Medium Voltage Distribution

PIX-36

with roll on floor type circuit breaker
Air-insulated switchgear PIX-36

Installation - Operation - Maintenance Manual

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Remarks on this manual

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 installation, operation and maintenance of air-insulated medium-voltage switchgear PIX-36. It is exclusively intended for use by the manufacturer’s staff or by persons certified for the PIX series (training certificate).
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 such that it is at all times readily accessible for and can be used by persons who are to work on the switchgear. If the switchgear is relocated to another site, this Technical Manual must be passed on to the new operators along with the unit.

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.

This Technical Manual does not include information regarding the safety of buildings in case of internal faults (pressure load of the switchgear room and necessary pressure relief ports). Pressure calculations for switchgear room incl. recommendations regarding pressure relief ports can be provided on request against a fee. For further details, 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 operating manuals of the low-voltage devices installed in the switchgear (e.g. voltage presence indicating systems, devices in low voltage cabinet)
- the assembly drawings supplied with the switchgear
- the Operating Instructions of the trucks used:
  - Circuit-breaker HVX-O
  - Metering truck MTX-O
  - Isolating truck UTX-O
  - Earthing truck ETX-O
- the Assembly Instructions of the manufacturer of the cable connection systems to be connected to the switchgear
Remarks on this manual

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.

“Warning!”
This danger symbol warns about the risk of falling.

“Important”
This instruction symbol is used for information which is important to avoid material damage.

Abbreviations used

“PIX-36”: Switchgear PIX-36 for rated voltage Ur = 36kV

“Truck” Withdrawable part

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 PIX series and the applicable safety provisions. Please read the whole manual carefully before working on the switchgear.

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

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.

**Warning!**
Risk of injury due to movable parts in mechanical drives.
- For maintenance work, isolate from supply voltage.
- Release the circuit breaker’s energy storing device by switching it OFF-ON-OFF.
- Ensure system is totally earthed.

---

**Behaviour in case of incidents or accidents**

For the case of an internal fault, the PIX-36 switchgear features pressure relief ports which prevent the panels and the switchgear unit from bursting. 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.
2.1 Panel Design

Fig. 1
Pix-36 panel with HVX-O circuit breaker

1. Low-voltage cabinet with control devices.
2. Metallic shutter for bus side
3. Spout
4. Circuit breaker compartment
5. Circuit breaker HVX-O
6. Metallic shutter of cable side
7. Guide rails
8. Front door
9. Busbar compartment
10. Risers
11. Current transformers
12. Earth-switch
13. Cable connections
14. Phase barriers
15. Rear cover
16. Cable compartment
17. Base frame
18. Cable clamp assembly
19. Earth bus
20. Pressure relief flaps
2 Design & description

2.2 Panel variants

The illustrations show the panel types with their respective basic equipment without pressure relief duct or deflectors. Customized models or add-on elements are described in the switchgear-specific documentation.

2.2.1 Branch-circuit panels with switching devices

Branch-circuit panel

- Circuit-breaker truck HVX-O
- Optional withdrawable voltage transformers
- Optional Earthing switch

2.2.2 Metering panel

Metering panel

- Metering truck - MTX
- Optional bus earthing switch

2.2.3 Panels for bus section coupler and riser

Bus section coupler panel

- Circuit-breaker truck HVX-O
- Current transformers
2 Design & description (contd.)

Bus section riser panel panel with riser
- Optional Metering truck MTX

2.2.4 Bus Earthing panel
- Optional Metering truck MTX
2.3 Dimensions and weights

For the precise panel dimensions, please refer to the switchgear-specific documentation. These depend on:

- the rated voltage
- the rated normal current
- the rated short-time current
- additional equipment.
- Voltage transformer - optional

**Fig. 2**
Dimensions of PIX-36 panels
a. Panel width = 1000 mm
b. Panel height = 2375 mm
c. Panel depth = 2640 / 3100 / 3560 mm

**Fig. 3**
Dimension of panel with deflector
a. Panel height = 2825 mm

**Dimensions & weights**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>mm</td>
<td>1000</td>
</tr>
<tr>
<td>Height</td>
<td>mm</td>
<td>2375</td>
</tr>
<tr>
<td>Depth</td>
<td>Mm</td>
<td>2640 3100 3560</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>&lt; 1600 1 1900 1 2300 1</td>
</tr>
</tbody>
</table>

1 Including moving part & average extent of Low-voltage cabinet equipments.

**Fig. 4**
Dimensions of panel with tunnel
a. Total height = 2875 mm
2 Design & description (contd.)

2.4 Applied standards

Switchgear units of the PIX-36 are
- metal-enclosed; loss of service continuity category acc. to IEC 62271-200: LSC 2B-PM
- type-tested
- tested for internal faults (qualification IAC AFLR)
- dimensioned for indoor installation

PIX-36 switchgear units meet the following standards and regulations:

<table>
<thead>
<tr>
<th>Item</th>
<th>IEC standard</th>
<th>EN standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchgear</td>
<td>IEC 62271-200 IEC 62271-1</td>
<td>EN 62271-200 EN 62271-1</td>
</tr>
<tr>
<td>Internal arc classification (IAC)</td>
<td>IEC 62271-200</td>
<td>EN 62271-200</td>
</tr>
<tr>
<td>Circuit Breaker</td>
<td>IEC 62271-100</td>
<td>EN 62271-100</td>
</tr>
<tr>
<td>Earthing switch</td>
<td>IEC 62271-102</td>
<td>EN 62271-102</td>
</tr>
<tr>
<td>Current transformer</td>
<td>IEC 60044-1</td>
<td>EN 60044-1</td>
</tr>
<tr>
<td>Voltage transformer</td>
<td>IEC 60044-2</td>
<td>EN 60044-2</td>
</tr>
<tr>
<td>Voltage detection systems</td>
<td>IEC 61243-5 IEC 61958</td>
<td>EN 61243-5 IEC 61958</td>
</tr>
<tr>
<td>Protection against accidental contact, foreign bodies and water</td>
<td>IEC 60529</td>
<td>IEC 60529</td>
</tr>
</tbody>
</table>

Degree of protection against accidental contact and foreign objects

Protection against accidental contact, foreign objects according to IEC 62271-200 and IEC 60529

| Degree of protection of switchgear enclosure | IP4X |
| Degree of protection of the accessible claddings in the panel | IP2X |

2.5 Environmental and operating conditions

PIX-36 is an indoor switchgear and may only be operated under normal conditions in acc. with IEC 62271-1.

Operation under conditions deviating from these is only admissible subject to consultation with and written approval from the manufacturer.

Ambient conditions in accordance with IEC 62271-1

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>°C Minus 5 indoors$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min./max. ambient temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Average value over 24 hours</td>
<td>°C</td>
</tr>
<tr>
<td>Average re. humidity : 24 hour / 1 month</td>
<td>%</td>
</tr>
<tr>
<td>Installation altitude above sea-level</td>
<td>m</td>
</tr>
</tbody>
</table>

$^1$ Other values available on request
2.6 Ratings of the PIX-36 Switchgear.

