

# DY803 - Ed. 6 - to e-Distribuzione specifications

## Instructions for installation, service and maintenance

Installation, service and maintenance instructions for 24 kV prefabricated assemblies with arc-proof metal enclosures and SF<sub>6</sub>-insulated switch-disconnector (IMS)

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# For your safety!

- Make sure that the installation room (spaces, divisions and ambient) is suitable for the electrical apparatus.
- Check that all the installation, putting into service and maintenance operations are carried out by qualified personnel with suitable knowledge of the apparatus.
- Make sure that the standards and legal prescriptions are complied with during installation, putting into service and maintenance, so as to ensure that installations conforming to the rules of good working practice and safety in the work place are constructed. The personnel who access the switchgear must possess PES or PEI qualification in accordance with IEC EN50110 standards.
- Strictly follow the information given in this instruction manual.
- Check that the rated performance of the apparatus is not exceeded during service.
- Pay special attention to the notes indicated in the manual by the following symbol:



- Check that the personnel operating the apparatus have this instruction manual to hand as well as the necessary information for correct intervention.

Responsible behaviour safeguards your own and others' safety! Please consult us if further details are required.

The instructions in this manual refer to standardized MV switchgear type DY803.

Please read the manual carefully to ensure that the product is used correctly.

Besides this manual, it is always necessary to consult the latest technical documentation (electric circuit and wiring diagrams, tables with overall dimensions, foundation project, etc.), especially regarding any variants requested in relation to the standard configurations.

Only use original spare parts for maintenance operations.

## 1. Packing and transport



**Strictly comply with the indications on the pictograms and the instructions on the packaging.**

The cubicles are packed in accordance with the instructions in the e-Distribuzione technical specifications.

Each cubicle is protected by a plastic cover to prevent water from infiltrating if it rains when the loading and unloading operations are performed and to keep the dust off during storage.

The cubicles are placed on wooden pallets and fixed in place with four bolts, one per corner.

The loading platform of the vehicle that transports the cubicles must be no more than 1.5 m from the ground so that the overall height is 4 m maximum.

The surface of the loading platform must be non-slip with a high coefficient of friction.

The assemblies must be arranged cross-wise and back to back on the platform with suitable material in between so as to prevent them from touching and pressing against each other.

Frame members must be arranged on the platform so as to space out the units and prevent them from shifting in either the longitudinal or cross-wise directions.

The units must be fastened to the structure of the vehicle with ropes so as to avoid damage and prevent them from tipping over when the transport vehicle is driven round bends or is sharply braked.

The vehicle must also be covered by a tarpaulin.

## 2. Checking on receipt

The cubicles must be unloaded from the transport vehicle with the utmost care, as described in chap. 4.

Upon receipt, immediately check the condition of the pack, that the apparatus is undamaged and that the data on the nameplate affixed to the outside of the pack (e.g. type of cubicle, serial number, weight, etc.) correspond to the information in the order confirmation and shipping note.

If damage or discrepancies are discovered, or the documents supplied with the goods fail to correspond, immediately inform ABB (either directly, or through your representative or supplier) and the haulage contractor that made the delivery.

The cubicles are supplied solely with the accessories specified at the time of order and validated in the order confirmation.

The following items are to be found inside the cubicles:

- this instruction manual;
- a packet containing screws, nuts and busbar washers, etc. for joining the cubicles;
- the shipping documents.

## 3. Storage

The switchgear must be stored in a dry, dust-free and condensation-free place with a non-corrosive atmosphere at a temperature between  $-25\text{ }^{\circ}\text{C}$  and  $+70\text{ }^{\circ}\text{C}$  and 95% relative humidity or less.

Please consult us if different requirements are involved.

## 4. Handling



**Make sure that the insulating parts of the apparatus are not damaged when the cubicles are handled.**

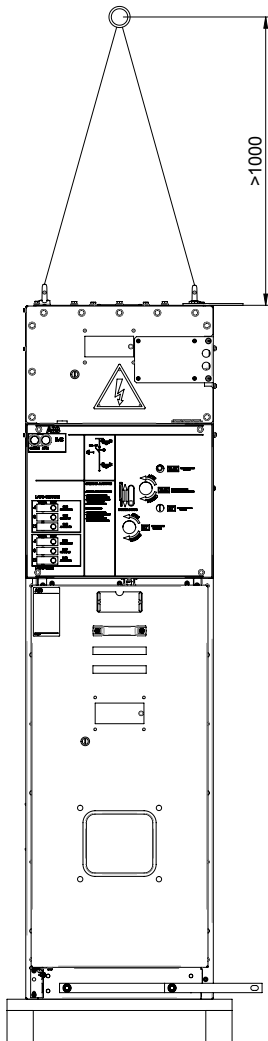
**Before proceeding with any operation, always make sure that the springs of the operating mechanism are discharged and that the switchgear is in the open position.**

**Keep the cubicles in the vertical position when using a lift truck for handling purposes.**

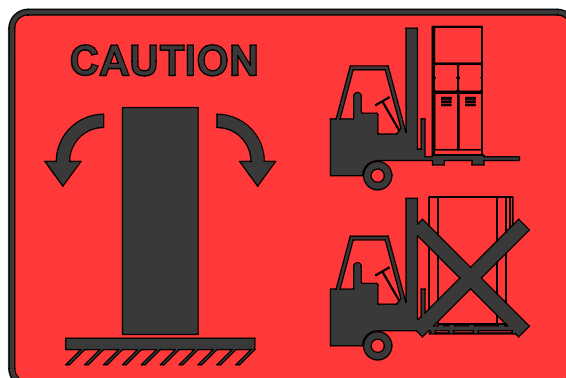
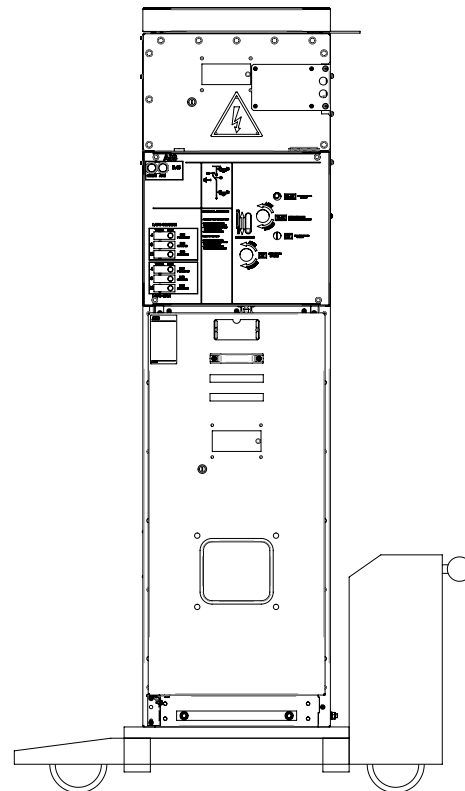
The switchgear is normally placed on a wooden pallet and fastened with four bolts, one per corner.

For handling purposes the switchgear can be lifted by crane, using ropes with snap hooks conforming to the safety standards inserted through the eyebolts on the top of the units, or by fork lift truck. In this case, for improved stability during the handling operations, the forks must be inserted at the sides where the cubicle will be joined.

