Medium Voltage Distribution

PIX
Withdrawable Voltage Transformer

Operation - Replacement of Fuses
Replacement of Voltage Transformers
Technical manual

Nr. AGS 531507-02

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As our products are subject to continuous further development, we reserve the right to make changes regarding the standards, illustrations and technical data described in this Technical manual.

All dimensions specified in this manual are in millimeters.

**Purpose and target group**

This Technical manual describes the operation, the replacement of voltage transformer fuses and the replacement of voltage transformers in PIX medium voltage switchgear panels. The work described in this manual may only be performed by specialist electricians with proven experience regarding

- the PIX series (training certificate)
- all relevant safety provisions

This Technical manual is an integral part of the product and must be stored so that it is at all times readily accessible for and can be used by persons who are supposed to work on the switchgear. If the switchgear is sold or replaced, it must be accompanied by this Technical manual.

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 containing the stipulations on the specific equipment of the switchgear and the legal details
- The switchgear-specific circuit diagrams/documentation
- The Instructions for assembly and the technical data of the fuses and the voltage transformers given by the manufacturers
- The assembly and operation instructions for PIX circuit breaker cubicles

**Terms and symbols used**

This manual uses certain terms and symbols. They warn about dangers or provide important information which must be complied with in order to avoid danger to persons and damage to equipment:

- **"Danger!"**
  This danger symbol warns about dangerous electrical voltage. Contact with voltage may result in fatal injury!

- **"Warning!"**
  This danger symbol warns about the risk of injury. Please comply with all the provisions identified by this symbol in order to avoid death or serious injury.

- **"Important:"**
  This instruction symbol is used for information which is important to avoid material damage.

**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

Read these instructions carefully before you work on the switchgear, and perform the work detailed in them as described. Only perform such work if you have understood the instructions. Do not perform any work which is not described in this manual.

Applicable standards and regulations:
- Metal-enclosed AC switchgear for rated voltages > 1 kV up to including 52 kV: IEC 62271-200
- The locally applicable accident prevention, operating and work instructions must be complied with.
- Assembly and maintenance: IEC 61936-1/HD 637 S1
- Operation of electrical equipment: EN 50110-1

1 The national standards applicable in the country where the equipment is to be installed must be complied with.

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

**Danger!**
Risk of fatalities due to high voltage. Isolation from high voltage and earthing must always be ensured before performing assembly or maintenance work.

**Warning!**
After the removal of covers from a switchgear unit, operator safety regarding internal arcs may be reduced unless the switchgear is isolated from the power supply. Optimum operator safety is only ensured if the switchgear is completely isolated from the power supply and earthed during assembly or maintenance work.

**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 Design and Description

2.1 Design

Design of withdrawable PIX voltage transformer trucks
1  Fuse cover
2  HV (High Voltage) Fuses
3  HV (High Voltage) Contacts
4  Fuse holders
5  Voltage transformers
6  Truck
7  Rollers
8  Handles to extract/insert the voltage transformer truck
9  Insertion opening for crank to move the voltage transformer into its disconnected/service position
10  Low voltage terminal of the voltage transformer

![Diagram of PIX voltage transformer trucks]

Fig. 1
Design of withdrawable PIX voltage transformer trucks
1  Fuse cover
2  HV (High Voltage) Fuses
3  HV (High Voltage) Contacts
4  Fuse holders
5  Voltage transformers
6  Truck
7  Rollers
8  Handles to extract/insert the voltage transformer truck
9  Insertion opening for crank to move the voltage transformer into its disconnected/service position
10  Low voltage terminal of the voltage transformer

2.2 Use in accordance with the intended purpose

PIX medium-voltage switchgear panels and components are exclusively designed for switching and distributing electrical power. 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.

Disclaimer of liability

The manufacturer shall not be held responsible for damage which occurs if:
- instructions in this technical instruction are not complied with,
- the switchgear is not operated in accordance with with its intended purpose (see above),
- the switchgear is assembled, connected or operated incorrectly,
- accessories or spare parts are used which have not been approved by the manufacturer,
- the switchgear is modified without the manufacturer’s approval, or if unapproved parts are attached.

No liability is accepted for parts provided by customers, e.g. voltage transformers.
3 Operation

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.

3.1 Move voltage transformer from disconnected into service position
- Open cover (Fig. 2, item 1) and insert crank (2).
- Turn crank clockwise (3) until the truck has been racked in. Remove crank.
- Check position of truck (Fig. 3) through the inspection glass (4).

