [kV] $\leq 15$

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated lightning impulse withstand voltage</td>
<td>$U_p$</td>
<td>[kV]</td>
<td>95</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>$U_d$</td>
<td>[kV]</td>
<td>36</td>
</tr>
<tr>
<td>Rated normal current</td>
<td>$I_r$</td>
<td>[A]</td>
<td>$\leq 3000$</td>
</tr>
<tr>
<td>Rated short-circuit breaking current</td>
<td>$I_{sc}$</td>
<td>[kA]</td>
<td>$\leq 50$</td>
</tr>
<tr>
<td>Rated short-time current (3 s)</td>
<td>$I_k$</td>
<td>[kA]</td>
<td>$\leq 50$</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>$f_r$</td>
<td>[Hz]</td>
<td>60</td>
</tr>
<tr>
<td>Weight (without packaging)</td>
<td></td>
<td>[kg]</td>
<td>approx. 230</td>
</tr>
</tbody>
</table>

Fig. 2 Schematic view of the vacuum circuit-breaker HVX-E for high rated normal current $I_r$ and rated short-circuit breaking current $I_{sc}$

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pole partitions</td>
</tr>
<tr>
<td>2</td>
<td>Moving contacts</td>
</tr>
<tr>
<td>3</td>
<td>Vacuum interrupter chambers</td>
</tr>
<tr>
<td>4</td>
<td>Press rod (transfer of ON/OFF switching movement)</td>
</tr>
<tr>
<td>5</td>
<td>Transport rollers</td>
</tr>
<tr>
<td>6</td>
<td>Truck for PIX panels</td>
</tr>
<tr>
<td>7</td>
<td>Insertion opening for crank to move the circuit-breaker into its disconnected/service position</td>
</tr>
<tr>
<td>8</td>
<td>Drive casing</td>
</tr>
<tr>
<td>9</td>
<td>Handles</td>
</tr>
<tr>
<td>10</td>
<td>Operator interface</td>
</tr>
<tr>
<td>11</td>
<td>Nameplate</td>
</tr>
<tr>
<td>12</td>
<td>Low-voltage connector for control lines</td>
</tr>
</tbody>
</table>
2 Variants and technical details

2.2 Dimensions

The dimensions of the individual HVX variants are specified in the selection list HVX. This document or additional customized dimensional drawings are available on request.

2.3 Applied standards

Series HVX circuit-breakers are
- type-tested
- dimensioned for indoor installation

<table>
<thead>
<tr>
<th>Designation</th>
<th>IEC standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-voltage switchgear and controlgear - Part 1: Common specifications</td>
<td>IEC 62271-1</td>
</tr>
<tr>
<td>Circuit-breaker</td>
<td>IEC 62271-100</td>
</tr>
<tr>
<td>Disconnector truck</td>
<td>IEC 62271-102</td>
</tr>
</tbody>
</table>

Regarding the switching capacity and the insulation level, the series HVX complies with the following ANSI specifications:
- ANSI C37.04
- ANSI C37.06
- ANSI C37.09

1 other standards available on request

2.4 Environmental and operating conditions

HVX circuit-breakers may only be operated under normal operating conditions acc. to IEC 62271-1. Operation under conditions deviating from these is only admissible upon consultation with and with the written approval of the manufacturer.

(Ambient conditions in accordance with IEC 62271-1)

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>°C (−5/+40)$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min./max. ambient temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Average value over 24 hours</td>
<td>≤ 35$^1$</td>
</tr>
<tr>
<td>mean rel. air humidity: 24 hour/1 month</td>
<td>% ≤ 95/≤ 90</td>
</tr>
<tr>
<td>Installation altitude above sea-level</td>
<td>m ≤ 1000$^1$</td>
</tr>
</tbody>
</table>

$^1$ other values available on request
2 Variants and technical details

2.5 Nameplate

The type designation on the nameplate (Fig. 3) specifies essential technical data.

![Nameplate Diagram]

Fig. 3
Nameplate
1 Type designation
2 Year of construction and serial number
3 Technical data

The following example shows the composition of the type designation:

Series HVX
Rated Voltage 15 kV
Rated short-circuit breaking current 25 kA
Rated normal current 1200 A
E: truck-mounted

When submitting enquiries to the manufacturer or ordering spare parts, the following information is required:
- Type designation
- Serial number
- Year of construction
2. Variants and technical details

2.6 Technical data of electrical control and operating devices

The circuit-breaker (Q0) and the truck versions (Q1) have been designed on principle for manual operation. The drive mechanisms can be equipped, depending on the specific customer’s model, with additional electrical control and operating devices. These are defined in the switch-specific circuit diagram (see separate documentation).

