Medium Voltage Distribution

PIX

12–17–24 kV
Air-insulated switchgear with vacuum switching devices

Installation Operation Maintenance Technical Manual

Nr. AMTNoT 060-02
Edition 03/2009

www.schneider-electric.com

Schneider Electric

Schneider Electric
35, rue Joseph Monier
CS 30323
92506 Rueil-Malmaison Cedex, France

www.schneider-electric.com

Manufacturer:
Schneider Electric Sachsenwerk GmbH

Service:
Should you have any queries as to our service, please contact:
Schneider Electric Sachsenwerk GmbH

Content

Content (contd.)

Content (contd.)

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, assembly, operation and maintenance of air-insulated medium-voltage switchgear of the PIX series. It is exclusively intended for use by the manufacturer's staff or by persons certified for the PIX series (training certificate).
This Technical Manual is an integral part of the product and must be stored in such a way 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.

Further applicable documents

The following additional documents must be observed for this switchgear:
- sales agreement with the stipulations regarding the switchgear-specific equipment 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 indicators, devices in low-voltage compartment)
- the assembly drawings supplied with the switchgear
- the assembly instructions of the manufacturer of the cable connection systems to be connected to the switchgear
- the assembly and operating instructions of the trucks / additional equipment used:
  - Circuit-breaker HVX with $U_r \leq 24$ kV, $I_r \leq 2500$ A (No. AGS 531301-01)
  - Circuit-breaker HVX with $U_r \leq 17.5$ kV, $I_r \leq 2500$ A (No. AGS 531461-01)
  - Metering truck MTX (No. AGS 531361-01)
  - Disconnector truck UTX (No. AGS 531361-01)
  - Vacuum contactor CVX (No. NTV 133)
  - Voltage transformer truck in cable compartment (can be racked out) (No. AGS 531505-02)
  - PIX Additional Equipment (No. AMTNoT 077-02)
- Motor Control Center with $U_r \leq 7.2$ kV (No. AGS 531500-02)

Terms and symbols used

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

„Warning"
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.

Remarks on this manual (contd.)

Abbreviations used

“PIX 12”:
PIX switchgear for rated voltage U_r = 12 kV
“PIX 17”:
PIX switchgear for rated voltage U_r = 17.5 kV
“PIX 24”:
PIX switchgear for rated voltage U_r = 24 kV

“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

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

Applicable standards and regulations:

- Common regulations for high-voltage switchgear and control gear: IEC 62271-1
- The locally applicable accident prevention, operating and work instructions must be complied with.
- Installation: IEC 61936-1 / HD 637 S11
- Operation of electrical equipment: EN 50110-11

[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, make sure that you comply with the following instructions:

Warning!
Before starting work on high-voltage components, de-energize the system, verify it for zero voltage and earth the system in accordance with the applicable safety rules pursuant to EN 50110-1.

Warning!
After removal of covers, operator safety in accordance with IEC 62271-200 may be restricted if the appropriate part of the switchgear panel has not been isolated from the power supply.

Warning!
Before performing work on the drive mechanism, switch off the supply voltage and prevent it from reclosing.

Warning!
There is a risk of injury when working on the drive mechanism. Before starting work, release the energy-storing device by
- an OFF–ON–OFF operating sequence for the circuit breaker and
- closing via the make-proof earthing switch.

Behaviour in case of incidents or accidents

For the case of an internal fault, the PIX switchgear features pressure relief flaps which prevent the panels and the switchgear 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 Design and description

2.1 Panel design

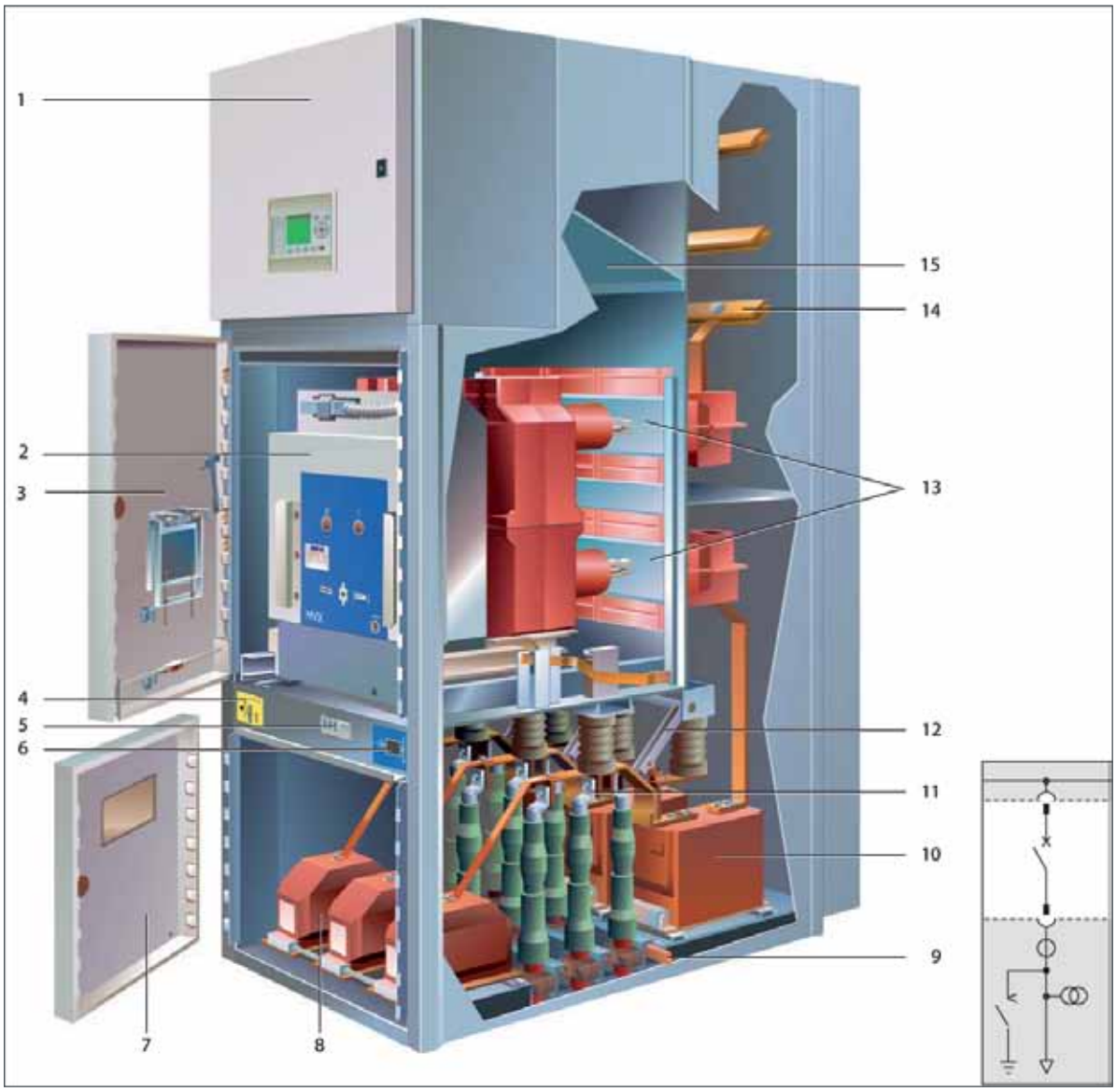


Fig. 2.1
Feeder panel PIX 12 with circuit-breaker truck HVX (for rated currents ≤ 2500 A)

1 Low-voltage compartment
2 Circuit-breaker truck HVX
3 Front door
4 Earthing switch control element
5 Voltage indicator
6 Position indicator of earthing switch
7 Cable compartment cover
8 Voltage transformer (optional)
9 Earth bar
10 Current transformer
11 Cable connections
12 Make-proof earthing switch
13 Shutter
14 Busbars
15 Pressure relief flap of switching device compartment

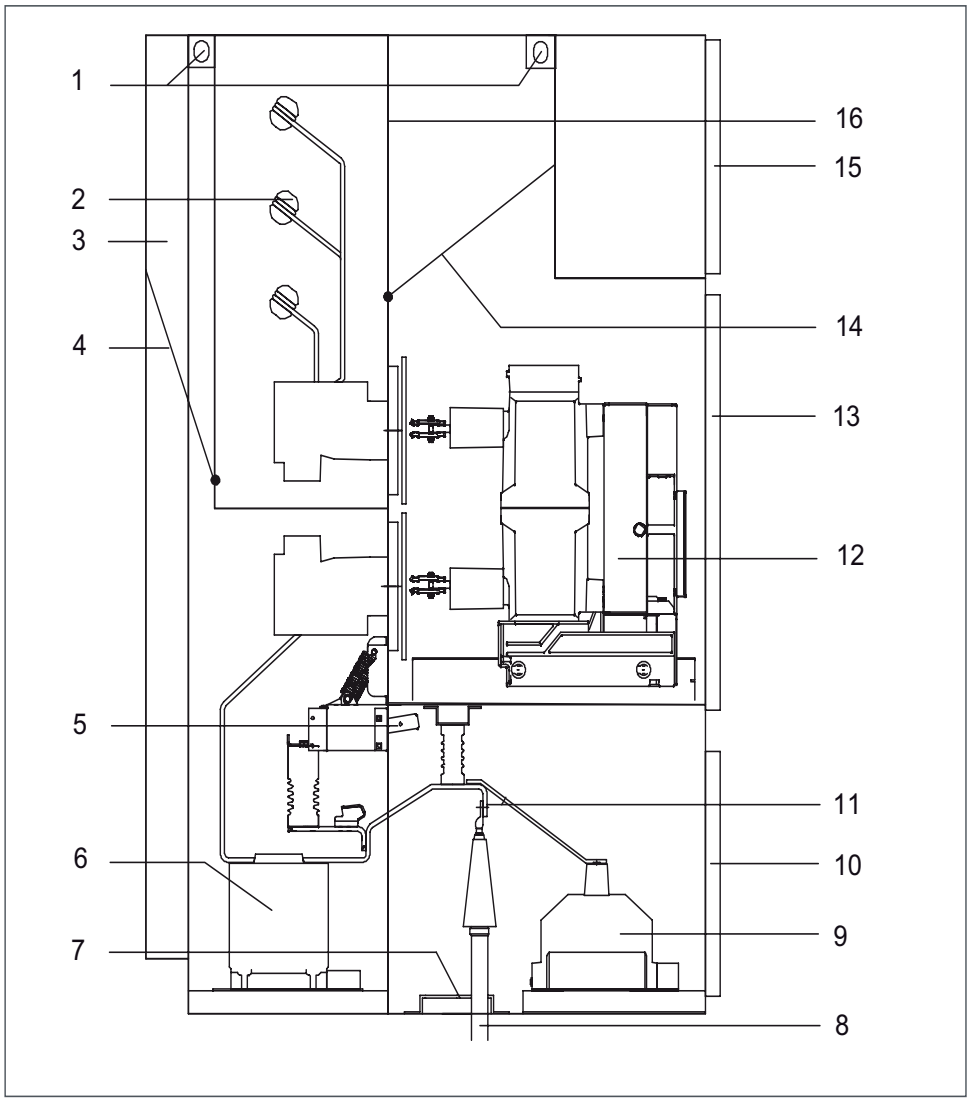


Fig. 2.2
Feeder panel with circuit-breaker truck HVX (for rated currents ≤ 2500 A)

1 Jack rings for transport harness
2 Busbars
3 Pressure relief duct
4 Pressure relief flap of cable compartment
5 Earthing switch
6 Current transformer
7 Cable fastening
8 High-voltage cable
9 Voltage transformer (optional)
10 Cable compartment cover
11 Cable connection
12 Circuit-breaker truck HVX
13 Front door
14 Pressure relief flap of switching device compartment
15 Door of low-voltage compartment
16 Pressure relief flap of busbar compartment

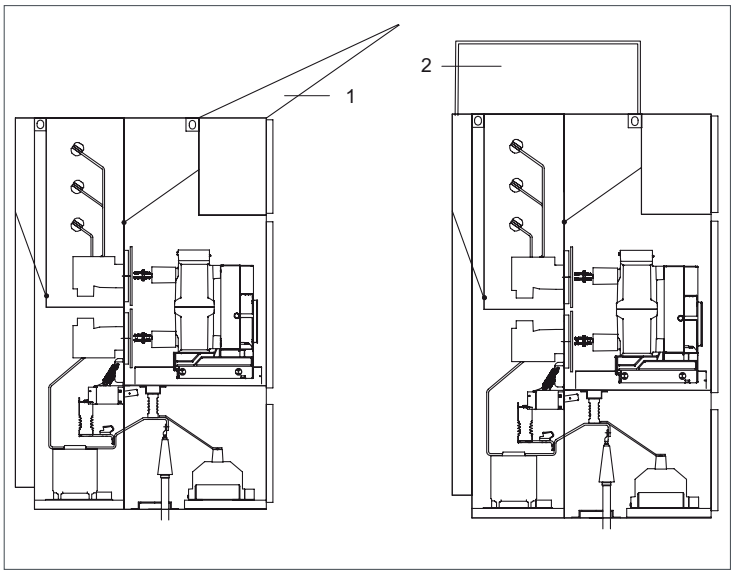


Fig. 2.3
Panel with internal arc classification (IAC)
1 Deflector
2 Pressure relief duct

2.2 Panel variants

The subchapters always show panel types with the appropriate basic equipment.
Customized models with additional equipment are described in the switchgear-specific documentation.

2.2.1 Feeder panels with switching devices

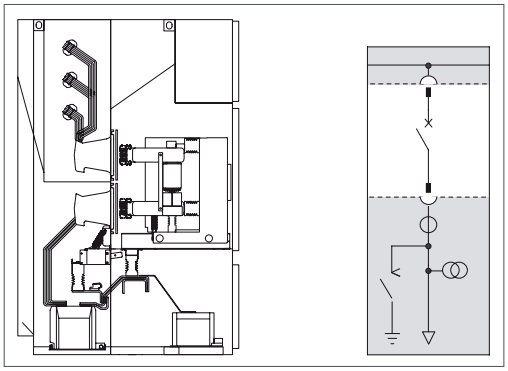


Fig. 2.4
Feeder panel with circuit-breaker truck HVX for rated currents > 2500 A and voltage transformer (optional)

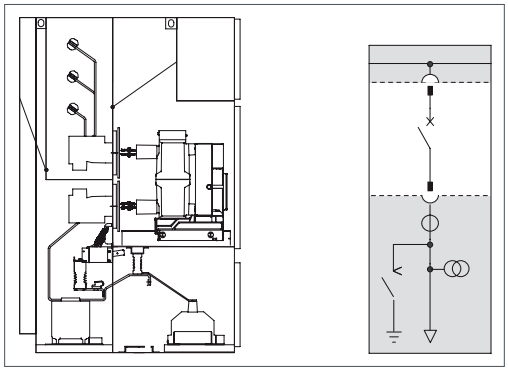


Fig. 2.5
Feeder panel with circuit-breaker truck HVX for rated currents ≤ 2500 A and voltage transformer (optional)

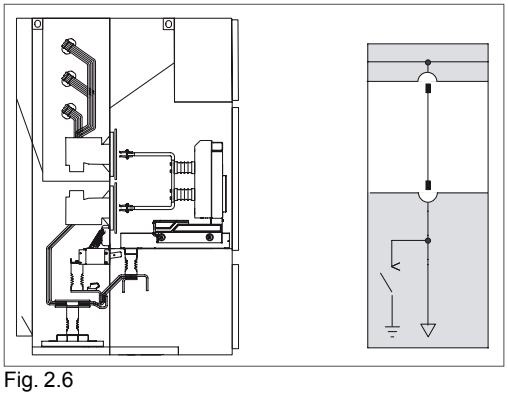


Fig. 2.6
Panel with disconnector truck UTX

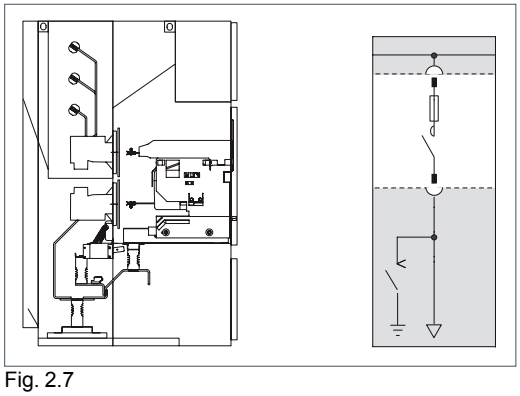


Fig. 2.7
“Motor Control Center” panel with vacuum contactor CVX (only 12 kV)

2.2.2 Panels for bus section coupler

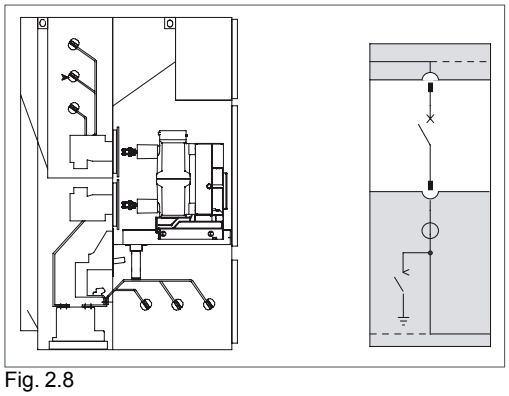


Fig. 2.8
Bus section coupler ”Circuit-breaker panel with earthing switch”

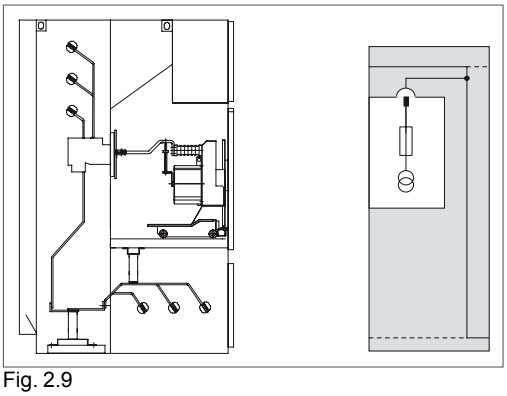


Fig. 2.9
Bus section coupler ”Bus riser panel with metering truck MTX”

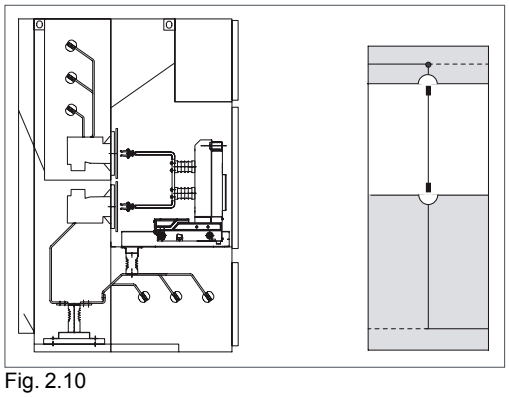


Fig. 2.10
Bus section coupler ”Bus riser panel with disconnector truck UTX”

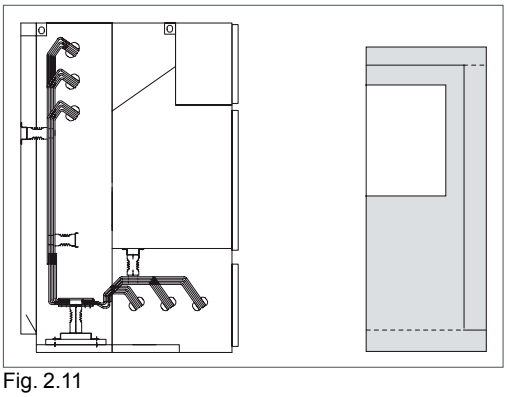


Fig. 2.11
Bus section coupler ”Bus riser panel”

2.2.3 Panels with busbar voltage transformer and earthing switch

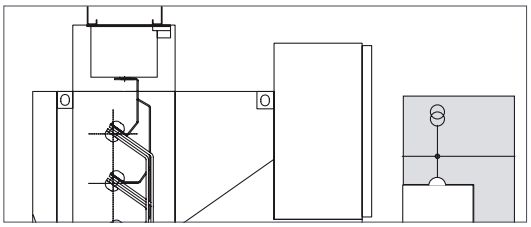


Fig. 2.12
Busbar with fixed busbar voltage transformer

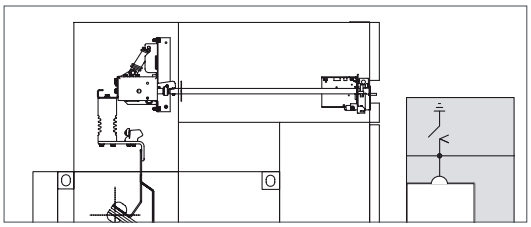


Fig. 2.13
Busbar with busbar earthing switch

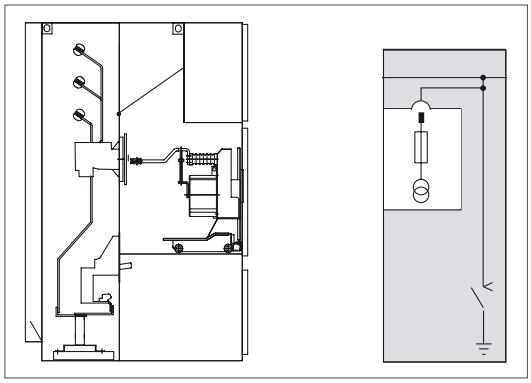


Fig. 2.14
Metering panel with metering truck and busbar earthing switch

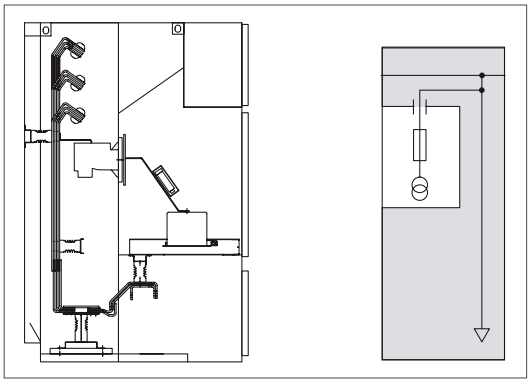


Fig. 2.15
Bus riser panel, optionally available with fixed voltage transformer

2.3 Dimensions and weights (without packaging)

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 and
- additional equipment, e. g.:
  - busbar or fan attachments
  - rear high voltage cable connection