1 Open cover
2 Insert crank
3 Turn crank clockwise
4 Inspection glass

Fig. 2

Fig. 3: Voltage transformer truck in service position

3.2 Move voltage transformer from service into disconnected position
- Open cover (Fig. 4, item 1) and insert crank (2).
- Turn crank counter-clockwise (3) until the truck has been racked out. Remove crank.
- Check position of truck (Fig. 5) through the inspection glass (4).

1 Open cover
2 Insert crank
3 Turn crank counter-clockwise
4 Inspection glass

Fig. 4

Fig. 5: Voltage transformer truck in disconnected position
4 Replacement of High Voltage Fuses and Voltage Transformers

4.1 Safety provisions and important information for replacement

**Warning!**
Before opening / removing the cable compartment cover, isolate the cable compartment, check for zero voltage and switch on the earthing switch in accordance with the safety provisions.

**Warning!**
Comply with the safety provisions on page 5.

Condensation, dirt and dust during assembly should be avoided on all accounts, in order to prevent damage to the panels.

4.2 Access to the cable compartment

The panels can be equipped with supplementary interlocks to lock the cable compartment cover. To this effect, see also Chapter “Interlocks” in the PIX technical manual.

**Removal of the cable compartment cover**

- Release the securing bolts of the cable compartment cover (Fig. 6, item 1).
- Lift and remove the cable compartment cover (2a). If the cable compartment cover is equipped with hinges, lift and open (swing to the left) the cable compartment cover (2b).

![Fig. 6](image)

1 Release securing bolts of the cable compartment cover
2a Lift cable compartment cover and remove it in forward direction or
2b Lift cable compartment cover and open it to the left

**Re-mounting the cable compartment cover**

After assembly work, place cable compartment cover onto the panel, lower it and fasten it again using the securing bolts.
4 Replacement of High Voltage Fuses and Voltage Transformers (contd.)

4.3 Replacement of the High Voltage Fuses

- Move truck into disconnected position (see page 7).
- Earth the cable compartment and open cable compartment cover (see page 8).
- Unscrew the fixation of the protective cover on the truck and remove it (Fig. 7, item 1 and 2).
- Pull fuses (3) carefully out of the clamping contacts.
- Check contact surfaces for cleanness and, if necessary, clean (see page 15).
- Insert new fuses - see Fig. 8:
  - Ref. No. AGS C13478-01 for rated voltage 17.5 kV
  - Ref. No. AGS C61689-01 for rated voltage 12 kV
- Remount the protective cover to the truck.
- Close the cable compartment cover (see page 8).

Fig. 7

Replacement of the high voltage fuses
1 Fixation of the protective cover (4 screws)
2 Protective cover
3 High voltage fuses

Fig. 8

Ref. No. AGS C13478-01 for rated voltage 17.5 kV
Ref. No. AGS C61689-01 for rated voltage 12 kV
4 Replacement of High Voltage Fuses and Voltage Transformers
(contd.)

4.4 Replacement of Voltage Transformers

4.4.1 Removing the truck from the panel

- Move truck into disconnected position (see page 7).
- Earth the cable compartment and open cable compartment cover (see page 8).
- Disconnect the transformer secondary lines and identify the connectors (Fig. 9, item 1).
- Insert the ramp (2) in the front crossarm of the switchgear panel. The ramp has to be linked to the switchgear panel (3).
- Push unlocking bar (4) forward to its stop. The latching of the truck in the panel is released.
- Pull truck onto the ramp via the two handles (Fig. 10).

Fig. 9
1 Disconnect secondary lines
2 Ramp (Ref. no. AGSC74208-01)
3 Insert the ramp in the front cross arm
4 Unlocking bar

Fig. 10
Pull truck onto the ramp via the two handles
4.4.2 Replacement of Voltage Transformers

- Remove high voltage fuses (see page 9).
- Unscrew the connections of the fuse holders to the voltage transformer (Fig. 11, items 1 and 2) and remove the fuse holders.
- Unscrew the transformer front screw connections (3).
- Disconnect the transformers low voltage wiring and identify the connectors (4).

Fig. 11

Removal of fuse holders
1 Fixation screws
2 Fuse holders
3 Front screw connections
4 Low voltage wiring
4 Replacement of High Voltage Fuses and Voltage Transformers (contd.)