Component fitting options:

- **Motor (M1)**
  - for charging the energy-storing device
  - HVX-E: electric actuation of the disconnector truck

- **Shunt closing release (F2)**
  - 1 pce.

- **Shunt tripping coil (F11/F12/F13)**
  - 3 ea. max.

- **Secondary release (transformer-operated release) (F31/F32/F33)**
  - 3 ea. max.

- **Undervoltage release (F4)**
  - 1 pce.

- **Blocking coil (Y1)**
  - Blocking coils prevent the circuit breaker from being closed and opened via the push-buttons “ON” or “OFF”, as well as manual actuation of the disconnector truck.
  - If the rated supply voltage has failed or is shut off, all blocking coils are in “blocked” position.

- **Auxiliary switch for circuit-breaker ON/OFF position (S11/S12/S13)**
  - Auxiliary switches are always actuated directly by the switch shaft via an intermediate linkage. Their position always corresponds to that of the main contacts. The circuit breaker is equipped as standard with S11 / S12 auxiliary switches, as option S13.
  - The switching functions have been set in the factory according to the wiring diagram.

- **Micro switch actuated by energy-storing device (S2)**

- **Micro switch actuated by ON/OFF push-button (S41/42)**

- **Micro switch actuated by OFF pushbutton (S43)**

- **Micro switch actuated by truck in intermediate position or by crank being inserted (S6)**

The circuit-breaker (Q0) and the truck versions (Q1) can be equipped with additional micro switches, depending on customers’ design.

- **Anti-pumping relay (K01)**
  - If an ON and OFF command is simultaneously and permanently present at the circuit-breaker, the latter returns to its initial position after closing. It remains in this initial position until the ON command is issued again. This prevents continuous closing and opening (“pumping”).

- **Terminal strip (X01)**

---

**Overview of rated supply voltages**

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct DC</td>
<td>24</td>
</tr>
<tr>
<td>Alternating AC</td>
<td>(110)/120</td>
</tr>
</tbody>
</table>
2 Variants and technical details

Technical data of the electrical releases and motors

<table>
<thead>
<tr>
<th>Solenoids / motor</th>
<th>Power consumption [W]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC [W]/AC 50/60 Hz [VA]</td>
</tr>
<tr>
<td>Rated normal current [A]</td>
<td>≤2500</td>
</tr>
<tr>
<td>Closing release</td>
<td></td>
</tr>
<tr>
<td>Opening release</td>
<td></td>
</tr>
<tr>
<td>Undervoltage release</td>
<td></td>
</tr>
<tr>
<td>Motor for energy-storing device</td>
<td></td>
</tr>
<tr>
<td>Motor for disconnector truck</td>
<td></td>
</tr>
<tr>
<td>Secondary release</td>
<td></td>
</tr>
</tbody>
</table>

Information about the power consumption of solenoids and the motor is available from the manufacturer. The supply voltage data is required to this effect.

Times for solenoids and motor

| Minimum command time “OFF” el. tripping [ms] | 20 |
| Minimum command time “ON” el. tripping [ms] | 20 |
| Motor charging time for energy storing device [s] | ≤ 12 |

Technical data of the auxiliary switches on the circuit-breaker

<table>
<thead>
<tr>
<th>Rated supply voltage</th>
<th>DC [V]</th>
<th>AC [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 48</td>
<td>125</td>
</tr>
<tr>
<td>Switching capacity [A]</td>
<td>10</td>
<td>3.8</td>
</tr>
<tr>
<td>Rated short-time current</td>
<td>250 A / 3 s</td>
<td></td>
</tr>
<tr>
<td>Time constant T = L/R [ms]</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Rated continuous current [A]</td>
<td>15</td>
<td>–</td>
</tr>
</tbody>
</table>

2.7 Intended use

Series HVX vacuum circuit-breakers are exclusively intended as switching units in air-insulating medium-voltage switchgear. They may only be used in the scope of the specified standards and the switchgear-specific technical data. Any other utilization constitutes improper use and may result in dangers and damage.

Liability Disclaimers

The manufacturer shall not be held responsible for damage which occurs if:
- instructions in this manual are not complied with,
- the circuit-breaker is not operated according to its intended use (Chapter 2.7)
- the circuit-breaker is assembled, connected or operated improperly,
- accessories or spare parts are used which have not been approved by the manufacturer,
- the circuit-breaker is converted without the manufacturer’s approval, or if inadmissible parts are attached.

2.8 Disposal after the end of service life

A material and recycling data sheet is available for disposal of the vacuum circuit-breaker unit at the end of its service life; this can be provided on request.