Handling by crane



Handling by lift truck



## 5. Description

### 5.1 Rated electrical characteristics and overall dimensions

The switchgear must be stored in a dry, dust-free and condensation-free place with a non-corrosive atmosphere at

a temperature between 25 °C and +70 °C and 95% relative humidity or less.

Please consult us if different requirements are involved.

#### Cubicle

Maximum insulation voltage	24 kV
Rated insulation level, withstand voltage:	
with lightning impulse to earth and and line-to-line	125 kV
with power-frequency to earth and and line-to-line	50 kV
with power-frequency between open contacts of disconnecter	60 kV
Rated frequency	50 Hz
Continuous duty rated current for busbars	630 A
Admissible short-time withstand current for busbars and branch lines	16 kA
Admissible short-time peak current value for busbars and branch lines	40 kA
Rated short-circuit time	1 s
External protection class	IP3X
Internal arc withstand value:	
IAC classification	AF
test current	16 kA
test duration	0.5 s

#### GSec 3-position IMS switch-disconnector – line side

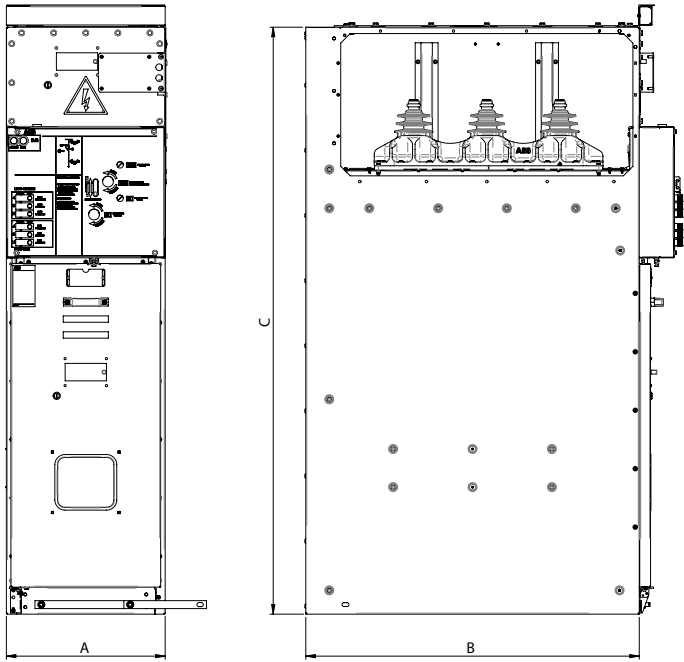
Rated voltage	24 kV
Frequency rated insulation level	
Rated lightning impulse withstand voltage	125 kV
Rated frequency	50 Hz
Rated thermal current	630 A
Admissible rated short-time withstand current	16 kA
Electrical endurance class (standard IEC 62271-103)	E3
Admissible short-time peak current value	40 kA
Rated short-circuit time	1 s
Rated short-circuit breaking capacity	16 kA
Mechanical life	1000 operations Class M1
Rated breaking current:	
circuit mainly active	630 A
vacuum transformer	6.3 A
no-load line	10 A
no-load cable	31.5 A
number of short-circuit makes	5 (E3)

#### GSec 3-position IMS switch-disconnector – earth side ST

Admissible rated short-time withstand current	16 kA
Rated short-time peak current	40 kA
Rated short-circuit making capacity	40 kA
Admissible rated short-circuit time	1 s
Mechanical life	1000 operations Class M0
Electrical endurance class (standard IEC 62271-102)	E2

#### Earthing switch ST2

Admissible rated short-time withstand current	1 kA
Rated short-time peak current	2.5 kA
Rated short-circuit making capacity	2.5 kA
Admissible rated short-circuit time	1s
Mechanical life	1000 operations Class M0
Electrical life class	E2



Unit	A [mm]	B [mm]	C [mm]	Weight [kg]
DY803/2 – LE	500	1050	1850	225
DY803/3 – T	600	1050	1850	265
DY803/9 – IM	700	1150	1950	250
DY803/10 – TM	700	1150	1950	285

## 5.2 Construction characteristics

### 5.2.1 Cubicles

DY803 switchgear is internal arc-proof and suitable for secondary distribution requirements.

DY803 switchgear uses an SF<sub>6</sub>-insulated 3-position (line, isolated and earth) (IMS) switch-disconnector.

The integrated apparatus is made of two materials: the top part is made of epoxy resin so as to guarantee the required degree of insulation while the bottom part is in steel, thereby providing metallic segregation and earthing between the busbar and cable compartments.

This guarantees maximum safety for operators working in the line compartment, even when the main busbars are energized. Thanks to this technical solution, panel classification is LSC2A-PM, in accordance with IEC 62271-200.

The main busbars are installed in the busbar compartment, while the following components are installed in the line compartment, depending on the type of cubicle: cables and terminals, fuses and and earthing switch.

All live parts of the integrated apparatus are SF<sub>6</sub>-insulated to guarantee higher-level protection over time against strongly aggressive outdoor environments.

The new technology featured by the integrated apparatus possesses the following advantages:

- it is the only 3-position disconnector apparatus
- small size
- low amount of SF<sub>6</sub> used for insulation
- ease of use.

All cubicles are internal arc-proof in accordance with the provisions established by standard IEC 62271-200.

IAC classification of the various types, restricted to authorized persons alone (class A), complies with the 5 criteria established by the standard. The types of DY803 cubicles are AF-classified.

### 5.2.2 Protection classes

DY803 switchgear is designed with the following protection classes:

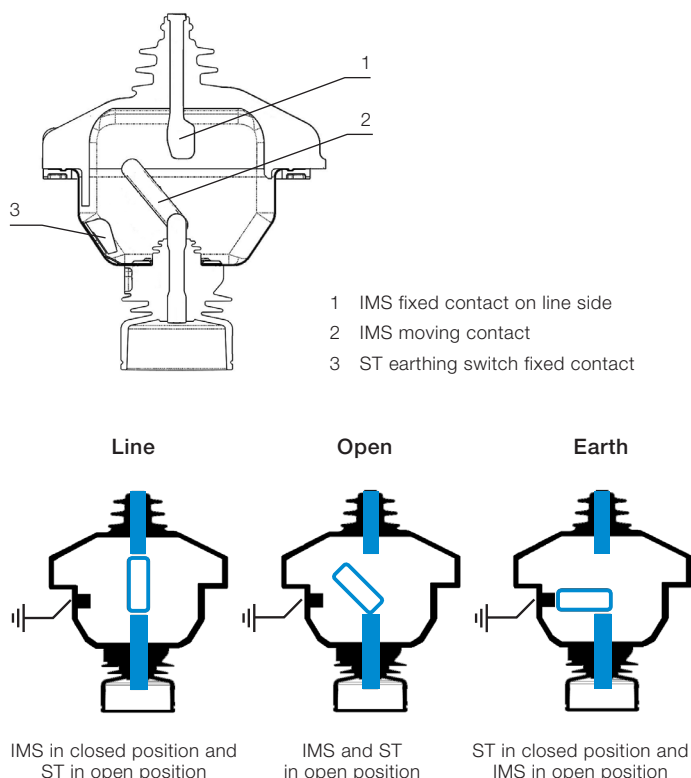
- IP2X protection class inside the switchgear
- IP3X protection class for the external enclosure.



