
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTION MANUAL

UniGear ZS1

with a panel width of 500 mm



- Safety
- Reliability
- Flexibility
- Economy

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Your safety first – at all times!

That is why our instruction manual begins with the following recommendations:

- Only install switchgear in closed rooms suitable for electrical equipment
- Ensure that installation, operation and maintenance are only carried out by qualified competent electricians only
- Fully comply with the legally recognized standards (IEC or local), the connection conditions of the local electrical utility and the applicable safety at work regulations
- Observe the relevant information in the instruction manual for all actions involving switchgear



Danger!

- Pay special attention to the hazard notes in the instruction manual marked with this warning symbol.
- Make sure that the specified data are not exceeded under switchgear operating conditions
- Keep the instruction manual accessible to all personnel involved in installation, operation and maintenance
- The user's personnel must act responsibly in all matters affecting safety at work and correct handling of the switchgear



Warning

Always follow the instruction manual and respect the rules of good engineering practice!

Hazardous voltage can cause electrical shocks and burns.

Disconnect power, then earth and shortcircuit before proceeding with any work on this equipment.



Warning

Using of safety clothes like safety gloves according to EN 388 Blade cut resistance class 5, long sleeved work jacket or safety sleeves, safety shoes is recommended during all activities done with the switchgear.

If you have any further questions about this instruction manual, the members of our field organization will be pleased to provide the required information.

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1 Summary

1.1 General

UniGear ZS1 is a three-phase, metal-enclosed, air insulated switchgear that is factory-assembled, type tested and suitable for indoor applications up to 12 kV. The units are designed to accommodate withdrawable modules and are fitted with a single busbar system. The withdrawable parts are equipped with circuit-breakers. Details of the technical design and configuration of individual switchgear, including detailed equipment lists for the individual panels and comprehensive circuit documentation etc. can be found in the relevant order documents.

1.2 Standards and specifications

UniGear ZS1 switchgear panels comply with the standards and specifications for factory-assembled, metal-enclosed and type-tested high voltage switchgear, i.e. IEC publications 62271-200 and 62271-1. In addition, in accordance with IEC 60529, the switchgear panels have the following degrees of protection: IP4X for the enclosure and IP2X for the partitions.

All other corresponding IEC publications, national or local safety at work regulations and safety regulations for production materials must be followed during the installation and operation of these systems. Above and beyond this, the order-related data from ABB must be taken into account.

1.3 Operating conditions

1.3.1 Normal operating conditions

The switchgear is basically suitable for normal operating conditions for indoor switchgear in accordance with IEC 62271-200. Among other considerations, the following limiting values apply.

Ambient temperature:

• Maximum	+40 °C
• Maximum 24 h average	+35 °C
• Minimum (according to "minus indoor class")	-15 °C

Ambient humidity:

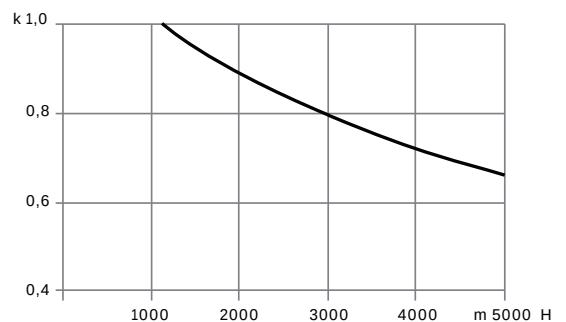
Maximum 24 h average of relative humidity	95% RH
Maximum 24 h average of water vapour pressure	2.2 kPa
Maximum monthly average of relative humidity	90% RH
Maximum monthly average of water vapour pressure	1.8 kPa

The normal operational altitude is up to 1,000 m above sea level.

The indoor ambient conditions are free of significant pollution, such as dust, smoke, corrosive and/or flammable gases, vapors or salt, etc.

1.3.2 Special operating conditions

The switchgear is suitable for operation in the WDa type of climate according to IEC 60721-2-1.



Special operating conditions must be discussed with ABB in advance. For example:

- At site altitudes above 1,000 m, the effects of the reduction in dielectric strength of the air on the insulation level must be taken into account (please refer to the diagram in Figure 1)
- Increased ambient temperatures must be compensated in the design of the busbars and branch conductors, otherwise the current carrying capacity will be limited

Note on special climatic operating conditions: When switchgear is operated in areas with high humidity and/or major rapid temperature fluctuations, there is a risk of dew deposits which must be excluded under normal operating conditions for indoor switchgear.

Preventive action (e.g. suitable ventilation and proper air conditioning of the building or housing, use of dehumidifying equipment, etc.) must be taken into consideration with ABB to avoid this condensation phenomenon and any resulting corrosion or other adverse effects.

2 Technical data

2.1 Electrical data

		IEC	GB
Rated voltage	kV	12	12
Rated insulation voltage	kV	12	12
Rated power frequency withstand voltage	kV 1 min	28	42
Rated lightning impulse withstand voltage	kV	75	75
Nominal frequency	Hz	50/60	50/60
Rated short-time withstand current	kA 3 s	...31.5	...31.5
Peak current	kA	80	80
Internal arc withstand current	kA 1 s	...31.5	...31.5
Main busbars rated current ¹⁾	A	...4000	...4000
Branch connections rated current	A	630-1250	630-1250

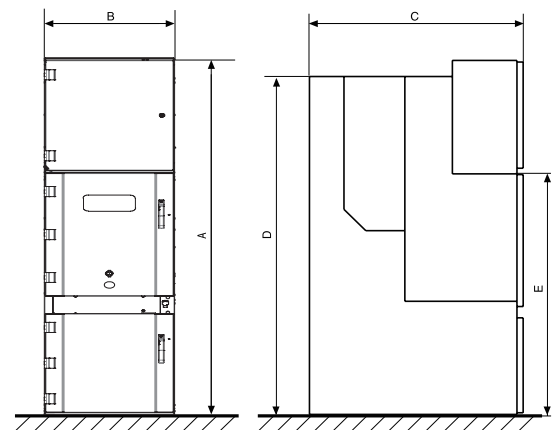
1) Up to 4000 A if coupled with other UniGear ZS1 units.

2.2 Resistance to internal arc faults

The fault withstand capacity is 31.5 kA for 1 s.

The switchgear units have been tested according to IEC 62271-200 standard (Annex A, accessibility type A, IAC classification FLR) and also to PEHLA recommendation No.4. In individual cases, depending on the configuration of the switchgear panels and/or the switchroom conditions (e.g. low ceiling height), additional measures may be necessary to ensure compliance with criterion 5.

2.3 Dimensions and weights



		Dimension (mm)	Weight (includes withdrawable modules)
Height	A	2200/2595 ¹⁾	610-850 kg
Width	B	500	
- Feeder panel			
Depth	C ²⁾	1310/1620	
Height of the basic part of panel	D	2100	
	E	1495	

1) Height of the control cabinet is 705/900 mm.

2) Deeper units are available on request.

3 Panel design and equipment

3.1 Basic structure and variants

The UniGear ZS1 panel uses insertion technology for the incoming/outgoing feeder panel with a vacuum circuit-breaker. Each UniGear panel consists of three high-voltage compartments - busbar, circuit-breaker and cable connection - while a control cabinet houses the secondary equipment. Apart from this, variants are possible for all operating needs.

Figure 2 shows example of possible panel configuration, including electrical equipment.

For busbar sectioning, two panels are necessary: a coupling panel with the withdrawable circuit-breaker part and a bus-riser panel (optional with busbar metering and earthing).

Further details about installation and switchgear equipment can be ordered from the manufacturer.

3.2 Enclosure and partitioning

A typical panel enclosure is made of 2 mm thick high quality galvanized steel sheets. The internal partitions consist of 2 mm thick high quality galvanized steel or stainless steel sheets. The materials used protect the panel against rust and oxidation under adverse circumstances. The three high-voltage compartments are equipped with top-mounted and secured pressure-relief flaps which are opened (by a shockwave) to release the pressure and gas buildup caused by an internal arc fault. The pressure-relief flaps are secured with steel screws on one longitudinal side and plastic screws on the other side. The internal overpressure causes the plastic screws to rupture.

The front of the panel is closed off by pressure resistant doors. The cable and circuit-breaker compartments have their own doors. Neighboring panels are separated from one another by the side walls of each panel, and an air cushion remains between these walls when the panels are jointed together.

Limiting, or even avoiding the end effects of an internal arc fault is dependent on ceiling height, and in individual situations, some special protection measures are needed.

- The mounting of a pressure relief duct on the top of the switchgear, with further channels leading out of the switchgear room in a form appropriate to the design of the building. The shock wave and arc discharge are channeled off in ducts
- A switchgear internal arc causes the air pressure inside a compartment to rise. Meanwhile the doors are closed and sealed, causing the high air pressure to burst through the pressure release plate and out through the top of the switchgear
- Steel plates are used to separate the low-and high-voltage compartments
- The switchgear end covers are designed not only for aesthetic purposes but their mechanical and electro-caloric properties provide good protection when an internal fault arc occurs

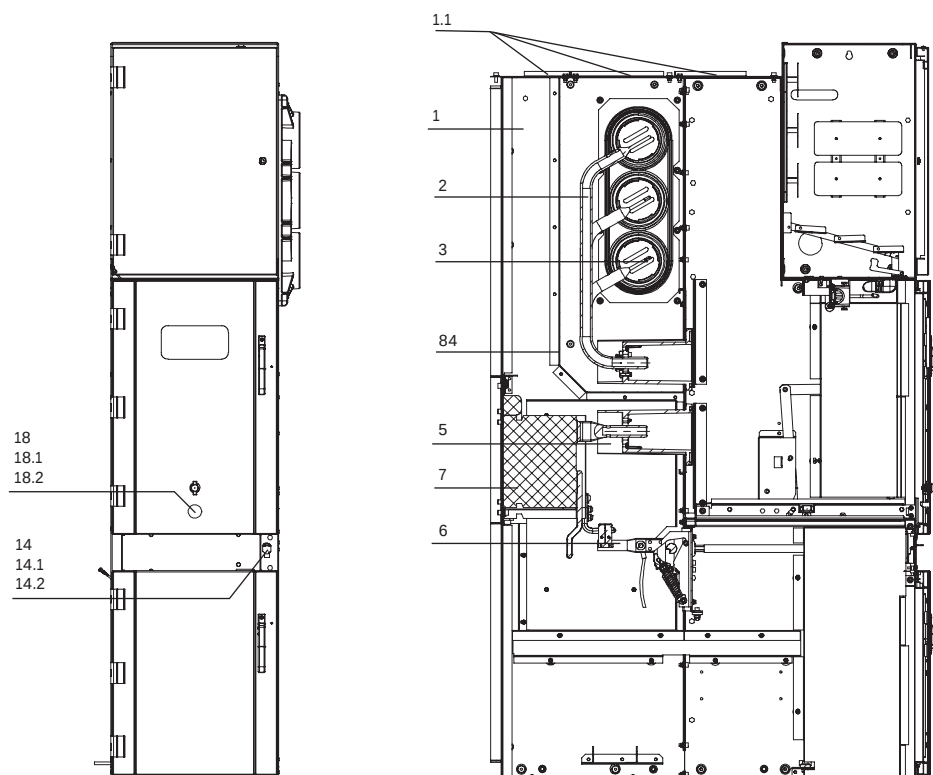


Figure 2-1 Example of UniGear ZS1 unit

1	Enclosure	14	Earthing switch operating mechanism
1.1	Pressure relief flap	14.1	Operating shaft for earthing switch
2	Branch conductor	14.2	Slide
3	Busbar	18	Spindle mechanism
5	Isolating bushing	18.1	Spigot on spindle
6	Earthing switch	18.2	Hole in spindle for insertion lever
7	Current transformer	84	Partition

3.3 Panel compartments

3.3.1 Busbar compartment

The main busbars are either flat or D-shaped and are made of copper. They are laid in sections from panel to panel.

According to the current rating, either a single or double configuration is used. They are held in place by branch conductors, and if installed, by busbar bushings. No special connection clamps are needed. The bolt connections in the busbar system have insulating covers. By means of bushing plates and busbar bushings, partitions can be created between panels. These partitions are necessary for every panel.

3.3.2 Circuit-breaker compartment

The circuit-breaker compartment (Fig. 3, 4) contains all the necessary equipment that allows the withdrawable part and the panel to work seamlessly together. Like the busbar compartment, it is metalically partitioned on all sides. The isolating contacts and the fixed isolating contacts are located on a mounting plate. The metal shutters covering the insertion openings are also included. The shutters are automatically opened by the actuating bars of the withdrawable circuit-breaker part when, by means of a lever, it is set up in the service position. The shutters are closed when the withdrawable

part is moved to the test/disconnected position. When the withdrawable part is in the test/disconnected position inside the panel, partitioning by separation is established in the main current circuit. Connection of the control wiring, required for test purposes, is not interrupted when in the test/disconnected position. The socket for the control wiring is mounted inside the circuit-breaker compartment.

In the test/disconnected position, the ON/OFF pushbutton located on the circuit-breaker, and the mechanical indicators for ON/OFF and CHARGED/DISCHARGED can be observed through an inspection window. All switching operations are carried out with the doors closed. Installation of an additional mechanical switching device to manually operate the circuit-breaker in the service position is also possible.



Figure 3-1 Circuit-breaker compartment, open.
Withdrawal part in the disconnected position

- | | |
|------|-------------------------------------|
| 10.1 | Control wiring socket |
| 12.1 | Top shutter |
| 12.2 | Lower shutter |
| 14 | Earthing switch operating mechanism |

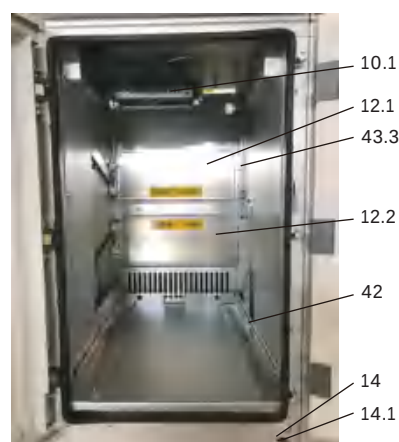


Figure 4 View into the circuit-breaker compartment

- | | |
|------|-----------------------|
| 14.1 | Drive shaft |
| 42 | Right travel rail |
| 43.3 | Duct cover, top right |

3.3.3 Withdrawable parts

1) Withdrawable circuit-breaker parts:

The withdrawable part of the UniGear ZS1 panel forms a complete module consisting of the vacuum circuit-breaker type VD4 (Fig. 5, 6), an isolated contact arm with its associated contact system and a control wiring plug.

The withdrawable assembly and the circuit-breaker are coupled via a multi-pole control wiring plug connector. The withdrawable assembly establishes the mechanical connection between the panel and the circuit-breaker. The fixed part of the assembly is connected, on both sides, to the panel by form-coded forking. The moving part with the circuit-breaker is moved manually between the service or test/disconnected positions - with the front doors closed - by means of a spindle. Auxiliary switches are used to register both the selected position and the angular position of the spindle.

The withdrawable part and the panel are earthed together by means of an earthing system in the panel.

Withdrawable parts with the same design are interchangeable. In cases where the dimensions are identical but the circuit-breaker fittings differ, the control wiring plug coding (Fig. 16) prevents incorrect connections between the withdrawable part and the panel. Detailed coding information is given in the relevant order documents.

2) Other withdrawable parts include:

- The metering voltage-transformer truck with fuses
- The earthing truck without making capacity (for the main busbar system and power cables)
- The power cable testing truck
- The isolation truck
- The metering truck



Figure 5 VD4 circuit breaker

- 13.1 – Close pushbutton
 13.2 – Open pushbutton
 13.4 – Signaling device for circuit-breaker open/closed
 13.5 – Operation counter



Figure 6 VD4 circuit-breaker pole side

- 13.4 – Signaling device for closing springs charged/discharged
 13.15 – Withdrawal part
 28a – Lever for manually charging the closing springs

3.3.4 Cable connection compartment

Depending on individual operating requirements, the cable compartment can house up to three current transformers, fixed and withdrawable voltage transformers, and an earthing switch. Should all three current transformers not be required, dummies are installed in their place using the same installation and connection procedures.

The fix-mounted voltage transformers are connected on the primary side with flexible, full-insulated cables that are inserted into the transformers.

The removable voltage transformers are fitted with HRC fuses.

The ET1 earthing switch can be used with a manual mechanism. Its switching position is indicated mechanically by an indication on the shaft and electrically by means of the auxiliary switch.