<table>
<thead>
<tr>
<th>Switchgear panel</th>
<th>kV</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>$U_r$</td>
<td>36</td>
</tr>
<tr>
<td>Rated lightening impulse withstand voltage</td>
<td>$U_{p}$</td>
<td>170</td>
</tr>
<tr>
<td>Rated power frequency withstand voltage</td>
<td>$U_d$</td>
<td>70</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>$f_r$</td>
<td>50</td>
</tr>
</tbody>
</table>
|Rated normal current                                   | $I_r$ | 800
|                                                        |     | 1250            |
|                                                        |     | 2000            |
|Rated short – time current / Rated peak withstand current | $I_{k}/I_p$ | 26.3 (3s) / 65.75 |
|                                                        |     | 31.5 (3s) / 78.75 |
|Internal arc classification (IAC - AFLR)               | $kA$ | 31.5 (0.1s)      |
|                                                        |     | 31.5 (1s)       |

1 The short-circuit capability of the current transformers must be considered separately.

The applicable panel-specific technical data are indicated on the nameplate (see Nameplate) and in the switchgear-specific documentation.

The technical data of the switching device (HVX-O, UTX-O, ETX-O) are indicated on the nameplate and in the operating manual of the device concerned.

2.7 Nameplate.

The type designation of the switchgear panels on the nameplate Fig. 5 specifies essential technical data. When submitting enquiries to the manufacturer or ordering spare parts, the following information is required:

Fig. 5
Name plate on front panel
1. Serial number
2. Type designation
3. Technical data
2.8 Technical data of electrical control and operating devices

The switchgear panels have been designed on principle so as to permit manual operation. The drive mechanisms of the individual switching devices can be equipped, depending on the specific customer's model, with additional electrical control and operating devices. These are defined in the switchgear-specific circuit diagram (see switchgear documentation).

Component fitting options:
- Blocking coil (optional)
  The blocking coil prevents manual actuation of the earthing switch. If the supply voltage has failed or is shut off, all blocking coils are in "blocked" position.
- Auxiliary switches
  Auxiliary switches are always actuated directly by the truck or by the switch shaft via an intermediate linkage. Their position always corresponds to that of the main contacts. The switching functions have been set in the factory according to the circuit diagram.
- Micro switches are used depending on the customized panel models.

Overview of rated supply voltages

<table>
<thead>
<tr>
<th>Overview of rated supply voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct voltage DC [V]</td>
</tr>
<tr>
<td>Alternating voltage AC [V]</td>
</tr>
</tbody>
</table>

Trucks

Electrical control and operating devices of trucks are described in the appropriate Technical Manuals (see "Reference documents" on page 5).
- Circuit breaker HVX-O
- Disconnector truck UTX-O
- Metering truck MTX-O
- Earthing truck ETX-O
2.9 Intended use

Air-insulated medium-voltage switchgear units of the PIX-36 are designed exclusively 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 Manual are not complied with;
- the switchgear is not operated according to its intended use (see above);
- the switchgear is assembled, connected or operated improperly;
- accessories or spare parts are used which have not been approved by the manufacturer;
- the switchgear is converted without the manufacturer’s approval, or if inadmissible parts are added.
- No liability is accepted for parts provided by customers, e.g. current transformers.

2.10 Disposal after the end of service life

A material and recycling data sheet can be provided on request for the disposal of switchgear units of the PIX-36 at the end of their service life. Disposal is performed as a service by the manufacturer’s Service Center and is subject to a fee.
3 Packaging, transportation, 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 panels are delivered individually and are fastened on pallets.
- The trucks are delivered within the panels. They are in "connected" position.
- The standard accessories are included.
- The panels are delivered in upright position.

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

**Packaging**

- If packed exclusively for land-based transport, the panels are delivered on a pallet with corrugated sheet & PE protective film (Fig. 6).
- For transport by sea/air, the panels are packed with PE protective film hood (dust protection) suitable for seaworthy transport (Fig. 7).
- Wooden case with tightly closed wooden base (also for container transport)

![Fig. 6](image1)
**Fig. 6**
Packed in PE protective Film on a pallet

![Fig. 7](image2)
**Fig. 7**
Packed in PE protective film suitable for seaworthy transport
3 Packaging, transportation, storage (contd.)

3.2 Transport

![Warning! Danger due to load tipping over. Transport units must be secured sufficiently during transport to prevent slipping and tipping over.]

**Transport using a forklift truck**

The panel may only be transported on a pallet. The entire length of the forks must be placed under the transport unit (Fig. 8).

![Fig. 8
Transport units must not be allowed to tip over]

**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.

![Fig. 9
Transportation using Forklift truck]

3.3 Warehousing

![Warning! Risk of accidents. Sufficient stability and evenness of the supporting area (floor) must be ensured.]

If the panels are not installed immediately after delivery, they can be stored under the following conditions:

- Panels must be stored in vertical position, and must not be stacked.
- Storage only admissible indoors.
- Switchgear panels and accessories must be sealed with desiccant in aluminium foil and be packed in a wooden crate (storage for max. two years after the date of packaging).

![Fig. 10
Schematic diagram of storage conditions for PIX-36 panels]
4 Access to main circuit compartment.

4.1 Safety provisions and important information

**Warning!**
Risk of injury due to non-respect of the safety provisions in Chapter 1.

**Important:**
The panels may be equipped with additional interlocks to lock the cable compartment cover and the front door. In this context, refer also to Chapter 9.4 “Interlocks”.

4.2 Access to the circuit-breaker Compartment

**Danger!**
Risk of fatalities due to high voltage. The front door may only be opened if the truck is in disconnected position (see Chapter 9.7.2).

4.2.1 Opening and closing the front door

**Opening the front door**
- Ensure truck is in disconnected position.
- Pull the handle lever
- Rotate the handle clockwise (approx. 120 degrees) to unlock
- Open the front door by pulling the handle. Access to switching device is possible.

**Closing the front door**
- Close the door completely.
- Press slightly the front door to compress the gasket
- Rotate the handle anti-clockwise (approx. 120 degrees) to lock
- Press the handle to rest position.
4.2.2 Removing and connecting the truck low-voltage connector

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

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

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

---

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

**Fig. 14**
Place low-voltage connector in tray above the truck
4.2.3 Removing the truck from the panel

- Place the ramp aligned with the cubicle rails
- Disconnect low voltage connector & store in the tray above the truck
- Unlock the truck by sliding the handles inwards (Fig. 16)
- Pull the truck outwards carefully and remove it from panel.

![Fig. 15](image_url)
Moving the truck outside the panel

Unlocking the truck in the panel

![Fig. 16](image_url)
Unlocking the truck in the panel
4.2.4 Inserting the truck into the panel

**Important:**
Optionally, trucks and panels can be given matching coding. This is to prevent a truck from being racked completely into a panel if the ratings do not match.

- Place the ramp byaligning with the cubicle rails.
- Slide the truck locking handle inwards.
- Push the truck inside the cubicle using ramp.
- Lock the truck in slots of guide rails by sliding the truck locking handles outwards (Fig. 18).

Fig. 17
Moving the truck to the front of the panel.

**Locking the truck in the panel**

Fig. 18
Locking the truck in the panel
4 Access to main circuit compartment. (contd.)

4.3 Access to cable connection

Danger!
Risk of fatalities due to high voltage. Ensure cable chamber is de-energized & earthed before opening the cable compartment cover

4.3.1 Removing cable compartment cover

- Release the securing bolts of cable compartment cover (fig. 19, item 1)
- Lift the cover to release (2) with the help of handles provided.
- Pull to remove the cable compartment cover (3)

Fig. 19
Removing the cable compartment cover

Mounting the cable compartment cover

After terminating assembly work, place cable compartment cover on to the panel & fasten it again using securing bolts.
4. Access to main circuit compartment. (contd.)