### 5.2.3 Main components

All cubicles use the same equipment, which consists of the following functional components:

#### 5.2.3.1 Three-position switch-disconnector (line, isolated, earth)



Key  
IMS = Switch-disconnector  
ST = Earthing switch

It is an SF<sub>6</sub>-insulated switch-disconnector. In the open position, the moving contacts ensure that the isolated position is maintained.

In the line closed position, the moving contacts fit into the bushing embedded in the epoxy resin.

In the closed earthed position, the moving contacts fit into the fixed lower contacts in the metal structure.

#### 5.2.3.2 Characteristic of the operating mechanisms of the three-position switch-disconnector

The switch-disconnector is equipped with a three-position stored energy operating mechanism operated by a dedicated lever.

The IMS is equipped with a 1S manual operating mechanism (line unit) or 2S manual operating mechanism (transformer protection unit), depending on the type of cubicle.

"Over dead-center" manual operating mechanism 1S uses a single spring to open and close the switch-disconnector and to close and open the earthing switch at an operating speed independent of the operator.

The 1S operating mechanism has a spring-loading gear motor that allows the switch-disconnector opening and closing operations to be performed by remote control.

The switch-disconnector cannot be operated by remote

control when the lever used to operate it and the earthing switch in the manual mode is inserted.

"Over dead-center" manual operating mechanism 2S uses two springs. The first closes the switch-disconnector at a speed independent of the operator. The second spring is loaded during the switch-disconnector closing phase and is used both for opening the switch-disconnector (in the manual mode by means of the lever or because the fuses have tripped) and for opening and closing earthing switches ST1 and ST2 at an operating speed independent of the operator.

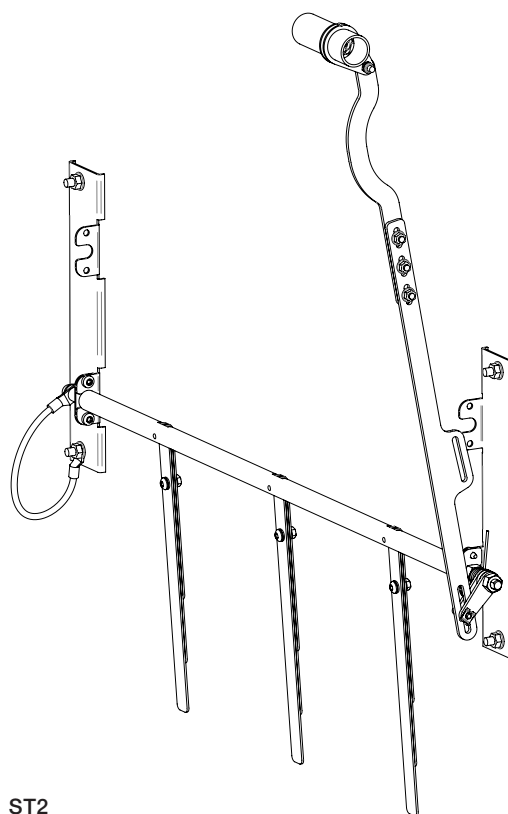
#### 5.2.3.3 Characteristics of the earthing switches

Earthing switch ST is an integral part of the GSec switch-disconnector. It has full making capacity and is designed to earth the cables in the Line cubicles.

Earthing switch ST1 is an integral part of the switch-disconnector. It is designed for earthing on the supply side of the fuses in the transformer protection cubicles.

Earthing switch ST2 (figure) has reduced making capacity. It is used in cubicles like the earthing switch on the load side of the fuses in the transformer protection cubicle.

Opening of earthing switch ST2 is independent of the operator and occurs at the same time as earthing switch ST1.



ST2



## 5.3 Reference Standards

DY803	e-Distribuzione Technical Specification and indicated references
IEC EN 60447	Man-Machine Interface. Operating principles
IEC EN 60529	Protection classes of enclosures. Classification
IEC 62271-200	Metal-enclosed factory-built switchgear and controlgear for rated voltages from 1 kV to 52 kV
IEC 62271-103	Switch-disconnectors for rated voltages from 1 kV to 52 kV
IEC 62271-102	Switch-disconnectors and earthing switches for voltages over 1000 V
IEC 62271-1	General specifications for high voltage switchgear and controlgear

## 5.4 Interlocks



- **The operations must be performed by applying a moment of force (< 200 Nm). If the operations are obstructed, do not force the mechanical interlocks but check that the operating sequence is correct.**
- **The locks are sized to withstand maximum 400 Nm actuating force without permanent deformation or breakage occurring.**

Mechanical and electrical locks are used in the compartments. The mechanical locks include:

- forcing locks
- prevention locks
- safety locks (padlocks/keys).

The electric locks feature microswitches that ensure continuity of service or make or break an electrical circuit.

The interlocks on DY803 units perform the following functions:

- 1) Earthing switch ST must only be able to close IMS in the open position with the moving contacts locked. This condition is achieved with an interlock of the mechanical type.
- 2) It must only be possible to open the cubicle door in conditions of safety, i.e. IMS open and earthing switch ST closed. This condition is obtained with a padlockable interlock of the mechanical type.

### 5.4.1 Interlock between switch-disconnector and earthing switch ST – ST1 – ST2

This is a mechanical prevention lock, which stops the operating lever from being inserted into the corresponding lever seat if the conditions are not correct.

The earthing switch (ST - ST1 - ST2) can only be closed if the IMS is open.

The IMS can only be closed if the earthing switch (ST - ST1 - ST2) is open.

### 5.4.2 Interlocks between door and earthing switch ST – ST1 and ST2

This is a mechanical lock, one of the forcing type that prevents the door from opening if the earthing switch is open, while the other is the inhibiting type that prevents the operating lever from being inserted into the lever seat of the earthing switch, closed when the door is open.

Inversely (inhibiting lock), the earthing switch cannot be opened unless the door is closed.

### 5.4.3 Interlock between operating lever of earthing switch ST and motor

This is an electrical lock that prevents the motor from functioning when the blades of the earthing switch are closed or the operating lever is in the seat of the ST.

A microswitch enables motor operation when the blades of the ST are open and the operating lever is withdrawn from its seat.

### 5.4.4 Interlock between the re-positioning actuator of the IMS operating shaft during normal operation in the absence of power, and the motor

This is an electrical lock that shuts off the power supplied to the motor when the operating shaft of the IMS is being re-positioned in its seat.

Insertion of the operating shaft re-positioning actuator (shown in position 10 in the figure on page 13) acts on a microswitch which shuts off the power supplied to the motor and prevents it from operating.

### 5.4.5 Thermovision door lock

This is a key lock (responsibility key) which is not part of the supply and which only allows authorized persons to open the door.

### 5.4.6 Padlock on the operating seat of earthing switch ST

This system allows a padlock to be fitted onto the operating shaft of earthing switch ST. When the padlock is in place, the operating lever cannot fit into the seat and earthing switch ST cannot be opened.

## 6. Instructions for the operating sequence of all cubicles



- Only use the supplied panic operating lever.
- Once started, all the operations must be completed and the lever removed from its operating seat.
- The operations must be performed by applying <200 Nm actuating force. If they are obstructed, do not force the mechanical interlocks but check that the operating sequence is correct.
- The locks are sized to withstand maximum 400 Nm actuating force without permanent deformation or breakage occurring.
- Before opening the door, always check the position of the IMS and earthing switch ST by means of the mechanical signals and through the windows.
- The procedure for accessing the busbar compartment is at the charge of those who run the installation because it depends on the relative circuit diagram.