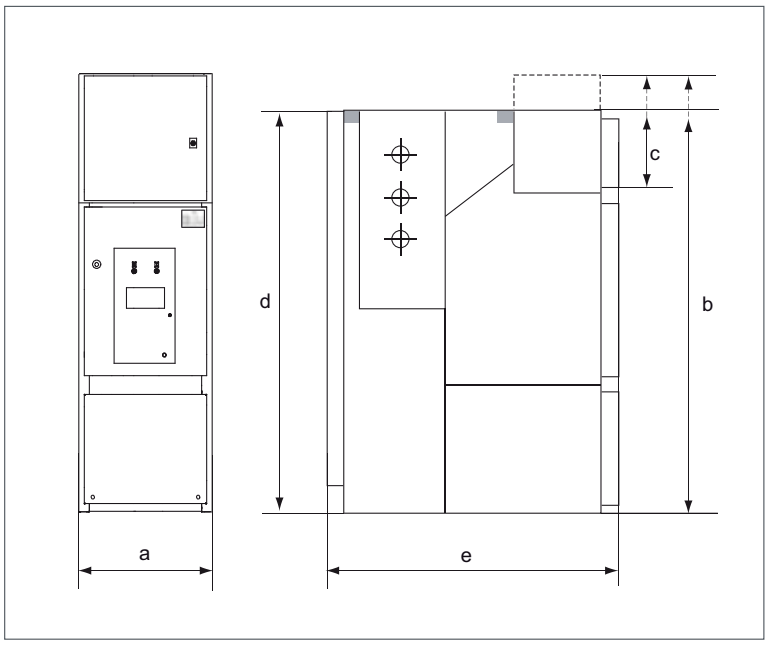


Fig. 2.16
Dimensions of PIX panels

a Panel width
b Panel height (depending on height of low-voltage compartment)
c Height of low-voltage compartment
d Panel height without low-voltage compartment and attachments
e Panel depth

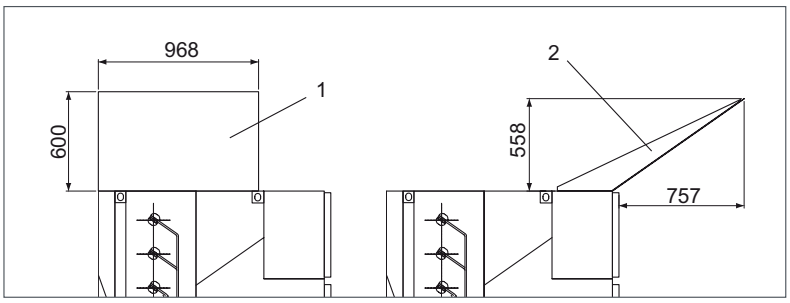


Fig. 2.17
Dimensions of pressure relief duct and deflector

1 Pressure relief duct
2 Deflector

PIX 12

Depth and height of panel[1]			
Panel depth e	[mm]	1405	Standard
		1605	in case of two current transformers per phase or panel width 650 mm with I_k = 40 kA
Panel height b	[mm]	2130 2230 2330	depending on the height of the low-voltage compartment c = 530, 630 or 730 mm
Panel height d	[mm]	2130	without low-voltage compartment and additional equipment

Panel type	Rated current[2] [A]	Panel width a[1] [mm]	Weight[3] approx. [kg]
■ Feeder panel with HVX circuit-breaker ■ Bus section coupler with HVX circuit-breaker	≤ 1250	650/800[4]	720
	1600/2000	800	850
	≥ 2500	1000	1100
■ Bus riser panel ■ Feeder panel with disconnector truck UTX (also for bus section coupler)	≤ 1250	650	650
	1600/2000	800	750
	≥ 2500	1000	900
Busbar metering panel	–	650	600
Feeder panel with vacuum contactor CVX	≤ 400	650	700

[1] see Fig. 2.16
[2] In case of branch-circuit panels, the rated current refers to the branch circuit (max. busbar nominal current: 4000 A)
[3] Weight including low-voltage compartment, without voltage transformer and without busbar attachments
Panels with voltage transformer in the branch circuit: + 120 kg
[4] Panel width depends on rated short-time current Ik:
- 650 mm at 31.5 kA
- 800 mm at 40 kA

(Exception: Panel width 650 mm at 40 kA with panel depth 1605 mm)

PIX 17

Depth and height of panel[1]			
Panel depth e	[mm]	1505	Standard
		1605	in case of two voltage transformers per phase
Panel height b	[mm]	2200 2300 2400	depending on the height of the low-voltage compartment c = 600, 700 and 800 mm
Panel height d	[mm]	2200	without low-voltage compartment and additional equipment

Panel type	Rated current[2] [A]	Panel width a[1] [mm]	Weight[3] approx. [kg]
■ Feeder panel with HVX circuit-breaker ■ Bus section coupler with HVX circuit-breaker	≤ 2000	750	850
	≥ 2500	1000	1100
■ Bus riser panel ■ Feeder panel with disconnector truck UTX (also for bus section coupler)	≤ 2000	750	750
	≥ 2500	1000	900
Busbar metering panel	–	750	650

[1] see Fig. 2.16
[2] In case of branch-circuit panels, the rated current refers to the branch circuit (max. busbar nominal current: 4000 A)
[3] Weight including low-voltage compartment, without voltage transformer and without busbar attachments
Panels with voltage transformer in the branch circuit: + 120 kg

PIX 24

Depth and height of panel[1]			
Panel depth e		1605	
Panel height b	**[mm]**	2330 2430 2530	depending on the height of the low-voltage compartment c = 530, 630 or 730 mm
Panel height d	**[mm]**	2330	without low-voltage compartment and additional equipment

Panel type	Rated current[2] [A]	Panel width a[1] [mm]	Weight[3] approx. [kg]
■ Feeder panel with HVX circuit-breaker ■ Bus section coupler with HVX circuit-breaker	≤ 1600	800	850
	≤ 2500	1000	1000
■ Bus riser panel ■ Feeder panel with disconnector truck UTX (also for bus section coupler)	≤ 1600	800	750
	2000	800/1000[4]	800
	2500	1000	800
Busbar metering panel	–	800	700

[1] see Fig. 2.16
[2] In case of branch-circuit panels, the rated current refers to the branch circuit (max. busbar nominal current: 4000 A)
[3] Weight including low-voltage compartment, without voltage transformer and without busbar attachments
Panels with voltage transformer in the branch circuit: + 120 kg
[4] Panel width depends on rated short-time current Ik:
- 800 at ≤ 25 kA
- 1000 at ≤ 31.5 kA

2.4 Applied standards

Series PIX switchgear units with vacuum switching devices are
- metal-enclosed; Loss of service continuity category in accordance with IEC 62271-200: LSC 2B-PM
- type-tested
- optional: tested for internal faults (qualification IAC)
- dimensioned for indoor installation

PIX switchgear units meet the following standards and regulations:

Designation	IEC standard	EN standard
Switchgear	IEC 62271-1 IEC 62271-200	EN 62271-200
Circuit-breaker	IEC 62271-100	EN 62271-100
Vacuum contactor	IEC 60470	EN 60470
Earthing switch	IEC 62271-102	EN 62271-102
Disconnector truck	IEC 62271-102	EN 62271-102
Current transformers	IEC 60044-1	EN 60044-1
Voltage transformer	IEC 60044-2	EN 60044-2
Voltage Detecting Systems	IEC 61243-5 IEC 61958	EN 61243-5 EN 61958
Protection against accidental contact, foreign bodies and water	IEC 60529	EN 60529
Installation	IEC 61936-1	HD 637 S1
Operation of electrical equipment	–	EN 50110-1

Degree of protection against accidental contact and foreign objects

Degrees of protection against accidental contact and foreign objects according to IEC 60529	
external enclosure of panel	IP3X[1]
between the compartments of the panel	IP2X

[1] optional IP4X; other values available on request

2.5 Environmental and operating conditions

PIX 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		
Temperature class		"minus 5 indoors"[1]
Min./max. ambient temperature	**°C**	–5/+40[1]
Average value over 24 hours	**°C**	≤ 35[1]
mean rel. air humidity: 24 hour/1 month	**%**	≤ 95/≤ 90
Installation altitude above sea-level	**m**	≤ 1000[1]

[1] higher values available on request

2.6 Ratings of the PIX series

Switchgear panel			PIX 12	PIX 17	PIX 24
Rated voltage U_r		**[kV]**	12	17,5	24
Rated lightning impulse withstand voltage U_p		**[kV]**	75	95	125
Rated power frequency withstand voltage U_d		**[kV]**	28	38	50
Rated normal current I_r	Busbar	**[A]**	≤ 3150/4000[1]		≤ 2500
	Circuit-breaker	**[A]**			
	Vacuum contactor	**[A]**	200 – 400	–	
Rated peak withstand current I_p[2]		**[kA]**	≤ 100		≤ 80
Rated short-time current I_k[2]		**[kA]**	≤ 40 (3 s)		≤ 31,5 (3 s)
Rated frequency f_r		**[Hz]**	50/60		

[1] with fan
[2] The short-circuit capability of the current transformers must be considered separately.

The applicable panel-specific technical data are indicated on the nameplate (see section 2.7 Nameplate) and in the switchgear-specific documentation.
The technical data of the switching device (HVX, UTX) are indicated on the nameplate and in the operating manual of the device concerned.

2.7 Nameplate

The type designation on the nameplates on the front of the panels (Fig. 2.18) informs about essential technical data. When submitting enquiries to the manufacturer or ordering spare parts, the following information is required:

- Type designation
- Serial number
- Year of construction

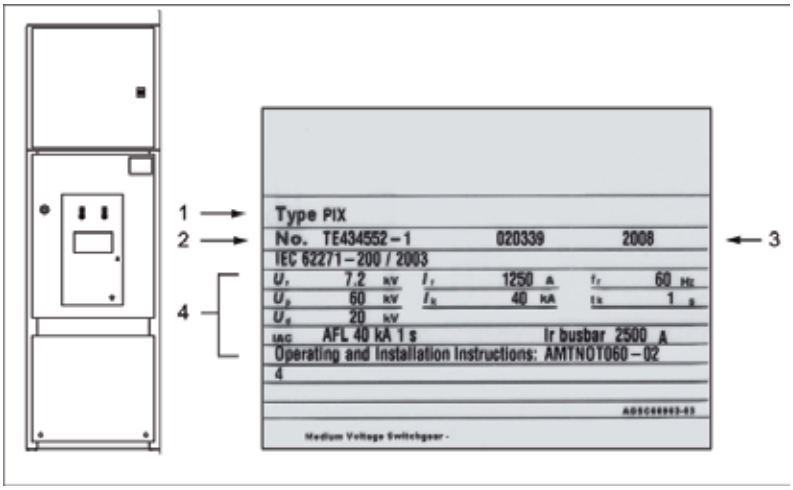


Fig. 2.18
Nameplate on panel front

1 Type designation
2 Serial number
3 Year of construction
4 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.

Fixtures in the switchgear panel

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:

- Motor-operated drive mechanism
for the earthing switch control element
- Blocking coil
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							
Direct voltage DC	[V]	24	48	60	110	125	220
Alternating voltage AC	[V]	(110)/120			(220)/230		

Power consumption

Device	Rated power consumption	
	DC approx. [W]	AC 50/60 Hz approx. [VA]
Blocking coil	12	
Motor for earthing switch	150–180	

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

Truck

Electrical control and operating devices of trucks are described in the appropriate Technical Manuals (see ”Reference documents” on page 6).
- Circuit-breaker HVX with Ur ≤ 24 kV, Ir ≤ 2500 A

see Technical Instruction AGS 531301-01
- Circuit-breaker HVX with Ur ≤ 17.5 kV, Ir > 2500 A

see Technical Instruction AGS 531461-01
- Disconnector truck UTX/Metering truck MTX

see Technical Instruction AGS 531361-01
- Vacuum contactor CVX

see Technical Instruction NTV 133

2.9 Utilization in line with the intended purpose

PIX series air-insulated medium-voltage switchgear units 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 attached.

No liability is accepted for parts provided by customers, e.g. current transformers.

2.10 Disposal after the end of the useful life

A material and recycling data sheet can be provided on request for the disposal of series PIX switchgear at the end of its service life:

Disposal is performed as a service by the manufacturer’s Service Center which to payment.

3 Packaging, transport, delivery and 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 transport aids. The standard accessories are included.
- In the case of panels with a width of 650, 750 and 800 mm, the trucks can be delivered within the panels. They are in ”disconnected position”, and secured in the switching device compartment using transport locks.
With 1000 mm wide panels, the trucks are delivered in separate packaging.
- The panels are delivered in upright position.

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

Packaging

- If the panels are transported exclusively on a lorry, they are fastened by wooden bars at the front and rear and packed in PE film (Fig. 3.1).
- 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, Fig. 3.2).
- 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. 3.2).

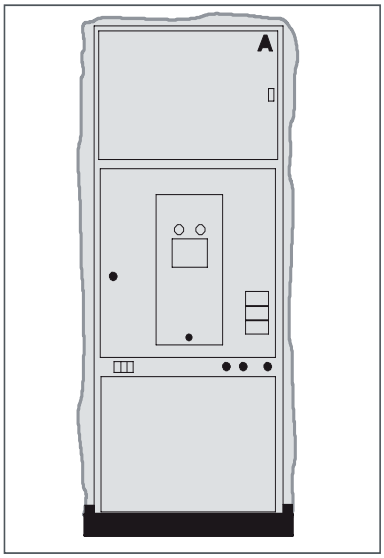


Fig. 3.1
Packed in PE protective film on a pallet

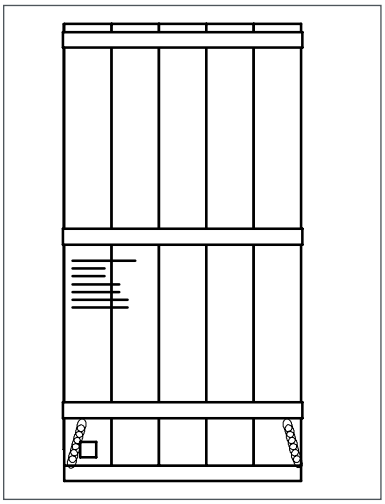


Fig. 3.2
Packed in a wooden case

3 Packaging, transport, delivery and storage (contd.)

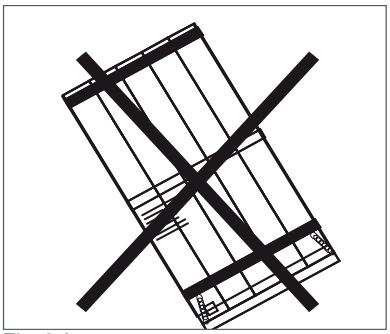


Fig. 3.3
Do not tip the transport units

Fig. 3.4
Transport using a forklift truck

3.2 Transport

Warning!
When transporting the switchgear, it must be ensured that the units do not slip or tip (if necessary, nail down transport pallets to the loading surface).

Important:
For transporting the trucks, comply with the transport specifications in the appropriate manuals.

Transport using a forklift truck

For transport, the panels must be packaged completely. The entire length of the forks must be placed under the transport unit (Fig. 3.4).

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 deviations.

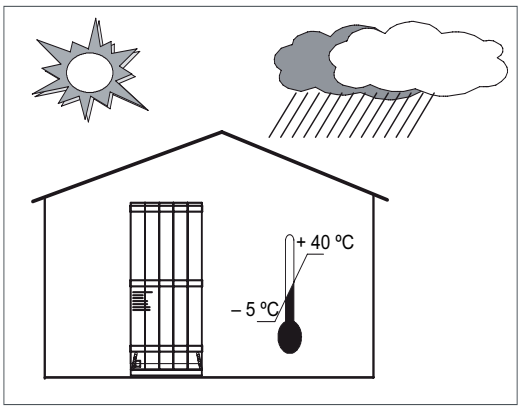


Fig. 3.5
Schematic diagram of storage conditions for PIX switchgear panels

3.4 Storage

Warning!
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 may only be stored vertically; they must not be stacked.
- Storage only indoors!
- Panels and accessories must be packed in sealed aluminium film with desiccant and in a wooden case (storage for max. two years after date of packing).

4 Access to the main circuit compartments

4.1 Safety provisions

Warning!
Before opening / removing doors / covers, isolate the compartment in question, check for zero voltage and earth in accordance with the safety provisions in EN 50110-1.

Warning!
After removal of covers, operator safety in accordance with IEC 62271-200 may be restricted if the appropriate part of the switchgear unit has not been isolated from the power supply.

4.2 Access to the cable compartment

Warning!
The cable compartment may only be opened if the earthing switch is ON (see Chapter 10.9.1).

The panels can be equipped with supplementary cylinder locks to lock the cable compartment cover. To this effect, see also Chapter 10.4.4 ”Interlocks via cylinder locks”.

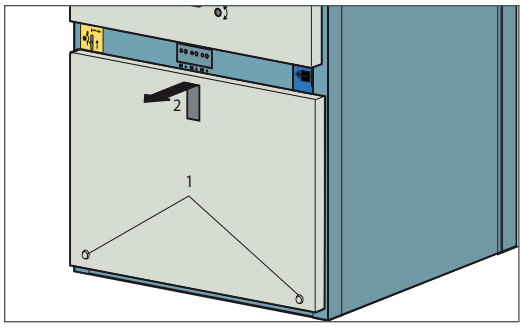


Fig. 4.1
1 Release securing bolts of cable compartment cover
2 Lift cable compartment cover and remove it in forward direction

4.2.1 Removal of the cable compartment cover

- Release the securing bolts of the cable compartment cover (Fig. 4.1, 1).
- Lift and remove the cable compartment cover (2).

Re-mounting the cable compartment cover

After terminating assembly work, place cable compartment cover onto the panel, lower it and fasten it again using the securing bolts.

4.2.2 Removing the truck carrier

The truck carrier can be removed as required, for example for maintenance work (Chapter 11) or for access to the busbar compartment (Chapter 4.4.1).

4 Access to the main circuit compartments (contd.)

- Remove truck from the panel (see Chapter 4.3).
- Remove insulating walls (only in case of 17 and 24 kV panels):
  - Release the 3 securing bolts (Fig. 4.2, 1) of the support (2).
  - First remove support (2) and then the four insulating walls (3).
- Dismantle auxiliary switch block for truck (4) and deposit carefully in the cable compartment.
- If the panel features a voltage indicator: disconnect the plug-and-socket connector of the unit (5).
- Remove the securing bolts of the truck carrier (6).
- First raise truck carrier on the front, then pull it out (7).

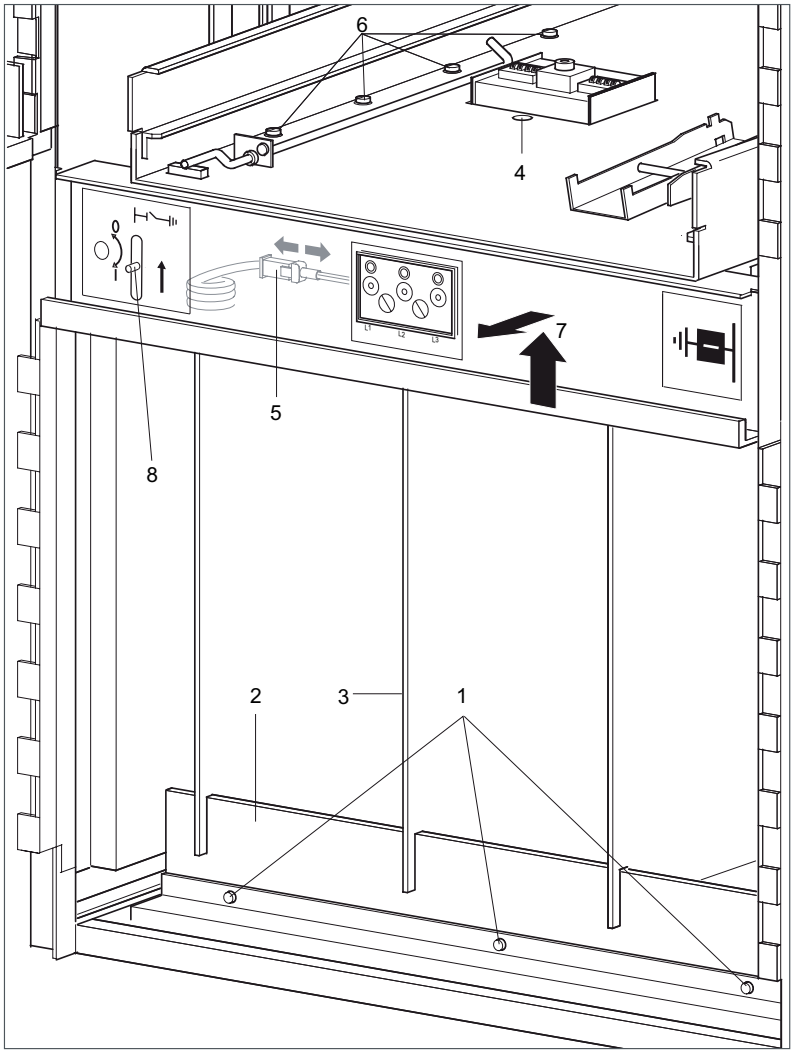


Fig. 4.2
Removing the truck carrier

1 Securing bolts of the support
2 Support (only for PIX 17 and 24)
3 Insulating walls (only for PIX 17 and 24)
4 Fastening the auxiliary switch block
5 Plug-and-socket connector of voltage indicator
6 Securing bolts of truck carrier
7 Raise truck carrier on the front and pull it out
8 Slide for earthing switch actuation

4 Access to the main circuit compartments (contd.)

Re-install truck carrier

Re-install truck carrier and dismantled components by reversing the above order. When screwing the truck carrier down, make sure that the slide (Fig. 4.2, item 8) to open the insertion opening for the earthing switch operates smoothly. If necessary, release bolts and reposition the truck carrier.