4.4 Access to the busbar compartment

- Open the front door and remove the truck from the panel (see chapter 4.2.3)
- Un-mount the busbar access cover from the CB compartment (Fig. 20 & 21). The busbar compartment is now accessible

![Fig. 20](image1) Remove truck (1) & partition plate (2)
![Fig. 21](image2) Posture of worker during main busbar mounting & panel fastening

**Re-mounting the partition plate**

After completion of assembly work, re-insert the partition plate and fasten it by means of the bolts.
5 Assembly

5.1 Safety provisions

The switchgear panels may only be installed and assembled by the manufacturer’s staff or by persons who have been certified for this work. PIX-36 panels are delivered with the earthing switch OFF. The circuit breakers are always shipped in open state (“OFF”) with the energy storing device released.

**Warning!**
Risk of injury due to movable parts in mechanical drives. The circuit-breakers energy storing device and the earthing switch must not be tensioned during assembly.

**Warning!**
Risk of accidents! Watch out for floor openings in the switchgear room.

**Warning!**
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel. When work has to be performed on the panel top - e.g. assembly of deflectors or pressure relief ducts – temporarily position a solid base plate to step on.

**Warning!**
Risk of injury in case of non-compliance with the safety instructions in Chapter 1.

5.2 Important instructions for assembly

**Important:**
- Condensation, dirt and dust during assembly should be avoided on all accounts, in order to prevent damage to the panels.
- For assembly, observe the assembly drawings supplied with the equipment. Read them before you commence assembly work. The drawing numbers are specified in this manual in the description of the assembly work in question.
- For all screw connections, refer to the tightening torques specified in the Chapter 11 “Annex”

5.3 Requirements regarding the switchgear room

Before installing the switchgear panels, make sure that the switchgear room is checked according to the switchgear documentation (Fig. 22).

- Observe the minimum distance between the switchgear and the wall of the building.
- The load-bearing capacity of the fastening areas must correspond to the weight of the switchgear (perform a stress analysis of the building).
- Check base frame (if used) for dimensions and positional tolerances.
- Check position of floor openings for high-voltage and low voltage cables. Before the switchgear is positioned at its site of installation, check that the fastening points are level. Unevenness must not exceed ± 2 mm/meter and 6 mm difference in height over the entire switchgear width.
Important:
- Observe switchgear-specific space assignment plan.

Fig. 22
Dimensions in the switchgear room example)
1. PIX-36 panels
2. Switchgear room
3. 450 mm incase of deflector & 500 mm in case of tunnel
Ground plan of PIX-36 panels.

**Fig. 23**
Ground plan of PIX-36 panel

1. Bus Coupler, Bus Riser, Bus Riser + Bus PT, Bus CT upto 2000 A
2. Bus PT, Bus Earthing

**Fig. 24**
Ground plan of PIX-36 panel

Feeder upto 2 Run/phase with Line PT

Feeder for 3 to 5 Run cable with Line PT
5.4 Transport of the panels and trucks at the construction site

Warning!
Make sure the rope or chain is strong enough to bear the weight of panel and the trucks. Comply with the relevant provisions of hoisting equipment.

Warning!
On lowering the panels and the trucks, make sure that the supporting platform is sufficiently stable and even.

Warning!
Risk of accidents! Watch out for floor openings in the switchgear room

Transport of panel by means of a crane
- Remove transport packaging and protective film from the cubicle.
- Attach 4 crane ropes/chains via hooks (observing minimum carrying capacity and length, Fig. 25). Release the cubicle fastening on the pallet.
- Lift the module carefully and deposit it slowly on the floor at the intended location.

Refer Drawing No.: VDRB05614-02

Transport of the panel on the floor
- If the panel needs to be moved on the floor:
  Use three rollers with a minimum diameter of 30 mm (Fig. 26). Evenness and stability of the supporting area (floor) must be ensured.
  Move the panel on the rollers to its final site of installation.

5.5 Aligning and fastening panels

Important:
The position of the first panel is decisive for placement of the subsequent panels, thus it is essential that measuring is effected with the utmost precision.
- Position first panel on the foundations in accordance with the switchgear specific space assignment plan.
- Remove cable compartment cover (see Chapter 4.3.1).
- Align panel. Check the panel front for correct horizontal and vertical position. If applicable, lift the panel and place shims in the direct vicinity of the fastening areas, until the horizontal position has been reached.
- Screw-fasten the panel to the two fastening points provided on the front and two fastening points on the rear (see also Fig. 23 & Fig. 24).
Installation of Panels:

Important:

The position of the first panel is decisive for the placement of the subsequent panels, thus it is essential that measuring is effected with the utmost precision.

Refer Drawing No.: VDRB05605-04

Fastening on Concrete Foundation:

1) Position the first panel on the foundation in accordance with the switchgear specific space assignment plan.
2) Open the Circuit breaker compartment door and rear cover.
3) Align the Panel. Check the panel front for correct vertical and horizontal position. If applicable, lift the panel and place shims in the direct vicinity of the fastening points, until the horizontal position has been reached.
4) Screw-fasten the panel to the two fastening points provided on the front and two fastening points on the rear (Refer to the picture below).

Fig. 27
Fastening of panels on concrete foundation.
5.6 Screw-fastening the panels to one another

Refer Drawing No.: VDRB05614-01

Position the next panel next to the previous one in accordance with the assignment plan and align it.

1) Position the Panel next to the previous one according to switchgear room assignment plan and align the Panel corresponding to the previous panel.
2) Screw-fasten the panels according to the following figure.

Use M8 x 30 / 40 mm bolts with plain & spring washer for coupling.

Fig. 28
Panel coupling details.
5.7 Busbar assembly

5.7.1 Access to the busbar compartment

See Chapter 4.4.

5.7.2 Busbar assembly

Arrangement of busbars in branch-circuit panels

<table>
<thead>
<tr>
<th>Number of outgoing feeder bars per phase</th>
<th>Number of busbars per phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 ≤ 1250 A</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2 ≤ 2000 A</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Please refer Annexure A for detailed instructions

Important:

- Comply with the specifications on treatment of contact surfaces and the tightening torques for busbar screw fastening in the Annex.
- Comply with the position and direction of screws and nuts as shown in the diagram.
- **Put shrouds on Bus joints after assembly.**
5 Assembly (contd.)

5.8 Assembly of the earth bus

Earth bars are screw-fastened between the switchgear panels using connecting bars (Fig. 30)

Important:
Comply with the specifications on treatment of contact surfaces and the tightening torque for screw fastening in the Annex.

Important:
Observe the specific standards referring to earthing systems which apply in your country

- Clean all contact areas of the connecting bar and the appropriate earth bar in the switchgear panels and coat them with Synthetic lubricant (see Chapter 11.1).
- Slip the connecting bar (Fig. 29, item 1) into the adjacent panel (4) through the cutout in the panel-supporting structure (2).
- Screw-fasten (5) connecting bar on both sides to the earth bar (3) in question.
- Connect earth bus (Fig. 30) to the earthing system of the switchgear building (connecting lines and screw accessories are not included in the scope of supplies).

5.9 Mounting of deflectors

Deflectors are required to ensure operator safety in accordance with IEC 62271-200 in case of internal faults.

IAC: Internal arc classification: AFLR

Please refer Annexure “B” for detailed instructions

5.10 Assembly of the pressure relief duct

The pressure relief duct on the upper side of the panel ensures operator safety in accordance with IEC 62271-200 in the case of internal faults.