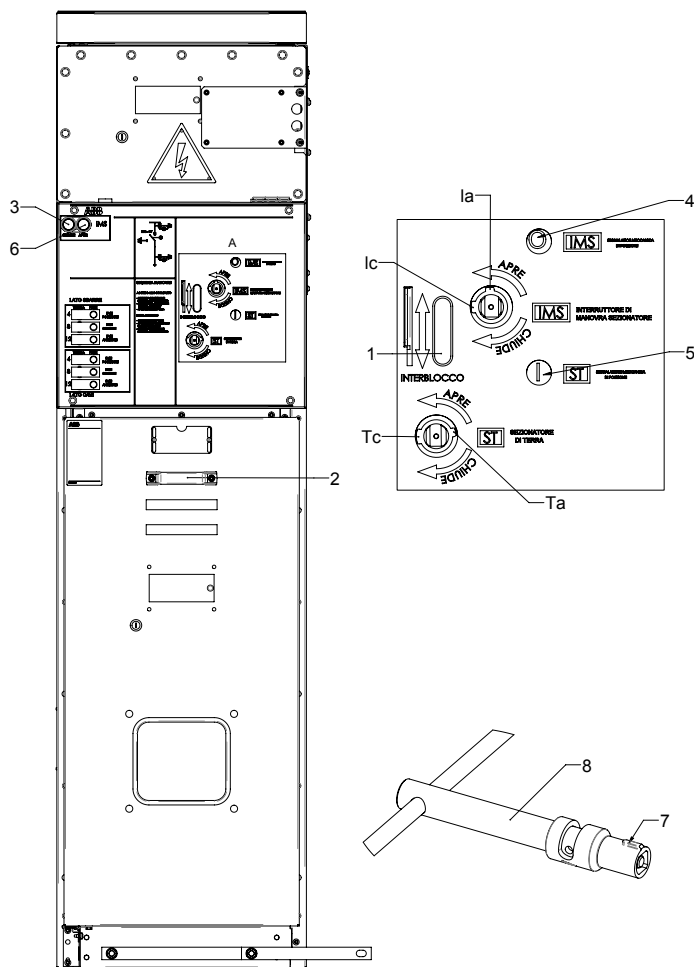
### 6.1 General information

The earth conductor blades of earthing switches ST - ST1 - ST2 are operated in the manual mode only, while operation of the switch-disconnector can be either manual or manual/motor-operated.

The line cubicles have a switch-disconnector IMS that can be operated in the manual mode and electrically. The rated voltage of the motor operator is 24 V DC.

The spring is loaded by a motor operated by push-buttons on the panel front. Insertion of the operating lever, which can only be done in the open/closed positions, cuts off the power supplied to the motor.

### 6.2 Line cubicle



#### 6.2.1 Manual operation

##### Access to the cubicle

- 1) Open the switch-disconnector
  - move the interlock (1) upwards and fit the lever (8) fully into the seat of the IMS. Make sure that the ridge (7) matches the slot (1a);
  - Turn the lever (8) counter-clockwise until the operation has been completed.
  - Remove the lever (8) through the slot (1c).
  - Check that the indicator (4) confirms that opening has occurred by displaying letter O in black on a green background.
- 2) Close earthing switch ST.
  - Move the interlock (1) upwards and fit the operating lever (8) fully into the seat of the ST. Make sure that the ridge (7) on the lever matches the slot (Tc).
  - Turn the lever (8) clockwise until the operation has been completed.
  - Remove the operating lever through the slot (Ta).
  - Check that the indicator (5) confirms that closing has occurred by displaying letter I in black on a yellow background.
- 3) Open the door by pulling the handle (2) up.

## Putting into service

- 1) Shut the door by pushing the handle (2) down.
- 2) Open earthing switch ST.
  - Move the interlock (1) upwards and fit the lever (8) fully into the operating seat of earthing switch ST. Make sure that the ridge (7) matches the slot (Ta).
  - Turn the lever (8) counter-clockwise until the operation has been completed.
  - Remove the lever (8) through the slot (Tc).
  - Check that the indicator (5) confirms that opening has occurred by displaying letter O in black on a grey background.
- 3) Close the switch-disconnector.
  - Move the interlock (1) upwards and fit the lever (8) fully into the seat of the IMS. Make sure that the ridge (7) matches the slot (Ic).
  - Turn the lever (8) clockwise until the operation has been completed.
  - Remove the lever (8) through the slot (Ia).
  - Check that the indicator (4) confirms that closing has occurred by displaying letter I in black on a red background.

### 6.2.1 Electrical operation

#### Access to the cubicle

- 1) Open switch-disconnector IMS by means of the green opening push-button (6).
- 2) Check that the indicator (4) confirms that opening has occurred by displaying letter I in black on a green background.
- 3) Close earthing switch ST.
  - Move the interlock (1) upwards and fit the operating lever (8) fully into the housing (ST). Make sure that the ridge (7) on the lever matches the slot (Tc).
  - Turn the lever (8) clockwise until the operation has been completed.
  - Remove the operating lever from its seat through the slot (Ta).
  - Check that the indicator (5) confirms that closing has occurred by displaying letter I in black on a yellow background.
- 4) Open the door by pulling the handle (2) up.

## Putting into service

- 1) Shut the door by pushing the handle (2) down.
- 2) Open earthing switch ST.
  - Move the interlock (1) upwards and fit the lever (8) fully into the operating seat of earthing switch ST. Make sure that the ridge (7) matches the slot (Ta).
  - Turn the lever (8) counter-clockwise until the operation has been completed.
  - Remove the lever (8) through the slot (Tc).
  - Check that the indicator (5) confirms that opening has occurred by displaying letter O in black on a grey background.

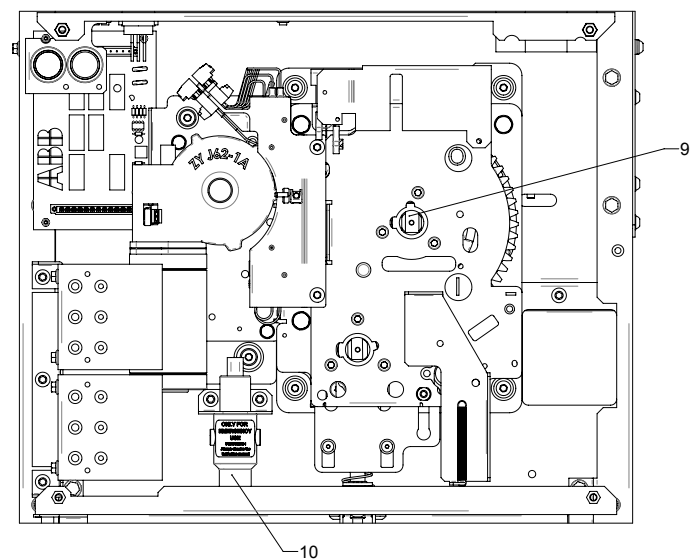
- 3) Close switch-disconnector IMS by means of the red closing push-button (3).
- 4) Check that the indicator (4) confirms that closing has occurred by displaying letter I in black on a red background.