The surge arrestors can be fix-mounted in the cable compartment.

Cable connection of units:

- As a standard solution, it is possible to connect up to three parallel plastic cables with single-core protection per phase. In a 1,250 A panel, the cable push-on sealing ends require a maximum cross section of 300 mm²
- Customer requests regarding connections to bars, three-core cables, special cables or sealing ends of different types must be considered during the order-planning stage

For more information regarding cable connections, please refer to chapter 5.10.

3.3.5 Control cabinet

The control cabinet, which covers all control and protection aspects, can accommodate both conventional or microprocessor control technology.

If the secondary devices are not intended for door installation they are mounted on DIN RAILS. These rails enable any subsequent changes to the wiring. Three rows of DIN RAILS on a swiveling DIN RAIL holder are located at the lower part of the control cabinet, and directly under these is an easily accessible auxiliary switch for the control wiring plug.

The secondary wiring inside the panel is housed in a duct on the right side of the panel. The left-hand side of the panel is for the external wiring. The ducts are covered with a steel metal sheet. Holes at the side of the control cabinet enable the ring conductors to be slid in.



Figure 7 Low-voltage compartment, internal view

3.4 Interlock/protection against incorrect operation

All interlocking features are realized mechanically or through an electrical interconnection.

3.4.1 Panel internal interlocking

To prevent hazardous situations and incorrect operation, there is a series of interlocks to protect both personnel and equipment.

- The withdrawable part can only be moved from the test/disconnected position (and back) when the circuit-breaker and earthing switch are off. In the intermediate position, the switch is mechanically interlocked. The interlock is electrical if the circuit breaker features an electrical release
- The circuit breaker can only be switched on when the withdrawable part is in the test or service position. In the intermediate position, the switch is mechanically interlocked. The interlock is electrical if the circuit-breaker features an electrical release
- In the service or test positions, the circuit breaker can only be switched off manually when no control voltage is applied and it cannot be closed (electromechanical interlock)
- Connecting and disconnecting the control wiring plug is only possible when the withdrawable part is in the test/disconnected position
- The earthing switch can only be switched on if the withdrawable part is in the test/disconnected position or outside of the panel
- If the earthing switch is on, the withdrawable part cannot be moved from the test/disconnected position to the service position
- Details of possible interlocks, for example in connection with a locking magnet on the withdrawable part and/or an earthing switch drive, can be obtained from the relevant order document

3.4.2 Interlocking doors

- The withdrawable parts cannot be racked in if the apparatus compartment door is open (Fig. 8, 9)
- The apparatus compartment door cannot be opened if the apparatus is in service or in an undefined position (Fig. 10, 11)
- The earthing switch cannot be operated if the cable compartment door is open (Fig. 12, 13)
- The cable compartment door cannot be opened if the earthing switch is open (Fig. 14, 15)

3.4.3 Interlocks between panels

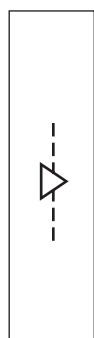
- The busbar earthing switch can only be closed when all the withdrawable parts in the relative busbar section are in the test/disconnected position (electrical interlock)
- When the busbar earthing switch is closed, the withdrawable parts in the earthed busbar section cannot be moved from the test/disconnected position to the service position (electromechanical interlock)

3.4.4 Locking devices

- The shutters can be secured independently of each other with a mechanical lock when the withdrawable circuit-breaker part has been removed
- Access to the operating shaft of the earthing switch can be restricted using a padlock (or keylock)
- Access to the circuit-breaker racking slot, the circuit-breaker compartment and the cable compartment can be restricted using a padlock (or keylock)

Types of interlocks

Standard safety interlocks (mandatory)



Type	Description	Condition to be fulfilled
1	A Apparatus racking-in/out	Apparatus in OFF position
	B Apparatus closing	Defined truck position
2	A Apparatus racking-in	Apparatus multi-contact plug plugged
	B Apparatus multi-contact plug unplugging	Truck in test position
3	A Earthing switch closing	Truck in test position
	B Apparatus racking-in	Earthing switch in OFF position
4	A Apparatus compartment door opening	Truck in test position
	B Apparatus racking-in	Apparatus compartment door closed
5	A Feeder compartment door opening	Earthing switch in OFF position
	B Earthing switch opening	Cable compartment door closed

Note: Apparatus is circuit-breaker.

Keys (on request)



6	Apparatus racking-in lock	Can only be removed with the truck in the racked-out position.
7	Earthing switch closing lock	Can only be removed with the earthing switch open.
8	Earthing switch opening lock	Can only be removed with the earthing closed.
9	Insertion of the apparatus raking-in/out crank lever	Can always be removed.
10	Insertion of the earthing switch operating lever	Can always be removed.

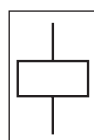
Padlocks



11	Apparatus compartment door opening	
12	Cable compartment door opening	
13	Insertion of the apparatus raking-in/out crank lever	
14	Insertion of the earthing switch operating lever	
15	Shutters opening or closing	

It is necessary to use padlocks with 5-8 mm hasp diameter.

Locking magnets (on request)



16	Apparatus racking-in/out	Magnet energized.
17	Earthing switch ON/OFF	Magnet energized.

Accessory devices

20	Shutters fail-safe	The device locks the shutters in the closed position when the apparatus is removed from the compartment. The operator cannot open the shutters manually. The shutters can only be operated by the apparatus truck.
21		
22		
Apparatus-switchgear unit compatibility matrix		The apparatus multi-contact plug and relative switchgear unit socket are equipped with a mechanical matrix, that disables apparatus racking-in into a switchgear unit with an inappropriate rated current.
Circuit-breaker mechanical operating mechanism		The apparatus compartment is equipped with a mechanical device, that enables circuit-breaker closing and/or opening directly by means of the front operating mechanism pushbuttons, keeping the door closed. The controls can be operated with the circuit-breakers in the operation and racked-out position.



Figure 8 Circuit- breaker compartment door enabling device

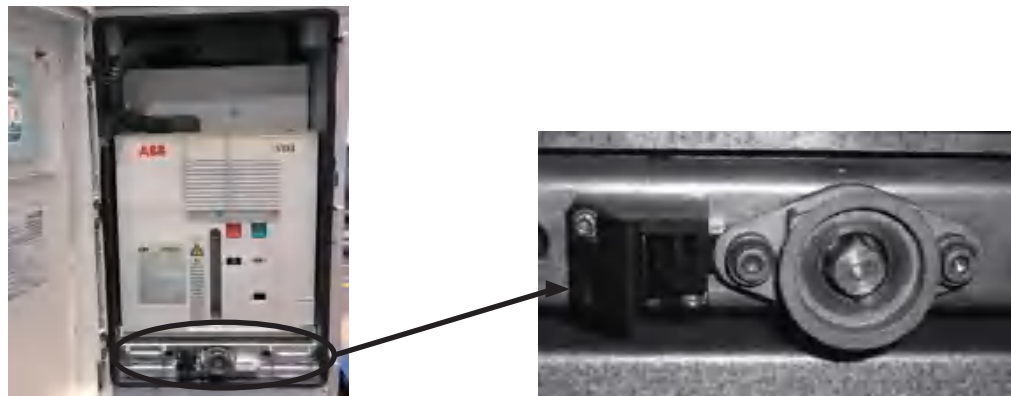


Figure 9 Circuit- breaker truck enabling slot

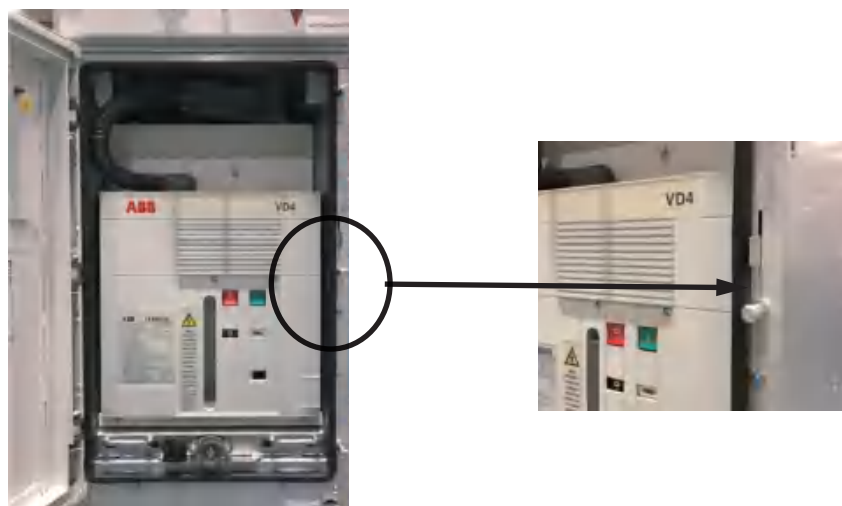


Figure 10 Circuit- breaker compartment door locking device

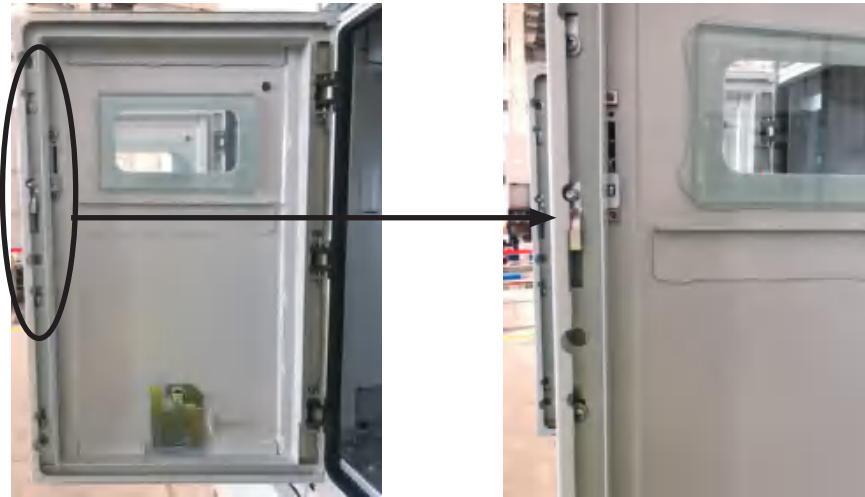


Figure 11 Circuit-breaker compartment door locking device



Note: It's not suitable for floor rolling version.

Figure 12 Cable compartment door enabling device

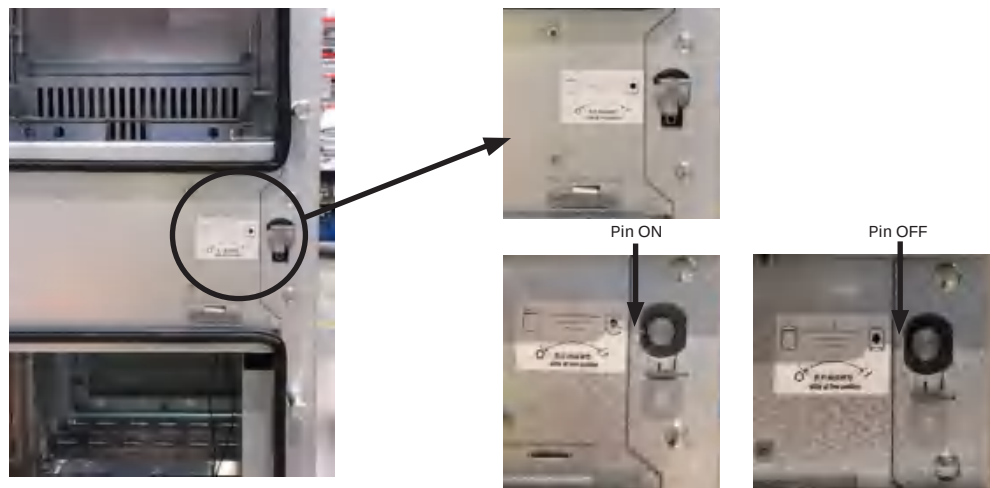


Figure 13 Cable compartment door enabling slot and earthing switch enabling pin

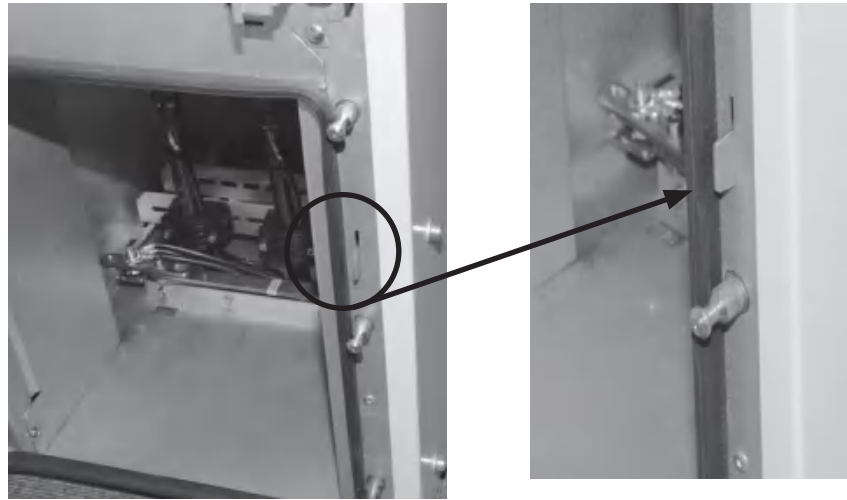


Figure 14 Cable compartment door locking device

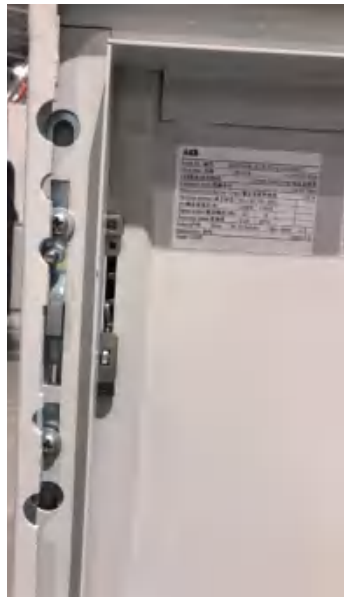


Figure 15 Cable compartment door locking device

3.5 Circuit-breaker plug connector coding

The control wiring plug connector coding allows the withdrawable parts for switching devices to be assigned to particular panels. This ensures that withdrawable parts with different rated currents or different control wiring circuits can only be used in the panels they are intended for.

Coding pins are fitted in the control wiring sockets 10.1 or control wiring plugs 10.2, and engage with the corresponding bores of the relevant plug 10.2 or socket when the two parts are connected.

The plug connector coding is order-related, and is noted in the relevant wiring documentation.

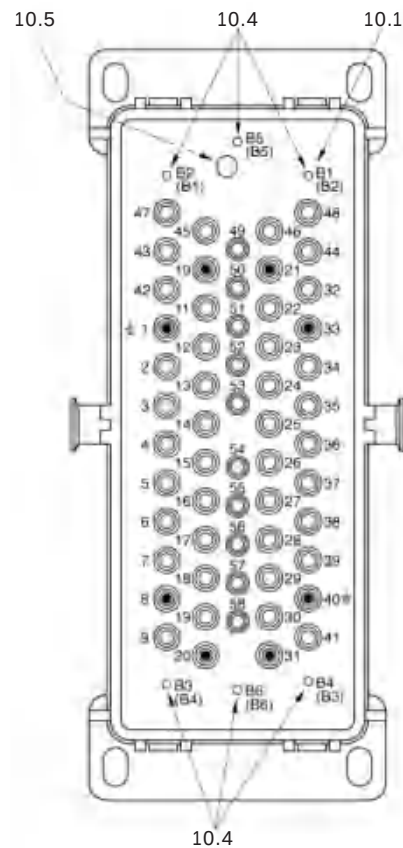


Figure 16 Control wiring plug connector coding

- 10.1 – Control wiring socket
- 10.4 – Centering striking tabs
- 10.5 – Bore for actuating pin of the control wiring plug for controlling the auxiliary switch

Coding:

(...) The corresponding coding designation for the control wiring plug is given in brackets.

The coding pins can be fitted in the control wiring socket and/or in the control wiring plug.