IAC (= Internal arc classification): AFLR.

Please refer Annexure “C” for detailed instructions
6 High–voltage connection

6.1 Overview of cable connection variants

<table>
<thead>
<tr>
<th>In panel [A]</th>
<th>Panel width [mm]</th>
<th>Cables per phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>1000</td>
<td>1 / 2</td>
</tr>
<tr>
<td>1250</td>
<td>1000</td>
<td>1 / 2 / 3 / 4</td>
</tr>
<tr>
<td>2000</td>
<td>1000</td>
<td>4 / 5</td>
</tr>
</tbody>
</table>

Fig. 31
Connecting brackets available for cable connection.
Max. 500 mm² cable

Fig. 32
1) Cable clamps
2) Cable clamp fasteners
3) Plastic plates
4) Plain gland plates

6.2 Mounting the high-voltage cables

Clamping assemblies for high-voltage cables, screws, bolts and plastic plates are included.

Access to cable compartment: See Chapter 4.3.

Preparation of cable compartment
- Remove cable clamp fasteners.
- Drill cable plastic plate as per cable requirement.
- Remove plain gland plates & drill as per cable requirement.
Connecting the cables

**Important:**
- Unless otherwise specified by the cable manufacturer: Comply with the specified tightening torques and pre-coat contact areas (see Chapter 11.2).
- Observe the phase grouping of the switchgear panel.

- Fasten the individual cables to the appropriate connection surfaces (Fig. 33, item 1).
- Re-mount the base plates (Fig. 33, item 3).
- Fasten high-voltage cables to the floor opening using clamping assemblies (Fig. 33, item 2, and Fig. 34/Fig. 35).
- Connect the ground wires to the panel rack (Fig. 33, item 4).

---

**Fig. 33**
High-voltage connection
1. Cable connection on the panel
2. Clamping assembly for the cables
3. Base plates
4. Connection of the ground wires to the panel

**Clamping assembly for the cables**

- **Fig. 34**
  Clamping assembly for cables with a diameter of ≥ 40 mm

- **Fig. 35**
  Clamping assembly for cables with a diameter of ≤ 40 mm
7 Low voltage terminal

7.1 Connection of the ring circuits in the low-voltage cabinet

- Route the ring circuits for the inter-panel wiring through the lateral openings of the low-voltage cabinet (Fig. 36, item 2).
- Connect ring circuits to the appropriate terminal strips in the low-voltage cabinet according to the circuit diagram.

![Fig. 36](image)

Connection of low-voltage cable
1) Terminal strip
2) Openings for ring circuits in the low-voltage cabinet

7.2 Placing external cables in the switchgear panel

Customized low-voltage cables for control and measuring purposes can be placed for each panel on the left inside of the panels to the low voltage cabinet (Fig. 37).

- Remove the metal cable duct covers on the left & right side of the panel depending on the need (2).
- Remove the LV gland plate (4) and drill as per cable requirement.
- Route external cables (6) from the cable basement through the cutout in the panel floor (3) and route them in the cable duct to the low-voltage cabinet. Fasten cables to the panel using cable clamps (5).
- Connect external cables to the terminal strip in the low-voltage cabinet according to the circuit diagram (1).
- Reposition cable compartment covers.

Routing external cables from top of Low-voltage cabinet.

- Open the gland plate (7) provided on the top of low-voltage cabinet.
- Drill as per cable requirement
- Route the cables to the low-voltage cabinet.
- Connect external cables to the terminal strip in the low-voltage cabinet according to the circuit diagram (1).
- Reposition gland plate on the cabinet.

**Important:**

If the cables are to be routed into the low-voltage cabinet from above, the cable fastening and protection equipment must be provided by the customer.

![Fig. 37](image)

Placing external cables in the switchgear panel
1) Connection to terminal strip in the low-voltage cabinet
2) Cable duct covers
3) Cutout in the panel floor
4) Low-voltage gland plate
5) Cable clamp
6) Low-voltage cables
7) Gland plate in case the cables has to be routed from above the low-voltage cabinet
8 Commissioning

8.1 Final steps

Danger!
The high voltage supply must not be connected. All active parts must be earthed.

Important:
Whenever you detect anomalies, faults or malfunctions, do not commission the switchgear, but inform the manufacturer.

Cleaning the panel and checking panel assembly

- Clean the switchgear, removing contamination resulting from assembly work.
- Remove all the attached information tags, cards, brochures and instructions no longer needed.
- Check the tightening torques of all screw fastenings and connections established on the site of installation:
  - High-voltage connection
  - Earth conductor
  - Panel screw fastenings
  - Busbar links
  - Deflector fastening
  - Special attachments

Damaged paint
The panels are powder-coated. Minor damage to the paint can be repaired using commercially available paint (standard colour RAL 7032 or corresponding colour).

Re-mounting the covers
- Low voltage cables duct cover (see Chapter 7.2)
- Remove cable compartment cover (see Chapter 4.3).
- Remove temporary base from the panel top, if such a base has been used.
- Re-mount partition between busbar compartment and circuit-breaker compartment.

Inspection
- Check the switchgear for damage which might be due to transport or assembly work.
- Compare data on nameplate to the required ratings.
- Check the connected cables for phase coincidence

Racking-in the trucks
Rack the following components into the panel:
- Circuit-breaker truck HVX-O
- Isolating truck UTX-O
- Metering truck MTX-O

Close front doors (see Chapter 4.2.1).
8 Commissioning (contd.)

8.2 Checking switching functions and interlocks

**Danger!**
The High-voltage supply must not be connected. All active parts must be earthed

**Important:**
- For switching operations, comply with Chapter 9 “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 under voltage 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.

Apply supply voltage.

- Perform several manual test operations with each switching device.
- Check switch position indicators.
- Check electrical functions of control and operating devices:
  - Closing and opening releases for circuit-breaker
- Check switch position indicators and interlocks (see Chapter 9 “Operation”).

8.3 Power frequency test of busbar (Optional)

**Danger!**
The High-voltage supply must not be connected. All active parts must be earthed

A test unit and a test adapter (not included in scope of supplies) are required for the power frequency test.

**Preparation**

- All panels must be isolated from the power supply and earthed (see Chapter 9.9).
- Busbar: Disconnect voltage transformers (MTX) and surge arrester.

**Earth voltage detection systems.**

- Incoming feeder panel for voltage test:
  Remove cable connection compartment cover and disconnect voltage transformers and surge arrester. Earth voltage detection systems.

**Important:**
Make sure that no high-voltage cables are connected. Observe the assembly and operating instructions for the test unit and the test adapter.
Perform the power frequency test of the busbar on the feeder panel:
- Connect test unit to the test cable.
- Switch the earthing switch OFF.
- Move circuit-breaker truck HVX service position and switch circuit breaker ON.
- Perform the power frequency test successively for all three phases (L1, L2, and L3) in accordance with the specifications of the test unit manufacturer.

**Important:**
Observe admissible test values for the switchgear and the admissible test values for power-frequency tests after installation of the switchgear in accordance with IEC 62271-200.