## Motor locking during an operation

If, during any operation, an outage should occur before "dead center" has been passed, the operating shaft (9) and relative slot will be misaligned with respect to the position of the apparatus before the operation began (Ia or Ic). In this case, it will not be possible to insert the operating lever (8) since this will be obstructed by the ridge (7), which will no longer match the slot of the previously mentioned position of the apparatus (Ia or Ic).

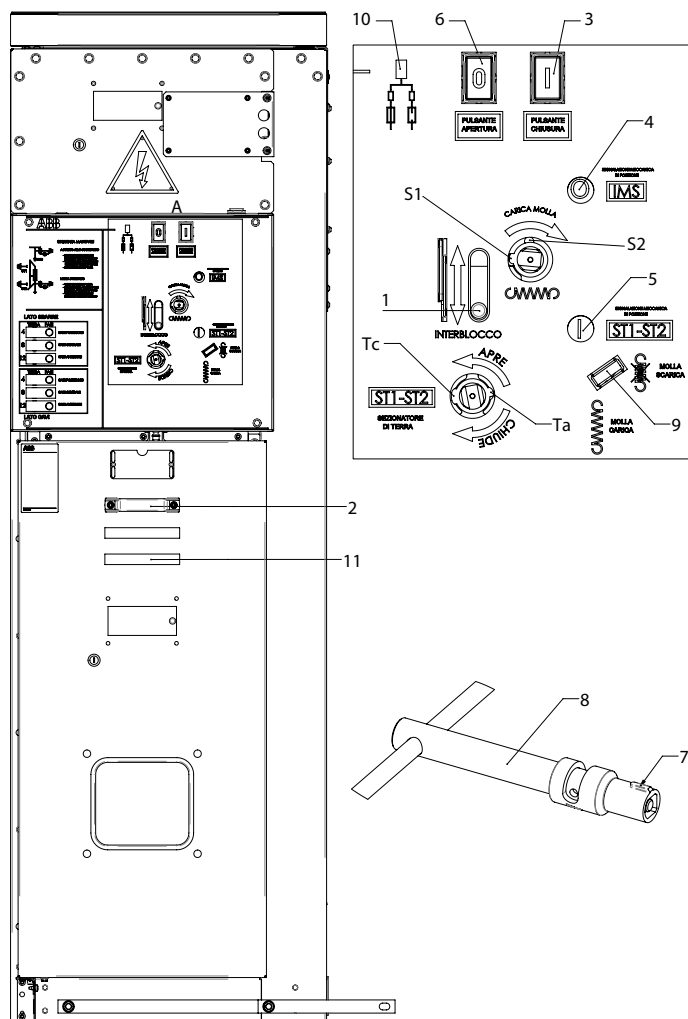
Proceed as described below to re-align the operating shaft:

- Remove the front casing from the cubicle by unscrewing the screws that fasten it to the structure.
- Move the interlock (1) upwards and insert the red tool (10) fixed to the structure of the cubicle, fully into the operating seat of the IMS.
- Use a 13 mm wrench to turn the tool (10) in the following way:
  - With the IMS closed, having checked the closed position indicated by a black letter I on a red background on indicator (4), slightly turn the tool counter-clockwise to release the motor clutch after which the shaft will then turn clockwise on its own and reach the closed position.
  - With the IMS open, having checked the open position indicated by a black letter O on a green background on indicator (4), slightly turn the tool clockwise to release the motor clutch after which the shaft will then turn counter-clockwise on its own and reach the open position.
- Remove the tool (10) from the operating shaft of the IMS and set it back in its original position.
- Fit the front casing back onto the cubicle using the previously removed screws.



## 6.3 Transformer protection cubicle

Earthing switches ST1 and ST2 have a single operating seat since they are mechanically connected to each other. If the fuses need to be installed or replaced, consult sect. 6.3.5.



### 6.3.1 How to load 2S operating springs

- Move the interlock (1) upwards and fit the lever (8) fully into the spring-loading seat. Make sure that the ridge (7) matches the slot (S1).
- Turn the lever (8) clockwise until the loading operation has been completed.
- Remove the lever (8) through the slot (S2).
- Check that the indicator (9) confirms that the springs have been loaded by displaying a black arrow on a white background pointing towards the spring loaded symbol on the cover of the operating mechanism.

### 6.3.2 Putting into service

- 1) Make sure that the three fuses have been installed and are in a perfect condition.
- 2) Shut the door by pushing the handle (2) down.
- 3) Open earthing switch ST.

  - Move the interlock (1) upwards and fit the lever (8) fully into the operating seat of earthing switch ST. Make sure that the ridge (7) matches the slot (Ta).
  - Turn the lever (8) counter-clockwise until the operation has been completed.
  - Remove the lever (8) through the slot (Tc).
  - Check that the indicator (5) confirms that opening has occurred by displaying letter O in black on a grey background.
  - Check through the window (11) to make sure that ST2 is open.

- 4) Close switch-disconnector IMS.

  - Check indicator (9) to make sure that the springs of the operating mechanism are loaded. If this is not the case, perform the loading procedure for the springs of operating mechanism 2S.
  - Press the red mechanical closing push-button (3).
  - Check that the indicator (4) confirms that closing has occurred by displaying letter I in black on a red background.

### 6.3.3 Access to the cubicle

- 1) Open switch-disconnector IMS.

  - Press the green mechanical opening push-button (6).
  - Check that the indicator (4) confirms that opening has occurred by displaying letter O in black on a green background.

- 2) Close earthing switch ST.

  - Fit the operating lever (8) fully into the seat of the ST. Make sure that the ridge (7) on the lever matches the slot (Tc).
  - Turn the lever (8) clockwise until the operation has been completed.
  - Remove the operating lever from the seat through the slot (Ta).
  - Check that the indicator (5) confirms that closing has occurred by displaying letter I in black on a yellow background.
  - Check through the window (11) to make sure that ST2 is closed.

- 3) Open the door by pulling the handle (2) up.

### 6.3.4 Putting back into service after the fuses have tripped



- All the operations described below must be performed by sufficiently trained personnel with in-depth knowledge of the equipment.
- Before opening the door, always check the position of the earthing switch by means of the mechanical signals and through the window.

A blown fuse causes the IMS to open. If this happens, the operator will note the following conditions:

- the position indicator (4) shows that the IMS is open by displaying letter O on a green background
- the fuse state indicator (10) displays “Fuse tripped” in red
- the position indicator (5) shows that earthing switches ST1 and ST2 are open by displaying letter O on a grey background.



### 6.3.5 Fuse installation or replacement



- The mechanical lock that prevents the apparatus from closing when a fuse trips deactivates when the tripped fuse is removed.
- Only remove the tripped fuse when you have procured a fuse to replace it.
- Make sure that all three fuses are installed before putting into service.
- Check that the rated thermal current of the fuses being installed corresponds to the established value.
- Before opening the door, always check the position of the earthing switch by means of the mechanical signals and through the window

The fuse holder is pre-engineered for the installation of fuses with dimensions and striker of the medium type according to standard DIN 43625 (1983) and with electrical specifications to IEC 282-1 (1974) standards.

The fuse holder clamps can be adjusted to allow 12 -17.5 – 24 kV fuses to be installed.