4.3 Access to switching device compartment

Warning!
The switching device compartment may only be opened if the truck is in disconnected position (see Chapter 10.7.2).

4.3.1 Opening and closing the front door

Opening the front door

- Insert double-bit key into the door opening and turn it to the left (Fig. 4.3, 1); the door is unlocked.
- Insert handle with the lever pointing down, and turn handle to the left (2); the front door is lifted.
- To open the door, swing it to the left (3).

Closing the front door

- Close the door completely.
- Turn the handle downwards; the door is lowered.
- Pull door handle off and stow it in the tool tray of the trolley (see Chapter 12.5).
- Lock the door using a double-bit key.

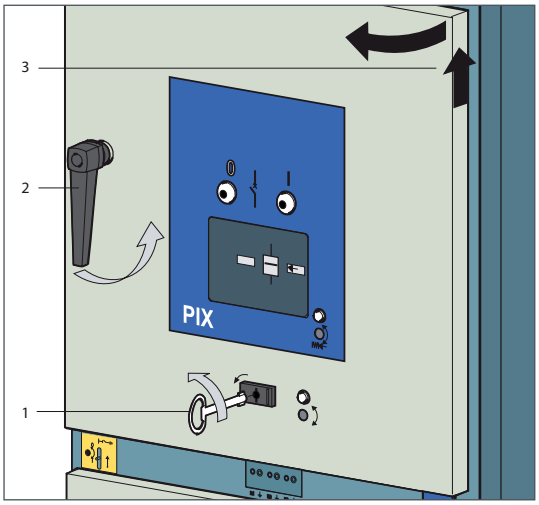


Fig. 4.3
Opening the front door
1 Insert double-bit key and unlock door. To this effect, turn the key to the left.
2 Insert handle with the lever pointing down, and turn handle to the left.
3 The door is opened and can be swung open to the left.

4 Access to the main circuit compartments (contd.)

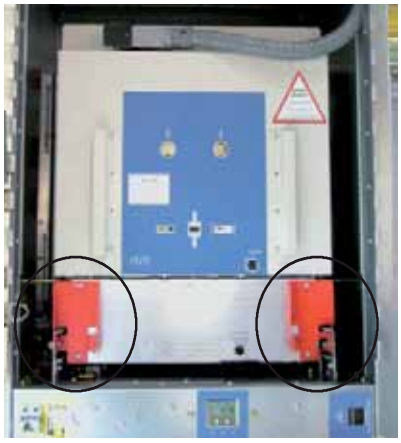


Fig. 4.4
Transport lock of circuit-breaker truck

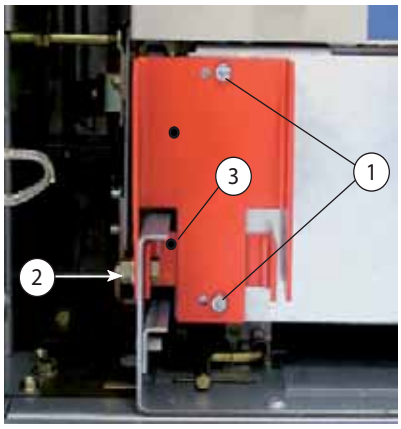


Fig. 4.5
1 Bolts
2 Lock bolts
3 Transport lock

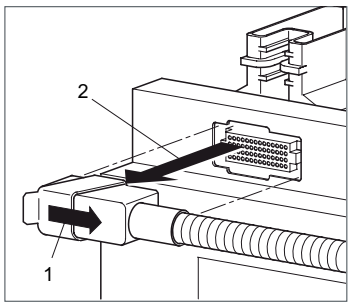


Fig. 4.6
1 Unlock low-voltage connector
2 Remove low-voltage connector

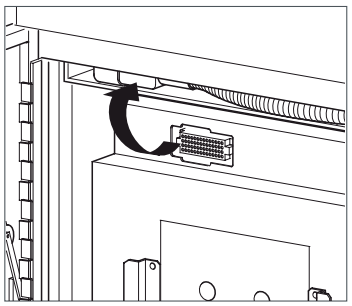


Fig. 4.7
Place low-voltage connector in tray above the truck

4.3.2 Removing the transport locke of the truck

In the case of panels with a width of 650, 750 and 800 mm, the trucks can be delivered within the panels and are secured by means of a transport lock (Fig. 4.4).

- Release the two bolts (Fig. 4.5, 1).
- Release lock bolts M8x25 (2).
- Remove transport lock (3).
- Reinsert the two bolts (1).

Remove transport lock on the other side following the same procedure.

4.3.3 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.

Removing the low-voltage connector

- Pull interlocking slide of low-voltage connector forward (Fig. 4.6, 1) and remove the connector (2).
- Stow low-voltage connector in storage tray above the truck (Fig. 4.7).

Connecting the low-voltage connector

- Take low-voltage connector from the storage tray above the truck (Fig. 4.7).
- Insert low-voltage connector into the truck and press interlocking slide forward.

4 Access to the main circuit compartments (contd.)

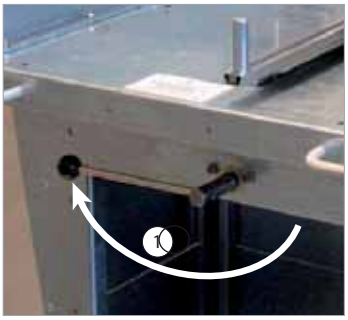


Fig. 4.8
Turning lever on trolley to the left

4.3.4 Removing the truck from the panel

- Adjust rails and unlocking bar of trolley to the correct track width of the truck (see Chapter 12.5).
- Turn lever to the left (Fig. 4.8, 1). The trolley is lifted on the front.

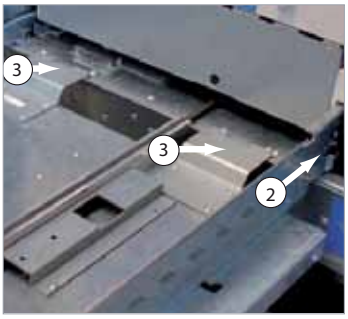


Fig. 4.9
Locking transport trolley on panel

- Approach trolley to the panel so that the lateral guides (Fig. 4.9, 2) are close to the panel, and turn lever (1) back to the right. The trolley is locked on the panel (3).

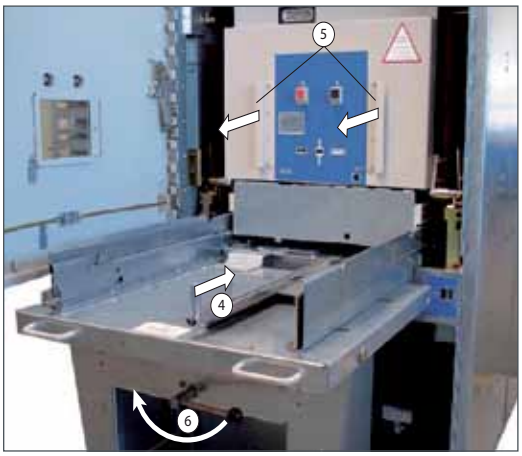


Fig. 4.10
Pull circuit-breaker onto trolley

- Push unlocking bar (Fig. 4.10, 4) forward to its stop. The latching of the truck in the panel is released.
- Pull truck onto the trolley via the two handles (5) until it snaps in on the trolley audibly.
- Turn lever back to the left (6). The trolley is lifted on the front, and removed from the panel.

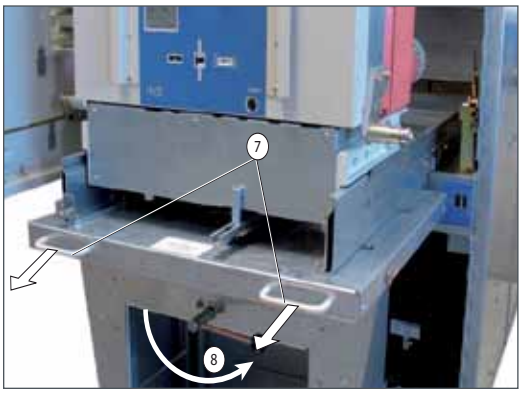


Fig. 4.11
Pull trolley with truck away from the panel

- Pull trolley with the truck away from the panel (7) and turn lever back to the right to lower it (8).
- Now the truck can be raised by means of a crane, and deposited. For further information, please refer to Chapter 5.3.2. Instructions regarding lifting and transporting trucks (HVX, UTX, MTX, CVX).

4 Access to the main circuit compartments (contd.)

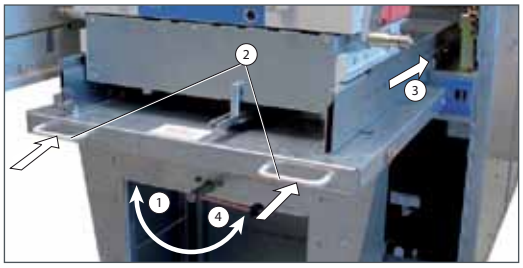


Fig. 4.12
Move trolley with circuit-breaker towards the panel until they are in contact, and lock.

4.3.5 Inserting the truck into the panel

Important:
Trucks and panels can be given matching coding, optionally. This is to prevent a truck from being racked completely into the panel if the rated data do not match.

- Turn lever to the left (Fig. 4.12, 1). The trolley is lifted on the front.
- Approach trolley to the panel via the handles (2) so that the lateral guides (3) are close to the panel, and turn lever back to the right (4). The trolley is locked on the panel.

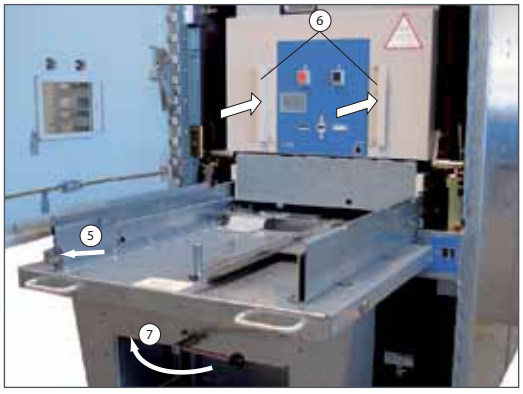


Fig. 4.13
Pushing the circuit-breaker into the panel.

- Press left-hand unlocking button (Fig. 4.13, 5) and slip truck briefly beyond the ratchet lever. Subsequently, slide truck into the panel using the handles (6), until it is latched in the panel.
- Turn lever back to the left (7). The trolley is lifted on the front, and removed from the panel.
- Pull trolley back from the panel and turn lever back to the right to lower it.

4 Access to the main circuit compartments (contd.)

4.4 Access to the busbar compartment

Warning!
The busbar compartment may only be opened if the busbar is earthed (see Chapter 10.11).

4.4.1 Front access

Steps for assembly (Fig. 4.14):

- Remove cable compartment cover (see Chapter 4.2).
- Open front door (see Chapter 4.3.1).
- Remove truck HVX, UTX etc. (see Chapter 4.3.4).
- Remove truck carrier (see Chapter 4.2).
- Unscrew pressure relief flap and take it out in forward direction.
- Remove partition plate to busbar compartment and take it out in forward direction.
- Insert temporary base plate to enable safe access to the cable compartment.

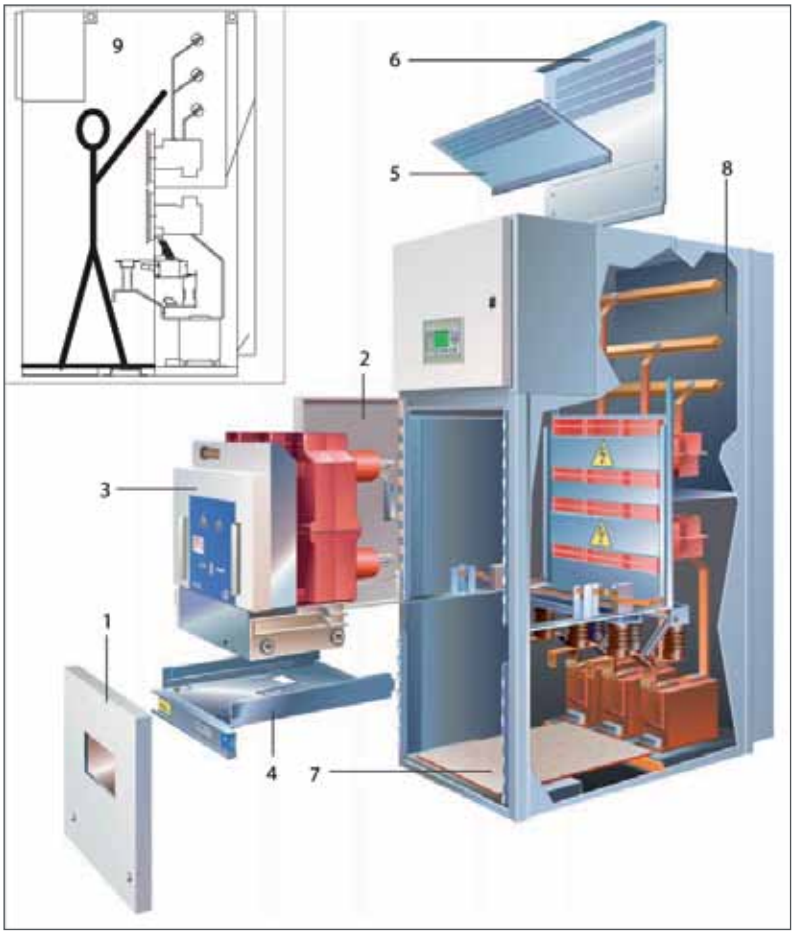


Fig. 4.14

1 Remove cable compartment cover
2 Open front door
3 Remove truck (the example shows the circuit-breaker truck HVX)
4 Remove truck carrier
5 Unscrew pressure relief flap and take it out in forward direction
6 Remove partition plate to busbar compartment and take it out in forward direction
7 Insert temporary base plate to enable safe access to the cable compartment
8 Busbar compartment
9 Working position

4 Access to the main circuit compartments (contd.)

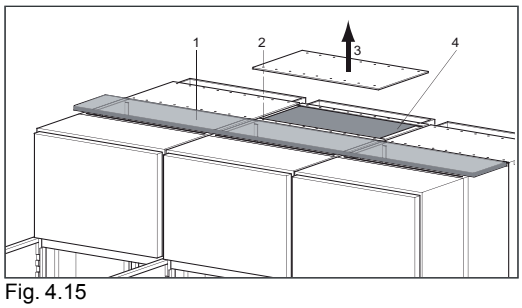


Fig. 4.15
Top access to the busbar compartment

1 Temporary base plate
2 Screw fastening
3 Sheet metal cover
4 Busbar compartment

4.4.2 Top access

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, temporarily position a solid base plate to step on.

Access to the busbars is also possible from the top via the panel top (Fig. 4.15) provided the space available so permits (sufficient ceiling height is required).

- Cover top of panel using a temporary base plate (1).
- Release the screw fastening of the upper busbar compartment cover (2) and remove sheet metal cover (3). Now, the busbar compartment (4) is accessible.

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 panels are delivered with the circuit-breaker switched OFF, the circuitbreaker energy storing device released and the earthing switch OFF.

Warning!
Risk of injuries!
During assembly, installation and connection, the energy storing devices must not be charged.

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, fans or pressure relief ducts - temporarily position a solid base plate to step on.

Warning!
The safety provisions of Chapter 1 must be observed.

5.2 Important information for assembly

- 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. The drawing numbers are specified in this manual in the description of the assembly work.
- For all screw fastenings, comply with the tightening torques specified in Chapter 12.3.

Assembly of the switchgear-specific additional equipment (e.g. deflectors, pressure relief ducts, fans, busbar attachments for voltage transformers or earthing switches etc.) is described in the manual regarding PIX Additional Equipment (No. AMTNoT 077-02).

5.3 Transport of the panels / trucks on the construction site

5.3.1 Panels

Warning!
Make sure the rope or the chain being used is strong enough to bear the weight of the panel (see Chapter 2.2). Comply with the relevant provisions for hoisting equipment.

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

Warning!
Risk of accidents. Pay attention to floor openings!

5 Assembly (contd.)

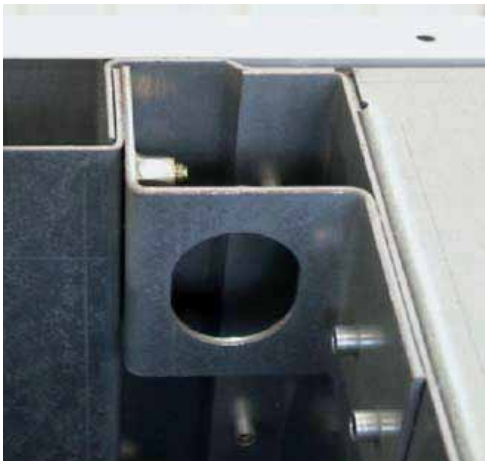


Fig. 5.1
Jack rings on top of the panel

Transport using a crane

- Attach the crane straps in the four jack rings on top of the panel (Fig. 5.1). Make sure to leave a minimum height of 1 m (Fig. 5.2).
- Release the front and rear panel screw fastening from the transport packaging. To this effect, remove the cable compartment cover, see Chapter 4.2.1.
- Carefully lift the panel and deposit it at the intended location.

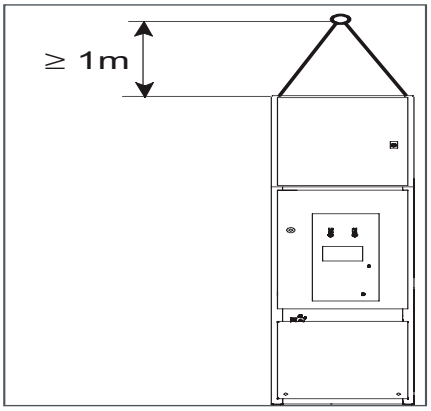


Fig. 5.2
Observe the minimum height

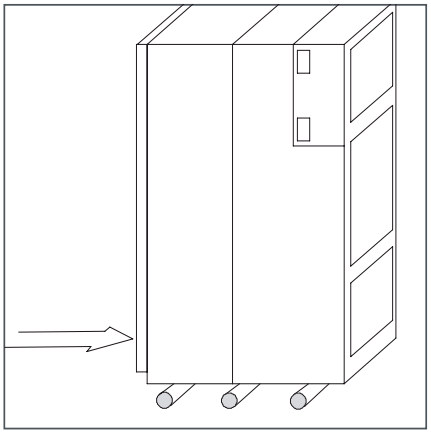


Fig. 5.3
Transport of the panel on the floor

Transport on the floor

- Push panel onto three cylindrical rollers (minimum diameter 30 mm) (Fig. 5.3).
- Thus, move the panel until it reaches its final location.

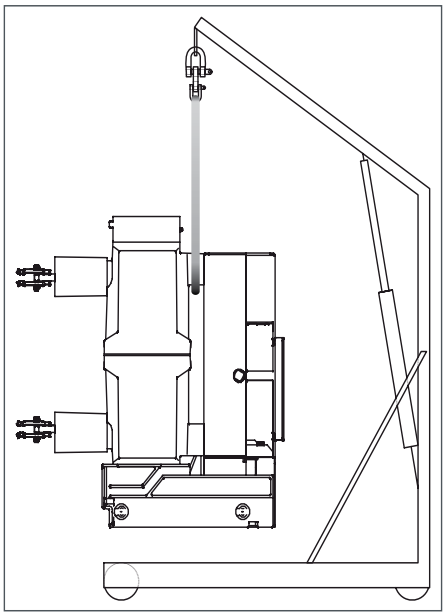


Fig. 5.4
Transport of truck using the handling crane

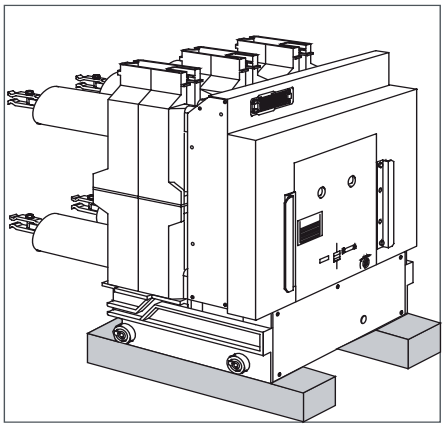


Fig. 5.5
Trucks must always be deposited on external wooden beams

5.3.2 Trucks

The trucks can be transported by means of the optional handling crane (Fig. 5.4). Item no. AGSC73258-01.
Trucks must always be deposited on external wooden beams (Fig. 5.5).
For further details, please refer to the instruction manuals for the trucks in question.