---

**Fig. 38**
Switch position during the power frequency test (example: five panels)
1) Branch-circuit panels
2) Incoming feeder panel for test voltage
3) Busbar
4) Test unit (e.g. high-voltage source, test transformers)
5) Test cable

---

**After the power frequency test**
- After the power frequency test:
  - Switch circuit-breaker OFF and put circuit-breaker truck to disconnected position; switch earthing switch ON.
  - Remove test unit and test cables.
  - Reconnect disconnected voltage transformers and surge arresters.
9 Operation

9.1 Operating interface of the panel

1. Feeder Nameplate
2. Rating plate
3. Handle for pulling door
4. Operating handle for door locking & unlocking
5. Switching circuit-breaker ON
6. Inspection glass
7. Opening for manual charging of the circuit-breakers energy storing device
8. Option for defeating the close door interlock (to be operated only by authorized person)
9. Insertion opening for raking the truck in/out manually
10. Slide for opening the insertion opening (9) for racking the truck in and out
11. Window for checking Test / Service indication
12. Low-voltage cabinet with control unit
13. Handle for pulling door
14. Locking for low-voltage cabinet door.
15. Switching circuit-breaker OFF

Fig. 39
Operating interface of a PIX-36 Panel

9.2 Operating interface of trucks

9.2.1 Vacuum circuit breaker HVX-O

1. Casing for high voltage components
2. Circuit-breaker housing
3. Rating plate
4. Operator interface
5. Low voltage socket
6. Rollers
7. Withdrawable unit
8. Insertion opening for crank to move the circuit-breaker into its disconnected/ service position/ manually
9. "IP" protection sheet
10. Shutter rails
11. Floor-rolling trolley

Fig. 40
Vacuum circuit-breaker HVX-O
9.2.2 Isolating truck UTX-O

1. Casing for high voltage components
2. Circuit-breaker housing
3. Rating plate
4. Low voltage socket
5. Rollers
6. Withdrawable unit
7. Insertion opening for crank to move the truck into its disconnected/service position/manually
8. "IP" protection sheet
9. Shutter rails
10. Floor-rolling trolley

9.2.3 Metering truck MTX-O

1. PT fuse contacts
2. Voltage transformers
3. Rating plate
4. Low voltage socket
5. Rollers
6. Withdrawable unit
7. Insertion opening for crank to move the truck into its disconnected/service position/manually
8. "IP" protection sheet
9. Shutter rails
10. Floor-rolling trolley
9.3 Operation accessories

**Important:**
These accessories are supplied with the panel. The panel may only be operated by means of these accessories.

---

**Fig. 43**
Standard double-bit key to lock/unlock the door of the low-voltage cabinet
Item no. SEM 101137-01

**Fig. 44**
Crank to charge the circuit-breaker’s energy-storing device
Item no. MVIA00207-01

**Fig. 45**
Operating rod to switch the circuit breaker ON and OFF
Item no. MVIB00775-01

**Fig. 46**
Rack-IN/OUT handle for Truck
Item no. VDRG00157-02

**Fig. 47**
Operating lever for the earthing switch
Item no. VDRB05405-01
9.4 Interlocks

**Important:**
Complete switchgear interlocking can only be ensured with complete locking devices.

PIX-36 panels have mechanical basic interlocks which help avoid operating errors. You must be familiar with these interlocks before operating panels.

### 9.4.1 Mechanical interlocks

<table>
<thead>
<tr>
<th>Interlocks</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</td>
<td>The rotary movement of the truck crank is blocked after one rotation. Do not apply force.</td>
</tr>
<tr>
<td></td>
<td>The low voltage plug cannot be removed when the truck is not in disconnected position</td>
<td>The low voltage plug is locked.</td>
</tr>
<tr>
<td>Between truck and earthing switch</td>
<td>The truck cannot be racked in if the earthing switch is ON</td>
<td>The movement of the truck is blocked. Do not apply force.</td>
</tr>
<tr>
<td></td>
<td>The earthing switch can no longer be switched ON if the truck has left its disconnected position</td>
<td>The insertion of the earthing switch lever is blocked.</td>
</tr>
<tr>
<td>Between the circuit breaker and the truck</td>
<td>Circuit-breaker cannot be racked in or out while it is switched on</td>
<td>The rotary movement of the truck crank is blocked after one rotation. Do not apply force.</td>
</tr>
<tr>
<td></td>
<td>Circuit-breaker cannot be switched on/off unless the truck is completely in its disconnected or service position</td>
<td>The circuit-breaker cannot be switched on or off.</td>
</tr>
<tr>
<td>Between truck and cubicle</td>
<td>If the truck front frame is not locked in the cubicle, the truck cannot be actuated.</td>
<td>The handle cannot be inserted to the truck if both truck handles in the front frame are not moved outwards. Rotation of the crank not possible if both truck handles in the front frame are not moved outwards.</td>
</tr>
<tr>
<td></td>
<td>If the truck has left its disconnected position the truck front frame cannot be unlocked in the cubicle.</td>
<td>Both truck handles in the front frame are locked.</td>
</tr>
<tr>
<td>Between the truck and front door (optional)</td>
<td>The front door can only be opened if the truck is in its disconnected position.</td>
<td>Door is latched with the truck. However handle can be operated.</td>
</tr>
<tr>
<td></td>
<td>If the front door is opened, the truck cannot be moved into service position.</td>
<td>The crank cannot be inserted to the truck if the front door is opened.</td>
</tr>
<tr>
<td>For the truck disconnected position (optional castle lock)</td>
<td>CB can be moved to service position only when key is inserted in the lock. Key is blocked in the lock when CB is in service position</td>
<td>LV plug insertion is blocked by the lock and is possible only when key is inserted. Key cannot be taken out unless LV plug is disconnected. LV plug cannot be disconnected when CB is in service position.</td>
</tr>
</tbody>
</table>
## 9.4.2 Interlocks (Cable earthing switch)

<table>
<thead>
<tr>
<th>Interlocks</th>
<th>Function of Interlock</th>
<th>Method of operation of Interlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomer /Outgoing Cubicle (Mechanical castle key lock optional)</td>
<td>Castle key lock fixed on the cubicle. Key required to operate ES. Insertion of ES operating handle is blocked by the key lock.</td>
<td>The key lock prevents the operation of earthing switch lever until key is inserted. (Key should be brought from upstream / downstream)</td>
</tr>
<tr>
<td>Incomer Cubicle (Electrical)</td>
<td>The insertion of the earthing switch operating handle is blocked using solenoid if cable is energized.</td>
<td>Supply to the solenoid is possible when there is no presence of voltage in incoming side.</td>
</tr>
<tr>
<td>Outgoing Cubicle (Electrical) Optional</td>
<td>The insertion of the earthing switch operating handle is blocked using solenoid if cable is energized. Can be adapted the interlock as per customer requirements.</td>
<td>Supply to the solenoid is possible when there is no presence of voltage in incoming side. As per specific customer requirements.</td>
</tr>
</tbody>
</table>

## 9.4.3 Interlocks (Bus earthing switch)

Interlocks (Bus earthing switch for Bus PT / Bus Earthing)

<table>
<thead>
<tr>
<th>Interlocks</th>
<th>Function of Interlock</th>
<th>Method of operation of Interlock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus PT &amp; Bus Earthing cubicle (Mechanical) key lock All feeders of same bus shall be in disconnected position</td>
<td>Key lock fixed on the cubicle. Key required to switch on ES Insertion of ES operating handle is blocked by the key lock.</td>
<td>Set of keys gets free from all cubicles, once all CB's are in disconnected position. The master key is released from the key junction box by inserting the above set of keys, which is used for switching ES in bus pt or bus earthing cubicle.</td>
</tr>
<tr>
<td>Bus PT &amp; bus coupler cubicle (Electrical) optional All feeders of same bus shall be in disconnected position</td>
<td>The insertion of the earthing switch lever is blocked using solenoid. Unless all CB of all cubicle are completely in its disconnected position.</td>
<td>The solenoid plunger prevents the operation of earthing switch until it gets supply when all CB's of all cubicles are completely in its disconnected position. Supply to the solenoid is possible when there is no presence of voltage in bus side.</td>
</tr>
</tbody>
</table>
9.4.4 Electromagnetic interlocks (optional)
Electromagnetic blocking coils can be used for inter-panel as well as intra-panel interlocks:
- The circuit-breakers ON and OFF pushbuttons are blocked.
- Manual actuation of the earthing switch is blocked.