Comply with the following instructions to move the lower fuse holder clamps:

1. Unscrew fixing screws X and Y shown in figure 1
2. Release the safety clip (a) and remove the pin of the earthing switch indicated in figure 3

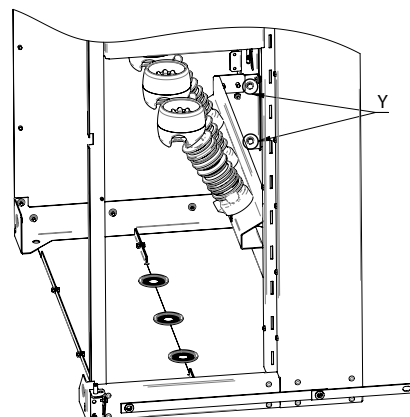
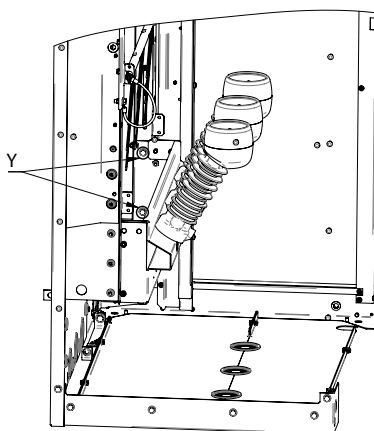
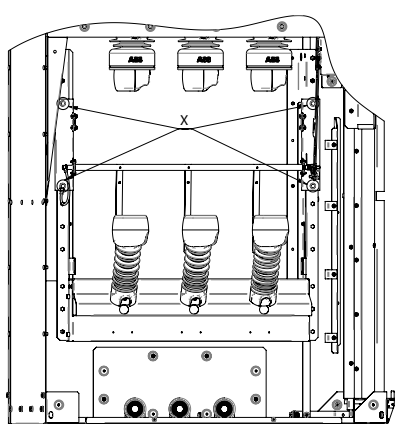


Fig. 1

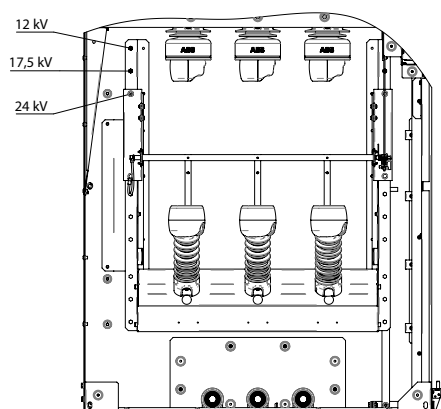


Fig. 2

3. Choose the correct position with respect to the insulation voltage of the fuses for both the fuse holder crosspiece (figure 2) and earthing switch drive (figure 3)
4. Fasten screws X, Y, the pin and safety clip (a) of the earthing switch drive again.

Even if only one fuse trips, the switch-disconnector will automatically open by means of an insulating rod, which acts on the release shaft. This occurs at the same time as activation of a mechanical lock which, when a fuse trips, prevents the IMS from closing.

#### Fuse installation

- Comply with the instructions in sect. 6.3.3 in order to access the cubicle.
- Make sure that the lower clamps are in the correct position with respect to the type of fuse being installed
- Insert the fuses (with their strikers pointing upwards) by resting them on the lower clamp (2) of figure 3
- Make sure that the releasing tab (1) of figure 3 is in the position shown in the figure.

#### Fuse replacement

- Comply with the instructions in sect. 6.3.3 in order to access the cubicle.
- Remove the tripped fuse
- Insert the new fuse (with its strikers pointing upwards) by resting it on the lower clamp (2) of figure 3
- Make sure that the releasing tab (1) of figure 3 is in the position shown in the figure.

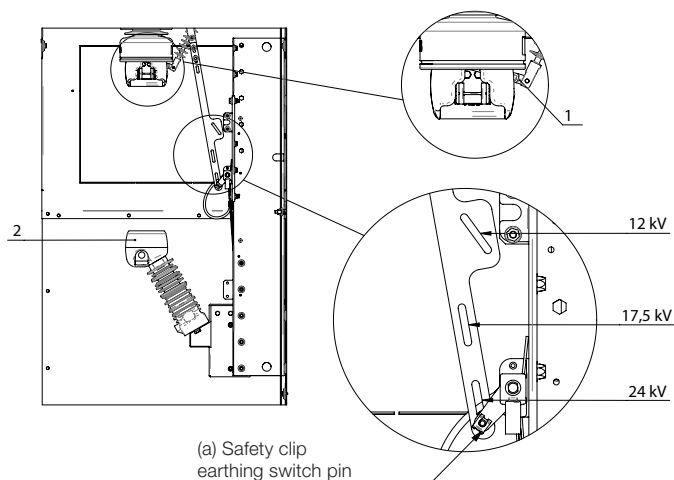


Fig. 3

## 6.4 Voltage indicator

These devices conform to the indications in the e-Distribuzione DY 811 and DY 1811 specifications. They are installed in DY803 cubicles and signal the presence-absence of voltage in the MV lines of secondary substations.

DY803 panels are equipped with a voltage indicator supplied by a capacitive coupling situated in the cable compartment. The device is indicated on the mimic plate as "CABLE SIDE". In addition, a voltage indicator is also supplied in the busbar compartment and is indicated on the mimic plate as "BUSBAR SIDE".

The signals are displayed by three lamps (3) in the signalling devices (2).

Make sure that the cable compartment and busbar casing are not live before accessing the base of the detector (1), where the shielded cables are connected. The earthing switch must be closed.

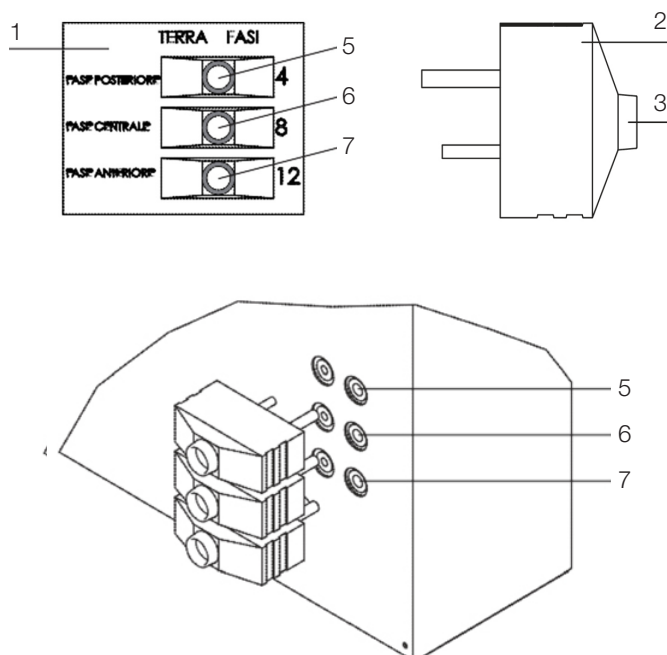
The signalling devices (2) can be connected and disconnected in the base (1) when the cubicle is live.

Make sure that the enclosure of the signalling device is earthed while the signalling devices are being connected and for as long as they remain in that position.