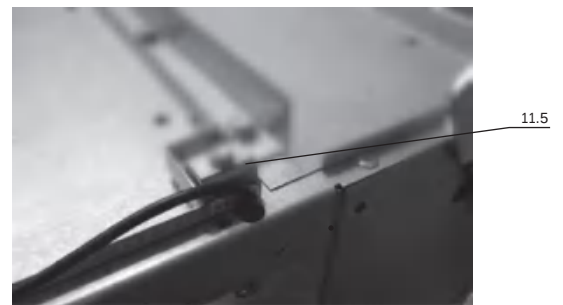
– Basic design

The number of sockets is optional but the basic assignment is 1, 8, 10, 20, 21, 31, 33 and 40.

Sockets and pins can be mixed as required in the control wiring socket and control wiring plug.

3.6 1st Limitors

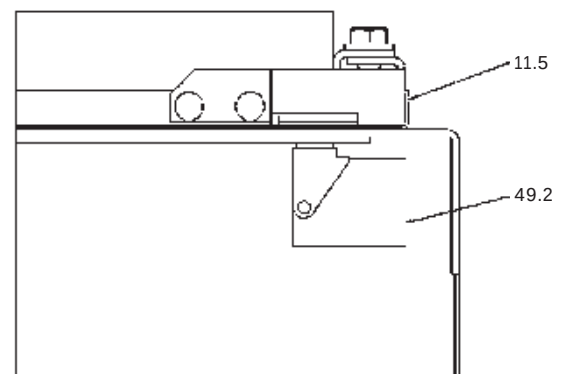
It is additional safety feature on the top of each unit. The microswitch generates an immediate fault signal when the overpressure flap is opened. Reaction time is less than 15 ms. The signal from the microswitch can be sent directly to trigger the circuit-breaker OFF.



It may be necessary to move the auxiliary switches into their service position when the lifting eyebolts have been removed.

11.5 1st limiter

The centre of the switch knob of the auxiliary switch must be adjusted to the centre of the pressure relief flap hole.



49.2 Pressure relief flap

Figure 17 Auxiliary 1st limiter switch

4 Dispatch and storage

4.1 Condition on delivery

At the time of dispatch, the UniGear panels are factory-assembled, the withdrawable parts are in the test position and the doors are closed.

The factory-assembled panels are checked at the works for completeness in terms of the order and simultaneously subjected to routine testing (normally without AC voltage testing of the busbars) to IEC publication 62271-200, and are therefore tested for correct structure and function.

The busbars are not assembled. The busbar material, fasteners and accessories are packed separately.

4.2 Packing

Available manners of packing:

- Polythene foil - storage time 1/2 year in clean and dry environment
- OSB boards - storage time 1/2 year in outdoor environment according to IEC
- Wood boxes - storage time 1 year in outdoor environment according to IEC

According to the kind of transport and country of destination, the panels remain unpacked or packed in seaworthy crates. A drying agent is provided to protect them against moisture.

- Panels with basic packing or without packing
- Panels with seaworthy or similar packing (including packing for containerised shipments):
 - Sealed in polyethylene sheeting
 - Transport drying agent bags included

4.3 Transport

The transport units normally comprise two panels and, in exceptional cases, small groups of panels. The panels are each fitted with four lifting eyebolts.

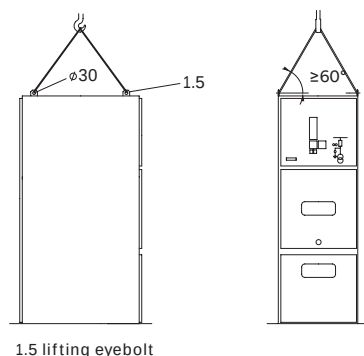


Figure 18 Handling by crane

Transport panels upright. Take the high centre of gravity into account. Only ever carry out loading operations when it has been ensured that all precautionary measures to protect personnel and materials have been taken and use the following:

- Crane
- Fork-lift truck and/or
- Manual trolley jack

Loading by crane:

- Fit lifting ropes of appropriate load capacity with spring catches (eyebolt diameter: 30 mm)
- Keep an angle of at least 60° from the horizontal for the ropes leading to the crane hook
- Hang the unit using ALL four eyebolts

For detailed information on switchgear handling, please refer to chapter 4.6.

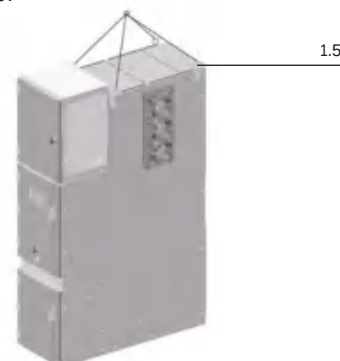
4.4 Delivery

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

- Checking the consignment for completeness and lack of any damage (e.g. also for moisture and its detrimental effects). In case of doubt, the packing must be opened and then properly resealed, putting in new drying agent bags, when intermediate storage is necessary
- If any quantities are short, or defects or transport damage are noted, these must be:
 - Documented on the respective shipping document
 - Notified to the relevant carrier or forwarding agent immediately in accordance with the relative liability regulations

Note:

Always take photographs to document any major damage.



4.5 Intermediate storage

Optimum intermediate storage, where this is necessary, without any negative consequences depends on compliance with a number of minimum conditions for the panels and assembly materials.

1. Panels with basic packing or without packing:
 - A dry well-ventilated store room with a climate in accordance with IEC 62271-1
 - The room temperature must not fall below -5 °C
 - There must not be any other negative environmental influences
 - Store the panels upright
 - Do not stack panels
 - Panels with basic packing
 - Open the packing, at least partially
 - Panels without packing:
 - Loosely cover with protective sheeting
 - Ensure that there is sufficient air circulation
 - Check regularly for any condensation until installation is started
2. Panels with seaworthy or similar packing with internal protective sheeting:
 - Store the transport units
 - Protected from the weather
 - In a dry place
 - Safe from any damage
 - Check the packing for damage
 - Check the drying agent (also see section 4.2):
 - On arrival of the consignment
 - Subsequently at regular intervals
 - When the maximum storage period, starting from the date of packing, has been exceeded:
 - The protective function of the packing can no longer be guaranteed
 - Take suitable action if intermediate storage is to continue



Warning

Do not walk on the roof of the panels (rupture points in pressure relief devices!). The pressure relief devices and/or Ith Limiters could be damaged.

4.6 Handling

4.6.1 Switchgear

The switchgear sections are usually fixed to wooden pallets. Handling should be carried out by means of bridge or mobile cranes. Otherwise, use rollers or fork lift trucks.

Weights and dimensions of each section are listed in the shipping documents and in the plant drawings.

4.6.1.1 Handling with bridge crane or mobile crane and unpacking

Handling the switchgear in the wood packing.

The switchgear must be lifted by means of a crane and circular slings 1 (Fig. 19). The slings must be inserted according to the lifting symbols marked on the crate.

Weight and lifting opening angle must be taken into account when choosing the circular slings.

Unpacking

- Remove the nails and crate lid and sides
- Open the compartment door and loosen the bolts fixing the switchgear to the pallet
- Lift the cubicles by means of the crane following the instructions below
- Remove the pallet
- Position the unloading shims
- Put the switchgear on the loading shims by using the crane

Switchgear handling



Warning

- Only use a suitable balanced lifting system

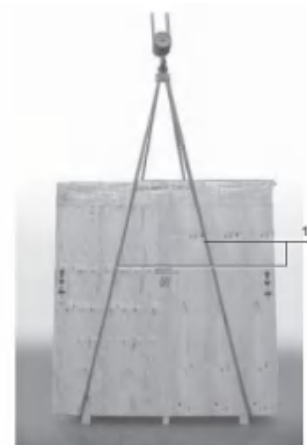


Figure 19 Handling the switchgear in the wooden crate

After unpacking, lift the unit groups by means of a crane (Fig. 18). Use the eyebolts (1.5) and the ropes fitted with safety. After installation of the panels, remove the eyebolts used for lifting.

4.6.1.2 Handling by means of rollers



Warning

- Only use rollers on a level floor
- Move the switchgear section avoiding any possible tilting

Lift the switchgear section by means of a bridge or mobile crane or using jacks (Fig. 18); remove the wooden pallet loosening the screws fixing it to the switchgear section base. Put a sturdy metal sheet between the rollers and the unit base and place the switchgear on the sliding rollers.

4.6.1.3 Handling by means of transpallet or fork lift trucks



Warning

- Only use transpallets or fork lift trucks on a level floor
- Move the switchgear section avoiding any tilting

To guarantee stability, the switchgear must not be lifted too high. Check the levelness of the forks.

4.6.2 Apparatus

The apparatus can be handled by cranes, fork lift trucks or using the truck provided by ABB. For each piece of apparatus follow the instructions below.

4.6.2.1 Handling by crane

Circuit-breakers

Hook the lifting bolts to the relevant supports. While handling, pay the utmost attention not to put any stress on the insulating parts or on the circuit-breaker terminals.

Before putting into service, remove all the lifting eyebolts.

4.6.2.2 Handling by fork-lift trucks

Handling by fork-lift trucks can be carried out only after the apparatus has been positioned on a sturdy support.

While handling, pay the utmost attention not to put any stress on the insulating parts or on the circuit-breaker terminals.



Warning

Do not insert the truck forks straight underneath the apparatus but put the apparatus on a sturdy support.

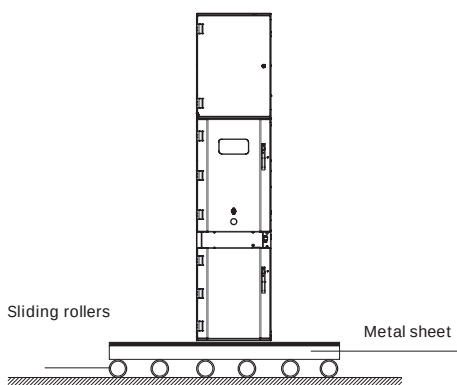


Figure 20 Handling by means of rollers



Figure 21 Lifting switchgear packed in a wooden crate

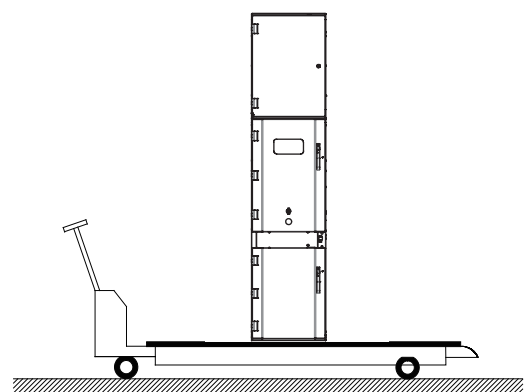


Figure 22 Switchgear handling

4.6.2.3 Handling by service truck

For handling and inserting the apparatus into the switchgear, use the service truck (Fig. 25).



Warning

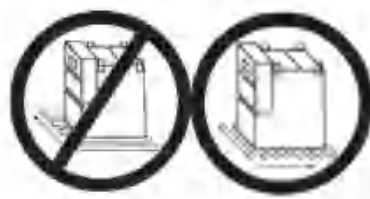
- Do not use the service truck for any purpose other than handling ABB's apparatus
- Fix the circuit-breaker to the truck before moving it

In order to handle the circuit-breaker with the relevant truck, follow the instructions below:

- Hook the lifting bolts to the circuit-breaker supports and align it above the truck (1)
- Press the handles (2) towards the circuit-breaker centre (*) to insert the horizontal check pins
- Put the circuit-breaker on the truck
- Push the circuit-breaker towards the circuit-breaker compartment and insert the truck into the guides until the handles (2) are released (**) outwards and the horizontal locking pins go into the slots (4), locking the circuit-breaker

Further warnings:

When moving the switchgear on cylinders always put the cylinders collinear (in parallel) with the front side of the switchgear!



Always keep the switchgear in the vertical position!



Do not try to open the cable or the circuit-breaker compartment doors, close the earthing switch or withdraw the circuit breaker if an auxiliary voltage is not connected to the switchgear!



Do not step on the pressure relief flaps!

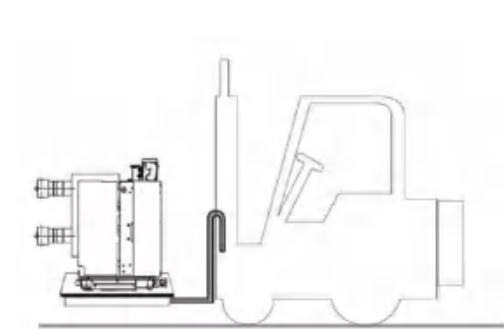


Figure 23 Handling by fork-lift trucks



Figure 24 Vmax circuit-breaker

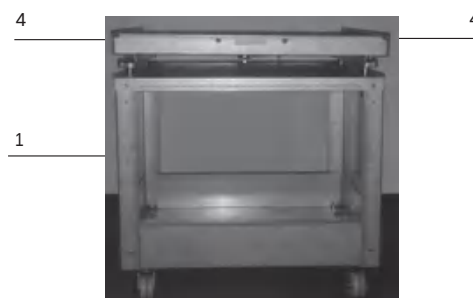


Figure 25 Service truck

5 Assembly of the switchgear on site

In order to obtain an optimum installation sequence and ensure high quality standards, on-site installation of the switchgear should only be carried out by specially trained and skilled personnel, or at least by personnel supervised and monitored by responsible persons.

5.1 General

On commencement of installation on site, the switch room must be completely finished. This means it must be provided with lighting and an electricity supply. In addition, it must be lockable, dry and with facilities for ventilation. All the necessary preparations, such as wall openings, ducts, etc., for routing the power and control cables up to the switchgear must already be complete. The ceiling height must be sufficient for the opening travel of the pressure relief plates (Higher than 3 m).

The ceiling must be high enough for the assembly of a pressure relief duct (Higher than 3 m).

Compliance with the conditions for indoor switchgear according to IEC 62271-1, including the conditions for the indoor temperature class must be ensured.

5.2 Foundations

It is recommended that the switchgear is installed on the base irons of a "C" profile shape set into the concrete floor of switch room.

Further structural data guidelines enable a rough calculation of the space required to be made and the planning of the room design for a switchgear project.

When the final construction documents are compiled for the execution of a building, the binding data supplied by ABB for a particular case must always be taken into account!

Dimension chart of structural data (Also see figures 5/1 to 5/11)

Rated voltage	kV	12
Panel width	FT	mm 500
Aisle width ¹⁾	G	mm 1300
Switchgear room door width	mm	700/1200
Switchgear room door height ²⁾	mm	2400
Opening in ceiling if transported through roof:		
Width	mm	1000
Length	mm	1500
Ceiling load ³⁾	kg / m ²	1200

1) Pay attention to the appropriate national standards.

2) Applies to low-voltage compartments of standard height.

3) Approximate numbers depending on the type of panels.

5.2.1 Method of installation A – Installation of the base irons

Due to different switchgear dimensions, one or more parts make up the base irons. Their installation is usually carried out by site personnel and should, if possible, be performed under the supervision of an ABB specialist.

Method of installation - Installation of the base irons:

- When base irons are composed of several parts, connect them with a bolt in the required order and position them horizontally
- Lay the irons in the specified position on the concrete floor as shown in the relevant foundation drawing
- Mark out holes for drilling. These holes are for the anchoring bolts that will fix the base irons in the floor
- Put the plugs in the holes and use the bolts to attach the base irons to the floor. Do not tighten the bolts until the base irons have been correctly leveled
- Carefully level the base irons both longitudinally and transversally over the entire length and correct the height by using strips with a suitable thickness and a levelling instrument. Usually the top edge of floor frame should be 2 mm above the finished floor surface (Fig. 26, 29)

Tolerances for laying the floor frame are:

- Evenness tolerance: ± 1 mm within a measuring length of 1 m
- Straightness tolerance: 1 mm per 1 m, but not

more than 2 mm over the entire length of the frame

- After levelling the base irons, the bolts can be tightened. The adjusted position of the base irons on the concrete floor must not be changed during this operation

Check again and, if need be, correct any deviations.

- Weld the individual parts of the base irons inside the "C" profile together at the seams so that a conductive connection is achieved
- When the floor top covering is applied, carefully backfill the floor frame, leaving no gaps
- The base irons must not be subjected to any harmful impacts or pressures, particularly during the installation phase

If these conditions are not respected, problems during switchgear assembly and possibly with movement of the withdrawable parts, as well as with the opening and closing of the doors cannot be ruled out.

5.2.2 Method B – installation on the levelled concrete floor

Installation directly on the levelled concrete floor makes much higher demands on the floor levelling, which must, in this case, fulfil the same tolerances as the base irons during method A installation.

Fastening is carried out by anchoring bolts in the concrete floor.