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

9.4.5 Interlock with padlock (Optional)
The holes are designed so that the shackles of padlocks with a diameter of max. 8 mm can pass through them.

9.5 Operating specifications
The switchgear unit may only be operated by specialist electricians who have proven experience (training certificate) in conjunction with the PIX-36 panels and all the relevant safety standards. Refer also to the safety provisions in Chapter 1.

Danger!
To rule out 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:
- While the power supply is not available, blocking coils (locking the interrogation slides and circuit-breaker push-buttons, depending on design), are in “locked” position. An under voltage release (optional) has dropped out. Measure: Re-establish the supply voltage.
- After each switching operation for which you have used a crank or a lever, remove this tool and store it in the tool board.
9.6 Operating the Circuit-breaker

9.6.1 Operator interface

1. OFF button (rocker “O”) or push button “O”
2. ON button (rocker “I”) or push button “I”
3. Rating plate
4. Operations counter
5. Position indicator of circuit-breaker
6. Position indicator of closing spring
7. Insertion opening for charging the closing spring

Fig. 51
Operator interface of HVX circuit-breaker

9.6.2 Charging the circuit-breaker’s energy storing device

Initial situation:
- Circuit-breaker OFF
- Energy-storing device released

Charging by hand

- Move the slider to the left and hold it (Fig. 53, item 1) and insert the crank (Fig. 52 and Fig. 53, 2).
- Turn the crank in clockwise direction until the charge drive mechanism is uncoupled (sound). The energy storing device indicates the “charged” condition through the inspection glass.
- Remove crank.

Charging via motor

The energy-storing device is charged automatically as soon as the motor’s supply voltage is applied. The position indicator of the energy storing device indicates the “charged” condition through the inspection glass.
## 9.6.3 Switching the circuit-breaker manually

### Switching ON via the operating rod

Insert the operating rod (Fig. 54 and Fig. 55) into the guide provided on the door and press it to perform the circuit breaker “ON” operation.

Confirm the circuit breaker “ON” status provided on the Circuit breaker by viewing window on the door.

The energy storing device can be charged immediately after switching ON (manually or by motor). If supply voltage is present, the energy storage device is charged automatically.

### Switching OFF via the operating rod

Insert the operating rod (Fig. 54 and Fig. 56) into the guide provided on the door and press it to perform the circuit breaker “OFF” operation.

Confirm the circuit breaker “OFF” status provided on the Circuit breaker by viewing window on the door.
9.6.4 Switching the circuit-breaker electrically

Switching ON (Closing)

Actuate closing release via bay computer or remote control. The energy storing device can be charged immediately after switching ON (manually or by motor). If voltage is applied to the motor, charging is performed automatically.

Switching OFF (Opening)

- Actuate the opening release via the bay computer or the remote control
- Under voltage release or
- Secondary release

9.6.5 Position indicators on circuit-breaker and possible operating sequences

<table>
<thead>
<tr>
<th>Item</th>
<th>Position indicator Energy-storing device (closing spring)</th>
<th>Position indicator ON/OFF Switch position</th>
<th>Possible operating sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>released</td>
<td>OFF</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>charged</td>
<td>OFF</td>
<td>C – O</td>
</tr>
<tr>
<td>3</td>
<td>released</td>
<td>ON</td>
<td>O</td>
</tr>
<tr>
<td>4</td>
<td>charged</td>
<td>ON</td>
<td>O – C - O</td>
</tr>
</tbody>
</table>

C = Closing (ON)  
O = Opening (OFF)
9.7 Move truck into operating/disconnected position

Warning! Isolating truck UTX should only be racked in or out if busbar and outgoing feeder cable are in de-energized condition.

Initial situation:
- Circuit-breaker OFF
- Earthing switch OFF

9.7.1 Racking-in the truck from disconnected into service position

- Move the slider (Fig. 57, item 1) to the left and hold it. Insert handle through the opening in the door onto the drive shaft of the truck (2).
- Turn crank clockwise until the truck has been racked in (Fig. 58). Remove crank.
- Check position of truck (Fig. 58) through the inspection glass (Fig. 57, item 3).

9.7.2 Racking-out the truck from service into disconnected position

- Press the slide (Fig. 59, item 1) to the left and hold it. Insert handle through the opening in the door onto the drive shaft of the truck (2).
- Turn crank counter-clockwise until the truck has been racked out (Fig. 60). Remove crank.
- Check position of truck (Fig. 60) through the inspection glass (Fig. 59, item 3).
9.8 Operating the earthing switch

9.8.1 Switching the earthing switch ON

Initial situation:
- Circuit-breaker OFF
- Earthing switch OFF
- Truck In disconnected position

- Rotate the flap anticlockwise to access the operating shaft.
- Insert the operating handle.
- Rotate the handle by 90 degrees (anticlockwise) to close the earthing switch.
- Ensure the earthing switch is “ON” by viewing from rear cover.
- Remove operating handle.

9.8.2 Switching the earthing switch OFF

Initial situation:
- Circuit-breaker OFF
- Earthing switch ON
- Truck In disconnected position

- Insert the operating handle.
- Rotate the operating handle by 90 degrees (clockwise.)
- Ensure the earthing switch is “OFF” by viewing from rear cover.
- Remove operating handle.
- Close the flap completely (clockwise).

9.8.3 Switching the earthing switch ON in case of solenoid interlock

Initial situation:
- Circuit-breaker OFF
- Earthing switch OFF
- Truck In disconnected position

- Press and hold the push button to gain access.
- Rotate the flap anticlockwise to access the operating shaft.
- Insert the operating handle.
- Rotate the handle by 90 degrees (anticlockwise) to close the earthing switch.
- Ensure the earthing switch is “ON” by viewing from rear cover.
- Remove operating handle.

Dont’s

- Do not attempt to rack in the breaker if earthing switch is “ON”.
- Do not attempt to close the earthing switch if the circuit breaker is in “SERVICE” position.
- Do not attempt to force open the flap, Ensure circuit breaker is in “TEST” position.
- Do not forcibly rack in the circuit breaker, Ensure earthing switch is “OFF” and flap is completely closed.
- Do not release the push button after inserting the handle and before earthing switch closing (in case of solenoid interlock).
9.9 Standard switching operations

Important:
Observe switching provisions (Chapter 9.5) and interlocking conditions (Chapter 9.4).

9.9.1 Operating the outgoing feeder cable

Initial situation:
- Circuit-breaker OFF
- Truck HVX in disconnected position
- Earthing switch OFF

Switching outgoing feeder cable ON
- Move truck into service position (Fig. 62, item 1).
- Switch circuit-breaker ON (2).

Switching outgoing feeder cable OFF
- Switch circuit-breaker OFF.
- Move truck into disconnected position.