Disposal is performed by the manufacturer’s Service Center as a service subject to a fee.
3 Packaging, transport, storage

3.1 Shipping units

- The conditions and types of transport have been stipulated in the contract details. The type of packaging depends on the type of transport and the storage conditions.
- The circuit-breakers are delivered ready for connection. The accessories are included.

Packaging

- If packed exclusively for truck transport, the circuit-breakers are delivered, depending on their outside dimensions, either
  - in cardboard boxes and delivered on a pallet (Fig. 4),
  - directly fixed to the pallet and packed in PE protective film, or
  - delivered in wooden crates with PE protective film (Fig. 5).
- For sea transport, the units are packed in sealed aluminium foil with desiccant and in a closed wooden case with tightly closed wooden base (also for container transport).
- In case of air transport, the panels are packaged in wooden crates with a protective PE film hood (dust protection) or in wooden crates, also with closed wooden bases, however without protective hoods (dust protection, Fig. 5).

**Important:**

*The weight of the entire transport unit is indicated on the packaging.*

![Fig. 4](image1)
Packed in cardboard box on a pallet

![Fig. 5](image2)
Packed in a wooden case
3 Packaging, transport, storage

3.2 Transport

- Transport using a forklift truck:
  Move packing unit only complete with pallet. Move the forks completely under the whole pallet. The circuit-breaker must be fixed safely on the pallet.

3.3 Delivery

- Handle shipping units carefully when unloading and unpacking them.
- Shipping units must be checked upon receipt. Any damage which may have occurred in transit must be recorded and reported to the manufacturer immediately.
- Check completeness of consignment based on the transport documents. The supplier must be notified in writing without delay about any possible deviations.

3.4 Storage

**WARNING**

Risk of injury due to sliding or tilting of transport units. Sufficient stability and evenness of the supporting area (floor) must be ensured.

The transport packaging is not intended for storage.

If the circuit-breakers are not put into operation immediately after delivery, they can be stored under the following conditions:

- only indoors
- Circuit-breakers must be packed in a wooden crate with a desiccant and sealed in aluminium foil (storage period max. 2 years after date of packaging).

![Fig. 7 Schematic diagram of the storage conditions for HVX circuit-breakers](image)
4 Assembly

4.1 Safety provisions and instructions for assembly

**WARNING**
- Risk of injury due to movable parts in mechanical drives. Do not charge the circuit-breaker's energy-storing device during assembly.
- Please comply with the safety provisions in Chapter 1.

The circuit-breakers may only be assembled and installed by the manufacturer’s staff or by persons who have been certified for this work.

The circuit-breakers are delivered in circuit-breaker position "OFF" and with the energy storing device "released".

**Instructions for assembly**

- For all screw connections which are not specified directly in the assembly description, the tightening torques mentioned in Chapter 8.3 must be used.
- Check technical data on nameplate.
- Dimension drawings are provided on request.
- Any other than standard installation positions must be agreed upon with the manufacturer.
- Screws, bolts and attachments are not included in the scope of supplies.
- Parts designed for fastening must be suitable for the weight of the circuit-breaker.
- The circuit-breaker must not be deformed by the fastening.

4.2 Transport using a crane

**WARNING**

Risk of injury during crane transport. Comply with the relevant provisions for hoisting equipment. Make sure the crane mounting harness is sufficiently strong.

For crane transport, a crane mounting harness with a rope (not a metallic steel cable) with a diameter of Ø 12–15 mm or a strap is used. The specified weight must be complied with.
HVX model designed for
$U_r \leq 27$ kV
$I_r \leq 2500$ A
$I_{sc} \leq 31.5$ kA

Fig. 8
Transport by means of a crane
HVX model designed for
$U_r \leq 15 \, \text{kV}$
$I_r \leq 3000 \, \text{A}$
$I_{sc} \leq 50 \, \text{kA}$

**Important:**
Position circuit-breaker with guide rollers on the truck on wooden bars or rails in order not to damage the guide rollers (Fig. 9).

**Fig. 9**
Transport by means of a crane
1. Guide rollers (only on truck with pole center spacing 254)
2. Wooden bars or rails as a support
4.3 Mounting the circuit-breaker HVX-E (truck-type)

A transport trolley must be used for racking the circuit-breaker into the panel (Fig. 10). The transport trolley depends on the panel type and is not included in the scope of supplies. For the design and method of operation of the transport trolley used, please refer to the instructions for the panel in question.