- Clean the switchgear installation area carefully
- On the slab, visibly trace the perimeter of all the units making up the switchgear according to the relevant drawing, taking the minimum wall and obstacle clearances into account
- Level the floor both longitudinally and transversally, evenness tolerance is ± 1 mm over a measuring length of 1 m
- Drill the floor at the intended fixing points, referring to the slab drilling drawings. To make the holes, use a hammer drill with a bit according to the steel plugs used

- Insert the plugs in the holes and put the individual panels on the traced perimeters of the units to create the switchgear
- Level the units and then bolt them together in the front and rear part
- Fix the units with bolts with special washers (the coupling material is supplied on request)
- In the case of a metal floor - to make the holes, use a drill with a suitable bit for the type of fixing to be made (through or threaded hole)

5.2.3 Method C – installation on a raised false floor

In this case, fastening of the units is carried out by welding outside panels to the steel floor frame in the places where the frame is larger than the base of the switchgear, i.e. on the outside lateral walls of the unit row. This method of installation is not recommended if seismic resistance is required.

- Clean the installation area
- After installation of the frame, take any necessary measures for perfect earthing of the frame with galvanized steel strips with min. dimensions 30x4 mm. Two earthing connections are recommended for a panel row longer than approx. 5 panels
- Place the units on the frame according to the relevant foundation drawings, taking the minimum wall and obstacle clearances into account
- Level the units and then bolt them together in the front and rear part
- Carry out attachment by welding the outside panels to the steel floor frame in the place where the frame juts out from the switchgear bottom, i.e. on the outside lateral walls of the unit row. This method of installation is not recommended if seismic resistance is required
- In the case of a metal floor - to make the holes, use a drill with a suitable bit for the type of fixing to be made (through or threaded hole)

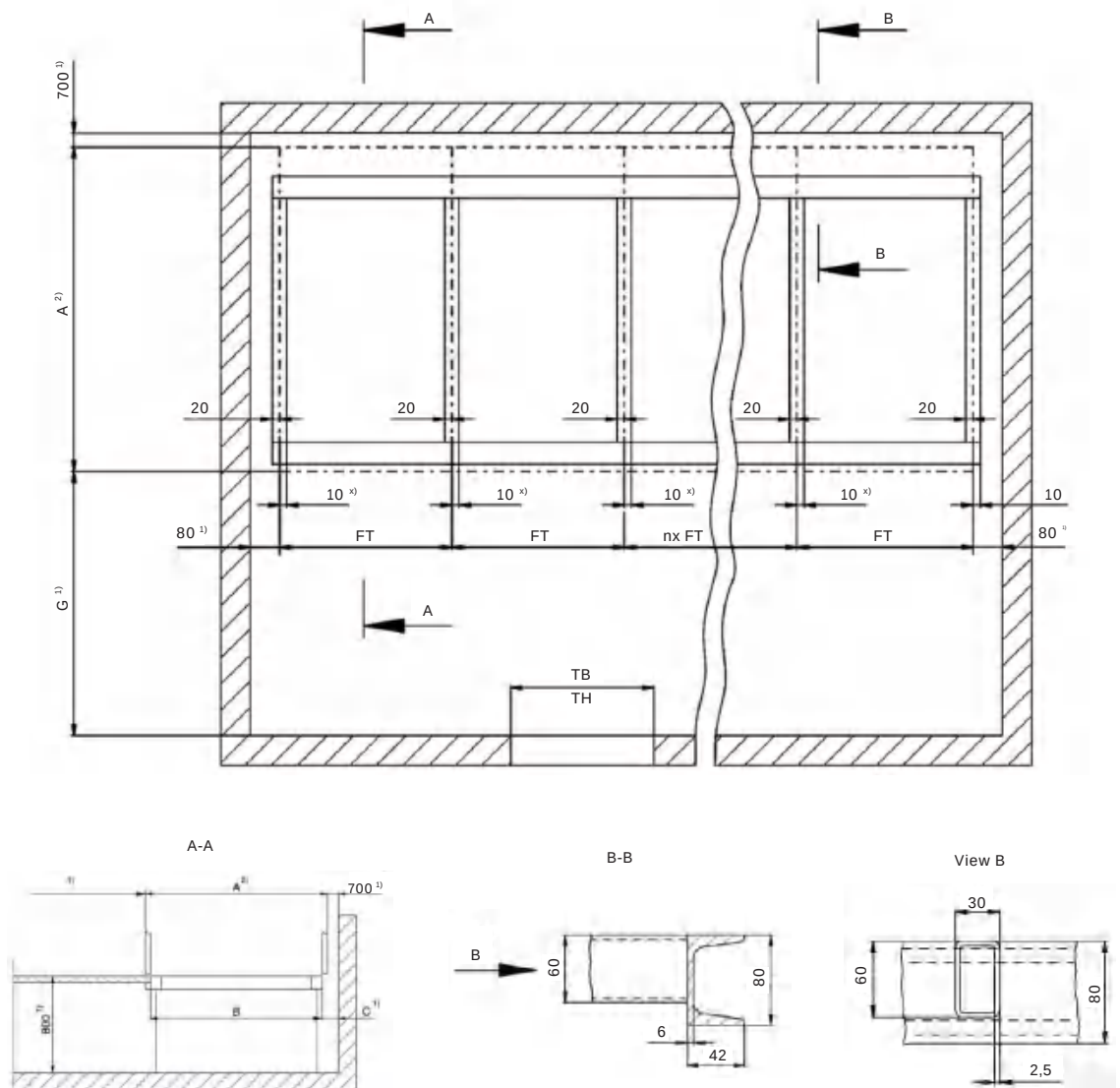


Figure 26 Guideline structural data for a raised false floor

- 10 Door
 11 Rear cover
 X): Max. dimensions
 1): Min. dimensions
 2): Dimension must be verified in documentation of the relevant order
 G: Width of operating aisle (See table on page 20)
 TB: Door width=FT+200 mm (See table on page 20)
 TH: Door height=FT+200 mm (See table on page 20)
 FT: Panel width (See table on page 20)
 FH: Panel height (See table on page 20)

Panel depth (A)	B	C
1310 mm	1205 mm	735 mm
1620 mm	1205 mm / 1515 mm	785 mm

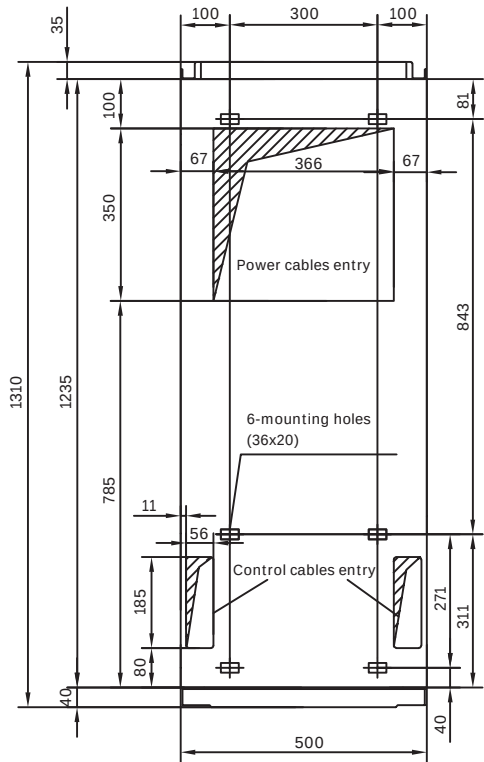


Figure 27 Base iron fixing system

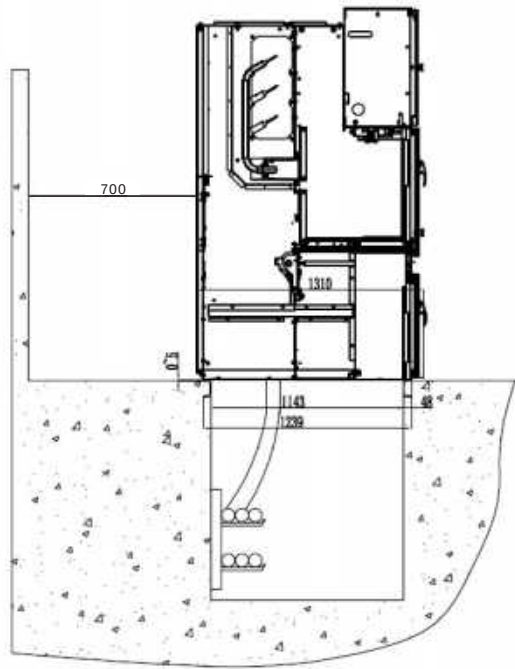
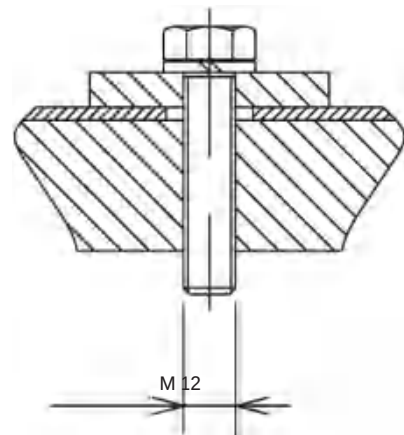
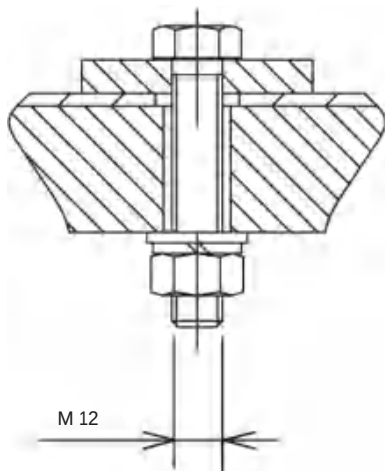
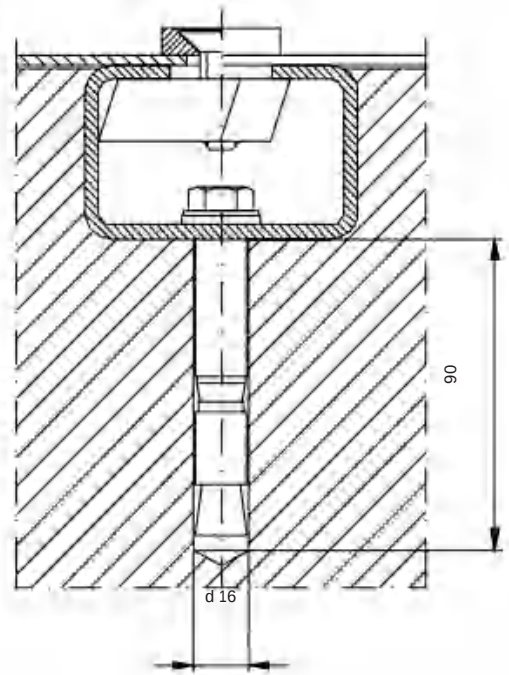
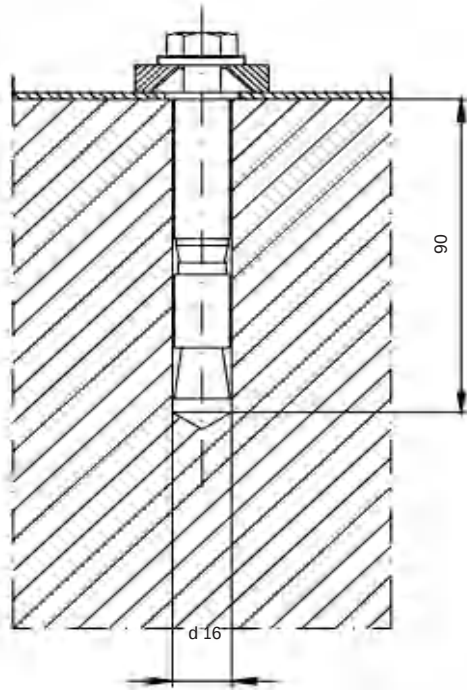


Figure 28 Structural data for foundation



5.3 Assembly of the switchgear panels

Use screws of tensile class 8.8. The maximum recommended tightening torques based on type of connection are given in the following tables.

The tightening torques for copper bars or busbars connections together.

Maximum recommended tightening torque ¹⁾ Nm		
Lubricant ²⁾		
Thread ³⁾	Without ($\eta=0,14$)	Oil or grease ($\eta=0,10$)
M5 ⁴⁾	-	-
M6 ⁴⁾	-	8
M8	-	20
M10	-	40
M12	-	69
M16	-	170

The tightening torques for copper bar connections combined with epoxy insulators.

Maximum recommended tightening torque ¹⁾ Nm		
Lubricant ²⁾		
Thread ³⁾	Without ($\eta=0,14$)	Oil or grease ($\eta=0,10$)
M8	15	-
M10	32	-
M12	45	-
M16	110	-
M20	220	-

The tightening torques for copper bar connections combined with ABB CTs.

Maximum recommended tightening torque ¹⁾ Nm		
Lubricant ²⁾		
Thread ³⁾	Without ($\eta=0,14$)	Oil or grease ($\eta=0,10$)
M12	70	-

The tightening torques for copper bar or cable connections combined with ABB VTs.

Maximum recommended tightening torque ¹⁾ Nm		
Lubricant ²⁾		
Thread ³⁾	Without ($\eta=0,14$)	Oil or grease ($\eta=0,10$)
M10	20	-

1) The recommended maximum tightening torques are based on a coefficient of friction for the thread of 0.14 (without lubrication) or 0.10 (with lubrication).

2) Thread and head contact surface lubricated.

3) The tightening torques are recommended for screws ISO 4014-4018 and ISO 4762 (tensile class 8.8). In case of usage of other types of screws contact please ABB for clarification.

4) Applicable only for fixing of subsidiary covers or terminal connections.

Any tightening torques that deviate from those in the general tables (e.g. for contact systems or device terminals) must be taken into account as stated in the detailed technical documentation.

It is recommended that the threads and head contact surfaces of bolts should be lightly oiled or greased so as to achieve the precise rated tightening torque.

The individual installation stages are as follows:

- Remove the withdrawable parts from the switchgear panels and store them with suitable protection
- Dismantle the lifting eyebolts
- Transport the switchgear panels to the prepared installation point, following the sequence shown on the switchgear plan
- Remove the vertical partitions in front of the busbar compartments by releasing the fixing screws
- Release the fixing screws and draw out the horizontal partition below the withdrawable part travel rails
- Release and remove the floor cover
- Remove the covers from the vertical control wiring ducts, positioned on the right- hand left-hand sides of the panel front

Fit and screw down the lids.

- Correctly position and vertically align the switchgear panels along the floor frame - the panel edges must not deviate by more than 2 mm from the vertical, especially at the front - and bolt the panels together. It is advisable to start from the centre when assembling switchgears with more than ten panels
- When the switchgear has been properly assembled, fix the panels to the concrete floor using plugs, or weld or adequately bolt them to the foundation frame

5.4 Procedure for setting-up the doors

Closing of doors could be problematic in some cases. To avoid problems with doors closing the following shall be fulfilled and followed:

If switchgear is installed properly the doors shall be in the position in which the upper edge of door will be parallel with the gap between the circuit breaker compartment and the low voltage control cabinet.

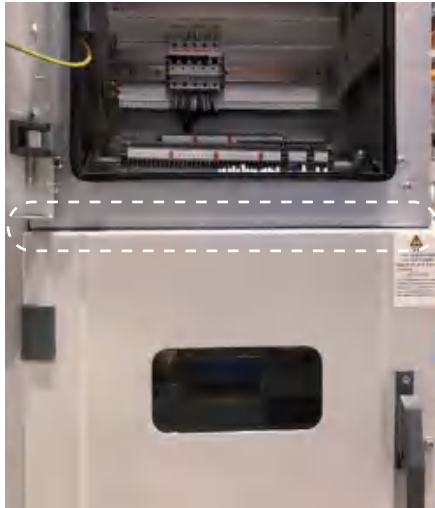


Figure 30 Correct position of cable compartment doors

Doors gasket shall be installed in correct direction (3 tooth on inner side and 1 tooth of the gasket on outer side).