9.9.2 Earthing the outgoing feeder cable

Initial situation:
- Circuit-breaker OFF
- Truck HVX in disconnected position
- Earthing switch OFF

Earthing the outgoing feeder cable
- Check the branch circuit for zero voltage
- Switch the earthing switch ON (Fig. 63, item 1).

De-earthing
Switch the earthing switch OFF

9.9.3 Coupling busbar sections using the bus section coupler

With HVX truck and direct bus riser

Initial situation:
- Circuit-breaker OFF
- Truck HVX in disconnected position

Coupling busbar sections
- Move truck into service position (Fig. 64, item 1).
- Switch circuit-breaker ON (2).

Uncoupling
- Switch circuit-breaker OFF.
- Move truck into disconnected position.
9.10 Earthing the busbar with busbar earthing switch

**Important:**
- Observe switching provisions (Chapter 9.5) and interlocking conditions (Chapter 9.4).
- Check the busbar for zero voltage

**Initial situation:**

-- Busbar earthing switch OFF

**Earthing the busbar**

Switch the earthing switch ON (Fig. 65, item 1).

**De-earthing**

Switch the earthing switch OFF
10 Maintenance

10.1 Safety provisions

Maintenance and repair work may only be performed by specialist electricians who have proved their experience with the PIX-36 series and the applicable safety provisions.

![Warning! Comply also with the safety provisions in chapter 1.]

10.2 Maintenance and servicing specifications

PIX-36 indoor switchgear units have been designed for normal operating conditions in accordance with IEC 62271-1. It is recommended to check the panels visually at regular intervals depending on the strain they are subject to during operation and in accordance with the 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 panels for contamination, condensation and damage, to be performed by certified staff. If there are traces of contamination or condensation, the panels must be cleaned in expert fashion (see Chapter 10.3 and Chapter 10.4) and subsequently the drives, interlocks and position indicators checked for proper functioning (see Chapter 9 “Operation”). If damage is detected on the panels, these must be repaired or components are replaced (see Chapter 10.5 and Chapter 10.6).

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

<table>
<thead>
<tr>
<th>Maintenance interval</th>
<th>Work to be carried out</th>
<th>Qualification / Work performed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 4 years</td>
<td>- Clean and grease drives and movable main current contacts (see Chapter 10.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Check releases and blocking coils for proper function</td>
<td>Staff who have been certified for this work</td>
</tr>
<tr>
<td>After 1,000 actuations of the truck or the earthing switch</td>
<td>Revision of the switching device in question</td>
<td>Staff who have been certified for this work</td>
</tr>
<tr>
<td>Truck Circuit-breaker HVX-O</td>
<td>Refer to the applicable instruction manual for the truck concerned</td>
<td>Service Center of the manufacturer</td>
</tr>
<tr>
<td>Metering truck MTX-O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolating truck UTX-O</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10.3 Cleaning

Warning! Risk of injury: the drives must not be disassembled for service and maintenance work.

To ensure the specified insulating level, the insulating components must be clean. On principle, cleanliness deserves utmost attention. When deposited dirt is detected, the panels must be cleaned in an expert fashion.

When cleaning, make sure that the lubrication in the drive mechanisms is not removed. If the drive mechanisms are no longer sufficiently lubricated, new lubrication must be applied.

Use a dry cleaning cloth to remove slight soiling:

- Clean using a dry, lint-free cloth. Depending on the degree of soiling, replace cloth as often as necessary.
- Use cleaning agents for severe soiling:
  - Cleaning agent (see Chapter 10.1). 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.

10.4 Avoiding condensation

To ensure the specified insulating level, the switchgear panels – especially their insulating components – must not be exposed to condensation.

Measures to take in case of condensation:

- Should condensation be detected in or on the panels, clean the panels in accordance with Chapter 10.3).
- Installation or inspection of panel heating. It must provide a sufficient heating performance to prevent condensation on the panels.
- Condensation can also be prevented by ensuring suitable ventilation and heating of the station or by using de-humidification devices.

10.5 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.

10.6 Replacement of components and panels

The drive mechanisms, current transformers and voltage transformers as well as the testing and monitoring systems can be replaced if necessary. Also, entire panels can be replaced.

Should you have any queries regarding replacement of components or panels, please contact the manufacturer’s Service Center.

The data on the nameplate are relevant for replacement of components or panels or in case of any queries (see also Chapter 2.7).
10.7 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
  - Push switches
  - Blocking coils
  - Auxiliary switches.
- Only approved lubricants may be used (see Chapter 11.1).

**Lubrication**

<table>
<thead>
<tr>
<th>Lubrication points (see also Fig.66)</th>
<th>Lubricants (refer to Annex)</th>
<th>Lubrication procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sliding contact surfaces</td>
<td>Synthetic lubricant</td>
<td>Apply a thin and uniform film of lubricant.</td>
</tr>
<tr>
<td>All accessible friction points and sliding surfaces</td>
<td>Synthetic lubricant</td>
<td>Clean lubrication points with lint-free cotton cloth; apply a thin film of lubricant (using e.g. a paintbrush).</td>
</tr>
<tr>
<td>Bearings and joints</td>
<td>Liquid lubricant</td>
<td>Pour drops of liquid lubricant (oil can, drip feed lubricator) into the bearing gap. Liquid lubricant gets between the bearing surfaces due to the capillary effect. In case of inaccessible lubrication points, use an extension tube or spray.</td>
</tr>
</tbody>
</table>

Once maintenance work is complete
- Remove all the tools and auxiliary equipment used.
- Reinsert truck into the panel (see Chapter 4.2.4).
- Reposition covers, close doors and check switching functions (see Chapter 8 “Commissioning”).
10.8 Replace fuses for voltage transformers

Voltage transformers in outgoing feeder cable

- Isolate outgoing feeder cable from the power supply and earth it.
- Remove cable compartment cover (see Chapter 4.3.1).
- Insert PT ramp on the rear end of panel.
- Push the trolley handles inwards & pull the PT trolley outside of the panel.
- Remove the PT contact & pull fuse carefully out of the PT.
- Coat all contact areas (see Chapter 11 “Annex”) and insert new fuses & assemble the PT contact.
- Re insert the PT trolley in to the cable chamber.
- Ensure the trolley is locked by pushing the handles outwards.
- Mount cable compartment cover again.
11.1 Auxiliary products

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

**Warning!**
Risk of injury: the drives must not be disassembled for service and maintenance work.

<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 ST 312-111-835</td>
<td></td>
</tr>
<tr>
<td>Liquid lubricant FL, 0.5 kg can S 008153</td>
<td></td>
</tr>
<tr>
<td>Touch-up pen RAL 7044, silk-grey, 50 ml S 009 561</td>
<td></td>
</tr>
<tr>
<td>Touch-up pen, special paint (specify colour shade)</td>
<td>S 009 562</td>
</tr>
</tbody>
</table>

11.2 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 screw fastening (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 surface⁴</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Clean¹, expose metallic surface⁴</td>
</tr>
<tr>
<td>Steel</td>
<td>Clean¹, expose metallic surface⁴</td>
</tr>
<tr>
<td>Zinc-plated steel</td>
<td>Clean¹, passivation need not be removed</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 Scotch brite abrasive agent (Ni layer must not be reduced)
11.3 Specifications for screw connections

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

**Screw fastening for power transmission**

Screws and bolts: Grade ≥ 8.8

<table>
<thead>
<tr>
<th>Conductor material: copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread Ø</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>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>
11.4 Required tools (not included in the scope of supplies)

- Cutter
- Nail puller
- Approved torque wrenches with different bits for hexagon socket screws and socket-head screws and nuts; bits for screw and nut grades M 5, M 6, M 8, M 10, M 12
- Screwdriver and Philips screwdriver
- Cutting pliers
- 4 crane straps/chains of L \( \geq 2000 \) mm each, capacity \( \geq 1500 \) kg
- lint-free, clean rags

11.5 List of assembly drawings

List of all assembly drawings specified in Chapter 5 “Assembly”.