- Release connection of the voltage transformer to the earthing bar (Fig. 12, item 4).
- Unscrew the transformer rear screw connections (5). Remove voltage transformer(s) (6).
- Change the voltage transformer (the voltage transformers must be defined in acc. with DIN 42600 Part 9, narrow design). Check the technical data of the voltage transformer (with the panel specific technical data).
- Screw-fasten new voltage transformer on the truck (rear and front).
- Clean all contact areas of the earthing bar, the voltage transformer and the fuse holders and coat them with lubricant (see page 15).
- Reconnect earthing point of the voltage transformer to the earthing bar (Fig. 12, item 4).
- Remount fuse holders to the voltage transformer (Fig. 11, items 1 and 2).
- Insert high voltage fuses (see page 11).
- Reconnect the transformers low voltage wiring (Fig. 11). Comply with the marking.

![Diagram](image)

Fig. 12
4 Connection of the voltage transformer to the earthing bar
5 Rear screw connections
6 Remove voltage transformer(s)
4 Replacement of High Voltage Fuses and Voltage Transformers (contd.)

4.4.3 Re-inserting the truck into the panel

- Push the truck into the cable compartment via the two handles until it is latched in the panel (Fig. 13, item 1).
- Remove the ramp.
- Reconnect the transformer secondary lines (2). Comply with the marking.
- Close the cable compartment cover (see page 8).

Fig. 13
1 Push the truck into the cable compartment via the two handles
2 Reconnect secondary lines
5.1 Screw fastenings

**Important:**
- The threads of screws and bolts must generally not be pretreated!
- 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>Screw/bolt</th>
<th>Grade or material</th>
<th>Plastic</th>
<th>≥ 8.8 ≤ 10.9</th>
<th>≥ 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 14</td>
<td>12</td>
<td>170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M 20</td>
<td></td>
<td>330</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Screw fastening for power transmission

Screws and bolts: Grade ≥ 8.8

**Conductor material: copper**

<table>
<thead>
<tr>
<th>Thread Ø</th>
<th>Tightening torques [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 6</td>
<td>6.5</td>
</tr>
<tr>
<td>M 8</td>
<td>17</td>
</tr>
<tr>
<td>M 10</td>
<td>35</td>
</tr>
<tr>
<td>M 12</td>
<td>68</td>
</tr>
<tr>
<td>M 16</td>
<td>135</td>
</tr>
</tbody>
</table>

### Screw connection for terminal strips

<table>
<thead>
<tr>
<th>Thread Ø</th>
<th>Tightening torques [Nm]</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>
5.2 Auxiliary products
The auxiliary products are available from the manufacturer. The use of alternative auxiliary products is not permissible.

**Warning!**
Risk of injury in case of inappropriate handling. Observe the safety data sheets of the manufacturers of the auxiliary products.

<table>
<thead>
<tr>
<th>Auxiliary products</th>
<th>Ref. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning agent</td>
<td>S 008 152</td>
</tr>
<tr>
<td>Synthetic lubricant, 0.5 kg can</td>
<td>ST 312-111-835</td>
</tr>
</tbody>
</table>

5.3 How to treat the contact surfaces

Important:
- Caution when handling bars insulated by heat-shrinkable sleeves: The heat-shrinkable sleeve must not get into contact with lubricant (swelling).
- Contact areas coated with synthetic lubricant should not be touched, if possible.

- Contact areas must be subjected to preliminary treatment before screwfastening (see Table).
- Immediately after the pre-treatment, coat the contact surfaces sparingly with a thin and uniform film of synthetic lubricant so that the space between the contact surfaces is completely filled once the screws have been fastened.

<table>
<thead>
<tr>
<th>Material of contact surfaces</th>
<th>Pre-treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver-plated</td>
<td>Clean¹</td>
</tr>
<tr>
<td>Nickel-plated</td>
<td>Remove passivation layer⁴</td>
</tr>
<tr>
<td>Copper or copper alloy</td>
<td>Clean¹, expose metallic surface²</td>
</tr>
<tr>
<td>Aluminium</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 Clean by means of lint-free cloth; use cleaning agent in case of serious contamination
² Expose metallic surface
³ by treating the entire surface with emery cloth or a rotating grinding tool (grain size 100 or 80) or
⁴ using a wire brush which is clearly marked for use exclusively for aluminium or exclusively for copper
⁵ using a brass brush, steel brush
⁶ rub slightly by hand using Scotchbrite abrasive agent (Ni layer must not be reduced)