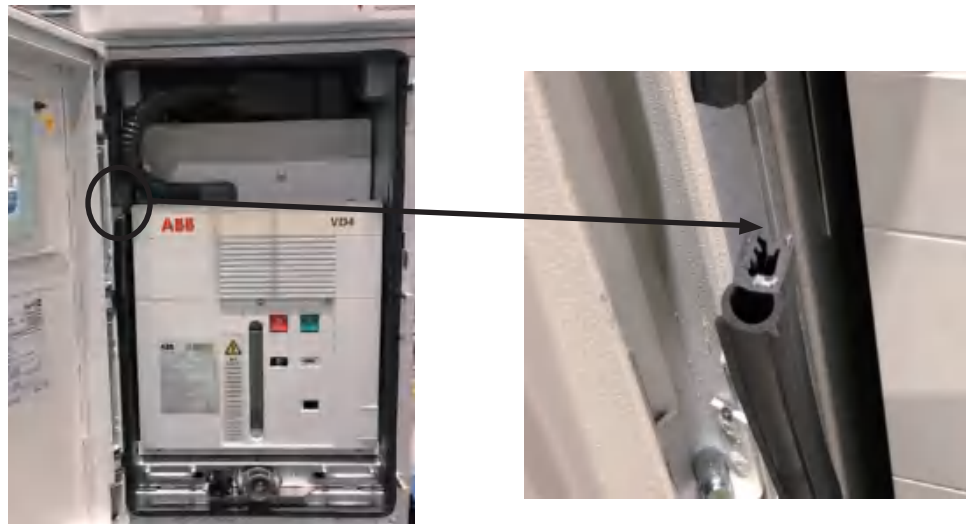


Figure 31 Doors gasket

Sliding part of the doors locking mechanism shall not be bended (could happen because of wrong and rough closing operation).



Figure 32 Sliding part of doors locking mechanism

If guiding screws in open position of handle don't reach end position, it's necessary to loose a bit screws.

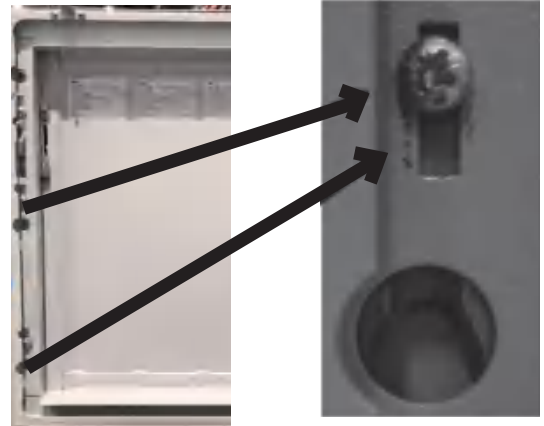


Figure 33 Guiding screws

If guiding screws after loosening still don't reach end position, then it's necessary to replace the handle.



Figure 34 Guiding screw

Doors shall be closed by both hands.



Figure 35 Doors closing

5.5 Installation of the bushing (if have)

Bushings are made of epoxy resin castings and are arranged as a single casting for all three phases (Fig. 36).

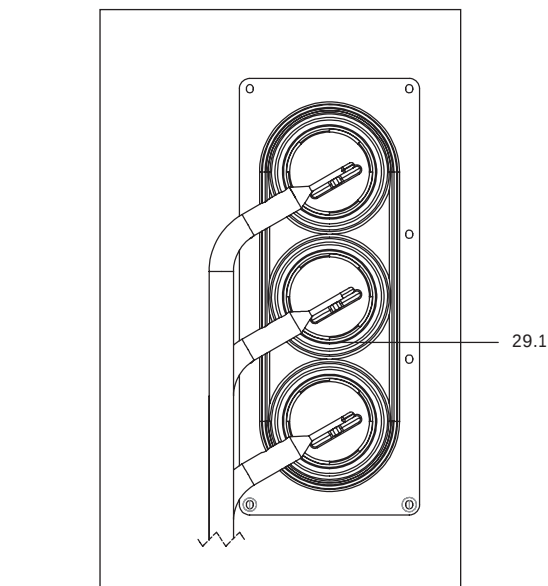
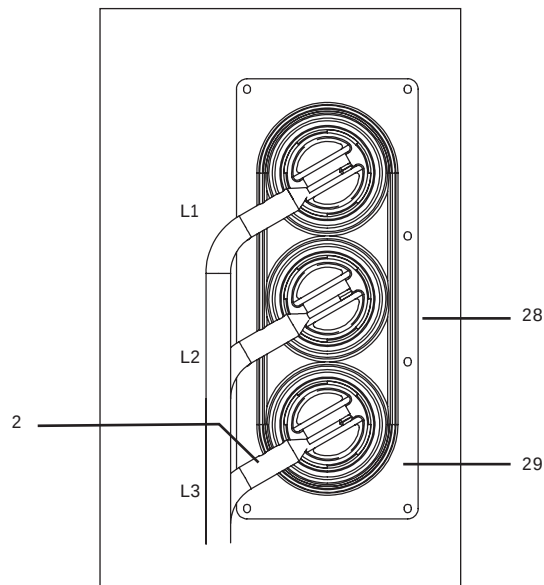


Figure 36 Bushing plate and busbar bushing arrangement

2 Branch bar
28 Bushing support
29 Bushing
29.1 Busbar support for single conductor

Before fixing the panels side by side (according to the general drawings) bushings 29.x must be fixed (for switchgear with busbar partitioning only).

Bushing of 12 kV panels

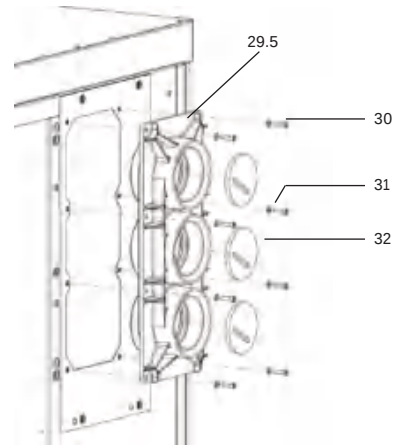


Figure 37 a) 12 kV panels - fixing bushings

29.5	nr. 1	Bushing
30	nr. 8	8x25 screws
31	nr. 8	M8 washer
32	nr. 3	Rubber partition (busbar support)

Lower bus-tie system

- Insert bushing 29.6 for the lower rear bus-tie into bushing plate 28.2 from the right side in contrast to the procedure for the other two bushings

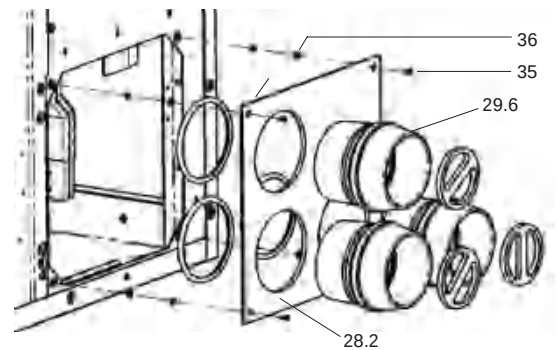


Figure 37 b) 12 kV panels - fixing bushings

28.2	nr. 1	Bushing plate
29.6	nr. 3	Bushing
35	nr. 12	8x25 screws
36	nr. 12	M8 washer

5.6 Fixing of the panels



Before fixing the panels side by side be sure that the bushings are fixed according to chapter 5.5.

Fit and screw down the side covers.

- Align the switchgear panels on the floor frame for correct positioning and vertical alignment (deviations of the panel edges from the vertical must not exceed 2 mm, especially at the front) and bolt the panels together (Fig. 38). It is advisable to start from the centre when assembling switchgear with more than 10 panels

The junction points where the panels should be fixed are as follows:

- Nr.6 in the front side (A-B-C-D-E-F)
- Nr.4 in the middle part (L-M-N-O)
- Nr.5 in the rear side (G-H-I-J-K)

The nuts are already fixed on the right side of the panel (except in the middle part); on the left side there is an empty space where the screws are to be fixed.

The screws needed are:

- 10x30 screws (complete with M10 washer)

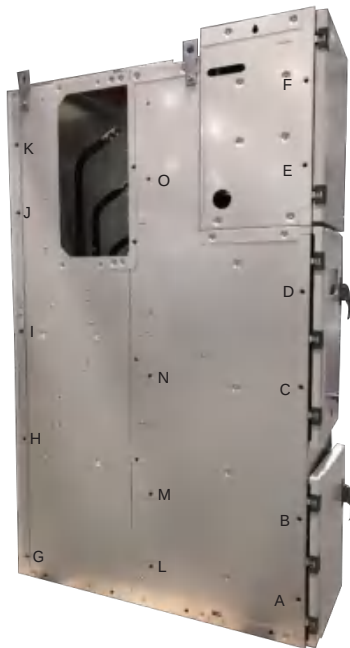


Figure 38 View of the fixing points



Figure 39 End panel of a switchboard with bolted-on cover plate

5.7 Installation of the busbars

Access to the busbars is possible either from above after the pressure relief plate has been removed, or from the front of the circuit-breaker compartment. To get at the busbars from the circuit-breaker compartment, first withdraw the circuit breaker and then remove the horizontal partition. Once this has been completed, the following steps should be taken:

- Install the bushings
- Clean the insulation on the busbar sections with a soft, dry cloth and check for insulation damage. Remove any grease or adhesive dirt
- Busbar connections
- The silver plated surfaces of the connections must be cleaned with a metal-free non-woven cleaning cloth, and thinly and evenly coated with Syn-Setral-EK 339 grease
- The non-silver plated surfaces of the connections are either brushed with a wire brush, to preserve the grease film, or cleaned with a metal-free non-woven cleaning cloth and evenly greased with a thin coat of Syn-Setral-EK 339
- Prepare the shield covers and install them to the busbar and T-off bar joint, to cover the screws

- Install the busbars panel by panel. Screw on the individual busbar elements one above the other (depending on the system layout) and in line with the branch conductor. Use the hexagonal socket head screws provided. See the table in section 5.3 for the correct tightening torque. Use two dished washers for each screw

Note:

The busbars are connected using so-called "stabilized connections". This means the quality of the copper busbar connections does not change irrespective of operating time and therefore regular inspection of the tightness of the busbar connections is unnecessary. However, this is on condition that switchgear assembly is carried out exactly as described above and that all connections are tightened with the prescribed torque according to the table in section 5.3.

We recommend that the tightness of the busbar connections are inspected during repairs only.

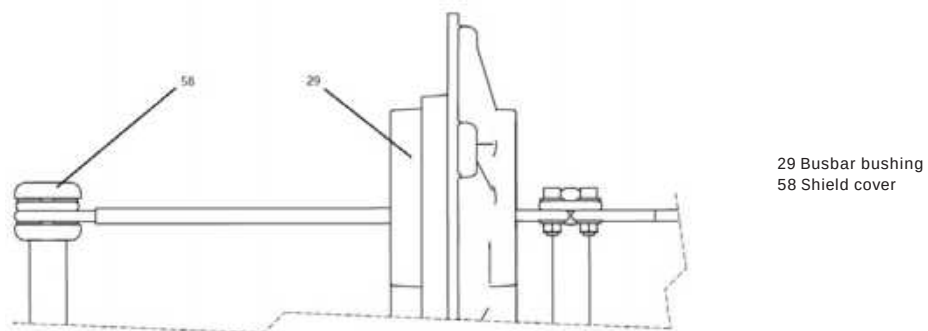


Figure 40 Installation of the busbars and the installation at the busbar ends

Busbars for 12 kV units

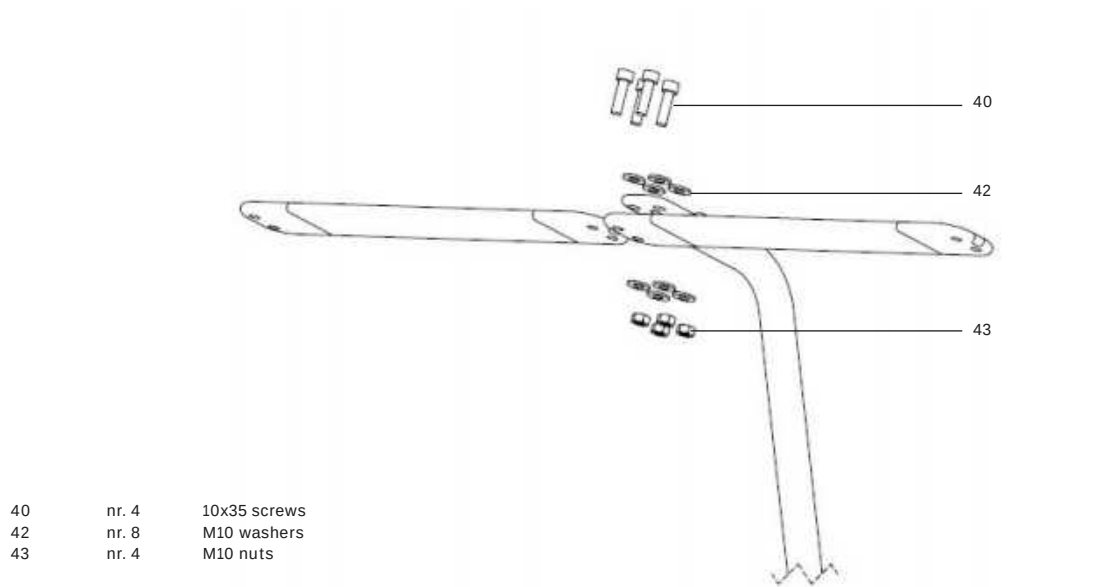
Busbars are made of copper and have a flat cross-section for rated current up to 1250 A. For 1600 and 2000 A, the busbars have a single D-shaped cross-section. For 2500, 3150 and 4000 A, the busbars have a double D-shaped cross-section. Branch conductors always have a flat cross-section.

12 kV bushings are arranged as a single casting for all three phases. For bus-tie units the

bushings are single and are arranged in the lower part of the unit. Bushings are held in bushing plates.

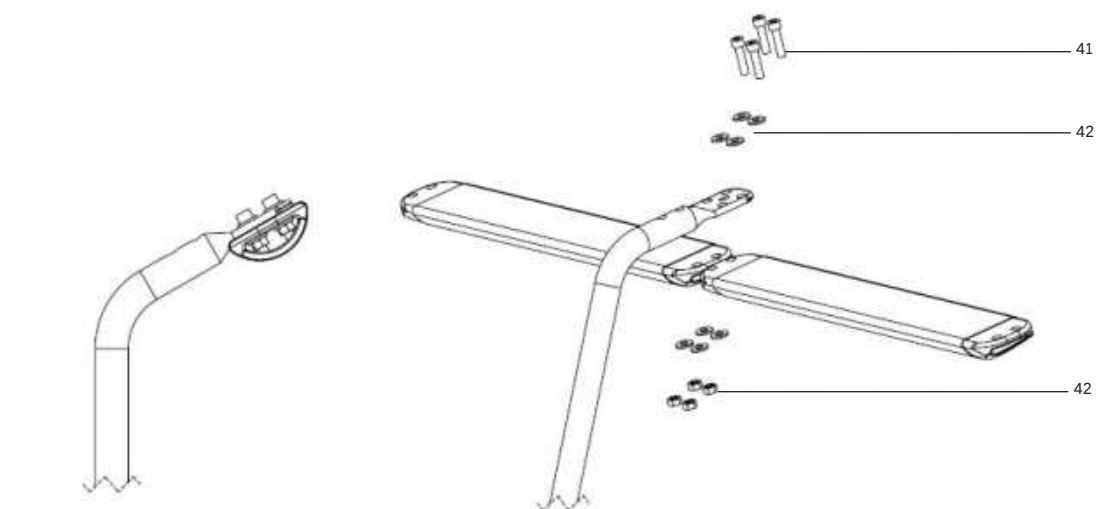
For 12 kV, the busbars are fitted without insulating covers up to 1250 A.

1600, 2000, 2500, 3150 and 4000 A D-shaped busbars are fitted with insulating covers.