Fig. 10
Circuit-breaker HVX-E (≤ 40 kA) on transport trolley in front of the panel PIX Standard
Placing circuit-breaker on transport trolley and racking it into the switchgear

- Important:
  - When performing the following assembly steps, observe and comply with the instructions given for the panel used.
  - Optionally, HVX trucks and panels may be coded to match (Fig. 11). This is to prevent a truck from being racked completely into the panel if the ratings do not match.

1. Check the ratings indicated on the nameplate of the HVX-E against those of the appropriate panel.
2. Place the circuit-breaker on the transport trolley rails.
3. Lock the circuit-breaker on the transport trolley.
4. Couple the transport trolley to the panel.
5. Unlock the circuit-breaker from the transport trolley. Push the circuit-breaker into the panel. The HVX trucks must latch in the lock rockers of the panels (Fig. 11).
6. Release the transport trolley from the panel.

Earth terminal

The equipotential bonding connection of the circuit-breaker and the panel is effected via the two front truck rollers (Fig. 12). The HVX-E circuit-breaker is optionally available with short-circuit proof earthing (Fig. 11 item 3).

Fig. 11: HVX-E underside
1 Circuit-breaker coding
2 Spindle nut of truck (must be latched in the cell)
3 Earth bar (optional)
4 Spindle of disconnector truck

Fig. 12: Equipotential bonding in the cell above the truck rollers
Removing and connecting the low-voltage connector

**Important:**
The low-voltage connector can only be removed or inserted while the truck is in disconnected position.

1. Pull interlocking slide of low-voltage connector forward (Fig. 13, 1) and remove the connector (2).
2. Stow low-voltage connector in storage tray above the truck (Fig. 14).

### Fig. 13
1. Unlock low-voltage connector
2. Remove low-voltage connector

### Fig. 14
Place low-voltage connector in tray above the truck

Connecting the low-voltage connector

1. Take low-voltage connector from the storage tray above the truck (Fig. 14).
2. Insert low-voltage connector into the truck and press interlocking slide forward (Fig. 15).

### Fig. 15
1. Insert control connector
2. Lock
5 Commissioning

5.1 Final steps

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of fatalities due to high voltage. All active parts must be earthed.</td>
</tr>
</tbody>
</table>

Checking assembly

- Check securing bolts.
- Check the conductor bars’ screw connections using a torque wrench.
- Check the screw connections of the earth terminal.
- Check wiring laid on site.

Damaged paint

Minor damage to the paint can be repaired using a commercially available touch-up pen (standard colour RAL 9003 or corresponding colour) (see Chapter 8.1 “Auxiliary products”).

Inspection

- Check the circuit-breaker for damage which might be due to transport or assembly work.
- Compare the data on the nameplate (see Chapter 2.5) to the required rating specifications.
- Check rated supply voltage of control and operating devices.
- Check surfaces of insulating components for impurities. If necessary, clean (see Chapter 7.3).

5.2 Checking switching functions and interlocks

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td>The high-voltage supply must not be connected. All active parts must be earthed.</td>
</tr>
</tbody>
</table>

Important:
- For switching operations, comply with Chapter 6 “Operation”.
- In case supply voltage is not available,
  - blocking coils (optional; lock circuit-breaker button and/or truck in disconnected position) are in locked position, thus blocking manual switching operations;
  - there is a dropped-out undervoltage release in the circuit-breaker (optional).
- The energy-storing device of the circuit-breaker drive is charged autonomously as soon as the supply voltage is applied.

Checking switching functions and interlocks:

1. Charge energy-storing device using the crank. Check position indicator on the circuit-breaker.
2. Apply supply voltage.
3. Switch circuit-breaker on and off several times manually. Check position indicator.
4. Move truck to its operating and disconnected positions via the crank. Check mechanical interlocks between the HVX-E and the cell. Check position indication.
5. Check electrical functions of control and operating devices:
   - Closing and opening releases for circuit-breaker
   - Optional motor-operated drives for the truck (only HVX-E)
6. Check switch position indicators and interlocks (Chapter 6).
6  Operation

6.1  Operator interface

Fig. 16
Operating interface of HVX circuit-breakers
1  OFF button (rocker “0”)
2  ON button (rocker “1”)
3  Operation counter
4  Position indicator of circuit breaker
5  Position indicator of spring mechanism
6  Insertion opening for charging the closing spring

Fig. 17
Operating interface of HVX circuit-breakers with push-buttons (optional)
### 6.2 Operation accessories

**Important:**

Only the auxiliary equipment required for operation (depending on the circuit-breaker design) is supplied in the accessories. Only these accessories may be used to operate the circuit-breaker.