5.4 Requirements regarding the switchgear room

Before installing the switchgear panels, make sure that the switchgear room is checked according to the switchgear documentation (Fig. 5.6):

- Observe the minimum distance between the switchgear and the wall of the building.
- The load-bearing capacity of the fastening points must correspond to the weight of the switchgear (perform a stress analysis of the floor).
- Check base frame (if used) for dimensions and positional tolerances.
- Check position of floor openings for high-voltage and low-voltage cables.

Before the panel 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 locating surface.

Important:
Observe switchgear-specific space assignment plan.

5 Assembly (contd.)

Ground plan of a PIX switchgear within a switchgear room

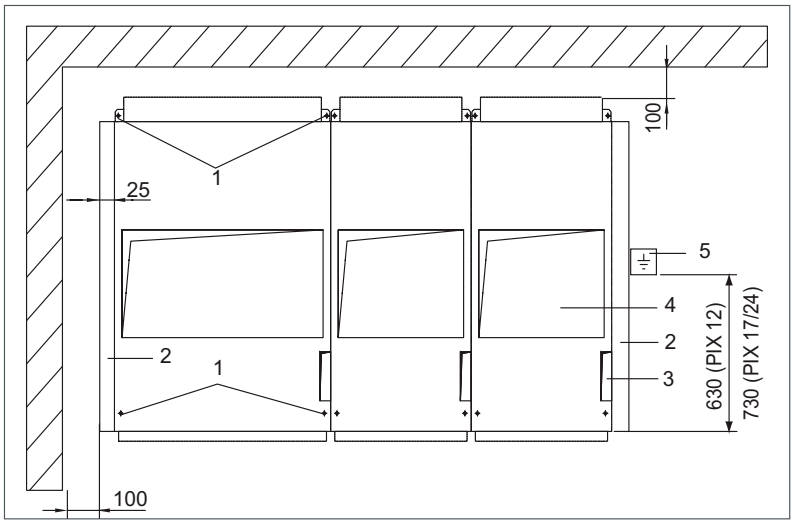


Fig. 5.6
Design example: The switchgear is located in the left-hand corner of the room
1 Bore-hole for fastening of panel
2 Switchgear side wall
3 Openings for routing external low-voltage cables
4 Openings for routing high-voltage cables
5 Reserved (100 x 100 mm) for the connection of the earth bus of the switchgear to the building's earth cable

Ground plan of the panels

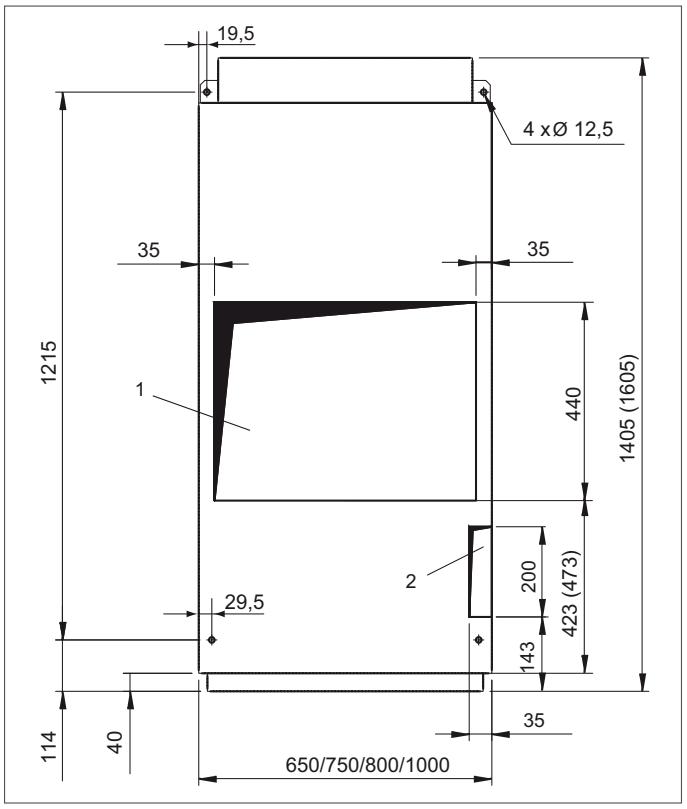


Fig. 5.7
Dimensions (example: PIX 12 panels)
1 Opening for routing high-voltage cables
2 Opening for routing external low-voltage cables

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!

Fastening on concrete foundations

- Position first panel on the foundations in accordance with the switchgearspecific space assignment plan.
- Remove cable compartment cover (see Chapter 4.2).
- 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 points, until the horizontal position has been reached. Assembly drawing: SEM102173-01
- Screw-fasten panel to the two fastening points on the front end and at least one fixation pont on the rear end (Fig. 5.8); hex. bolt M 10 x 30 + dowel pin.

Important:
Panel fastening with seismic qualification or vibration-proof characteristics can be supplied on request. For further details, please, contact the manufacturer..

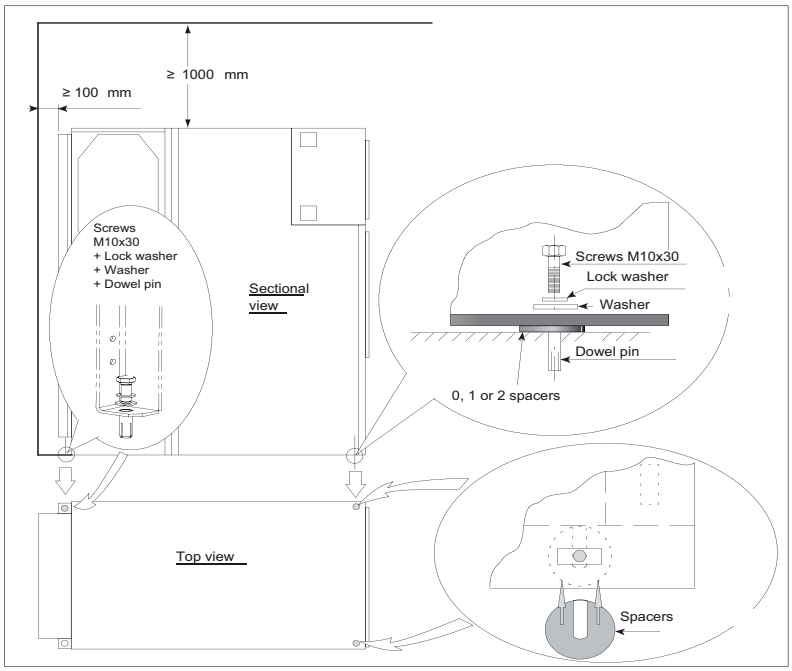


Fig. 5.8
Panel fastening on concrete foundations

5.6 Screw-fastening the panels to one another

Assembly drawing: SEM102056-01

- 1. Screw-fastening panel fronts to one another using 6 fastening points (Fig. 5.9).
- 2. Fasten panels to one another at the top on the rear side using a connecting link. To this effect, use the screws provided on the panel.

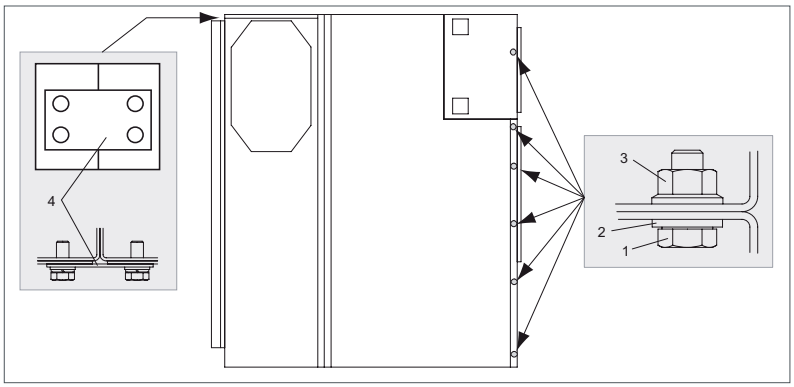


Fig. 5.9
Screw-fastening the panels to one another

1 Screw M8
2 Spring washer
3 Hex. nut M8 with lock washer
4 Connecting link

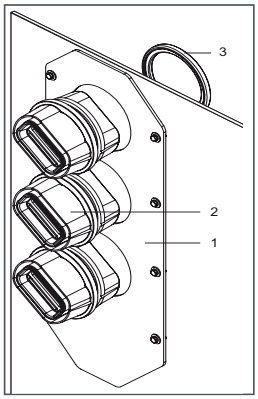


Fig. 5.10
1 Busbar section segregation (option)
2 Bushing
3 Retaining ring

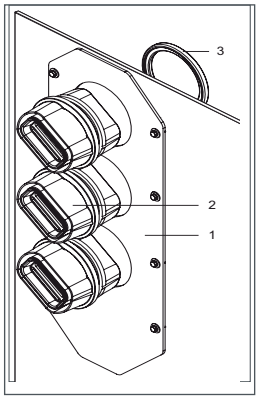


Fig. 5.11
1 Busbar retaining plate
2 Bushing
3 Retaining ring

5.7 Installation of the busbar bushings

Panels can be equipped, depending on the customer specifications, with retaining plates (Fig. 5.11 and 5.12) or busbar section segregations (Fig. 5.10) for the busbar.

The retaining plates/busbar section segregations are pre-mounted at the factory. The bushings (2) are included in the accessories.

Slip bushing from the outside through the bore-hole and mount retaining ring (3) from the inside.

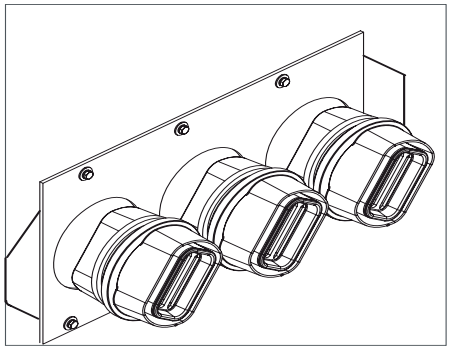
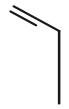
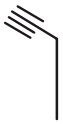
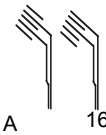
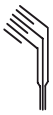


Fig. 5.12
Busbar retaining plate in bus section couplers

5.8 Busbar assembly

5.8.1 Arrangement of busbars in branch-circuit panels

		Number of busbars per phase		
		1	2	3
Number of feeder bars per phase	1			
	2		 1250 A (60x10) 1600 A (80x10)	 1250 A (60x10) 1600 A (80x10)
	3	-		

5.8.2 Arrangement of the lower busbars in bus section couplers

		Number of busbars per phase		
		1	2	3
Number of feeder bars per phase	2			-
	3	-	-	

5.8.3 Mounting busbars

Access to the busbar compartment: see Chapter 4.4

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

- Clean all contact areas of the busbars and feeder bars in the switchgear panels and coat them with lubricant KL (see Chapter 12.2).
- Screw-fasten busbars to the feeder bars as shown in Fig. 5.14 using four bolts (PIX 12, Fig. 5.15) or four bolts and an electrode (PIX 17/24, Fig. 5.16). Observe location of busbars and feeder bars (Chap. 5.8.1).

5 Assembly (contd.)

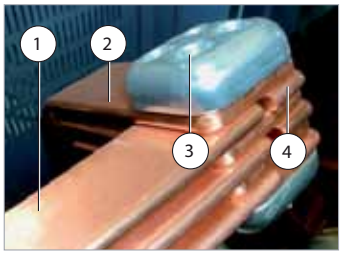


Fig. 5.13
Assembly of busbar in a left-hand end panel

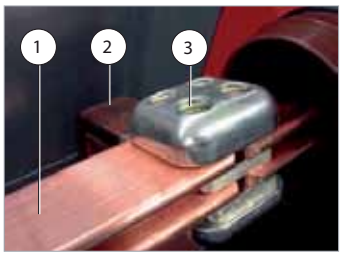


Fig. 5.14
Busbar fastening in a center panel (example shown: PIX 17/24)

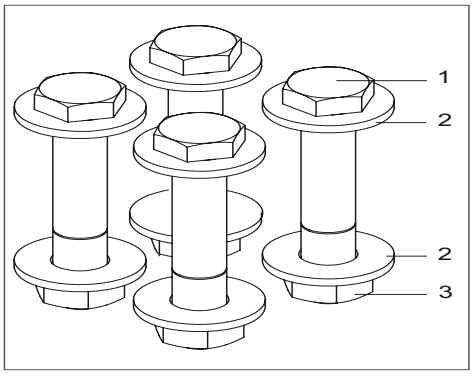


Fig. 5.15
Busbar screw fastening PIX 12

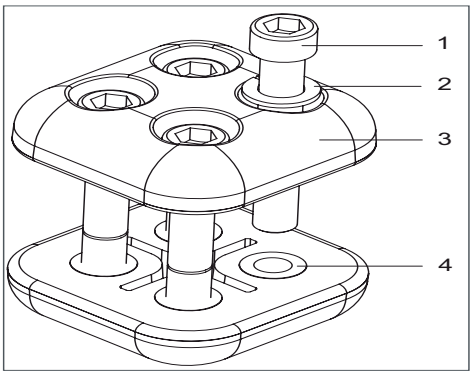


Fig. 5.16
Busbar screw fastening PIX 17/24

Busbar screw fastening for PIX 12/17/24

1 Busbar
2 Feeder bar
3 Busbar screw fastening with electrode
4 Intermediate layer

1 Busbar
2 Feeder bar
3 Busbar screw fastening with electrode

1 Bolt M 12
2 Spring washers
3 Nut M 12

1 Bolt M 12
2 Lock ring
3 Electrode
4 Electrode with inner thread

Take differing busbar screw fastening in PIX-12 busbar end panels into consideration:

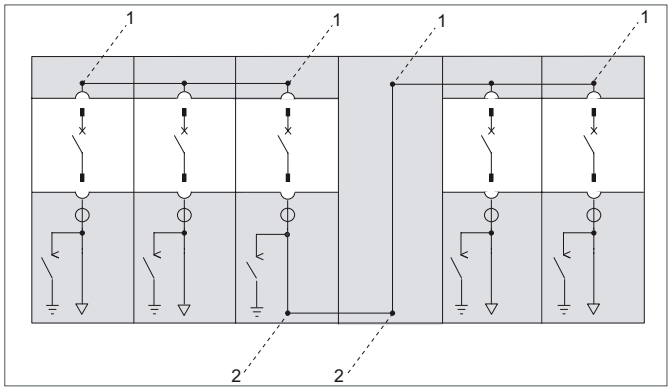


Fig. 5.17
[1] In busbar end panels, the phases L1 and L3 must be screw-fastened to electrodes in accordance with PIX 24 (Fig. 5.16)
[2] In the bus section coupler, all phases L1/L2/L3 in the lower busbar must be screwfastened to electrodes in accordance with PIX 24 (Fig. 5.16)

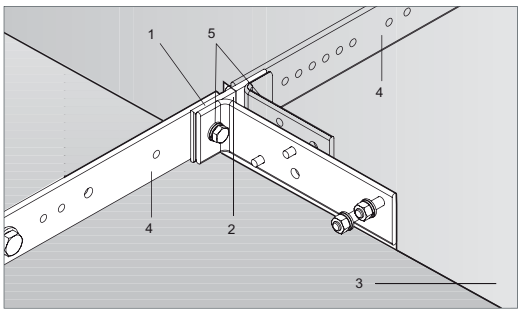


Fig. 5.18
Mounting the earth bar
1 Connecting bar
2 Cutout in panel-supporting structure
3 Adjacent panel
4 Earthing bars in the panels
5 Screw fastening of connecting bar to earthing bars

Fig. 5.19
Connecting point of switchgear earth bus to building earth

5.9 Assembly of the earth bus

Earth bars are screw-fastened between the switchgear panels using connecting bars (Fig. 5.18).

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

- Clean all contact areas of the connecting bar and the appropriate earth bar in the switchgear panels and coat them with lubricant KL (see Chapter 12.2).
- Slip the connecting bar (1) into the adjacent panel (3) through the cutout in the panel-supporting structure (2).
- Screw-fasten (5) connecting bar on both sides to the earth bar (4) in question.
- Connect earth bus (Fig. 5.19) to the earthing system of the switchgear building (connecting lines and screw accessories are not included in the scope of supplies).

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

6 High-voltage connection

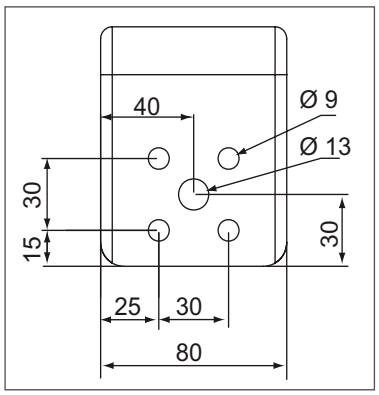


Fig. 6.1
Connecting bar 80 x 10 with dimensions for the fastening of cable sealing end

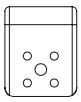
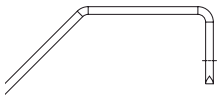
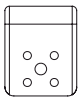
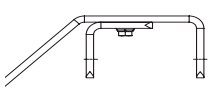
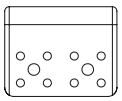
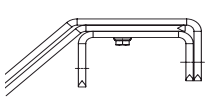
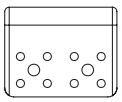
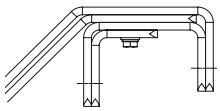
6.1 Overview of cable connection system

Cable connection variants:

Cable connection for Ø 13:
- Cable cross section ≤ 400 mm²

Cable connection for 4 bore-holes of Ø 9:
- Cable cross section 500 or 630 mm²

Overview of cable connection variants

Cable terminal per phase	Representation of a connection phase	
	Front view	Side view
max. 2		
max. 4		
max. 6		
max. 8		

Further cable connection variants optionally available:
- Metal-clad rear cable compartment for cable connections behind the panel (see Chapter 6.4)
- Conductor bar terminal

Please clarify technical details and design specifications with the manufacturer, as required.

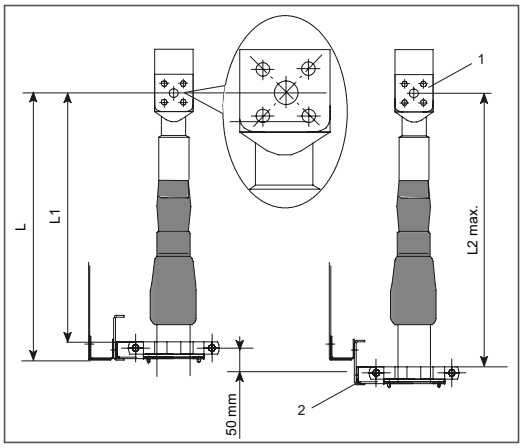


Fig. 6.2
Cable connection height in panel
1 Cable connection
2 Adjustable lateral support

6.2 Adjusting the cable connection height

The cable connection height can be increased by approx. 50 mm as required.
- Remove the base plates and the lateral supports. Measure and drill new fastening holes in the supports.
- Fasten support in the panel to the new fastening holes.

	Connection clearances [mm]		
	PIX 12	PIX 17	PIX 24
L	430	460	555
L1	390	420	515
L2	440	470	565

6 High-voltage connection

(contd.)

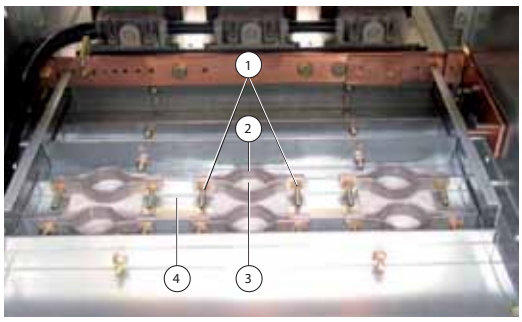


Fig. 6.3
1 Release fastening of cable clips
2 Remove cable clips
3 Remove rubber sleeves
4 Remove base plate as required

6.3 Connection of high-voltage cables

Preparation of cable compartment

Access to cable compartment: See Chapter 4.2.
- Remove cable clips and rubber sleeves (Fig. 6.3).
- If necessary, remove the base plates.

Fig. 6.4
Cut rubber sleeves to size and slip them onto the cables

Mount sealing end

- Route the individual cables outwards through the cable compartment of the panel to enable assembly of the cable ends.
- Cut the rubber sleeves to fit the cable diameter, and push them onto the cables (Fig. 6.4).
- Strip cable ends and assemble the sealing end as specified by the cable manufacturer.

Warning!
Do not use aluminium cable lugs for the cable connection. Inadmissible matching of materials.