40	nr. 4	10x35 screws
42	nr. 8	M10 washers
43	nr. 4	M10 nuts

Figure 41 12 kV panels – T-off 630-1250 A, busbars 1250 A



41	nr. 4	10x60 screws
42	nr. 8	M10 washers
43	nr. 4	M10 nuts

Figure 42 12 kV panels – T-off 630-1250 A, busbars 1600 A-2000 A

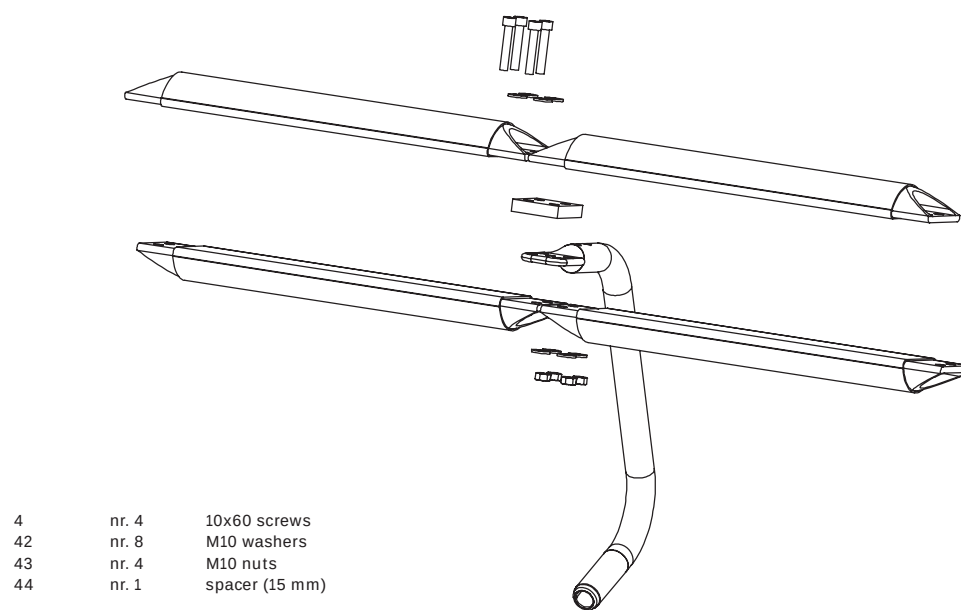


Figure 43 12 kV panels – T-off 630-1250 A, busbars 2500 A-3150 A-4000 A

Busbar compartment access

Access to the busbar compartment is possible either from the top of the panel after dismantling the pressure relief plate after the dismantling of the gas duct, or from the front of the circuit-breaker compartment.

See figure 45 taken from cable compartment. On each side there are two screws which must be unscrewed (detail on fig. 46).

After circuit-breaker has been withdrawn from the panel, it is possible to remove the horizontal partition.

After that, the partition can be dismantled and taken out of the panel, which makes access to busbars from the circuit-breaker compartment easier.



Figure 45 View from cable compartment



Figure 46 Two screws on each side



Figure 47 Front view on window among cable and circuit - breaker compartment



Figure 48 Circuit- breaker compartment

5.8 Installation of the top-mounted boxes

For ease of transportation top mounted boxes are delivered separate from the panel in pre-assembled sections.

5.8.1 Anti-ferroresonant resistor for voltage transformers open delta connection

When using a ferroresonance resistor for VTs open delta connection is necessary to adjust the position of this resistor during site installation.

The ferroresonance resistor is placed on the top of switchgear on the CB relief flap for the transportation (Fig. 52).

When moving the resistor from relief flap to LV compartment (LVC) please follow pictogram (Fig. 53) on the top of LVC.

The resistor has to be fixed by means of screws on the top of the LVC (Fig. 54).

Assemble resistor prior to installation of pressure relief gas duct. Pay attention to the resistor's wires whilst installing gas duct.



Figure 49 Transport position of antiferro-resonant resistor

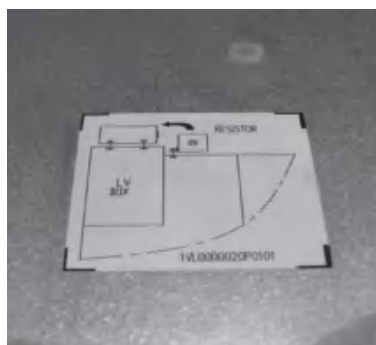


Figure 50 Pictogram on the top of LVC

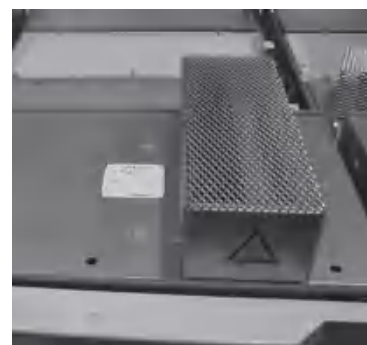


Figure 51 Correct position of antiferro-resonant resistor

5.9 Pressure relief ducts

- The pressure relief duct is supplied dismantled in single components. The rear and front wall correspond, as far as length is concerned, with the appropriate panel width
- The screw fixing material is contained in the “pressure relief duct” set of bags. Rivet nuts are already provided in the metal sheets
- Detailed instructions for gas exhaust duct assembly are described in document 1VLG100135 and in assembly manual 1VLM000034

Note:

The rear pressure relief flap must be mounted according to figure 55.

Details regarding connection to the wall and a discharge grating for pressure relief outside the switchroom will be agreed on with the customer.

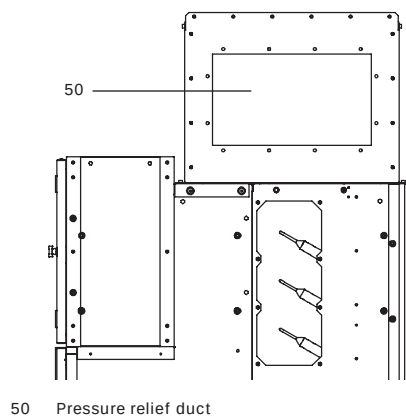


Figure 52 Schematic diagram of the pressure relief duct.

5.9.1 Gas duct with outlet

Once the panels are bolted up, and busbars are installed, it is possible to start fixing the gas duct on the top of the switchgear. Every panel has three fixing points in the front part (Fig. 56) and three fixing points on the rear part (Fig. 57).



Figure 53 Fixing points on the front

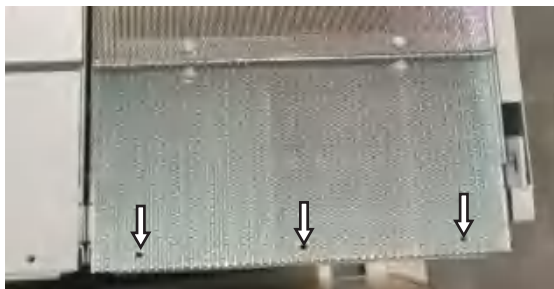


Figure 54 Fixing points on the rear



Figure 55 Assembly of pressure relieve flaps with or without gas duct

5.9.2 Gas duct with top chimneys

In order to mount the gas duct with top chimneys please follow the appropriate instructions.

The difference between the two solutions is that in this case there are no side exits, but the gas generated from an internal the arc exits from the duct through the top chimneys located on the top part of the gas duct on each panel.

On the top of the gas duct there are two openings (Fig. 59); for each opening the perforated metal plate must be fixed with 6 spacers (Fig. 60).



Figure 56 Openings on top of the gas duct



Figure 57 Net and spacers of top chimneys



At this point it is possible to fix the top cover with 12xM8 screws.

Figure 58 Top cover of top chimneys

5.10 Cable connection

5.10.1 Power cables

Power cables connection

- The cables are routed from below through the floor covering, which is divided at the cable entry point. The cables go through rubber reducer rings, which can be adapted to the required cable diameter in a range from 35 to 54 mm (Fig. 62)
- Cable sealing ends are mounted onto the cable cores according to the manufacturer's instructions. It is possible to use cable sealing ends from different manufactures (e.g. Pirelli, Raychem etc.), but it is necessary to keep the length of the cable ends, including cable sealing ends, which is given by the distance of cable connecting bars from the panel floor covering. These bars have different versions, the difference being the number of parallel cables and the values of the rated and short-circuit currents
- The bars are equipped with holes to accommodate M16 screws. If M12 screws are used for the cable connections, special washers for these screws are also supplied. In all cases, the earthing of the cable screens is carried out on the strip-holding cable clamps. The cable strip is connected to the earth potential
- The removable arrangement of voltage transformers can also be placed in the cable compartment. These can be fitted with high-voltage fuses similar to those used in the measuring panel. Three fixed-mounted surge arresters can also be installed. However, in both cases the number of parallel cables must be reduced - see table below

Connection of cables in typical panels:

Rated voltage (kV)	Rated current (A)	Max. number of parallel cables per phase	Max. cross section of cables (mm ²)	Range of cable clamp (mm)	Range of reducer ring (mm)
12	...1250	2 ⁽¹⁾ (2)	300	35-54	27-62

(1) In the case where removable voltage transformers are on the truck or surge arresters are used, the number of parallel cables is reduced by one per phase.

(2) For an IF panel with cable bottom entry and depth of 1,650 mm, up to 2 parallel cables per phase can be used.

Important notice

Typically, connections in the panel are made using single-core plastic insulated cables. Special or unusual cable connection cases (e.g. three-core cables, cables with paper or special insulation etc.) must be agreed between the customer and manufacturer.

Mounting procedure for power cables:

- The power cables must be first inserted, then cut to length and stripped
- The reducer rings must be adapted to the cable diameter before being fitted onto the cable
- Cable sealing ends must be prepared and mounted on cable cores according to manufacturer's instructions
- The cable eyes must be connected to the prepared connection bars with strain relief
- The cables must be correctly earthed
- Individual parts of the floor covering must be mounted
- The reducer rings must be moved down so that nuts in the rings fit into the corresponding recesses in the floor coverings. In this way the cable passages are sealed
- Cables must be fastened in the prepared cable clamps (the maximum tightening torque applicable to the clamp screws is 9 Nm)

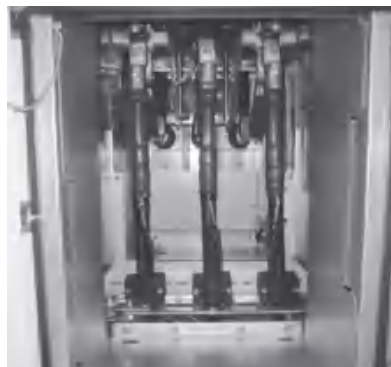


Figure 59 a) Cable compartment

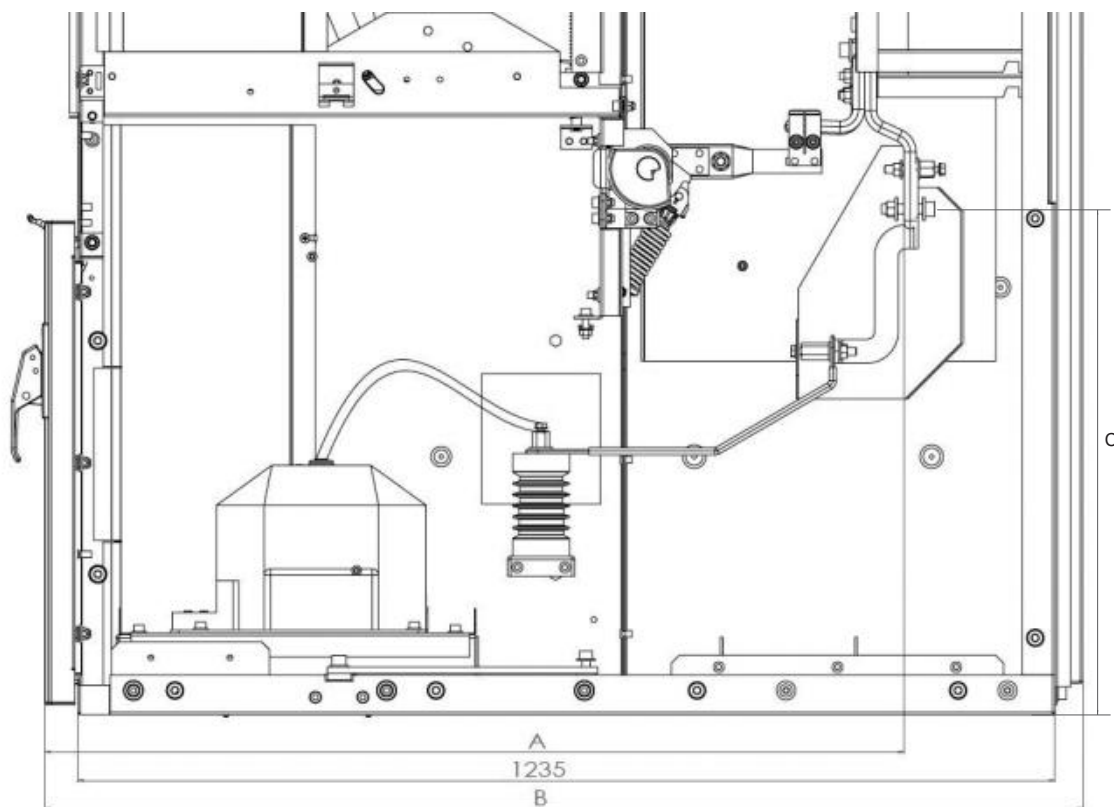


Figure 59 b) Dimension of power cable connection

In (A)	Width (mm)	Ith (kA)	A	B	C	Max. number of cables in one phase
...1250	500	...31.5	1086	1310	691	2 (300 mm ²)

5.10.2 Control cables

The control cables are conveyed into the panel through the control wiring duct on the left-hand side of the panel. Mounting procedure:

- Insert the cables into the control wiring duct on the left-hand side. The duct is covered by covers
- Fasten the control cables at the top end of the duct, strip the insulation and convey the cable control cores into the low-voltage compartment after the terminal strip frame has been swung up
- Connect the control cables to the terminal strip according to the circuit diagram
- Control wiring connections to adjacent panels are made using a bushing

5.11 Earthing the switchgear

- Connect the main earthing bar to the connections provided in every panel
- The floor frame or the erected raised false floor needs to be protected using the correct wiring connection
- Connect the earthing conductor - coming from the earth electrode preferably via a removable bolted connection for testing purpose - to the main earthing bar of the switchgear

5.12 Laying the ring circuits

The ring circuits are supplied - as a rolled-up bundle - in the control cabinet or in the accessories. They are marked and fitted with ferrules or connectors at both ends.

Openings are provided in the side walls of the control cabinet so that these lines can be looped through from panel to panel.

5.13 Final erection work

- Check painted areas of the switchgear for possible damage and touch up where required
- Check bolt connections, in particular all those made during the on-site erection of the busbars and earthing system. Tighten if required
- Thoroughly clean the switchgear
- Remove all foreign bodies from the panels
- Correctly replace all coverings, etc. removed during erection and connection
- In the enclosure, any remaining openings must be closed if they are no longer needed
- Check the isolating contacts and interlocking mechanisms for smooth motion, and grease again with isoflex topas NB 52 where necessary
- The withdrawable circuit-breaker parts must be inserted and the control wirings connected
- The panels doors must be properly closed



Figure 60 An open terminal frame

6 Operation of the switchgear

Note on safety at work

All relative work and operating procedures must be carefully carried out by trained specialists familiar with the installation, taking into account all the relative safety regulations according to the IEC and other relevant professional bodies, as well as any local and work regulations and instructions.



Warning:

Do not walk on the top surfaces of the switchgear panels as they contain rupture points for pressure relief which could be damaged!

6.1 Switching operations



Carry out switching operations with the front doors closed!

6.1.1 Withdrawable circuit-breaker part

Manual insertion from the test/disconnected position to the service position:

- Connect the control wiring plug (Fig. 64)
- Close the front door
- Ensure that the apparatus is in the OFF position
- Fit the hand crank onto the square spigot of the spindle mechanism after the hole has been opened for it by turning the slide. The slide is turned using a knob (Fig. 65)

- Turn the crank clockwise (approx. 20 turns) until the stop is reached and the withdrawable part is in the service position (Fig. 66)
- Observe the position indicator
- Remove the hand crank

The spring loaded pin head will lie completely on the rear side of the panel door when the hand crank is moved from the square spigot of spindle mechanism. This ensures that the rear part of the pin head has been shifted onto the hexagonal cap of the spindle and prevents unintentional wrenching of the spindle during panel service. Wrenching may lead to the circuit-breaker blocking.

Note:

The withdrawable part must not be stopped in any intermediate position as it is moved between the service and test/disconnected positions!