<table>
<thead>
<tr>
<th>Position (Fig. 41)</th>
<th>Designation</th>
<th>Ref. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operating rod for ON/OFF actuation</td>
<td>AGS H35 446-01</td>
</tr>
<tr>
<td>2</td>
<td>Spring charging crank for energy-storing device</td>
<td>AGS H30 498-01</td>
</tr>
<tr>
<td>3</td>
<td>Moving crank handle with integrated slip coupling for disconnector truck (HVX-E)</td>
<td>AGS H31 601-01&lt;sup&gt;1&lt;/sup&gt; AGS H32 532-01&lt;sup&gt;2&lt;/sup&gt; AGS H31 674-01&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

1. Disconnector truck, manually actuated, shape of insertion opening: hexagonal
2. Disconnector truck, manually actuated, shape of insertion opening: square
3. Emergency crank handle for disconnector truck, motor-actuated

---

Fig. 18

Accessories for circuit-breaker and HVX-E

1. Operating rod for ON/OFF actuation
2. Spring charging crank for energy-storing device
3. Moving crank handle with integrated slip coupling for disconnector truck
4. Closed door of switchgear panel
6.3 Interlocks

**WARNING**

Risk of injury. You must be familiar with these interlocks before operating the circuit-breaker.

**Electromagnetic interlocks (optional)**

The manual operating facilities on the circuit-breaker can be locked optionally by blocking coils. Electromagnetic blocking coils can be used for inter-panel as well as intra-panel interlocks:

- The circuit-breaker’s ON and OFF pushbuttons are blocked.
- The insertion opening for the crank to move the circuit-breaker into its disconnected/service position is blocked (only for HVX-E).

**Important:**

- In case of failure of the supply voltage, all electrical interlocks are in their “locked” position. Measure: Re-establish power supply.
- Please note the purchase contract and the switchgear-specific circuit diagram as regards the design of the interlocking systematics.

**Mechanical interlocks**

The circuit-breaker HVX-E (truck) features mechanical basic interlocks to prevent operating errors:

<table>
<thead>
<tr>
<th>Interlock</th>
<th>Function of interlock</th>
<th>Method of operation of interlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between truck and low-voltage connector</td>
<td>The truck cannot be racked in unless the low-voltage connector is inserted and locked.</td>
<td>The opening for the moving crank handle is locked.</td>
</tr>
<tr>
<td></td>
<td>The low-voltage connector can only be inserted or removed while the truck is in its disconnected position.</td>
<td>The interlock for the low-voltage connector on the drive end has been activated.</td>
</tr>
<tr>
<td>Between the truck and the operating state of the circuit-breaker</td>
<td>Circuit-breaker cannot be racked in or out while it is switched on</td>
<td>The opening for the moving crank handle is locked.</td>
</tr>
<tr>
<td></td>
<td>Circuit-breaker cannot be switched on unless it is completely in its disconnected or service position and the operating crank for the racking-in mechanism has been removed.</td>
<td>The circuit-breaker cannot be switched ON or OFF.</td>
</tr>
</tbody>
</table>
6 Operation

6.4 Operating specifications

**WARNING**
- Risk of injury. Please comply with the safety provisions in Chapter 1.
- To rule out risks due to faulty switching operations, the operating sequences described below must be complied with. Each switching operation must be completed.

Check whether the supply voltage is ON.

**Important:**
- When operating the circuit-breaker, observe and comply with the instructions given for the panel used.
- After each switching operation for which you have used a crank or a lever, remove this tool.
- In case supply voltage is not available
  - blocking coils (optional, see Chapter 6.3) are in "locked" position;
  - an undervoltage release (optional) has dropped out.
  Measure: Re-establish the supply voltage.
- Comply with the switch-specific mechanical and electromechanical interlocking conditions; see also Chapter 6.3.

**Warning**
Risk of an arc occurring on switching unless the truck is operated in isolated or deenergized condition. The circuit-breaker must always be switched off previously.

**Important:**
- Do not pull the crank out before the truck in question has reached its end position; do not pull it out in an undefined intermediate position.

6.5 Charging the energy storing device

Initial position:
- Circuit-breaker in "open" position
- Energy storing device discharged

Manually

**WARNING**
Danger of malfunction of the circuit-breaker. Do not use any electric or pneumatic tools for charging the energy storing device. Only the crank in the accessories is permitted.

1. Insert crank into opening for tensioning the energy storing device (Fig. 19).
2. Turn clockwise, until the charge drive mechanism is uncoupled (sound).
   The energy storing device indicates the "charged" condition.
3. Remove crank. The circuit-breaker is ready for closing (Chapter 6.7, Table item 2).