When the signalling device is disconnected, a circuit-breaker per phase ensures that the source from the M.V. system is earthed.

Correspondence between cubicle phases and cells (5-6-7) of the indicator (1) base is as follows:

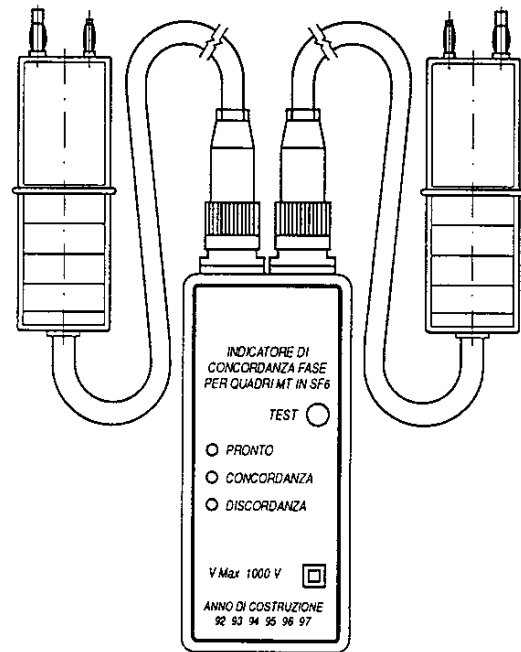
- bushing (5) of upper lamp connected to phase on bottom of cubicle;
- bushing (6) of central lamp connected to central phase of cubicle;
- bushing (7) of lower lamp connected to phase near front of cubicle.



Indicator plug-in

## 6.5 Phase correspondence check


Consult the instruction manual supplied with the apparatus for a description of the operating method.





# 7. Installation

## 7.1 General information



- Installation must be performed by our personnel or by the customer's personnel so long as they possess detailed knowledge about the apparatus.
- Correct installation is of prime importance. The manufacturer's instructions must be carefully studied and followed.
- It is good practice to wear gloves for handling the components during installation.
- Make sure that the IMS is open and the springs discharged before removing the cover of the operating mechanism.
- Do not walk on the switchgear. Keep away from the area overlooking the fumes exhaust stacks and do not install apparatus in that area.


## 7.2 Normal installation conditions

Maximum ambient air temperature	+ 40 °C
Minimum ambient air temperature	- 15 °C
Relative humidity	% ≤ 95
Altitude	≤ 1000 m

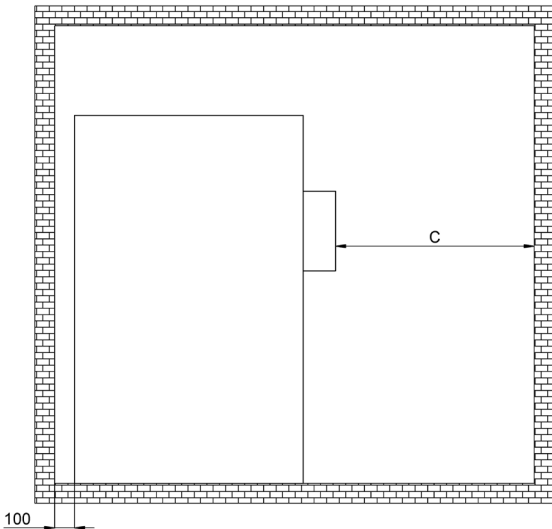
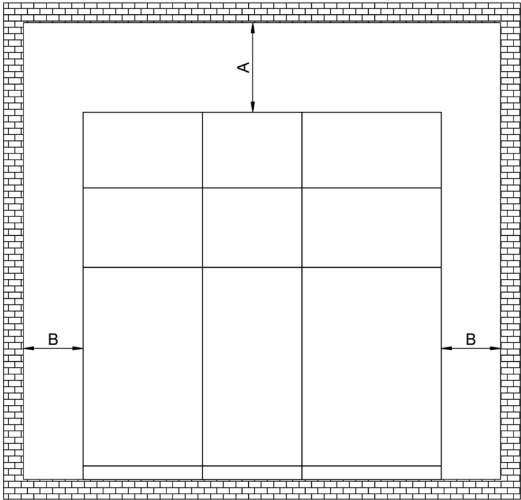
Comply with the indications in the product standards if other installation conditions are involved. Please consult us for special installation requirements.

The areas through which power conductors or auxiliary circuit conductors are routed must be protected against the access of animals, as this could lead to damage or disservice.

## 7.3 Installation room




- The zone where gas is exhausted from the room must be studied when the installation is designed.
- The utmost attention must be paid to the overpressure that may be created inside the substations.
- The area over the fumes exhaust stacks situated in the rear part of the cubicles must be free from all obstructions. Comply with the indicated distances from the ceiling and walls.



A [mm]	B [mm]	C [mm]
≥ 450	≥ 300	≥ 1200 <sup>(*)</sup>

(\*) Dimension C represents the space required to withdraw the cubicle



Accessibility class AF, restricted solely to persons authorized to access the front, in accordance with standard IEC 62271-200.

## 7.4 Fumes overpressure exhaust stack



- Do not touch the exhaust vents of the fumes exhaust stack when the switchgear is live.
- Do not install apparatus in the area where fumes are exhausted.
- Do not walk on the switchgear and keep away from the area over it when the switchgear is live.

The possibility of an electric arc occurring inside the cubicle is very remote.

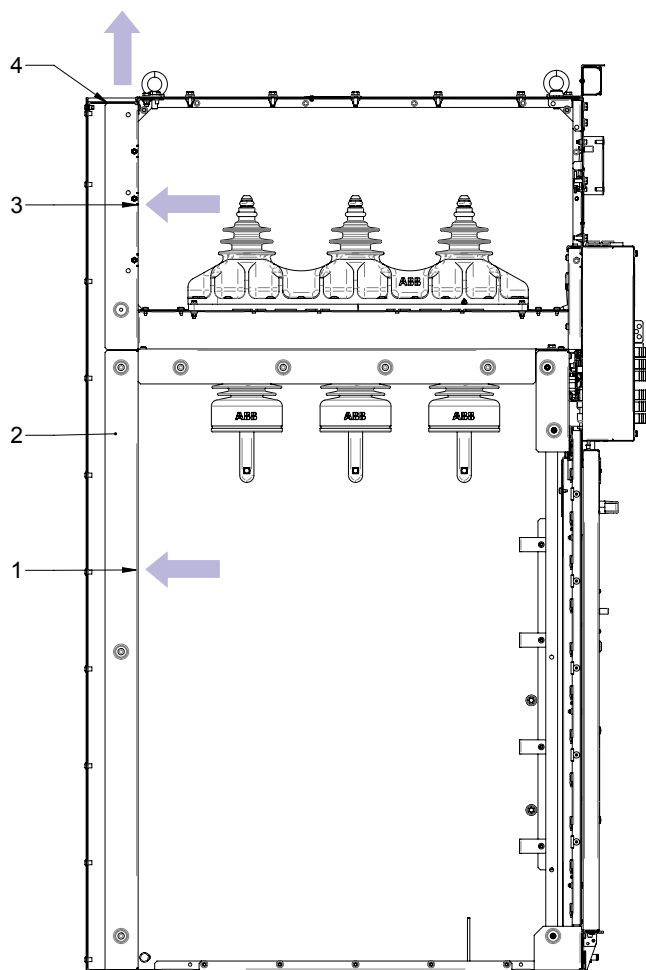
If it should occur, proceed as described below to eliminate the fumes:

Arc in the cable compartment

- open the flap (1) to allow the fumes to flow into the stack (2);
- the cable compartment flap (3) remains closed;
- fumes escape from the exhaust vent of the stack (4).