Manual withdrawal from the service position to the test/disconnected position:

- Ensure that the apparatus is in the OFF position
- Reverse the procedure described above for insertion into the service position



Figure 61 The control wiring plug connector is blocked to prevent disconnection with the withdrawable part in the service position

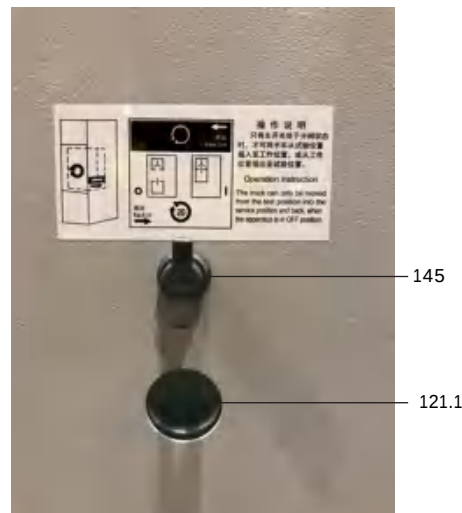


Figure 62 Before inserting the hand crank, it is necessary to open the hole for it. To do this, turn the slide by means of the key

**Important note:**

The insertion and withdrawal of circuit-breakers (and other withdrawable parts) must be gradual to avoid any shocks that could deform the mechanical interlock. If any operations are prevented, do not force the interlocks and check that the operating sequence is correct. The force normally applicable to the insertion/withdrawing lever is 260 N. In any case, the maximum applicable force must never exceed 400 N. Please refer to the circuit-breaker technical documentation for installation operations.

Caution

Insertion and withdrawal must always be carried out with the apparatus open!

In the event of an auxiliary voltage drop, do not use force to move the withdrawable parts with locking magnets Y0 or RL2. After a voltage drop has occurred, the magnets are locked along the entire travel range between the service and test positions. To remove the interlock, consult the circuit-breaker technical documentation.

Withdrawal from the test/disconnected position onto the service truck:

- Open the door of the circuit-breaker compartment
- Release the control wiring plug and place it in the storage position on the withdrawable part
- Position the service truck, with the adjustable bench-top guide pins, at the correct height facing the panel front and allow the catch to engage (Fig. 67)
- Move the sliding handles inwards against the springs to release the withdrawable part. Draw the withdrawable part out onto the service truck and secure it in the catches on the truck (Fig. 68)
- Press the release lever - positioned at the front underneath the bench top - and release the service truck from the switchgear panel
- Insertion from the service truck into the test/disconnected position
- Carry out the procedure described above for withdrawal in reverse order



Figure 63 Movement of the withdrawable part between the test/ disconnected position and the service position: clockwise up to the stop for service position and anticlockwise for the test/disconnected position

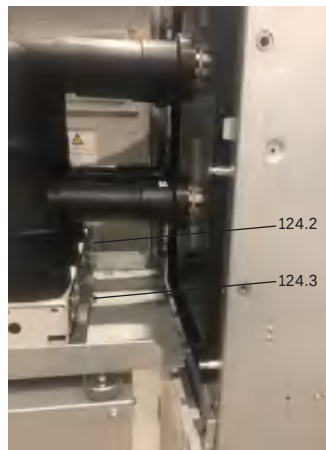


Figure 64 Positioning the service truck with the guide pins on the adjustable - height bench top at the correct height for approach to the switchgear panel and engaging the catch

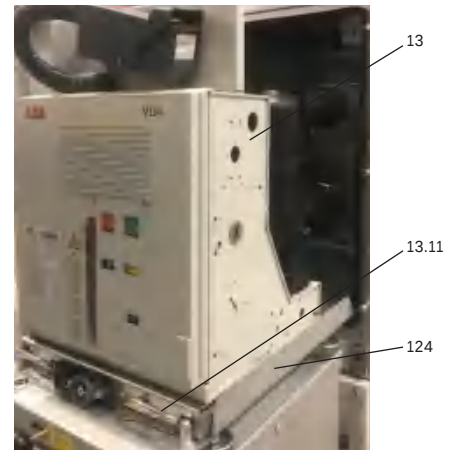


Figure 65 Service truck engaged with the switchgear panel. Withdrawable part released for removal with the handles slid inwards

121 Hand crank

124.2 Guide pin
124.3 Catch pin

13 Withdrawable part
13.11 Sliding handle
124 Service truck

6.1.2 Cicuit-breaker - type VD4

Charging the stored energy spring system:

- Automatic charging is carried out on a circuit-breaker with charging motors. If the charging motor fails, the charging procedure can be carried out or completed manually
 - On breakers with manual charging systems, take the lever and pump 8 or 9 times until the charged condition is indicated (Fig. 70)
 - When the charged condition is reached, the charging mechanism is automatically disengaged. Any further strokes of the lever will have no effect
 - Opening and closing the circuit-breaker
 - Opening and closing operations with the withdrawable part in the service position should only be performed with the door closed
- Operate the local or remote electrical control - observe the switch position indicator
 - The switching operation counter (Fig. 70) for the circuit-breaker automatically increases by one unit with each operating cycle
 - An additional control mechanism fitted in the door of the circuit-breaker compartment enables mechanical operation of the circuit-breaker with the door closed and with the withdrawable part in either position (Fig. 71)
 - Press the relative mechanical pushbutton, having first turned the knob anti-clockwise to the stop position in the event that the withdrawable part was in the service position
 - Observe the switch position indicator

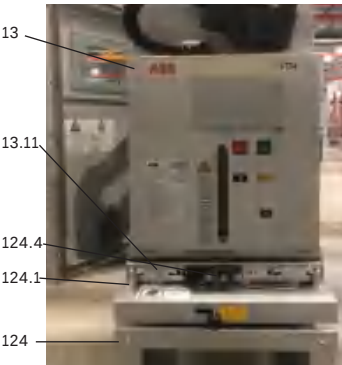


Figure 66 Withdrawable part standing on service truck and secured in the catches

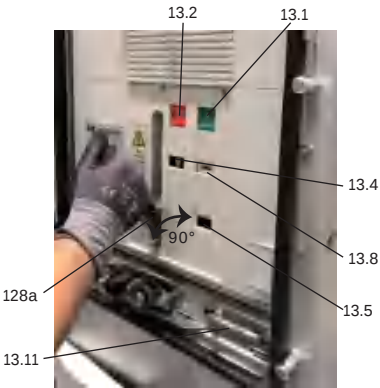


Figure 67 Manual operation of the withdrawable part with V-max circuit-breaker

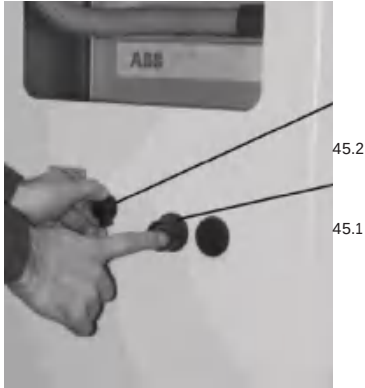


Figure 68 Handling of the mechanical circuit - breaker operation in the switchgear panel door with the withdrawable part in the service position

13	Withdrawable part	13.1	Mechanical ON push-button	45.1	Mechanical pushbutton
13.11	Sliding handle	13.2	Mechanical OFF push-button	45.2	Knob
13.12	Catch (connected to sliding handle 13.11)	13.4	Mechanical switch-position indicator		
124	Service truck	13.5	Mechanical operating-cycle counter		
124.1	Height adjuster	13.8	Charging condition indicator		
124.4	Release lever for catch pin	13.11	Sliding handle connected to the catch on the withdrawable assembly		
		128a	Charging lever		

6.1.3 Withdrawable metering part

Handling of the withdrawable metering or the voltage-transformer part in the metering panel is described in section 6.2.1. Withdrawable voltage-transformer parts in incoming and outgoing feeder panels are put into the cable compartment using a ramp. They reach the service position immediately and engage with the panel earthing. The voltage transformers used correspond to the type used in the voltage-transformer panel, thereby allowing HRC fuses to be implemented.

6.1.4 Earthing switch - ET1

The earthing switch has a snap closing mechanism which is independent of the rotation of the drive shaft. An earthing switch allocated to a circuit-breaker is only enabled for switching when the withdrawable part is in the test/disconnected position or removed from the switchgear panel. Earthing switches should be turned on only when the doors are closed.

Manual opening and closing:

- Press the slide of the operating lever recess socket downwards (Fig. 72) to open. If the switch is closed, the slide will already be in this position

Caution: If the operation is prevented, do not force the interlock and check that the operation sequence is correct.

- Fit the operating lever (Fig. 73) onto the hexagonal shaft, which is now released for operation.

Note: Put the operating lever in a pointed upwards or downwards position so that there is sufficient room for it to move.

- To close the earthing switch, turn the lever clockwise through approx. 180 °until the stop position is reached. Turning the lever in an anticlockwise until the stop position is reached opens the earthing switch
- Observe the mechanical/electrical switch position indicator
- Remove the operating lever. The slide remains open if the earthing switch is in the closed position

Make sure the operating lever fully reaches the stop position in the opening process to ensure that the earthing switch is in its defined limit position. The manual operating mechanism can also be fitted with a locking magnet.

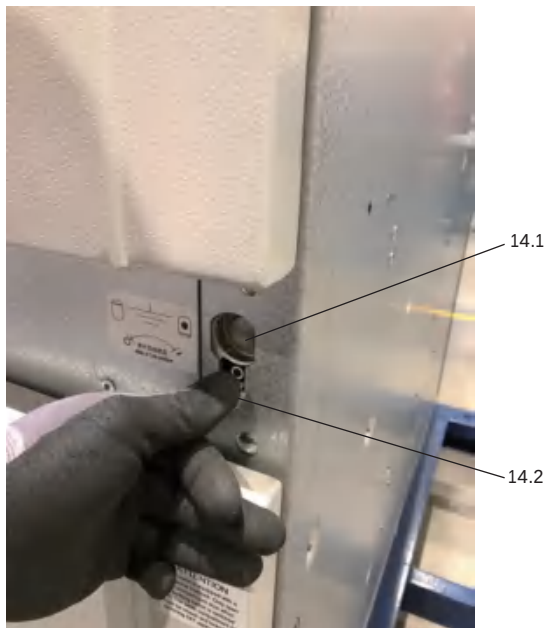


Figure 69 Preparing to operate the earthing switch - press the slide downwards

- | | |
|------|---|
| 14.1 | Hexagonal shaft for earthing switch operating mechanism |
| 14.2 | Slide |



Figure 70 Preparing to operate the earthing switch - operating lever in upright position ready to switch to on/off position

- | | |
|-----|-----------------|
| 122 | Operating lever |
|-----|-----------------|

6.2 Test procedures

6.2.1 Testing the off-circuit condition

In switchgear panels which are not equipped with capacitive voltage indication, checking the off-circuit condition is carried out with a HV tester on the isolating contacts in the isolating tulips, after the corresponding upper shutter or lower shutter has been opened.

If the panels are equipped with capacitive voltage indication, checking the off-circuit condition can be carried out by means of this device. In this case, proceed according to the manufacturer's instructions or the indicators (Optionally, switchgear can be equipped with various types of indicators coming from various manufacturers).

In case of any doubt about correct operation of capacitive voltage indication, the off-circuit condition must be checked using a HV tester.

Checking the off-circuit condition must always be carried out in compliance with the relevant safety regulations and local operating conditions!

6.2.2 Current and voltage tests

The testing and earthing module is available for carrying out current and voltage tests. It is also suitable for supplying primary current to any current transformers which may be fitted during measurements in the protection circuit and, for example, for application of a test voltage during insulating tests.

- Isolate and secure the working area in accordance with the IEC safety regulations
- For primary current supply, fix the connecting cable of the test transformer to the contact pins
- For AC voltage tests, ball is required on the contact pin. The bore in the ball is used for connection of the voltage supply
- For current tests, for example of small connected generators, the short-circuit bridge must be fixed onto the contact pins

Note:

With voltage tests at power frequency withstand voltage and/or impulse voltage, carry out the following procedure:

- Disconnect any voltage transformers and capacitive dividers and cover them with an insulating plate

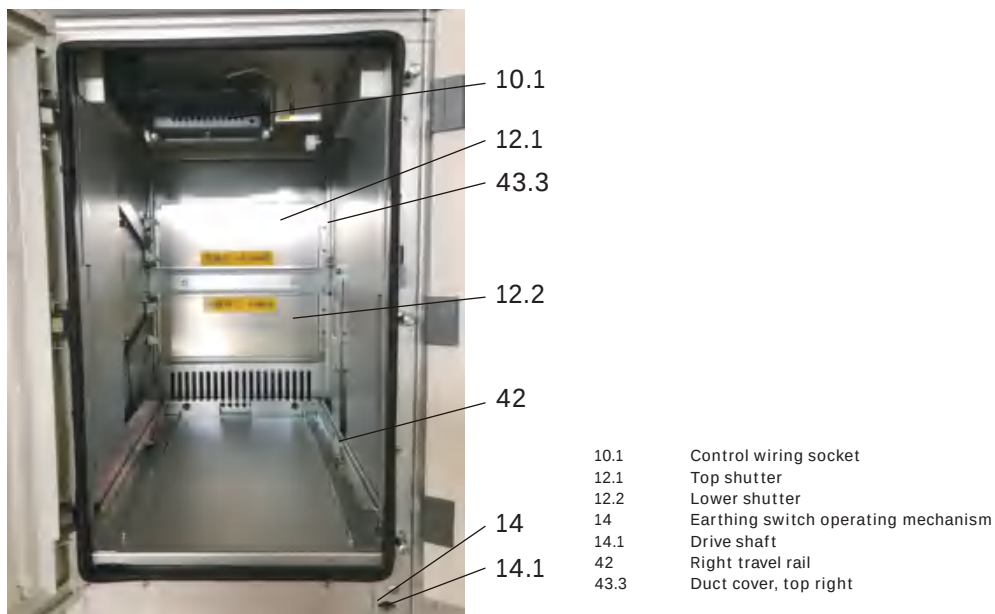


Figure 71 View into the circuit-breaker compartment

7 Commissioning

7.1 Preparatory work

To prepare for commissioning, the following work must be carried out prior to the connection of the high voltage power supply:

- Check the general condition of the switchgear for any damage or defects
- Visually inspect the switching devices, withdrawable parts, isolating contacts, insulating parts, etc
- Check the connection between the main earthing bar and the installation earthing conductor
- Check the paintwork for damage and, where necessary, touch up as described in section 8.5
- Remove all residues of materials, foreign bodies and tools from the switchgear
- Clean the switchgear, rubbing down the insulating parts with a soft, dry, clean, non-fraying cloth. Remove any greasy or sticky dirt as described in section 8.4
- Correctly remount all covers etc. removed during the assembly and testing procedures
- Remove the transport caps on the vacuum circuit-breakers if they are still fitted
- Perform AC voltage testing of the main circuits according to IEC 600271-200 where necessary. Pay special attention to the voltage transformers and cables, etc. during this procedure
- Switch the auxiliary and control voltage on
- Carry out testing operations on switching devices manually or by electrical control, and simultaneously observe the relative position indicators
- Check the mechanical and electrical interlocks for effectiveness without using force
- Set the protective devices in the switchgear to the required values and check their function with test equipment

- For any other matters regarding operation of the withdrawable circuit-breaker part and testing facilities for the withdrawable part, please see section 8.5
- Instruct local operators regarding the basic details in the regular handling of the switchgear
- Check readiness for operation and the switching status of electrical systems upstream and downstream of the switchgear
- Depending on the allocation of responsibilities, it may also be necessary to check the following equipment in areas adjacent to the switchgear:
 - Power cables
 - Auxiliary cables
 - Auxiliary power source
 - Remote control system
 - Complete earthing system
 - Switchroom equipment
 - Switchroom conditions

7.2 Start-up

- Comply with all relevant safety regulations
- Ensure that the circuit breakers in the system are in the OFF position
- Remove any existing earthing and short-circuiting connections in the critical switching area
- Energize the feeder cables
- Connect the switchgear step by step, observing the signals and indicators
- Check that the relative conductors are in phase and, where necessary, when there are several incoming feeder cables and switchgear sections
- Carry out all measurements and check the functions which depend on the connection of a high-voltage power supply
- Watch out for irregularities of any kind

8 Maintenance

8.1 Maintenance strategies

Preventive maintenance

is maintenance carried out at predetermined intervals or according to prescribed criteria, aimed at reducing the failure risk or performance degradation of the equipment. This method is based on scheduled activities performed on the out-of-service equipment including: visual checks, apparatus cleaning, mechanical components lubrication, worn parts replacement and routine tests execution.

Risk-based maintenance

is maintenance carried out by integrating analysis, measurement and periodic test activities to standard preventive maintenance.

The gathered information is viewed in the context of the environmental, operation and process condition of the equipment in the system. The aim is to perform the asset condition and risk assessment and define the appropriate maintenance tasks.

Please refer to next chapters for details of preventive and risk-based maintenance programs.