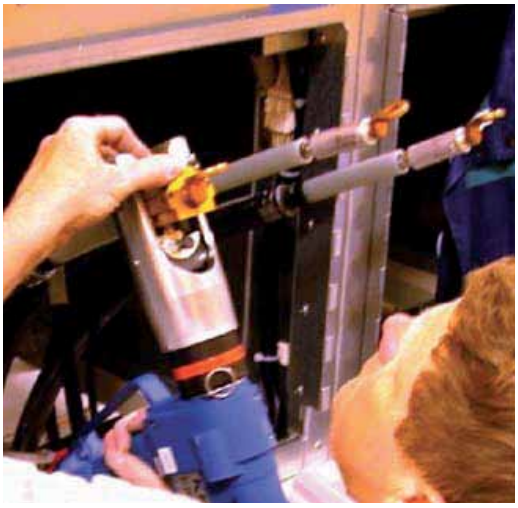


Fig. 6.5
Mount cable lug

6 High-voltage connection

(contd.)

Important:
- Unless otherwise specified by the cable manufacturer: Comply with the specified tightening torques and pre-coat contact areas (see Chapter 12.2).
- Observe the phase assignment of the switchgear panel.

■ Fasten the individual cables to the appropriate connection surfaces (Fig. 6.6 to 6.8). In case of two cables per phase: Connect the two cables to the first connection (Fig. 6.7).
■ Re-mount the base plates.
■ Fasten high-voltage cable to the base plates using clamping assemblies (Fig. 6.9 and 6.10).
■ Screw-fasten the earthing screens (2) of the cables to the earthing bar (3) of the panel.

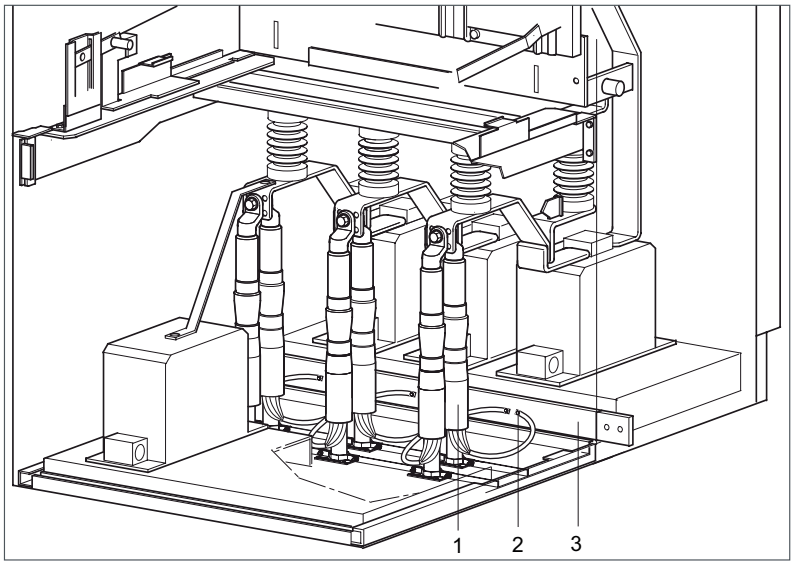


Fig. 6.6
1 High-voltage cable
2 Earthing screen
3 Earthing bar

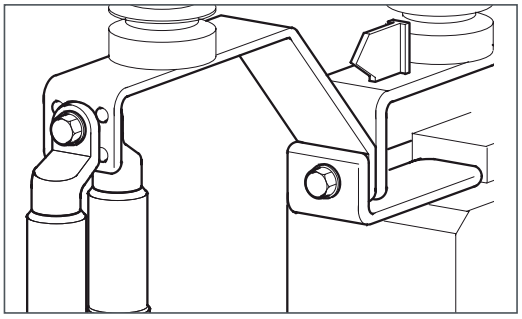


Fig. 6.7
Connection using 1 - 2 cables

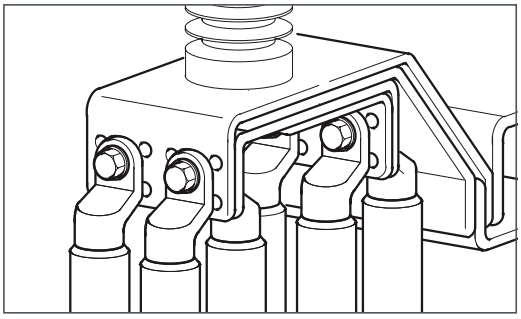


Fig. 6.8
Connection using 8 cables

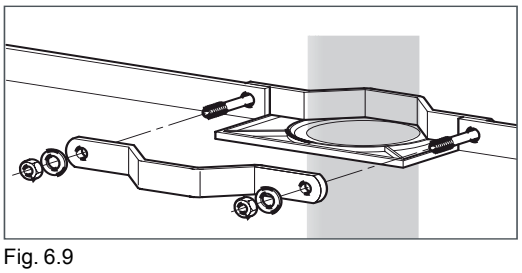


Fig. 6.9
Clamping assembly for cables with a diameter of ≥ 40 mm

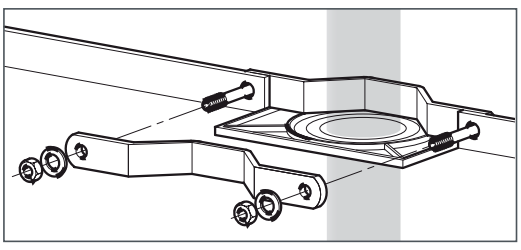


Fig. 6.10
Clamping assembly for cables with a diameter of < 40 mm

6 High-voltage connection

(contd.)

6.4 High-voltage connection to rear of panel (optional)

Panels can be extended optionally by a rear cable compartment (Fig. 6.11).

This rear connection compartment permits connection to high voltage behind the panel. Normally, the high-voltage cables or external conductor bars are routed in from above. The variants of the cable connection options (depending on the rated nominal current) correspond to the explanations in Chapter 6.1.

The preassembled sheet metal housing of the rear cable compartment is screw-fastened to the panel on the construction site.

The current transformers are located in the rear cable compartment. The front earth bar has a connection to the rear into the rear cable compartment, where a separate earth bus for earth connectors is located.

Important:
Please clarify further technical details and design specifications with the manufacturer, as required.

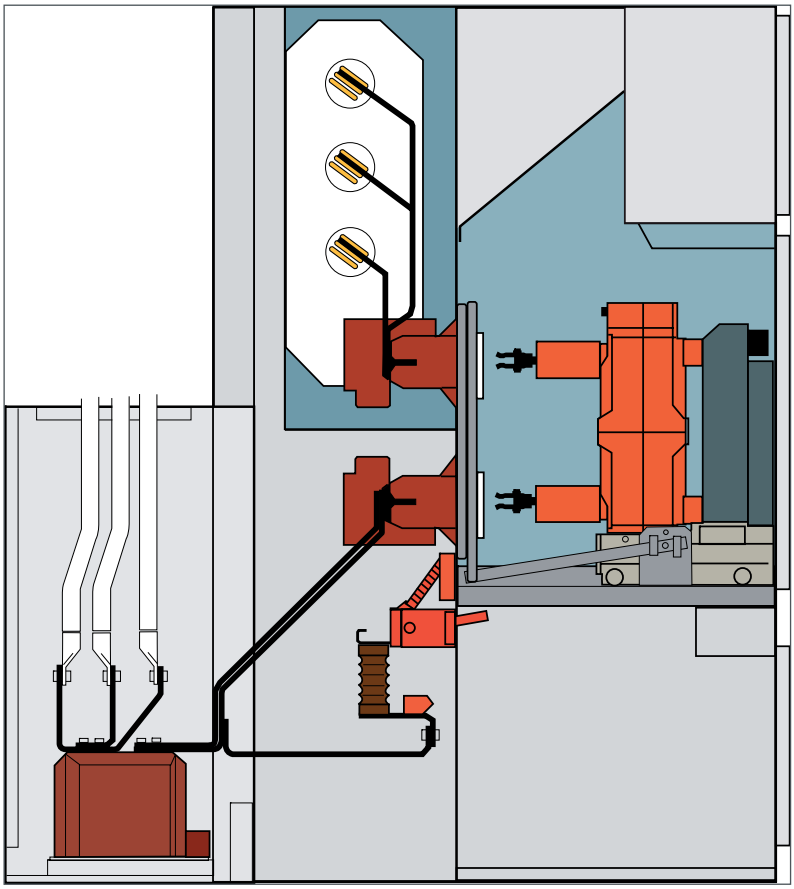


Fig. 6.11
High-voltage connection on rear side of switchgear panel (optional)

7 Low-voltage connection

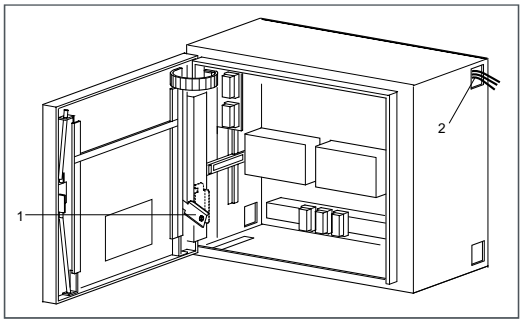


Fig. 7.1
1 Lock plate (optional)
2 Ring circuits

7.1 Open low-voltage compartment door

- Insert double-bit key into the lock of the low-voltage compartment and turn it to the left by 90°.
- Open door to the left.
- The door can be secured optionally in open position using a lock plate (Fig. 7.1, 1).

7.2 Attachment of the low-voltage compartment

The low-voltage compartments are delivered, depending on the order, either in pre-assembled condition or separately as accessories.

- Remove transport protection covers. Assign the low-voltage compartment to the appropriate panel.
- Position low-voltage compartment carefully on top of the panel, making sure that the top internal connection cables of the panel are not damaged.
- Align low-voltage compartment and screw-fasten it to the panel.

Assembly drawing: AGS C73 180-01

- Screw-fasten the low-voltage compartments to each other at the sides.
- Connect the panel's internal terminals for control and measuring cables according to the connector identification and the circuit diagram to the terminal strips in the low-voltage compartment.

7.3 Connection of the ring circuits in the low-voltage compartment

- Route the ring circuits for the intra-panel wiring through the lateral openings of the low-voltage compartment (Fig. 7.1, 2).
- The ring circuits have been designed with connectors. Connect ring circuits in accordance with the connector identification (or the circuit diagram) to the appropriate terminal strips in the low-voltage compartment.

7 Low-voltage connection

(contd.)

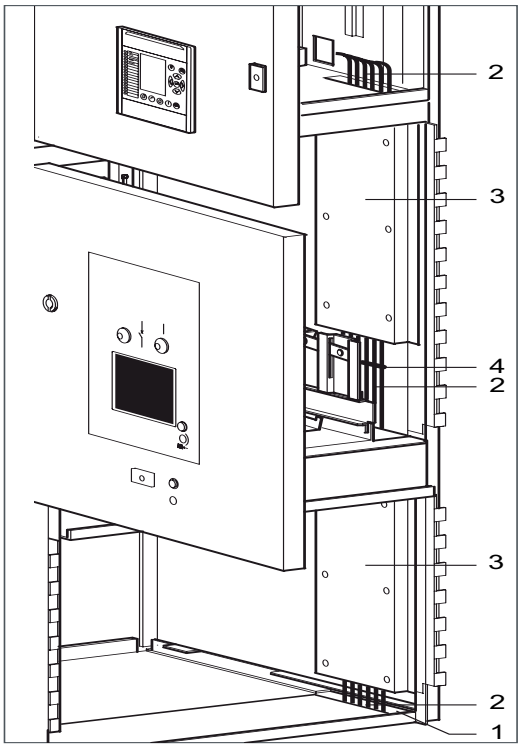


Fig. 7.2
1 Sheet metal cutouts in the panel base
2 External cables
3 Cable duct covers
4 Cable clamp

7.4 Connecting external cables in the switchgear panel

7.4.1 Routing the external cables through the panel's internal cable duct

Customized low-voltage cables for control and measurement can be routed to the low-voltage compartment inside each panel on the righthand side (Fig. 7.2). The cable duct for the external cables is only located on the left side in the bus section coupler.

- Remove the metal cable duct covers on the right inside of the panel (3).
- Break sheet-metal cutouts in the panel base (1) out as required.
- Route external cables (2) from the cable basement through the cutout into the panel's internal cable duct and to the low-voltage compartment. Fasten cables to the panel using cable clamps (4).
- Connect external cables to the terminal strip in the low-voltage compartment according to the circuit diagram.
- Reposition the cable duct covers (3).

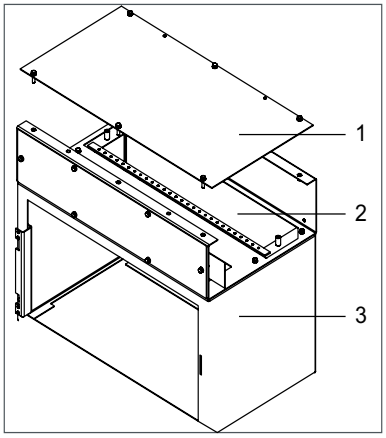


Fig. 7.3
Top cable duct
1 Cable duct cover
2 Cable duct
3 Low-voltage compartment

7.4.2 Routing the external cables through an additional cable duct (optional)

Customized low-voltage cables for control and measurement can be routed via an optional, separate cable duct above the low-voltage compartment (Fig. 7.3).
The cable duct is mounted on site, and is included in the accessories.

- Mount the cable duct in accordance with the assembly drawing AMT 000 376-01.
- Route external cables through the cable duct (2) to the lowvoltage compartment (3). Connect external cables to the terminal strips in the low-voltage compartment according to the circuit diagram.
- Screw-fasten cover of cable duct (1).

8 Commissioning

8.1 Final steps

Warning!
The high-voltage power 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.

Clean and check 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
  - busbar connections
  - panel screw fastenings
  - low-voltage wiring
  - special attachments

Damaged paint

The panels are powder-coated. Minor damage to the paint can be repaired using commercially available paint (standard colour RAL 7044 or customer specific colour).

Re-mount the covers:

- Removed partition and cover plates in the busbar and switching device compartment (see Chapter 4.4.1).
- Cable duct covers of the external control and measurement cables (see Chapter 7.4.1)
- Cable compartment cover (see Chapter 4.2).
- Remove temporary base from the panel top, if such a base has been used (see Chapter 4.4.2).

Inspection

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

Racking-in the trucks

Insert trucks in the panels depending on the panel configuration (see Chapter 4.3.5):

- Disconnector truck UTX
- Vacuum contactor CVX
- Metering truck MTX
- Circuit-breaker truck HVX

The HVX circuit-breaker is delivered without transport securing device in the drive mechanism as of October 2008. The circuit-breaker can be commissioned immediately.

Important:
HVX circuit-breakers with a former date of manufacture (up to approx. October 2008) are equipped with a transport securing device in the drive mechanism. This securing is marked on the front cover (Fig. 8.1) with an label. In this case, do not operate the circuit-breaker. Remove the transport securing device before commissioning (see Assembly and Operating Instructions HVX, AGS 531 301-01 and AGS 531 461-01).

Close front doors

See Chapter 4.3.1.

Fig. 8.1
Label on the front cover of the circuitbreaker, only if delivered with transport securing device

8.2 Checking switching functions and interlocks

Warning!
The high-voltage power supply must not be connected. All active parts must be earthed.

Important:
- For switching operations, comply with Chapter 10 (Operation).
- In case supply voltage is not available:
• are blocking coils (optional; lock circuit-breaker button and/or truck in disconnected position) in locked position, thus blocking manual switching operations;
• is there 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.

- 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
  - Optional motor-operated drives for the truck and the earthing switch
- Check switch position indicators and interlocks (see Chapter 10).

8.3 Power frequency test for busbar (optional)

Warning!
Comply with the safety provisions in Chapter 1.

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 (Fig. 8.2).
- Busbar:

Disconnect voltage transformer (MTX) and surge arrester. Earth voltage detection systems.

- Incoming feeder panel for voltage test:

Remove cable compartment cover and disconnect voltage transformer 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.

Performing the power frequency tests

- 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 into service position and switch circuit-breaker ON.
  - Perform the power frequency test successively for all three phases (L1, L2, L3) in accordance with the specifications of the test unit manufacturer. Make sure to earth the adjacent phases.

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.

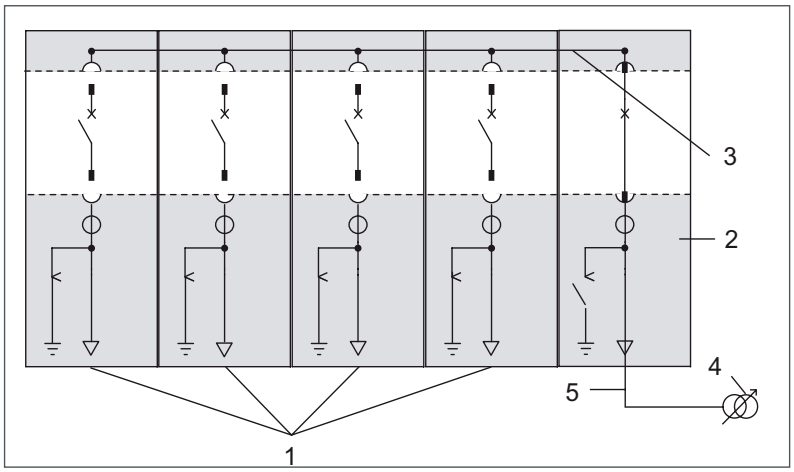


Fig. 8.2
Switch position during the power frequency test (example: five panels)
1 Feeder panels
2 Incoming feeder panel for test voltage
3 Busbar
4 Test unit (e g. high-voltage source, test transformer)
5 Test cable

After the power frequency test

■ Switch circuit-breaker OFF and put circuit-breaker truck into disconnected position; switch earthing switch ON.
- □ Remove test unit and test cables.
- □ Reconnect disconnected voltage transformers and surge arresters.

8.4 Cable test after assembly

Warning!
Comply with the safety provisions in Chapter 1.

During the cable test, the busbar can be operated at rated voltage (see nameplate). For qualification of the current transformers for cable tests, enquire at the appropriate manufacturer's.
A test unit and a test adapter (not included in scope of supplies) are required for cable testing.

8 Commissioning (contd.)

Important:
Observe the assembly instructions for the test adapters and the operating and inspection instructions for the test unit.

Preparation

- Isolate feeder cable of the panel which is to be tested.
- Isolate feeder cable in remote station.
- Earth feeder cable of the panel which is to be tested.
- Remove cable compartment cover (see Chapter 4.2).
- Disconnect voltage transformer and surge arrester; earth voltage detection systems.

Performing the cable test

- Connect the test adapter to a free cable connection in the panel and on the test unit. To this effect, observe the specifications of the test unit's manufacturer.

Important:
Make sure that the metallic components of the test adapter are at a sufficient distance from the earthed switchgear components (e.g. housing).

- Set switchgear panel to test position:

Circuit-breaker:	OFF
Truck:	in disconnected position
Earthing switch:	OFF

- Perform cable test according to the cable manufacturer's specifications. When doing so, do not exceed the admissible limits (see Table).

Once the cable test has been completed:

- Earth feeder cable again.
- Remove test set.
- Reconnect voltage transformer, surge arrester and voltage detection systems or de-earth them.
- Reposition cable compartment cover.

Admissible limits for the cable test in panels

	DC test voltage [kV] max. 15 min.
PIX 12	34
PIX 17	42
PIX 24	67

Admissible limits for the switchgear in case of cable tests with a testing frequency of 0.1 Hz available on request from the manufacturer's.

9 Voltage indicators

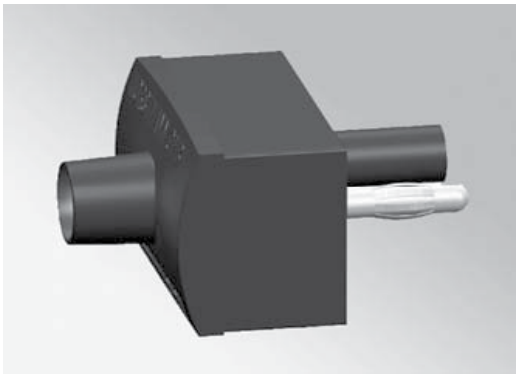


Fig. 9.1
Voltage indicator
(Type HR-ST, Horstmann GmbH)

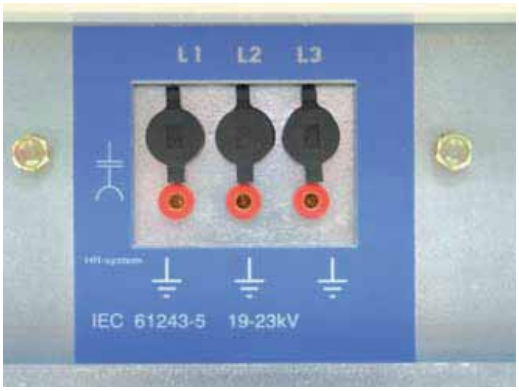


Fig. 9.2
Socket-contacts for HR system on the panel front

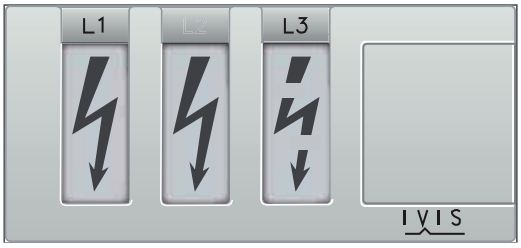


Fig. 9.3
Integrated Voltage Detection System IVIS

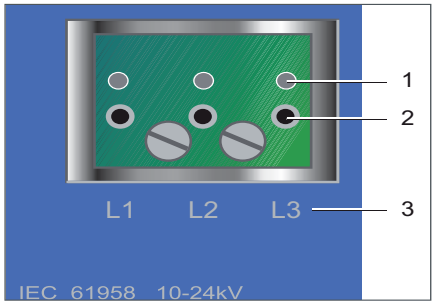


Fig. 9.4
Voltage indicator VPIS

1 Indicator lamps
2 Connection points
3 Phases

9.1 Voltage Detection Systems (VDS)

Important:
Refer to the operating manual of the voltage detection system concerned.