This does not apply to special modules or customer-specific special designs.

According to the switchgear configuration in question, only such drawings from the list are supplied by the factory as are actually required.

<table>
<thead>
<tr>
<th>Description</th>
<th>Assembly drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening on concrete foundations</td>
<td>VDRB05605-04</td>
</tr>
<tr>
<td>Screw-fastening the switchgear panels</td>
<td>VDRB05614-01</td>
</tr>
<tr>
<td>Transportation of panels</td>
<td>VDRB05614-02</td>
</tr>
<tr>
<td>Busbar assembly</td>
<td>See Annexure “A”</td>
</tr>
<tr>
<td>Mounting deflector for IAC</td>
<td>See Annexure “B”</td>
</tr>
<tr>
<td>Mounting tunnel for IAC</td>
<td>See Annexure “C”</td>
</tr>
</tbody>
</table>
A.1 Busbar assembly for

- Cubicle rating: \( \leq 1250 \text{A} \) &
- Busbar rating: \( \leq 1250 \text{A} \)

Shroud removed to show connections
A.2 Busbar assembly for

- Cubicle rating: \( \leq 1250A \)
- Busbar rating: \( 1250 \geq 2000A \)
A.3 Busbar assembly for

- Cubicle rating: 2000A
- Busbar rating: 2000A

Shroud removed to show connections
B.1 Deflectors are necessary to ensure personal safety in case of Internal Faults in accordance with IEC 62271-200.

- Internal Arc Classification: AFLR
- Rating: 31.5kA 0.1 sec
- Accessibility Type A: Restricted to authorized personnel only. F for Front side Accessibility; L for Lateral side Accessibility; R for Rear side Accessibility.

Before performing work on the panel, it is essential to 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.

**Warning!**
Risk of injury due to movable parts in mechanical drives. For maintenance work:
- Isolate from supply voltage
- Release the circuit breakers energy storing device by switching it OFF-ON-OFF
- Close via the earthing switch.

**Warning!**
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel.

When work has to be performed on the panel top - e.g. assembly of deflectors – temporarily position a solid base plate to step on.
Annexure B

Step 1: Start from one end of the switch board, first assemble the front deflector (Part No.1) on top of the end panel.
Step 2: Assemble the side deflectors (Part No.2 & 3) on top of the end panel.
Step 3: Assemble the rear deflector (Part No.1) on top of the end panel.
The detailed corner assemblies are shown below.
Step 4: Assemble the front supports (Part No.6) followed by the front and rear deflectors (Part No.1) for the adjacent panel.
Repeat Step 4 for all the panels in the switchboard starting from one end.
Step 5: Assemble the side deflectors (Part No. 2 & 3) on top of the end panel.
Step 6: Assemble the side supports (Part No.4 & 5) as given in detail in Step 3.
The complete assembly will be as shown below. (Incase of all standard / all extended panels)
The complete assembly will be as shown below. (In case of combination of different depth panels)
The below steps are additional for Top Cable Entry Panel only.

Step 7: If the top cable entry panel is the end panel, in addition to the side deflectors (Part No.2 & 3) assemble side deflector (Part No. 6) on top of the end panel.
Step 8: Then assemble the rear deflector (Part No.1) as given in Step No.3 behind the gland plate for top cable entry, followed by the side support (Part No. 4 or 5) as given in Step No.4 depending on whether it is the left or right end panel.

Then assemble the side deflector (Part No.6) if the adjacent panel is a standard depth panel, else follow Step no.4.
Step 9: Depending on the adjacent panel follow Step 8 – if adjacent panel is of different length or Step 4 – if adjacent panel is of same length.

The complete assembly will be as shown below.
The complete assembly will be as shown below.
Annexure C

C.1 Arc ducts is necessary to ensure personal safety in case of Internal Faults in accordance with IEC 62271-200.

<table>
<thead>
<tr>
<th>Internal Arc Classification</th>
<th>AFLR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>31.5kA, 1 sec</td>
</tr>
<tr>
<td>Accessibility Type A</td>
<td>Restricted to authorized personnel only.</td>
</tr>
<tr>
<td></td>
<td>F for Front side Accessibility;</td>
</tr>
<tr>
<td></td>
<td>L for Lateral side Accessibility;</td>
</tr>
<tr>
<td></td>
<td>R for Rear side Accessibility.</td>
</tr>
</tbody>
</table>

Before performing work on the panel, it is essential to 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.

**Warning!**
Risk of injury due to movable parts in mechanical drives. For maintenance work,
- isolate from supply voltage
- release the circuit breakers energy storing device by switching it OFF-ON-OFF
- Close via the earthing switch.

**Warning!**
The top sides of the panels are not meant to be walked on. Persons may fall through them, get injured or may damage the panel. When work has to be performed on the panel top - e.g. assembly of deflectors – temporarily position a solid base plate to step on.
Step 1: Top Duct Assembly for each individual panel.
First assemble the top duct of the panel as per the order mentioned below.

1. Part No.1 - 1 Quantity
2. Part No.2 - 4 Quantity
3. Part No.3 - 1 Quantity
Step 2: Start from one end of the switch board, assemble the rear support (Part No. 4) on the panel. Then mount the assembled top duct on top of the panel as shown.
Step 3: Assemble the coupling joints (Part No.5 & 6) under the top duct towards the side of the adjacent panel as shown.
Next repeat Step 1 & 2 for the adjacent panel. Then couple together the top ducts of the two adjacent panels.
Annexure C

Step 4: Determine on which side – left or right – the tunnel would exit. The tunnel end cover would be on the opposite side.

Assemble the tunnel end cover (Part No.7) with the top duct on the side as shown.
Step 5: Towards the tunnel exit, first assemble the extension cutout for duct (Part No.8) with the top duct and then assemble to it the duct of 1m length (Part No.9) as shown.
Annexure C
Step 6: Next assemble the Duct to Duct Joint (Part No. 10) under the duct before assembling another duct of 1 meter length (Part No. 9) as shown.

The manufacturer recommends a minimum duct length of 2 meter.

If the duct is longer than 2 meter then follow the same procedure as given in Step 5 for each successive duct.
Step 7: Next assemble the angular duct with flap (Part No. 11) at the end of the duct as shown.
Annexure C

The complete assembly will be as shown below.
The below steps are additional for Top Cable Entry Panel only.

**Step 8:** Assemble the vertical side deflector (Part No.12) and rear end vertical deflector (Part No.13) behind the gland plate for top cable entry as shown.
Step 9: If the adjacent panel is a Top Cable Entry panel then first assemble the rear support (Part No. 14) and then assemble the rear end vertical deflector (Part No. 13) and finally the vertical side deflector (Part No. 12).
If the adjacent panel is not a Top Cable Entry Panel then assemble another vertical side deflector (Part No.12) only.

The complete assembly will be as shown below.