**Important:**
- If the motor drive starts during this process, this does not constitute a risk.
6 Operation

Via motor-drive

The energy storing device of motorized circuit-breakers is charged automatically as soon as the supply voltage is applied.

6.6 Switching operations

All available versions for switching the circuit-breaker ON and OFF are listed below. Depending on the switch-specific equipment, versions may be shown, but not be available.

Switching ON (Closing)

- Press ON button (I) using the operating rod (Fig. 20, item 1) or
- press ON button (I) (Fig. 21, item 3) or
- actuate closing release electrically.

Position indicator indicates the “ON” position (2).

Important:
Max pressure time: 1s (Do not keep pressure on the button).

Fig. 19
Charging the energy storing device manually

Fig. 20
1 Switching ON by means of an operating rod
2 Position indicator indicates "ON"

Fig. 21
1 Switching ON via pushbutton
2 Position indicator indicates "ON"
6 Operation

The energy storing device can be charged again immediately after switching ON (manually or by motor). If voltage is applied to the motor, charging is performed automatically. The position indicator shows the energy storing device position “charged” (Chapter 6.7, table item 4).

Switching OFF (Opening)

**Important:**

*Max pressure time: 1s (Do not keep pressure on the button).*

- Press OFF button (O) by means of the operating rod or
- Press OFF button (O) or
- actuate opening release electrically, or
- by undervoltage release or secondary release

The position indicator indicates the switch position OFF (Chapter 6.7, Table item 1 or 2).

6.7 Position indicators on circuit-breaker and possible operating sequences

<table>
<thead>
<tr>
<th>Item</th>
<th>Position indicator, energy-storing device</th>
<th>Position indicator</th>
<th>Possible operating sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>discharged</td>
<td>open</td>
<td>none</td>
</tr>
<tr>
<td>2</td>
<td>charged</td>
<td>open</td>
<td>C–O</td>
</tr>
<tr>
<td>3</td>
<td>discharged</td>
<td>closed</td>
<td>O</td>
</tr>
<tr>
<td>4</td>
<td>charged</td>
<td>closed</td>
<td>O–C–O</td>
</tr>
</tbody>
</table>

C = ON (Close) O = OFF (Open)
6.8 Moving truck into service / disconnected position

Initial situation:
- Circuit-breaker OFF

The crank features an integrated slip coupling which prevents damage to the drive mechanism due to an excessive torque. The slip coupling can react if the truck is moved to its final stop in disconnected or service position.

1. Open cover in panel (Fig. 22, item 1) and insert crank (2).
2. Turn crank clockwise (3) until the truck has been racked in. Remove crank.
3. Check position of the truck (Fig. 23) through the inspection port.

Racking-in the truck from disconnected into service position

Racking-out the truck from service into disconnected position

1. Open cover in panel (Fig. 24, item 1) and insert crank (2).
2. Turn crank counter-clockwise (3) until the truck has been racked out. Remove crank.
3. Check position of the truck (Fig. 25) through the inspection port.
7 Maintenance

7.1 Safety provisions

**WARNING**

- Risk of injury. Please comply with the safety provisions in Chapter 1.
- Risk of injury due to mechanically precharged drive components. The circuit-breaker must not be disassembled for maintenance work.

Maintenance and maintenance work may only be performed by specialist electricians who have been certified by the manufacturer for series HVX vacuum circuit-breakers and who are familiar with the appropriate safety provisions.

For inspection and maintenance the circuit breaker HVX-E have to be on the transport trolley (Fig. 26).

7.2 Maintenance and maintenance specifications

Series HVX vacuum circuit-breakers are indoor switching devices designed for normal operating conditions in acc. with IEC 62271-1.

It is recommended to check the circuit-breakers visually at regular intervals depending on the strain they are subject to during operation and in accordance with national regulations.

**Important:** In case of frequent condensation or air pollution (dust, smoke or corrosive gases), the maintenance intervals must be adapted to the actual conditions.

A visual inspection includes a complete check of the circuit-breaker for contamination, condensation and damage, to be performed by certified staff.

**Maintenance**

If there are signs of contamination or condensation, the circuit-breakers must be cleaned in an expert manner (see Chapters 7.3 and 7.4) and subsequently the drives, interlocks and position indicators checked for proper functioning (see Chapter 5).

**Overhauling**

If damage is detected, it must be repaired immediately, or components replaced (see Chapter 7.5 and 7.6).

In case of ambiguities or irregularities, please contact the manufacturer’s Service Center immediately.