Safety warning

Always follow 7 safety steps:

- Clearly identify the work location
- Disconnect and secure against reconnection
- Protect against any other live parts
- Take special precautions when close to bare conductors
- Check the installation is dead
- Carry out earthing and short circuiting
- Issue a permit work

8.2 Preventive maintenance

Maintenance serves to preserve trouble-free operation and achieve the longest possible working life of the switchgear. It comprises the following activities.

Inspection: Determining the actual condition.

Servicing: Measures to preserve a specified condition.

Repair: Measures to restore the specified condition.

Note:

When carrying out all maintenance work, the regulations in the country of installation must be strictly adhered to. Maintenance work should only be undertaken by trained personnel familiar with the characteristics of the individual switchgear. All work should be carried out in accordance with all relevant IEC safety regulations and with those of other technical authorities and with other overriding instructions. It is recommended that ABB service personnel perform the servicing and repair work detailed below.

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

The operating instructions for the Vmax circuit breaker must also be followed, and if necessary, further details (such as special operating conditions agreed on with the manufacturer) described in the technical documentation specific to the switchgear installation should also be taken into consideration.

Intervals for inspection, servicing and repairs
The time intervals for any maintenance work depend on the operating conditions of the switchgear, and in particular on the mode of operation, the number of rated and short-circuit current switching operations, ambient temperature, pollution etc. We recommend carrying out maintenance work at the following intervals:

Activity performed	According to section	Time interval in years	According to number of switching operations
Inspection	8.3	3 ¹⁾	2500
Servicing	8.4	3 ²⁾	2500 ³⁾
Repair	8.5	As required	As required

1) In more demanding service conditions, we recommend reducing this interval suitably – also see sections 1 and 2.

2) According to the results of the inspection.

3) See the instruction manuals of the circuit-breakers.

*) Earthing switch.

8.3 Inspection

- Where necessary, the working area must be isolated and secured against reconnection in accordance with the safety regulations specified by IEC and any appropriate national standards before inspection
- Correct switchgear functionalities should be monitored by regular inspections
- Under normal operating conditions, inspection should be carried out once every four years by specially trained professional electricians
- Under abnormal operating conditions (including adverse climatic conditions) and/or special environmental stresses (heavy pollution and an aggressive atmosphere among others), the frequency of inspection may have to be increased
- Inspection is primarily to carry out a visual check for grime, corrosion and moisture:
 - Effects of high temperature on the main circuits
 - Traces of partial discharge on the insulating material parts
 - Traces of leakage current on the insulating material parts
 - Surfaces of the contact systems
- However, inspection must also include correct mechanical/electrical operation of the following parts: switching devices, actuating, interlocking, protection and signalling devices



Caution

With regard to the switching devices, their separate Instruction manual should be followed.

8.4 Servicing

When, during an inspection, the need to carry out cleaning operations is noted, proceed as follows:

- Clean the surfaces:
 - Remove any dry dust deposits which are not very adherent using a soft dry cloth
 - Remove any more adhering dirt with ethanol F 25 M
- Clean the insulating surfaces and the conductive components with ethanol F 25 M
- After cleaning, rinse with clean water and dry carefully
- Should any partial discharges occur as a consequence of the condensation phenomenon, a temporary remedy which is often effective is application of a thin layer of silicone over the surface involved. For a permanent remedy to this type of unusual problem, contact the ABB service department

8.5 Repair

8.5.1 Repair on switchgear assemblies

8.5.1.1 Repair of surface damage

- Carry out repair work immediately after a defect has been discovered
- Completely remove all rust from damaged paintwork areas on steel sheet and other steel parts by mechanical means, e.g. with a wire brush
- Lightly grind the surrounding paint coat and carefully degrease the entire area. Then immediately apply an anti-rust primer and, after an appropriate hardening time, apply the top coat. Only use suitable and compatible paint products
- Apply the top coat in standard RAL7035 colour, or the relevant special colour
- Carefully remove any white rust on aluminium / zinc surfaces with a wire brush or cleaning pad, e.g. Scotch-Brite, and clean loosely adhering particles with a dry, non-fraying cloth. Next treat the cleaned parts with zinc spray or zinc powder paint and, finally, treat with aluminium spray for colour matching
- Carefully remove any white rust from passivated operating parts and rust formation on phosphatised parts with a wire brush or metal-free cleaning pad, e.g. Scotch-Brite, and clean with a dry cloth. Then grease evenly (with mechanical grease for moving parts)

Remove the contact system and thoroughly clean.

Note:

The set installation position of the contact arms must not be changed by undue use of force. Replace the contact pins when the surface has been damaged. Replaced pins should be retightened using socket head bolts.

8.5.1.2 Repair on earthing switch signaling contact

The auxiliary switches of the interchangeable groups are adjusted at the factory.

When final installation of the earthing switch and operator takes place on site, it may be necessary to carry out further precise adjustment of the auxiliary switch. In this case, the following should be taken into account:

- There must be a run-on of 0.5 mm in the fully operated position before the plunger reaches the stop position (for safety reasons)
- The auxiliary limit switch for earthing switch ON must be operated immediately after the toggle spring mechanism is precisely centered in the closing process and the automatic rapid closing process has started

- The auxiliary limit switch (Fig. 72) for earthing switch OFF must be operated on earthing switches with manual mechanisms during the opening movement of the slide (Fig. 72), and before half of the hexagonal shaft has become visible, or 1 mm before the tab of the slide makes contact with the armature of the de-energized locking magnet

8.5.2 Repairs on withdrawable parts

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

The following operating instructions must also be followed, together with this instruction manual in the individual cases concerned.

- Vacuum circuit-breaker: type VD4

Thread	Rated tightening torque ungreased
M10	50 Nm

8.6 Risk-based maintenance

ABB supports UniGear users with optimized and cost effective strategies to ensure that the correct actions are implemented at the right time. Asset managers are fully supported in moving from conventional approaches ("corrective maintenance" and "preventive maintenance") to advanced strategies ("risk-based maintenance" and "condition-based maintenance").

In this way, the service activity is no longer driven by predefined timeframes, observations and past experiences, but takes into account the actual condition of the equipment, the required reliability level and the expectation for life time extension.

This assessment is performed by trained technicians as part of risk-based maintenance programs or is carried out automatically by on-line monitoring systems for condition-based maintenance solutions.

Please refer to brochure 1VCP000427 - maintenance by ABB for more details on risk-based maintenance.

8.7 Spare parts, auxiliary materials and lubricants

A spare parts list is available on request for procurement of spare parts. It basically includes moving parts and parts subject to wear. When parts are required, the serial number of the relevant switchgear or switching device should always be quoted.

Auxiliary materials, lubricants

Lubricant

- Isoflex topas NB 52

Halogen-free cleansers (optional)

- Ethanol F 25 M (for general cleaning)

Touch-up paint (optional)

- Standard colour RAL7035

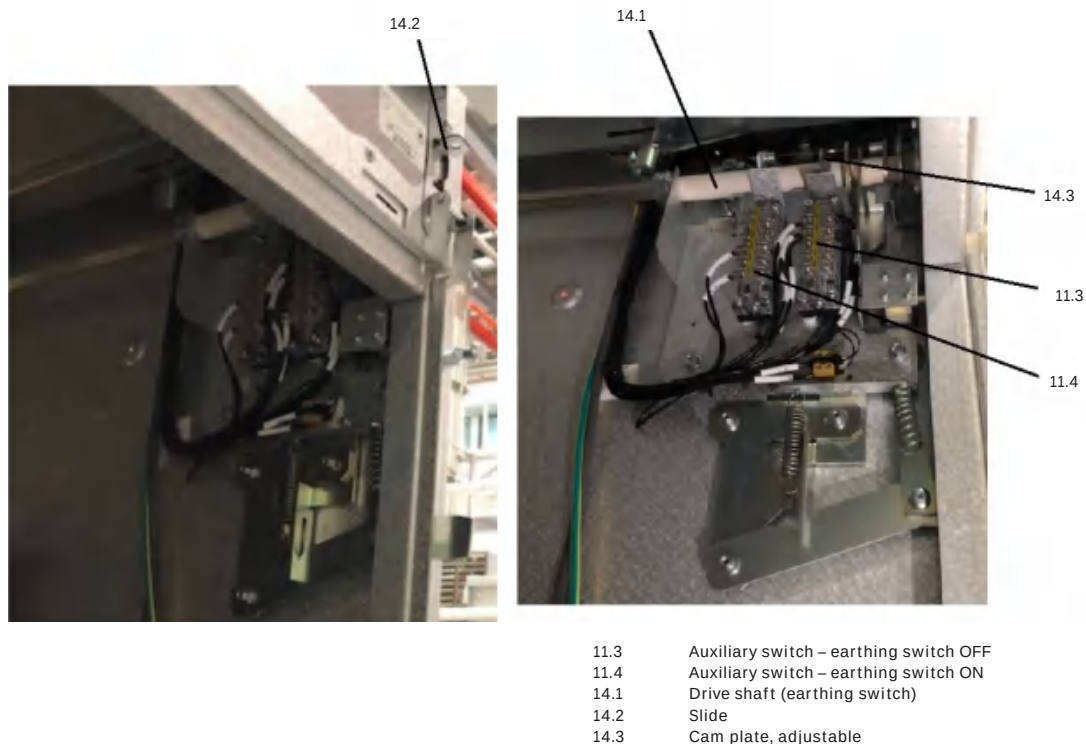


Figure 72 Manual earthing switch mechanism with auxiliary switches (side cover has been removed)

8.8 Operating accessories

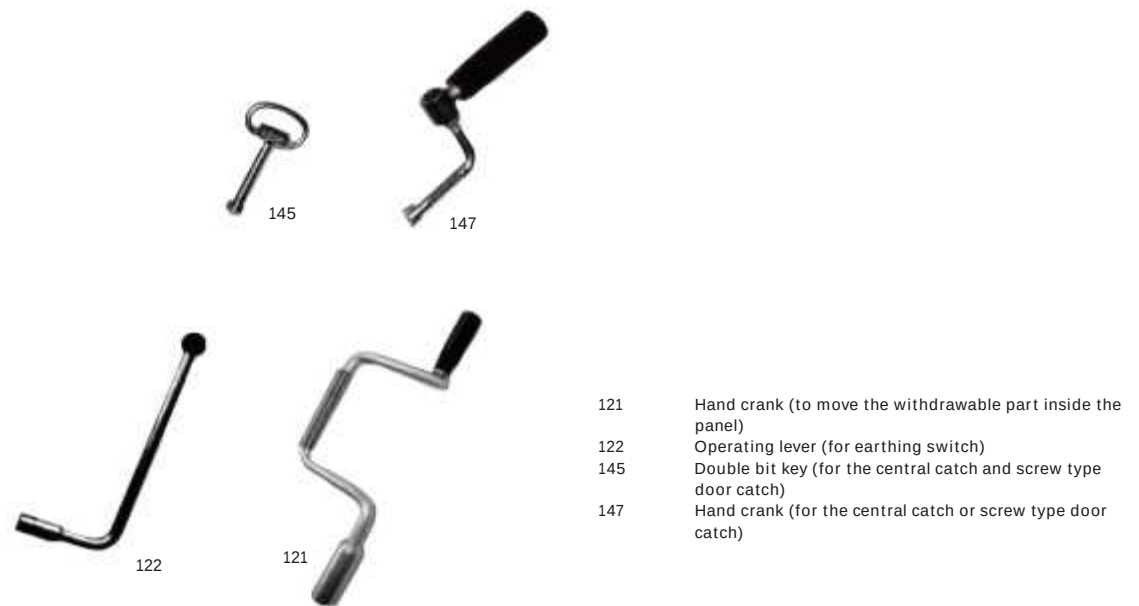


Figure 73 Operating accessories

9 Product quality and environmental protection

The UniGear type panels are produced in compliance with the requirements of international standards for the quality management system and environmental management system. In these fields, the excellent level is proved by quality certificates according to ISO 9001 and by the EMS according to ISO 14001.

End of life of product

The ABB company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14001 standard.

The duty of company is to facilitate subsequent recycling or disposal at the end of product life.

During disposal of the product, it is always necessary to act in accordance with local legal requirements in force.

We the following methods of disposal:

Disposal can either be carried out thermally in an incineration plant or by storing on a waste site.

Raw material	Recommended method of disposal
Metal material (Fe, Cu, Al, Ag, Zn, W, others)	Separation and recycling
Thermoplasts	Recycling or disposal
Epoxy resin	Separation of metal material and the disposal of rest
Rubber	Disposal
Oil as dielectric (transformer oil)	Draining from equipment and further recycling or disposal
Packing material – wood	Recycling or disposal
Packing material – foil	Recycling or disposal

ABB Connect

The digital assistant for all your electrification needs

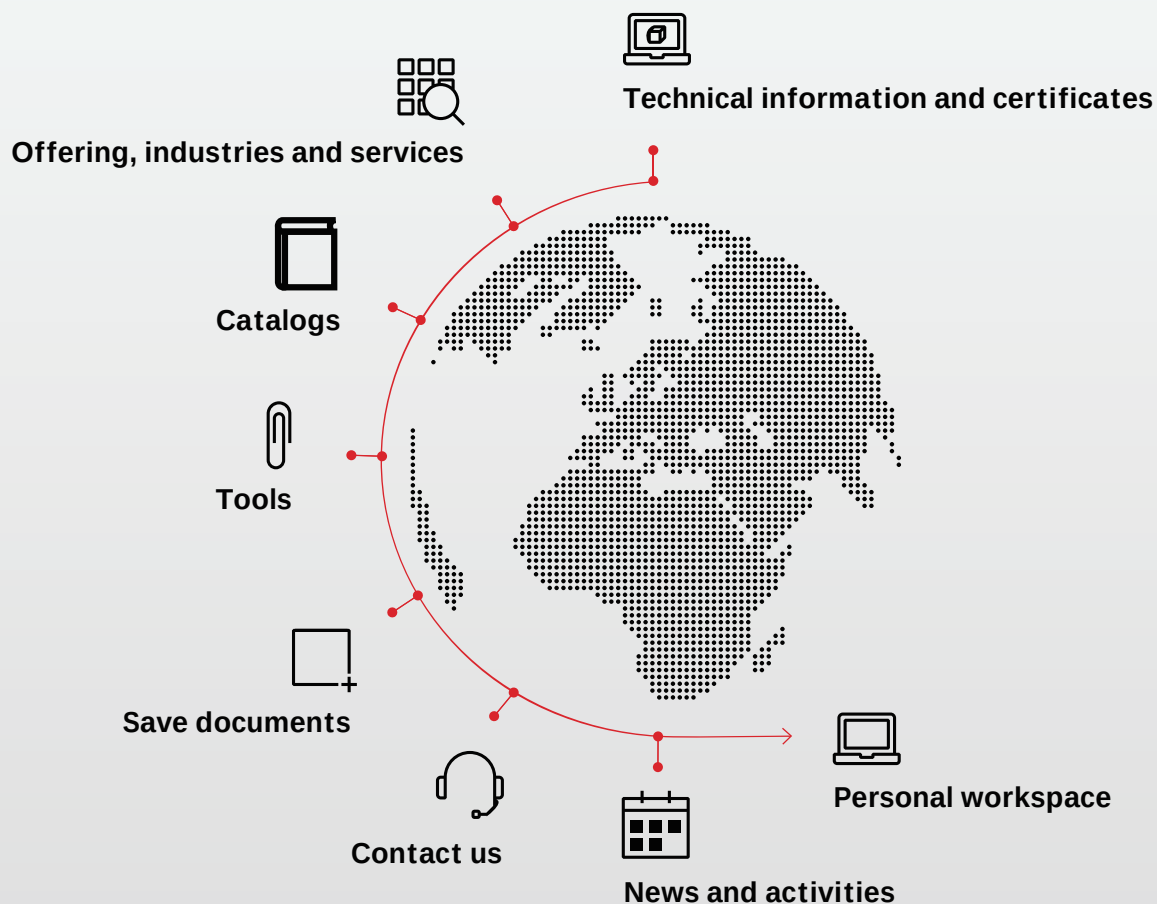
ABB Connect helps you to find product information and stay connected to the latest news and tools. It's a digital assistant that enables customers to connect to the broadest range of electrification solutions in one place.

- Easy to find what you need by search
- Get all information about our products, applications, selection guides, installation manuals, service, certificates, and engineering tools, etc.
- Saving documents locally, updating automatically.
- Receive your expected messages
- Online customer service

You can use ABB Connect on iOS, Android and Windows 10 device



Scanning QR code
to enter ABB Connect





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