Pluggable voltage detection system

The operating voltage or the zero voltage state of the feeders is detected via a separate voltage detection system according to IEC 61243-5. Socket-contacts for the indicator units are located on the panel front (Fig. 9.2). Capacitive voltage indicators of all the approved manufacturers can be used (Fig. 9.1).

Important:
All three phases L1, L2 and L3 must always be checked together.

Close non-used socket-contacts using caps.

Integrated Voltage Detection System IVIS

IVIS (Fig. 9.3) is an integrated voltage detection system with display unit used to determine zero voltage according to IEC 61243-5.

The IVIS system has been designed for maximum operating reliability. It does not require supply from an external source. It features climateproof encapsulated electronics and is maintenance-free, due to permanent monitoring of the indication thresholds.

Flash arrow symbols on the indicators display the operating voltage still existing within the defined response thresholds (Fig. 9.3). The IVIS system does not require the electrical repeat tests common for voltage detection systems.

For a description of all functions and messages of the IVIS system, please refer to the separate Operating Manual IVIS (No. AGS 531757-01).

9.2 Voltage Present Indicating System VPIS

VPIS (Abb. 9.4) is a capacitive voltage indicator in accordance with IEC 61958. It is exclusively used to display the specified operating voltage.

In operation, each of the 3 phases L1, L2 and L3 (3) is displayed by its own flashing indicator lamp (1).

For each phase, a connector point (2) is available below each indicator lamp for connection of the phase comparator. Only approved phase comparators may be used for this VPIS system (see Chapter 9.3).

Warning!
These devices cannot be used to verify zero voltage. Voltage indicators in accordance with IEC 61243-5 must be used to determine zero voltage. Thus, before opening the switchgear or before performing work on live components, these areas must always be earthed by means of a make-proof earthing switch.

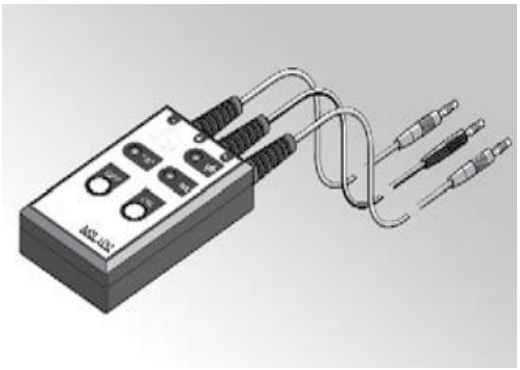


Fig. 9.5
Phase comparator MS 100

Fig. 9.6
Phase comparator for HR system
(Type ORION 3.0, Horstmann GmbH)

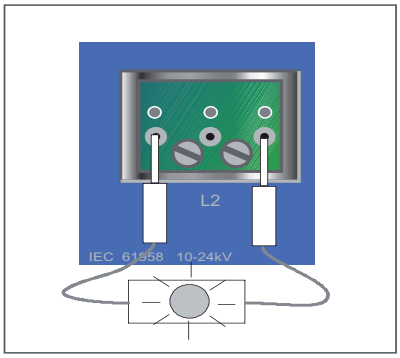


Fig. 9.7
No phase coincidence: indicator lights up

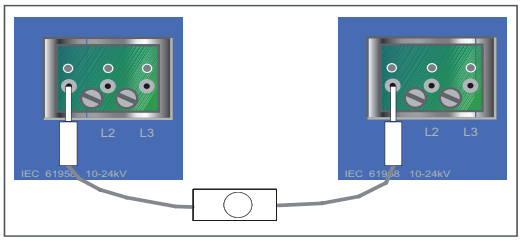


Fig. 9.8
Phase coincidence: indicator does not light up

9.3 Phase comparators

Phase comparators are optionally available and not included in the scope of supplies.
Make sure to check phase coincidence before connecting different supply lines for the first time.

Phase comparators for VDS systems (see Chapter 9.1)

If IVIS is used, phase comparison can be performed by means of the phase comparator MS 100 (Fig. 9.5).

Phase comparator for VPIS system (see Chapter 9.2)

This phase comparator may only be used for the VIPS system in Chapter 9.2.

Rated voltage U_r [kV]	VPIS item number
5–7.2	AMT150384-01
10–24	AMT150384-02

- Check the device before each operation. Connect the two plugs of the phase comparator to the two connection points of a VPIS device (Fig. 9.7). The lamp must light up: The phase comparator is working properly.
- Checking phase coincidence of two panels: Connect the plugs of the phase comparator to the same phase connection points of two different VPIS devices (panels) (Fig. 9.8). The indicator must not light up. If the phases do not coincide, check the cable connection and, if necessary, exchange.
- After each operation, check the device once more (see item 1).

10 Operation

10.1 Operator interfaces of panels

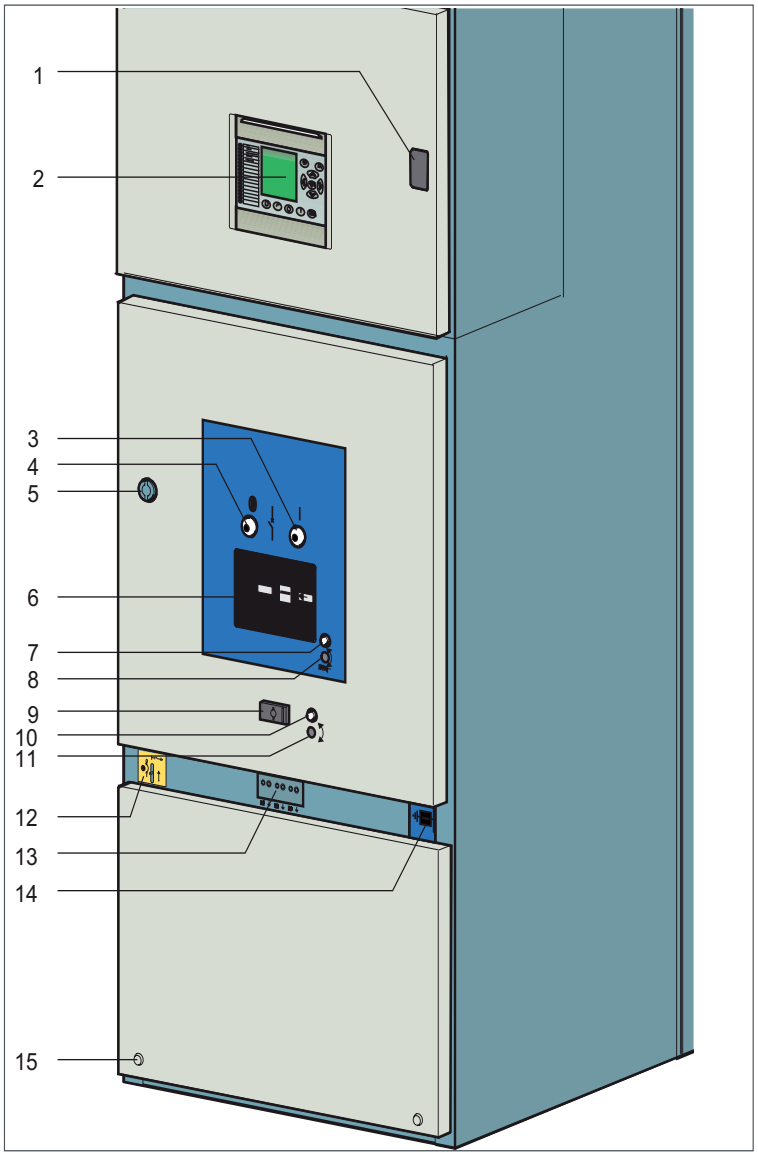
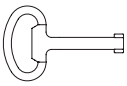
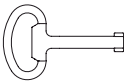


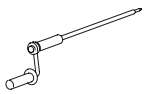
Fig. 10.1
Operator interface of PIX panels (shown in conjunction with the circuit-breaker HVX)

1 Lock to open and close the door of the low-voltage compartment
2 Protection and control device
3 Circuit-breaker ON
4 Circuit-breaker OFF
5 Insertion opening for handle to open and close the front door
6 Inspection glass for indications and position of the circuit-breaker
7 Knob for releasing the opening, for manual charging of the circuit-breaker's energy storing device
8 Opening for manual charging of the circuit-breaker's energy storing device
9 Lock permitting locking and unlocking of the front door
10 Knob for releasing the opening for racking the truck in/out manually
11 Opening for racking the truck in/out manually
12 Earthing switch operating element
13 Voltage indicator
14 Position indicator of earthing switch
15 Securing bolts of the cable compartment cover

10.2 Operation accessories

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

Designation	Item no.	Illustration
Handle for opening and closing the front door	SEM101120-01	
Double-bit key for the front door	SEM101137-01	
Double-bit key for the low-voltage compartment	SEM101137-02	
Crank to charge the circuit-breaker's energy-storing device	AGS H30498-01	
Operating rod to switch the circuit-breaker on and off	AGS H35446-01	

Designation	To be used for:	Rated value	Connector design	Item no.	Illustration
Operating lever for earthing switch	Cable feeder	Short circuit current ≤ 31.5 kA	square	AMT000223-08 (motorized)	
			square	AMT000223-09	
		Short circuit current 40 kA	hexagonal	AMT000223-10	
	Busbar	Short circuit current ≤ 31.5 kA	square	AMT000223-05	
		Short circuit current 40 kA	hexagonal	AMT000223-07	
Crank for truck	Truck HVX/UTX/MTX	Rated current I_r < 2500 A	hexagonal	AGSH31601-01 (manual drive) AGSH31674-01 (motor drive)	
	Truck HVX/UTX	Rated current I_r ≥ 2500 A	square	AGSH32532-01 (manual drive) AGSH31674-02 (motor drive)	

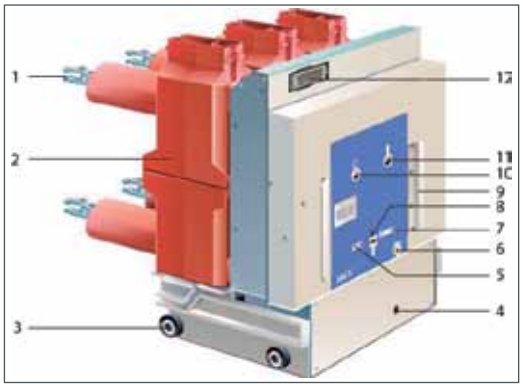


Fig. 10.2
HVX circuit-breaker ≤ 24 kV/≤ 2500 A

10.3 Trucks for PIX panels

1 Moving contacts
2 Pole casing with vacuum interrupter chamber
3 Truck rollers
4 Opening for racking the truck in/out manually
5 Operations counter
6 Insertion opening for manual charging of the energy storing device
7 Indicator, energy-storing device (charged/released)
8 Indicator, circuit-breaker ON/OFF
9 Handles for racking the circuit-breaker in/out
10 Circuit-breaker OFF
11 Circuit-breaker ON
12 Sockets for low-voltage connector

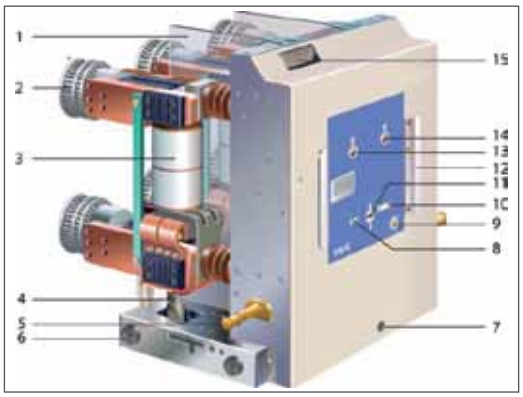


Fig. 10.3
HVX circuit-breaker ≤ 17.5 kV/> 2500 A

1 Pole partitions
2 Moving contacts
3 Vacuum interrupter chambers
4 Press rod (transmission of ON/OFF switching movement)
5 Shutter actuation
6 Truck rollers
7 Opening for racking the truck in/out manually
8 Operations counter
9 Insertion opening for manual charging of the energy storing device
10 Indicator, energy-storing device (charged/released)
11 Indicator, circuit-breaker ON/OFF
12 Handles for racking the circuit-breaker in/out
13 Circuit-breaker OFF
14 Circuit-breaker ON
15 Sockets for low-voltage connector

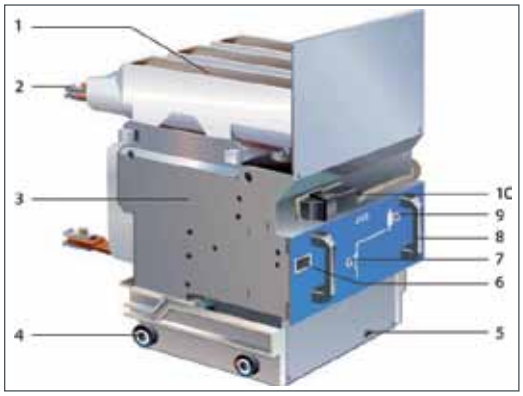


Fig. 10.4
Vakuumschütz CVX

1 H.V.H.R.C. fuses
2 Moving contacts
3 Vacuum interrupter chambers with magnetic drive
4 Truck rollers
5 Opening for racking the truck in/out manually
6 Operations counter
7 Indicator, vacuum contactor ON/OFF
8 Handles for racking out/in
9 Fuse status indication
10 Low-voltage connector

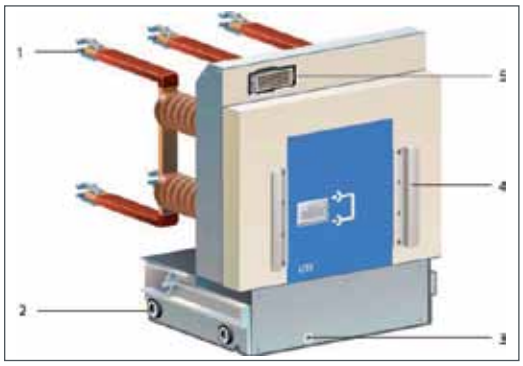


Fig. 10.5
Disconnector truck UTX 12 kV

1 Moving contacts
2 Truck rollers
3 Opening for racking the truck in/out manually
4 Handles for racking out/in
5 Sockets for low-voltage connector

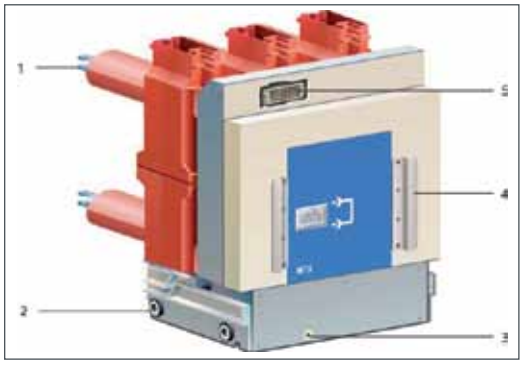


Fig. 10.6
Disconnector truck UTX 17.5/24 kV with pole casing

1 Moving contacts
2 Truck rollers
3 Opening for racking the truck in/out manually
4 Handles for racking out/in
5 Sockets for low-voltage connector

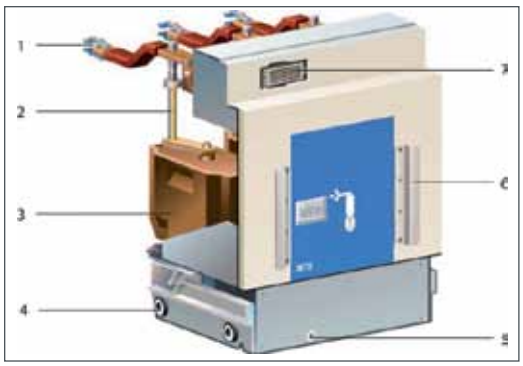


Fig. 10.7
Metering truck MTX

1 Moving contacts
2 High-voltage fuse for voltage transformer
3 Voltage transformer
4 Truck rollers
5 Opening for racking the truck in/out manually
6 Handles for racking out/in
7 Sockets for low-voltage connector

10.4 Interlocks

PIX panels have mechanical basic interlocks which help avoid operating errors.

You must be familiar with these interlocks before operating panels.

10.4.1 Mechanical interlocks

Interlock	Function of interlock	Method of operation of interlock
Between truck and low-voltage connector	The truck cannot be actuated unless the low-voltage connector is inserted	The opening for the moving crank handle is locked.
Between truck and earthing switch	The truck cannot be racked in if the earthing switch is ON.	The moving crank handle is uncoupled automatically.
	The earthing switch can no longer be switched on if the truck has left its disconnected position.	The rotary movement of the earthing switch lever is blocked. Do not apply force!
Between the circuit-breaker and the truck	Circuit-breaker cannot be racked in or out while it is switched on	The opening for the moving crank handle is locked
	Circuit-breaker cannot be switched on unless ■ it is completely in its disconnected or service position and ■ the operating crank for the rack-in mechanism has been removed	The circuit-breaker cannot be switched on or off
Between the cable compartment cover and the earthing switch (optional)	The cable compartment cover can only be removed if the earthing switch is ON.	The cable compartment cover is locked mechanically by means of a sheet metal plate.
Between the truck and the front door (optional)	The front door can only be opened if the truck is in its disconnected position.	The front door cannot be lifted via the opening handle unless the truck is in disconnected position.
	If the front door is opened, the truck cannot be moved into service position.	The crank of the truck cannot be inserted if the front door is open.

10.4.2 Electromagnetic interlocks (optional)

Electromagnetic blocking coils can be used for inter-panel as well as intrapanel interlocks:

- The circuit-breaker's ON and OFF pushbuttons are blocked.
- Manual actuation of the disconnector truck is blocked.
- Manual actuation of the earthing switch is blocked.

Warning!
Complete switchgear interlocking can only be ensured with complete locking devices to avoid malfunctions.

Important:

- In case of failure of the supply voltage, all electrical interlocks are in their "locked" position. Measure: Re-establish supply voltage.
- Please note the purchase contract and the switchgear-specific circuit diagram as regards the design of the interlocking systematics.
- If no blocking coils are being used for the locking devices, a mechanical lock-out with cylinder or U lock must be provided.

10.4.3 Mechanical lock-outs due to padlocks (not included in scope of supplies)

The boreholes are provided for padlock yokes of Ø ≤ 8 mm.

Fig. 10.8
Cover flaps on ON/OFF pushbutton for the circuit-breaker can be locked by means of a padlock (optional).