<table>
<thead>
<tr>
<th>Maintenance interval</th>
<th>Maintenance work</th>
<th>Qualification / Work performed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 10 000 operating cycles</td>
<td>Revision of circuit-breaker</td>
<td>Manufacturer’s Service Center</td>
</tr>
<tr>
<td>after 1,000 truck operations</td>
<td>Revision of the truck</td>
<td></td>
</tr>
<tr>
<td>once the max. admissible number of breaking operations for the vacuum chambers has been reached (see Chapter 7.8)</td>
<td>Replacement of vacuum chambers</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 26
Transport trolley
7 Maintenance

7.3 Cleaning insulating components

To ensure the specified insulating level, the insulating components must be clean. On principle, general cleanliness of the circuit-breaker and of its external parts should be ensured.

Slight contamination

Clean using a dry, lint-free cloth. Depending on the degree of soiling, replace cloth as often as necessary.

Severe soiling

Cleaning agent, 1 l can (see Chapter 8.1) must be used for cleaning. The use of other cleaning agents is not admissible.

- Wear protective gloves
- Use cleaning agent according to manufacturer’s instructions.
- Soak the cloth thoroughly and wipe the insulating components. Keep duration of exposure as short as possible.
- Expose the cleaned surface to the air for at least two hours.

When cleaning, make sure that the lubrication in the drive mechanisms is not removed. If the drives are no longer sufficiently lubricated, replace the grease (see Chapter 7.7).

7.4 Avoiding condensation

To ensure the specified insulating level, the circuit-breaker – especially its insulating components – must not be exposed to condensation.

1. If condensation is detected, clean the circuit-breaker (see Chapter 8.3).
2. Check heating system or install a heating. It must provide a sufficient heating performance to prevent condensation on the circuit-breaker.
3. Condensation can also be prevented by ensuring suitable ventilation and heating of the station or by using de-humidification devices.

7.5 Corrosion protection

Drive mechanisms and covers have a long-term protection against corrosion. Any damage to the paint, scratches and other damage must be repaired immediately to avoid corrosion. Contact the manufacturer’s Service Center.

7.6 Replacement of components

Drive or live high-voltage components may be replaced as required. The following data on the nameplate are relevant for replacement of components or in case of any queries (see also Chapter 2.5):

- Type designation
- Serial number
- Year of construction

If you have any queries regarding replacement of components, please contact the manufacturer’s Service Center.
7.7 Lubrication instructions

**Important:**

- The bearings and joints must not be washed out by the cleaning agent.
- The following elements must not be lubricated:
  - Motor
  - Ball bearings
  - Auxiliary releases
  - Micro switches
  - Blocking coils
  - Auxiliary switches
- Only approved Mobilith SHC 100 grease must be used (see Chapter 8.1).

**Truck mechanism**

- Spindle of truck mechanism (Fig. 27, item 1). The spindle is accessible from below.
- Geared wheels of truck mechanism (only in case of motor-drive) (Fig. 27, item 2). The geared wheels are accessible once the lower front cover has been removed.

![Fig. 27](image)

**Points of lubrication of the racking-in mechanism**

- Mobilith SHC 100 grease
- 1 Spindle
- 2 Geared wheels

**Moving contacts**

![Fig. 28](image)

**Greasing the moving contacts**

- Mobilith SHC 100 grease
Circuit-breaker

Remove operating Interface:
Tools: TORX screwdriver, size T25 / slotted screwdriver
Remove the five M5 screws on the front and remove the operating panel.

Fig. 29
Points of lubrication on the circuit-breaker drive mechanism
☐ Mobilith SHC 100 grease

Final steps
Mount operating interface and insert circuit-breaker in panel (see Chapter 4 “Assembly”). Check circuit-breaker in acc. with Chapter 5 “Commissioning”.
7.8 Maximum admissible numbers of breaking operations of vacuum chamber

The diagram (Fig. 31) defines exclusively the max. admissible numbers of breaking operations of the circuit-breaker depending on the rated normal current \( I_r \) and of the short-circuit breaking current \( I_{sc} \). It indicates when the vacuum interrupter chambers need to be replaced.

The diagram shows examples of values for the rated normal current \( I_r \) and the short-circuit breaking current \( I_{sc} \).

The data for the rated normal current \( I_r \) and the short-circuit breaking current \( I_{sc} \) are indicated on the nameplate (Fig. 30).

![Fig. 30](image)

Data for rated continuous current \( I_r \) (1) and short-circuit breaking current \( I_{sc} \) (2) on the nameplate

![Fig. 31](image)

Admissible breaking numbers for the vacuum chamber with values (example)

\( I_r = \text{rated normal current} = 0.8 \text{ kA} \)

\( I_{sc} = \text{short-circuit breaking current} = 25 \text{ kA} \)
8.1 Auxiliary products

The auxiliary products are available from the manufacturer. The use of alternative auxiliary products is not permissible.