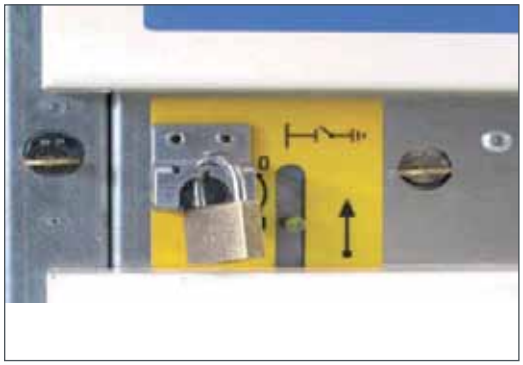


Fig. 10.9
Mechanical lock-out of earthing switch via padlock

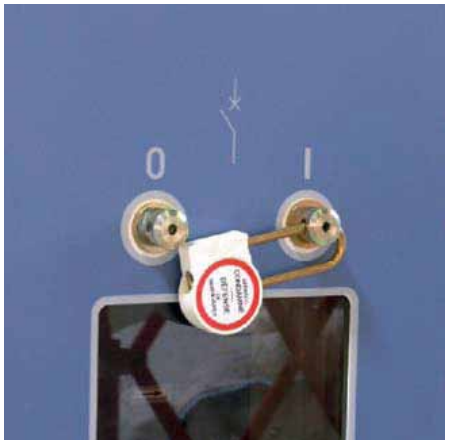


Fig. 10.10
Manual switching ON of circuit-breaker locked by padlock

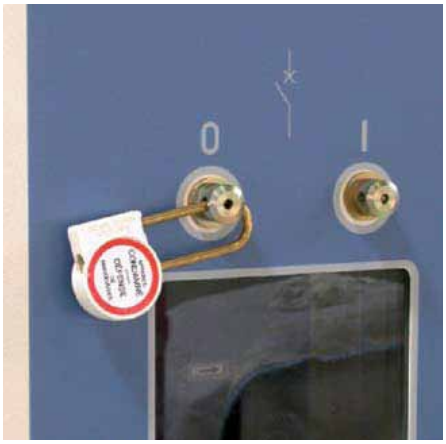


Fig. 10.11
Manual switching OFF of circuit-breaker locked by padlock

Fig. 10.12
Mechanical lock-out for shutter (same principle for left-hand and right-hand sides)

Fig. 10.13
Interlock of truck (optional)

10.4.4 Interlocks by means of cylinder locks (optional)

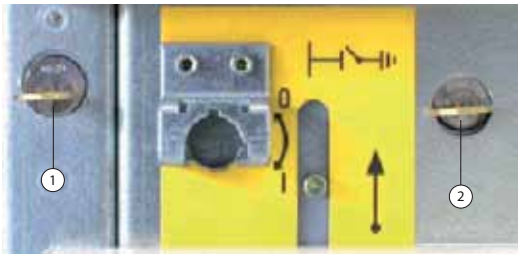


Fig. 10.14

1 Interlocking of earthing switch in closed condition
2 Interlocking of earthing switch in open condition

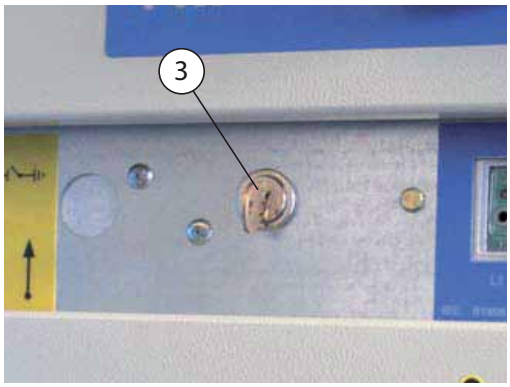


Fig. 10.15

3 Interlock of truck

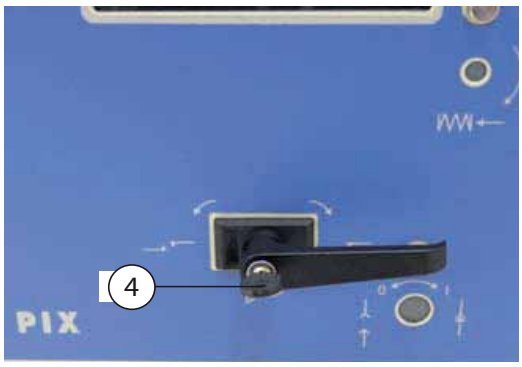


Fig. 10.16

4 Interlocking of front door

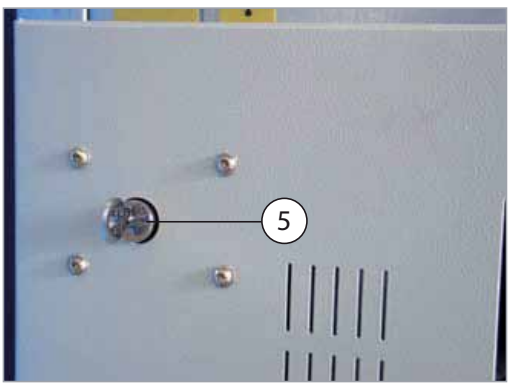


Fig. 10.17

5 Interlocking of cable compartment cover

10.4.5 Supplementary interlocks

Further mechanical lock-outs and additional interlocks can be provided as specified in the contract.

10.5 Operating specifications

The switchgear unit may only be operated by specialist electricians who have proven experience (training certificate) in conjunction with the PIX 12-17-24 kV series and all the relevant safety standards.
Refer also to the safety provisions in Chapter 1.

Warning!
To rule out faulty switching, the operating sequences described below must be complied with. Each switching operation must be completed.

Check whether the supply voltage is ON.

Important:
- After each switching operation for which you have used a crank or a lever, remove this device and store it in the tool board.
- In case supply voltage is not available:
  - blocking coils (locking the interrogation slides and circuit-breaker pushbuttons, depending on design) are in “locked” position.
  - an undervoltage release (optional) has dropped out.

Measure: Re-establish the supply voltage.

10.6 Operating the circuit-breaker

10.6.1 Charging the circuit-breaker’s energy storing device

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

Charging by hand

- Open cover (Fig. 10.18, 1) and insert crank (2).
- Turn clockwise (3), until the charge drive mechanism is uncoupled (sound). The energy storing device indicates the “charged” condition (4).
- 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 (Fig. 10.18, 4).

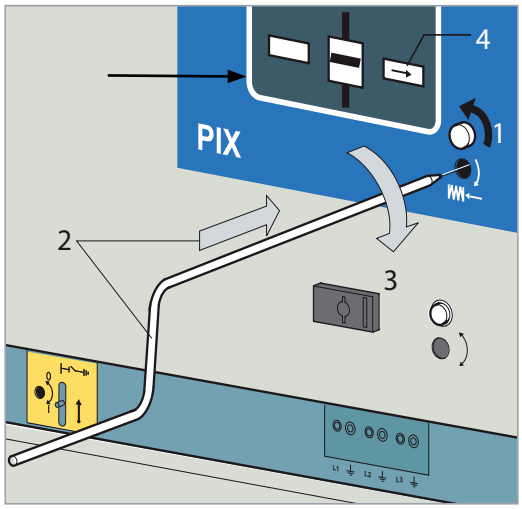


Fig. 10.18
Charge energy storing device of circuitbreaker manually
1 Open cover
2 Insert crank
3 Turn clockwise
4 Position indicator, energy-storing device (charged)

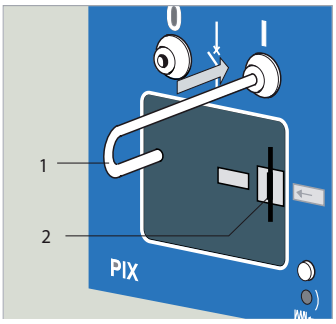


Fig. 10.19
Switching the circuit-breaker ON via the operating rod

10.6.2 Operating the circuit-breaker manually

Switching ON via the operating rod

Insert the operating rod into the right-hand guide of the front door and press it right to the back (Fig. 10.19, 1). The circuit-breaker is switched ON; the position indicator indicates ”ON“ (2).

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

1 Operating rod
2 Position indicator reads: Circuitbreaker ON

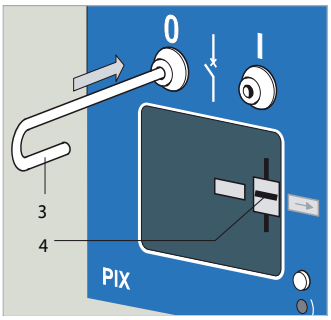


Fig. 10.20
Switching the circuit-breaker OFF via the operating rod

Switching OFF via the operating rod

Insert the operating rod into the left-hand guide of the front door and press it right to the back (Fig. 10.20, 3). The circuit-breaker is switched OFF. The position indicator indicates ”OFF” (4).

1 Operating rod
2 Position indicator reads: Circuitbreaker OFF

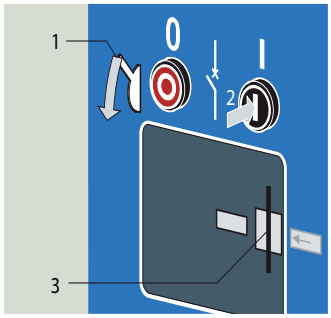


Fig. 10.21
Switching circuit-breaker ON via pushbutton

Switching ON via pushbutton (optional)

Press the left-hand lever down (Fig. 10.21, 1). To switch ON, press the black pushbutton (right-hand - 2). The circuit-breaker is switched ON. The position indicator indicates ”ON” (3).

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

1 Press lever down
2 Press pushbutton I
3 Position indicator reads: Circuitbreaker ON

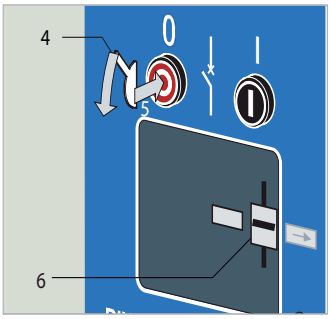


Fig. 10.22
Switching circuit-breaker OFF via pushbutton

Switching OFF via pushbutton (optional)

Press the left-hand lever down (Fig. 10.22, 4). To switch OFF, press the red pushbutton (left-hand - 5). Circuit-breaker is switched OFF. The position indicator indicates ”OFF” (6).

4 Press lever down
5 Press push-button O
6 Position indicator reads: Circuitbreaker OFF

10.6.3 Switching the circuit-breaker electrically

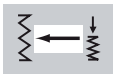
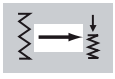
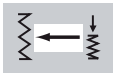
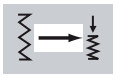
Switching ON (Closing)

Actuate closing release via bay computer or remote control.
The energy storing device can be charged immediately after switching ON (by hand 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
- by undervoltage release or
- by secondary release

10.6.4 Position indicators on circuit-breaker and possible operating sequences

Item	Position indicator for energy-storing device (spring mechanism)		Position indicator for circuit breaker ON/OFF		Possible operating sequence
1		released		OFF	none
2		charged		OFF	C–O
3		released		ON	O
4		charged		ON	O–C–O

C = Switching ON (Closing) O = Switching OFF (Opening)

10.7 Move truck into service/disconnected position

Warning!
Trucks may on principle only be moved into service or disconnected position when de-energized. Switch circuit-breaker and vacuum contactor OFF or, in case of disconnector truck UTX, isolate the feeder.

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.

Initial situation:

- Circuit-breaker OFF
- Earthing switch OFF

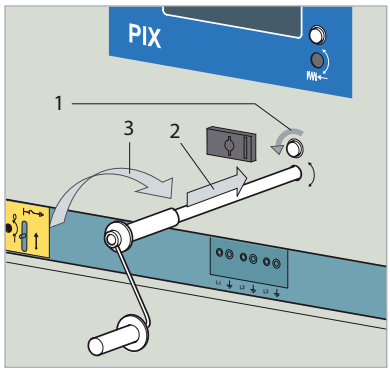


Fig. 10.23

1 Open cover
2 Insert crank
3 Turn crank clockwise

10.7.1 Racking-in the truck from disconnected into service position

- Open cover (Fig. 10.23, 1) and insert crank (2).
- Turn crank clockwise (3) until the truck has been racked in. Remove crank.
- Check position of truck (Fig. 10.24) through the inspection glass.

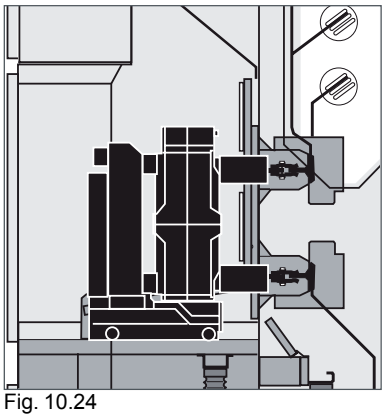


Fig. 10.24
Truck in service position

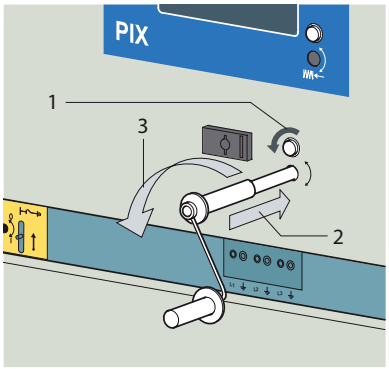


Fig. 10.25

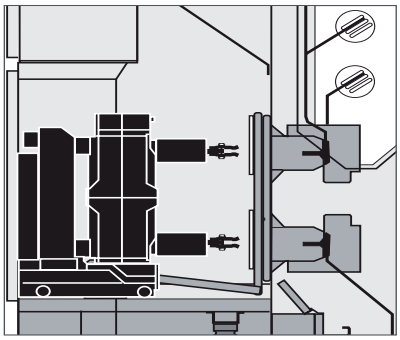


Fig. 10.26
truck in disconnected position

10.7.2 Racking-out the truck from service into disconnected position

- Open cover (Fig. 10.25, 1) and insert crank (2).
- Turn crank counter-clockwise (3) until the truck has been racked out. Remove crank.
- Check position of truck (Fig. 10.26) through the inspection glass.

1 Open cover
2 Insert crank
3 Turn crank counter-clockwise

10.8 Vacuum contactor CVX

Position indicator

Whether the vacuum contactor CVX is switched on or off is indicated directly on the device (Fig. 10.27 and 10.28).

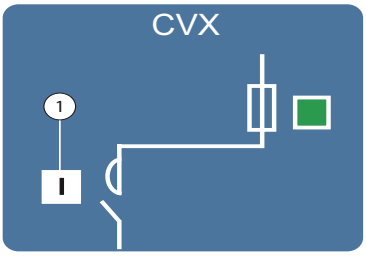


Fig. 10.27

1 Vacuum contactor ON

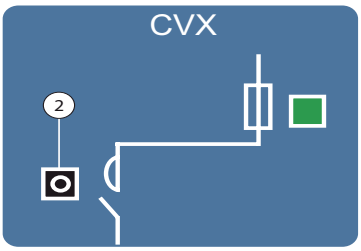


Fig. 10.28

2 Vacuum contactor OFF

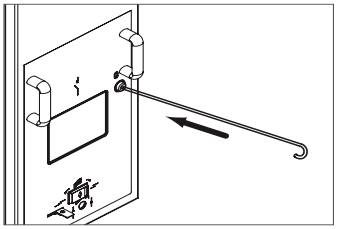


Fig. 10.29
Switching OFF the vacuum contactor CVX by means of an operating rod

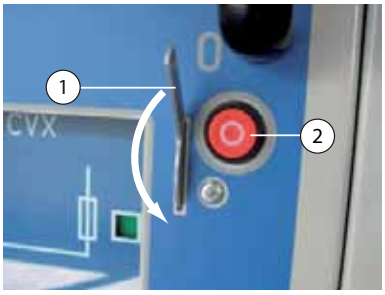


Fig. 10.30
Switching OFF the vacuum contactor CVX by means of a push-button
1 Press lever down
2 Press pushbutton O

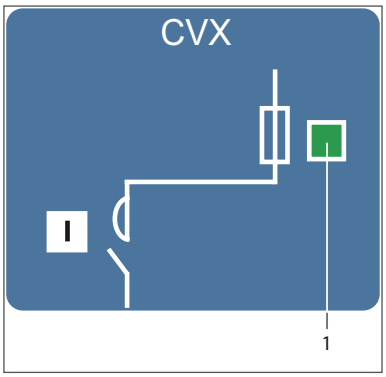


Fig. 10.31
1 Indicator green: no fuse tripped

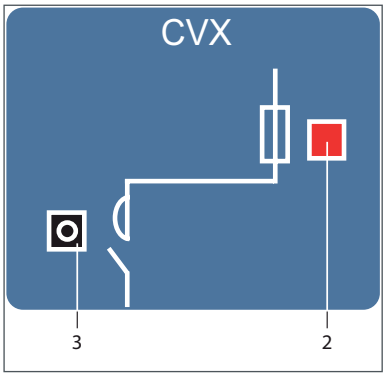


Fig. 10.32
2 Indicator red: one or several fuses have tripped
3 Switch position indicator: vacuum contactor has switched off automatically

Switching
The vacuum contactor CVX is switched on and off by means of a remote control device or the control and protection device GEMSTART (see switchgear documentation).

Switching OFF manually (optional)

This feature is only available for mechanically latched vacuum contactors CVX. In this case, the vacuum contactor CVX can be switched off directly on the panel (Fig. 10.29 and 10.30).

- Insert operating rod through the guide hole in the front door until the vacuum contactor switches OFF (Fig. 10.29). Check the position indicator (Fig. 10.28).
- Alternatively: Switching off by means of a pushbutton (Fig. 10.30). To this effect, move the lever (1) downwards to its stop and press the OFF pushbutton (2). Check the position indicator (Fig. 10.28).

10.8.1 Fuse tripping

The inspection port of the vacuum contactor on the panel front indicates the fuse tripping status:

Measures to be taken in case of fuse tripping

- Put vacuum contactor to disconnected position and move it out of the panel. This approach corresponds to the description in Chapter 4.3.4 with the HVX truck.
- Always exchange all three fuses. Fuse replacement is described in the Operating Manual of the vacuum contactor CVX (no. NTV 132).

10.9 Operating the earthing switch manually

Initial situation:

- Leistungsschalter OFF
- Truck in disconnected position

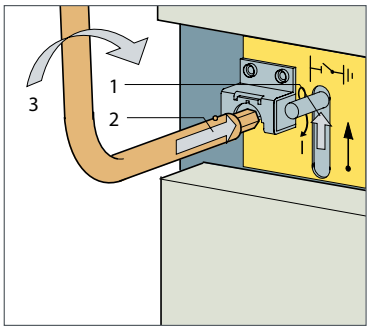


Fig. 10.33
Switch earthing switch ON:
1 Press slide upwards
2 Insert the operating lever
3 Turn operating lever clockwise

10.9.1 Switching ON the earthing switch

- Push the slide (Fig. 10.33, 1) upwards and insert the control lever of the earthing switch with the lever rod pointing upwards (2).
- Turn the lever clockwise by approx. 95° (3).
- Check position indicator. It must indicate that the earthing switch is ON (Fig. 10.34, 4). Remove lever.

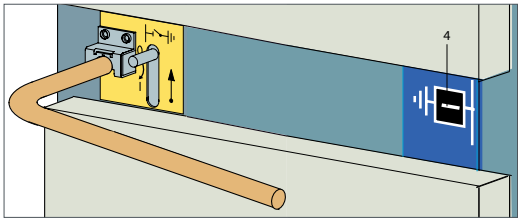


Fig. 10.34
4 Position indicator reads: Earthing switch is turned ON

10.9.2 Switching earthing switch OFF

- Push the slide (Fig. 10.35, 1) upwards and insert the control lever of the earthing switch with the lever rod pointing to the right (2).
- Press the lever counterclockwise by approx. 95° (3).
- Check position indicator: It must indicate that the earthing switch is OFF (Fig. 10.36, 4). Remove crank.

10.10 Standard switching operations

Important:
Observe the switching provisions (Chapter 10.5) and the interlocking conditions (Chapter 10.4).

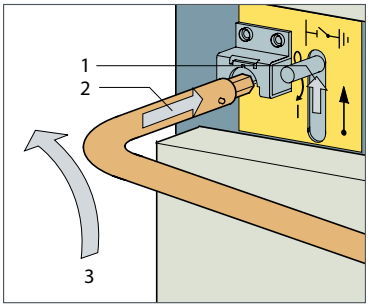


Fig. 10.35
Switch earthing switch OFF
1 Press slide upwards
2 Insert the operating lever
3 Turn operating lever counterclockwise

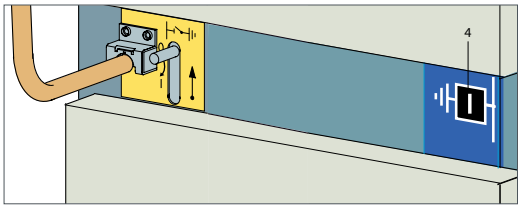


Fig. 10.36
4 Position indicator reads: earthing switch is OFF

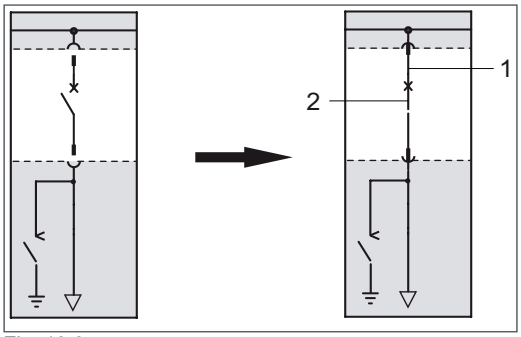


Fig. 10.37
Switch feeder cable ON

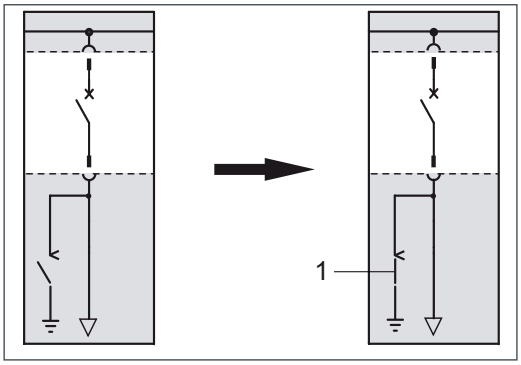


Fig. 10.38
Earthing feeder cable

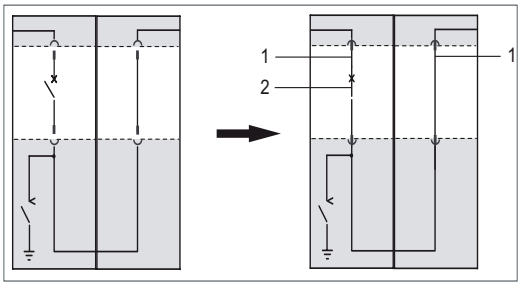


Fig. 10.39
Coupling busbar sections via bus section coupler and HVX and UTX trucks

10.10.1 Operating feeder cable

Initial situation:

- Circuit-breaker OFF
- HVX truck in disconnected position
- Earthing switch OFF

Switch feeder cable ON

- Move truck into service position (1).
- Switch circuit-breaker ON (2).

Switch feeder cable OFF

- Switch circuit-breaker OFF.
- Move truck into disconnected position.