**WARNING**

Risk of injury if these products are handled improperly. Observe the safety data sheets of the manufacturers of the auxiliary products.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Symbol</th>
<th>Ref. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning agent, 1-l can</td>
<td></td>
<td>S 008152</td>
</tr>
<tr>
<td>Mobilith SHC 100 grease¹</td>
<td></td>
<td>87635</td>
</tr>
<tr>
<td>Touch-up pen, special paint (specify colour shade)</td>
<td></td>
<td>S 009 562</td>
</tr>
</tbody>
</table>

¹ The size of the packing unit is not defined. It will be defined upon consultation with the manufacturer.

8.2 Treatment of firmly screw-connected contact surfaces

**Important:**

Caution when handling bars insulated by heat-shrinkable sleeves: *The heat-shrinkable sleeve must not get into contact with contact grease (swelling).*

1. Contact areas must be subjected to preliminary treatment before screw-fastening (see Table below)
2. Immediately after the pre-treatment, coat the contact surfaces with contact grease, so that the space between the contact surfaces is completely filled once the screws have been connected.

<table>
<thead>
<tr>
<th>Material of contact surfaces</th>
<th>Pre-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver-plated</td>
<td>Cleaning¹</td>
</tr>
<tr>
<td>Copper or copper alloy</td>
<td>Clean¹, expose metallic surface²</td>
</tr>
<tr>
<td>Steel</td>
<td>Clean¹, expose metallic surface²</td>
</tr>
<tr>
<td>Zinc-plated steel</td>
<td>Remove passivation, not, however, the zinc layer³</td>
</tr>
<tr>
<td>Hot-galvanized sheet-metal</td>
<td>Clean¹, passivation need not be removed</td>
</tr>
</tbody>
</table>

¹ by means of lint-free cloth; use cleaning agent in case of serious contamination
² – by treating the entire surface with emery cloth or a rotating grinding tool (grain size 100 or 80) or
   – using a wire brush which is clearly marked for use exclusively for aluminium or exclusively for copper
³ with brass or steel brush
8.3 Specifications for screw connections

**Important:**
The threads of screws and bolts must generally not be pre-treated.
- Max. tolerance for the effective tightening torques: ±15%
- The nut must correspond in strength to the grade of the screw/bolt used or be of better quality.

### General screw connections

<table>
<thead>
<tr>
<th>Grade or material</th>
<th>Screw/bolt</th>
<th>Plastics</th>
<th>≥ 8.8 ≤ 10.9</th>
<th>Self-locking screw ≥ 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thread Ø</strong></td>
<td><strong>Tightening torques [Nm]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 4</td>
<td>0.25</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 5</td>
<td>0.5</td>
<td>5.0</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>M 6</td>
<td>0.8</td>
<td>8.8</td>
<td>12.3</td>
<td></td>
</tr>
<tr>
<td>M 8</td>
<td>1.8</td>
<td>21.0</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>M 10</td>
<td>3.5</td>
<td>42.0</td>
<td>59.0</td>
<td></td>
</tr>
<tr>
<td>M 12</td>
<td>6.0</td>
<td>70.0</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>M 16</td>
<td>12</td>
<td>170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 20</td>
<td>330</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Screw fastening for power transmission

<table>
<thead>
<tr>
<th>Screw and bolts: Grade ≥ 8.8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conductor material:</strong> copper</td>
</tr>
<tr>
<td><strong>Thread Ø</strong></td>
</tr>
<tr>
<td>M 6</td>
</tr>
<tr>
<td>M 8</td>
</tr>
<tr>
<td>M 10</td>
</tr>
<tr>
<td>M 12</td>
</tr>
<tr>
<td>M 16</td>
</tr>
</tbody>
</table>

### Screw connection for terminal strips

<table>
<thead>
<tr>
<th><strong>Thread Ø</strong></th>
<th><strong>Tightening torques [Nm]</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>M 2.5 (M 2.6)</td>
<td>0.5</td>
</tr>
<tr>
<td>M 3</td>
<td>0.7</td>
</tr>
<tr>
<td>M 3.5</td>
<td>1.0</td>
</tr>
<tr>
<td>M 4</td>
<td>1.5</td>
</tr>
<tr>
<td>M 5</td>
<td>2.5</td>
</tr>
</tbody>
</table>
As our products are subject to continuous development, we reserve the right to make changes regarding the standards, illustrations and technical data described in this Technical Manual. For any requests, please contact the address given below.

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