10.10.2 Earthing the feeder cable

Initial situation:

- Circuit-breaker OFF
- HVX truck in disconnected position
- Earthing switch OFF

Earthing feeder cable

Switch the earthing switch ON (1).

De-earthing

Switch the earthing switch OFF.

10.10.3 Coupling busbar sections via bus section coupler

With HVX and UTX truck

Initial situation:

- Circuit-breaker OFF
- both trucks (HVX, UTX) in disconnected position
- Earthing switch OFF

Coupling the sections

- Move both trucks into service position (1).
- Switch circuit-breaker ON (2).

Uncoupling

- Switch circuit-breaker OFF.
- Move both trucks into disconnected position.

With HVX truck

Initial situation:

- Circuit-breaker OFF
- HVX truck in disconnected position

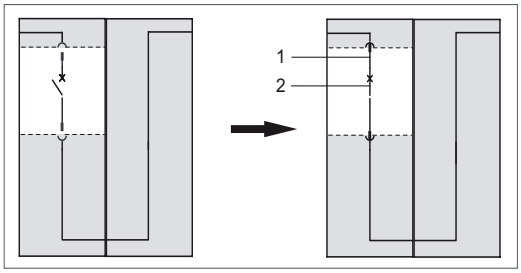


Fig. 10.40
Coupling busbar sections via bus section coupler and HVX truck

Coupling the sections

- Move truck into service position (1).
- Switch circuit-breaker ON (2).

Uncoupling

- Switch circuit-breaker OFF.
- Move truck into disconnected position.

10.11 Earthing the busbar

Warning!
The trucks (HVX, UTX) in the appropriate busbar sections must be in disconnected position.

Important:
Observe the switching provisions (Chapter 10.5) and the interlocking conditions (Chapter 10.4).

10.11.1 Earthing the busbar with the circuit-breaker of an feeder panel

The earthing device can be connected to a free cable terminal in the cable compartment (access: see Chapter 4.2). If necessary, remove cable. The earthing device and the earthing adapter are not included in the scope of supplies.

Important:
Comply with the specifications of the manufacturer of the earthing device and
- if applicable - the earthing adapter.

Initial situation:

- Feeder cable	EARTHED
- Earthing switch	ON
- Circuit-breaker	OFF
- HVX truck	in disconnected position

Earthing the busbar:

- Connect earthing device in cable compartment (1).
- Switch the earthing switch OFF (2).
- Move truck into service position (3).
- Switch circuit-breaker ON (4).

De-earthing:

- Switch circuit-breaker OFF.
- Move truck into disconnected position.
- Switch the earthing switch ON.
- Remove the earthing device.

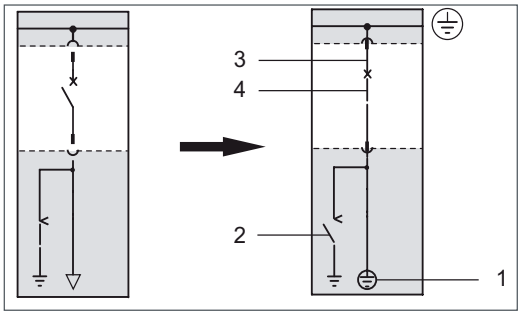


Fig. 10.41
Earthing the busbar with the circuit-breaker of an feeder panel

10.11.2 Earthing the busbar with busbar earthing switch in the metering panel

Initial situation:

- Earthing switch OFF
- Metering truck MTX in service position

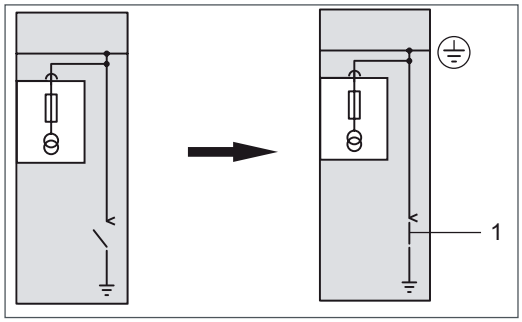


Fig. 10.42
Earthing the busbar with busbar earthing switch in the metering panel

Earthing the busbar

Switch the earthing switch ON (1).

De-earthing

Switch the earthing switch OFF.

10.11.3 Earthing the busbar with busbar earthing switch

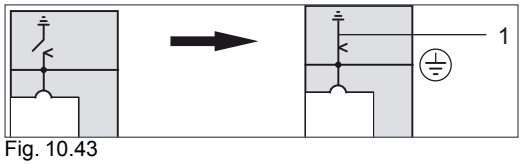


Fig. 10.43
Earthing the busbar with busbar earthing switch

Initial situation:

- Busbar earthing switch OFF

Earthing the busbar

Switch the earthing switch ON (1).

De-earthing

Switch the earthing switch OFF.

11 Maintenance

11.1 Safety provisions

Only specialist electricians certified by the manufacturer for maintenance work and who have the required knowledge regarding handling of medium-voltage switchgear of the series PIX 12-17-24 kV and all the relevant safety provisions are permitted to perform maintenance and cleaning work.

Warning!
Refer to the safety provisions in Chapter 1.

11.2 Servicing schedule

We recommend performing a visual inspection of the panels at least every four years, depending on the strain to which they are subjected during operation and the operating conditions.

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

For cleaning and maintenance work, please refer to Chapter 4 ”Access to the main circuit compartments”.

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

Maintenance interval for ambient conditions according to IEC 62271-1	Work to be carried out	Qualification / Work performed by
4 years or depending on the actual ambient conditions	■ Check panels completely for contamination, condensation and damage, e.g. due to partial discharge ■ Clean panels, if necessary (see Chapter 11.3). Perform a manual switching test of the drives and check interlocks and position indicators (see Chapter 10) ■ Repair damage or replace components (see Chapter 11.5 and 11.6)	Staff who have been certified for this work
12 years	■ Clean and grease drives and movable main current contacts (see Chapter. 11.7) ■ Check releases and blocking coils for proper working order ■ Check tightening torque of busbar screw fastenings	
Circuit-breaker truck HVX Metering truck MTX Disconnector truck UTX Vacuum contactor CVX	Refer to the applicable instruction manual for the truck concerned: AGS 531461-01, AGS 531301-01 AGS 531361-01 AGS 531361-01 NTV 133	
After 1,000 actuations of the truck or the earthing switch	Revision of the switching device in question	Manufacturer’s Service Center

11.3 Cleaning

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

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

Slight contamination

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

Serious contamination

Use cleaning agent, 1 litre can (see Chapter 12.1). 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.

11.4 Avoid condensation

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

Measures to take in case of condensation

- Should condensation be detected in or on the panel, clean the panel in accordance with Chapter 11.3.
- Installation or inspection of panel heating. It must provide a sufficient heating performance to prevent condensation on the panel.

11.5 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.

11.6 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.
The following data on the nameplate are relevant for replacement of components or panels or in case of any queries (see also Chapter 2.6):
- Type designation
- Serial number
- Year of construction

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

11.7 Lubrication instructions

Warning!
Risk of injuries: Circuit-breakers and drives must not be disassembled for lubrication.

Important:
Only approved lubricants may be used (see Chapter 12.1).
The following elements must not be lubricated:
- Motor
- Ball bearings
- Auxiliary releases
- Push switches
- Blocking coils
- Auxiliary switches

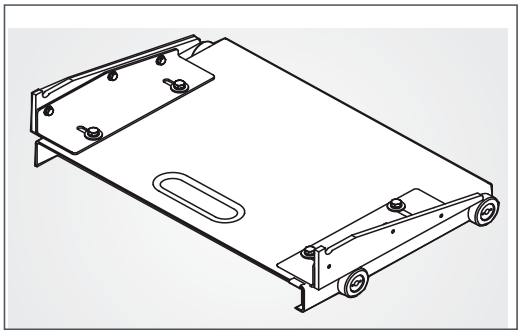


Fig. 11.1
Shutter lift for a panel width of 650 mm:
Item number ADM I25 125-01
for panel width 800/1000 mm:
Item number ADM I25 126-01

Preparation

- Remove truck from the panel (see Chapter 4.3.4).
- To get access to the fixed contacts behind the shutters, use a shutter lift (Fig. 11.1). Handling of the shutter lift corresponds to that of standard trucks (HVX, UTX).
- Clean lubrication points using a lint-free cloth; use cleaning agent in case of serious contamination (see Annex).

Lubrication

Points of lubrication	Lubricant	Lubrication procedure
Sliding contact surfaces	KL	Clean by means of lint-free cloth; use cleaning agent in case of serious contamination. Apply a thin and uniform film of lubricant.
All accessible friction points and sliding surfaces	KL	Clean lubricating points using a lintfree cloth or a soft paint-brush, if necessary using cleaning agent (use sparingly, just moisten points of lubrication). Apply a thin coat of lubricant (using e.g. a paintbrush).
Bearings and joints	FL	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.

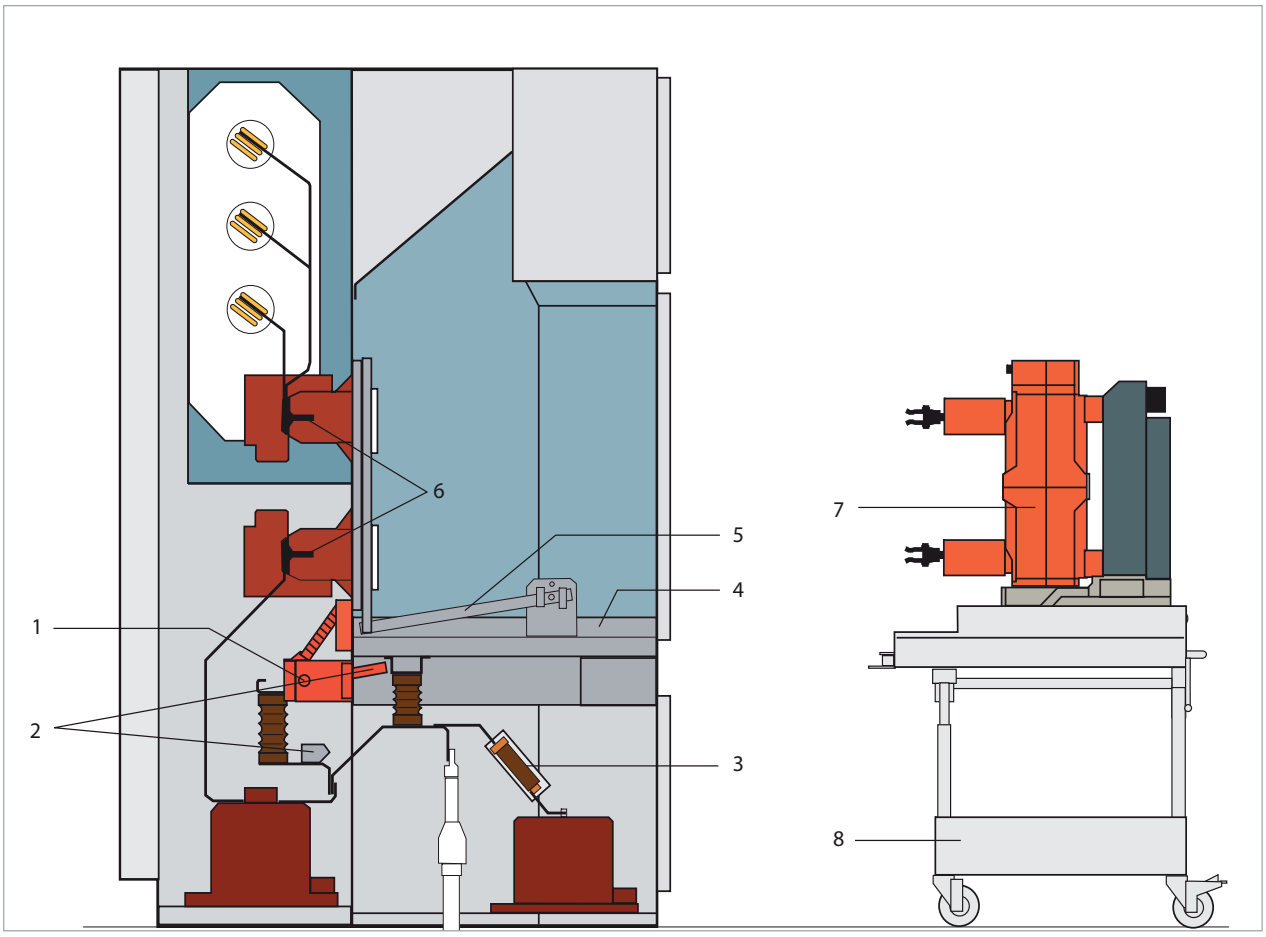


Fig. 11.2
Points of lubrication/maintenance
1 Earthing switch operating mechanism
2 Earthing switch contacts
3 Fuse of voltage transformer (optional)
4 Tracks for truck
5 Shutter mechanism
6 Fixed contacts for the truck
7 Switching device (lubricate in accordance with lubricating instructions in the appropriate operating manual HVX/UTX/MTX)
8 Trolley, handling: see Chapter 12.5

Once maintenance work is complete:

- Remove all the tools and auxiliary equipment used.
- Reinsert truck into the panel (see Chapter 4.3.5).
- Reposition covers, close doors and check switching functions (see Chapter 8 ”Commissioning”).

11.8 Replacing fuse of voltage transformer

Voltage transformer in feeder cable

- Switch ON the panel’s earthing switch.
- Remove cable compartment cover (see Chapter 4.2).
- Pull fuse (Fig. 11.2, item 3) carefully out of the clamping contact. Check contact surfaces for cleanness and, if necessary, clean (see section 11.3).

Insert new fuse; remount cable compartment cover.

Voltage transformer on metering truck MTX

See Operating Manual AGS 531361-01.

12 Annex

12.1 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.

Auxiliary product	Item no.
Cleaning agent	S 008 152
Lubricant KL, 0.5 kg can	ST 312-111-835
Liquid lubricant FL, 0.5 kg can	S 008153
Repair paint, 500 g can, RAL 7044, silk-grey	S 009 492

12.2 Treatment of firmly screw-connected contact surfaces

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

Important:
Contact areas coated with lubricant KL should not be touched, if possible.

- Contact areas must be subjected to preliminary treatment before screwfastening (see Table).
- Immediately after the preliminary treatment, coat contact surfaces completely with a thin and uniform film of lubricant KL.

Material of contact surfaces	Pre-treatment
Silver-plated contact surfaces	Clean[1]
Nickel-plated contact surfaces	Remove passivation layer[4]
Copper or copper alloy	Clean [1], expose metallic surface[2]
Aluminium	Clean [1], expose metallic surface[2]
Steel	Clean [1], expose metallic surface[2]
Zinc-plated steel	Remove passivation, not the zinc layer[3]
Hot-galvanized sheet-metal	Clean [1], passivation need not be removed

[1] Clean by means of lint-free cloth; use cleaning agent in case of serious contamination (see above)
[2] Expose metallic surface
- 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] using a brass brush, steel brush
[4] rub slightly by hand using Scotchbrite abrasive agent (Ni layer must not be reduced)

12.3 Screw fastenings

The following elements must be used for all screw fastenings:
- Screws and bolts: Grade ≥ 8.8
- Nuts: Grade 8

Important:
Do not grease screws or nuts.

Thread size	Tightening torque [Nm]	
	min.	max.
M5	3.8	4.7
M6	7	9
M8	16	24
M10	36	44
M12	63	77

Table 1:
Hex. bolts and socket-head capscrews (except slotted screws) and nuts (except self-locking nuts)

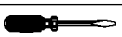
Thread size	Tightening torque [Nm]	
	min.	max.
M6	5	7.5
M8	12	18
M10	24	38
M12	36	54

Table 2:
Screw fastening with casting nuts in cast resin parts (transformer and post insulator)

Thread size	Tightening torque [Nm]	
	min.	max.
M6	5.5	7.5
M8	15	19
M10	30	40
M12	60	76

Table 3:
Screw fastening for current transmission, conductor material: copper

12.4 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 ≥ 2000 mm	
lint-free, clean rags	

12.5 Operation accessories

12.5.1 Transport trolley for truck

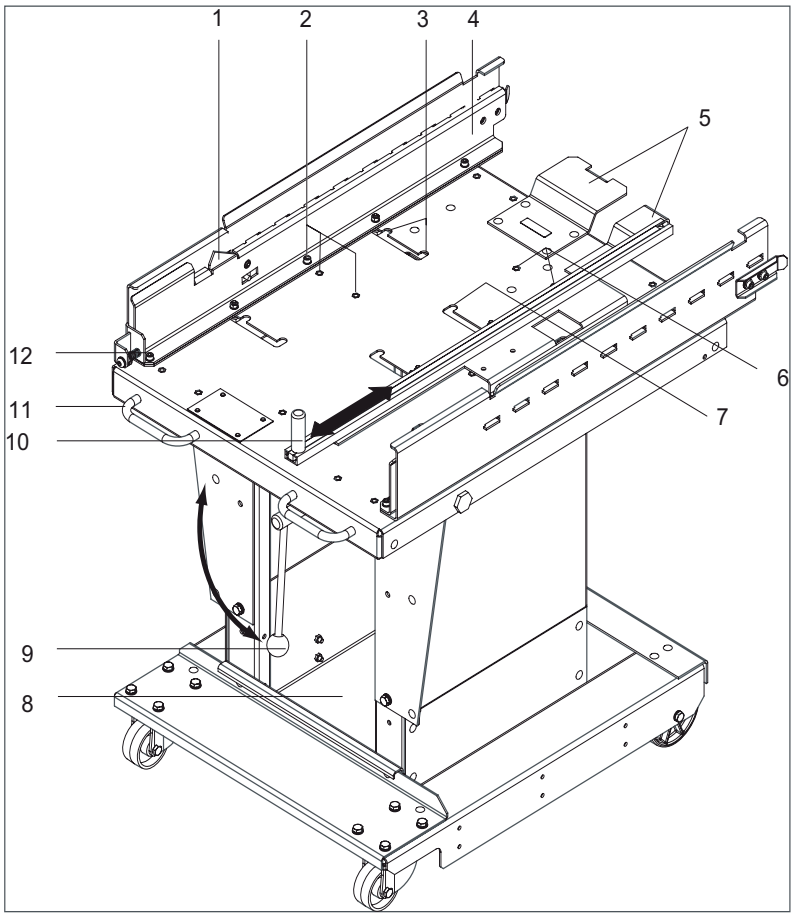


Fig. 12.1
Transport trolley for truck

1 Autonomous interlocking of the racked-in truck on the trolley
2 Variable screw fastening of track
3 Positioning of track to adjust the various track widths
4 Track
5 Interlocking with panel
6 Variable screw fastening of unlocking bar
7 Positioning of unlocking bar to match various panel versions
8 Tray for accessories (lever, keys, handle)
9 Lever to lock / unlock the transport trolley on the panel. Table of trolley is lifted or lowered.
10. Unlocking bar. The truck is unlocked in the panel.
11 Handles of trolley
12 Slide to unlock the truck from the trolley

Rated voltage U_r of the panel [kV]	Panel width [mm]	Truck	Item number of trolley
≤ 12	650/800	HVX/UTX/MTX/CVX	EIB AE1 148-01[1]
	1000	HVX/UTX (I_r = 2500 A)	EIB AE1 148-02
		HVX/UTX (I_r = 3150 A)	AGS C74 125-01
≤ 17,5	750	HVX/UTX/MTX/CVX	EIB AE1 148-01[1]
	1000	HVX/UTX (I_r = 2500 A)	EIB AE1 148-02
		HVX/UTX (I_r = 3150 A)	AGS C74 125-0[1]
24	800	HVX/UTX/MTX/CVX	EIB AE1 148-011
	1000	HVX/UTX (I_r = 2500 A)	EIB AE1 148-02

Adjusting the track width

[1] The trolley can be used for panel widths of 650, 750 and 800 mm:
- Release 3 screws on each track (Fig. 12.1, 2).
- Adjust the two tracks to the appropriate panel track width and check them. Re-mount the six screws.
- Adapt position of unlocking bar (10) also to the appropriate panel (same procedure).

12.5.2 Handling crane for trucks (optional)

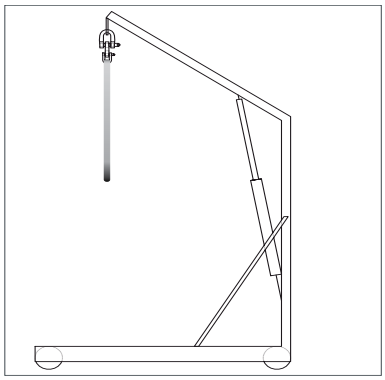


Fig. 12.2
Handling crane for trucks
Item no. AGSC73258-01

12.6 List of the assembly drawings

List of all assembly drawings specified in this manual.
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.

Description	Assembly drawing	Chapter
Panel fastening on concrete foundations	SEM102173-01	5.5
Screw-fastening the panels to one another	SEM102056-01	5.7
Mounting the low-voltage compartments	AGS C73 180-01	7.2
Mounting an additional cable duct	AMT 000 376-01	7.4.2

Note

Schneider Electric
35, rue Joseph Monier
CS 30323
92506 Rueil-Malmaison Cedex, France

RCS Nanterre 954 503 439
Capital social 896 313 776 €
www.schneider-electric.com

This document has been printed on ecological paper

Publishing: Schneider Electric
Design: Schneider Electric
Printing

AMTNoT 060-02

02-2011