Arc in the busbar compartment

- open the flap (3) to allow the fumes to flow into the stack (2);
- flap (1) remains closed;
- fumes escape from the exhaust vent of the stack (4).



## 7.5 Foundations and fixing bed

The cubicles are normally pre-engineered for connection of the medium voltage circuit from the bottom.

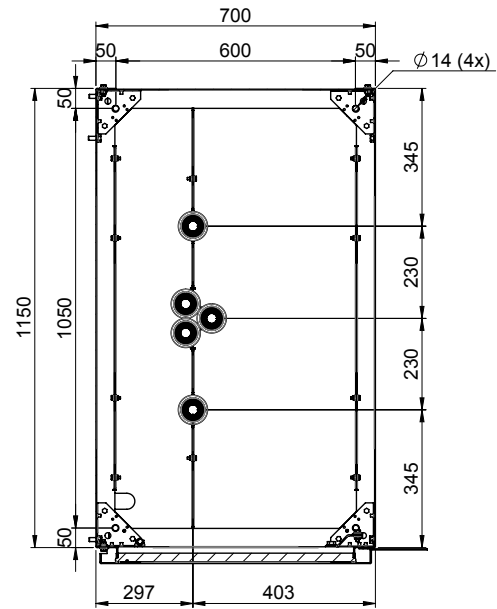
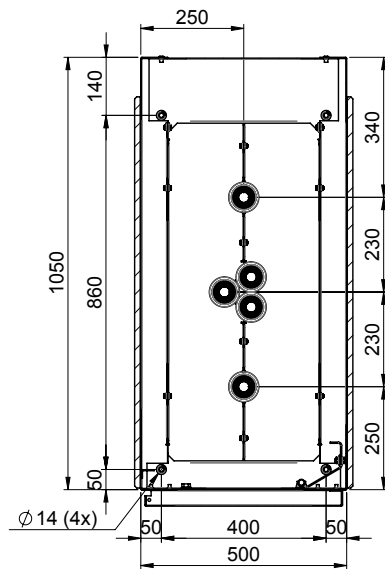
The front part of the roof of the cubicles has a duct for routing the auxiliary circuit cables.

Make the relative routing holes under each cubicle before they are installed. The foundation layout is shown in the figure.

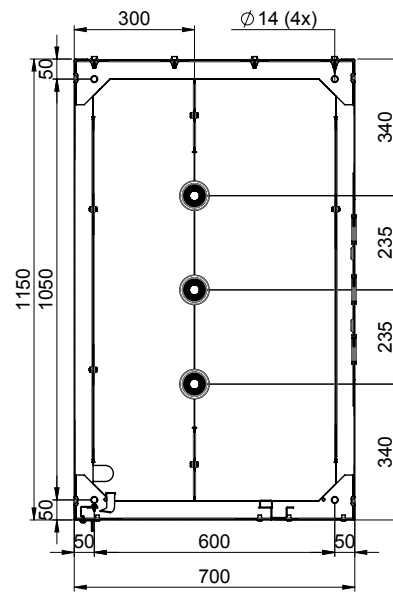
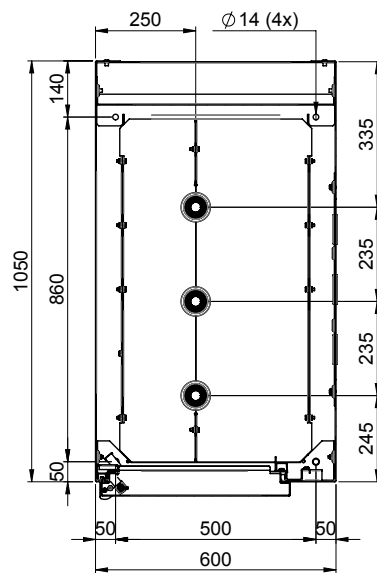
The switchgear can be fastened straight to the floor by inserting expansion plugs into the fixing holes.

The fixing surface must be horizontal and well levelled, with 2 x 1000 flatness tolerance.

## Holes in the floor for fixing the cubicles



## DY803/2 and DY803/9 line cubicles



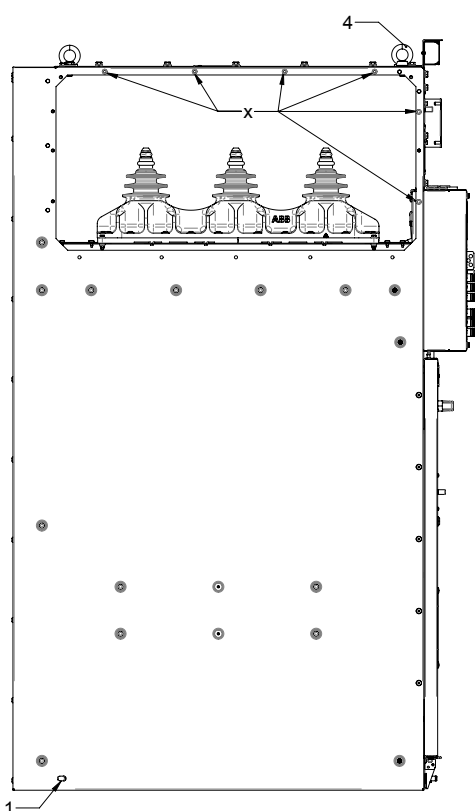
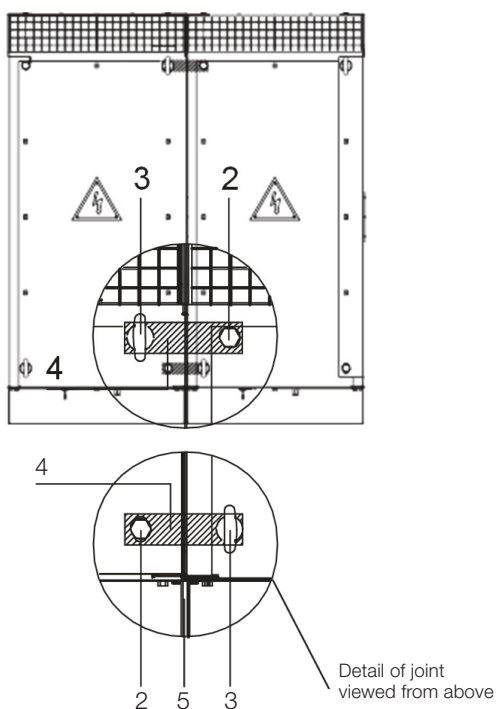
## DY803/3 and DY803/10 transformer protection cubicles

## 7.6 Joining and fastening the cubicles

Make sure that the floor is flat before joining the cubicles.  
The cubicles must be joined in the following way:

### Panels with structures 1050 mm in depth

- unscrew the screws (2) and eyebolts (3) from the roofs of the cubicles;
- position the first cubicle on a level with the holes in the floor;
- fit the fastening bolts into the floor and screw them in but without fully tightening them;

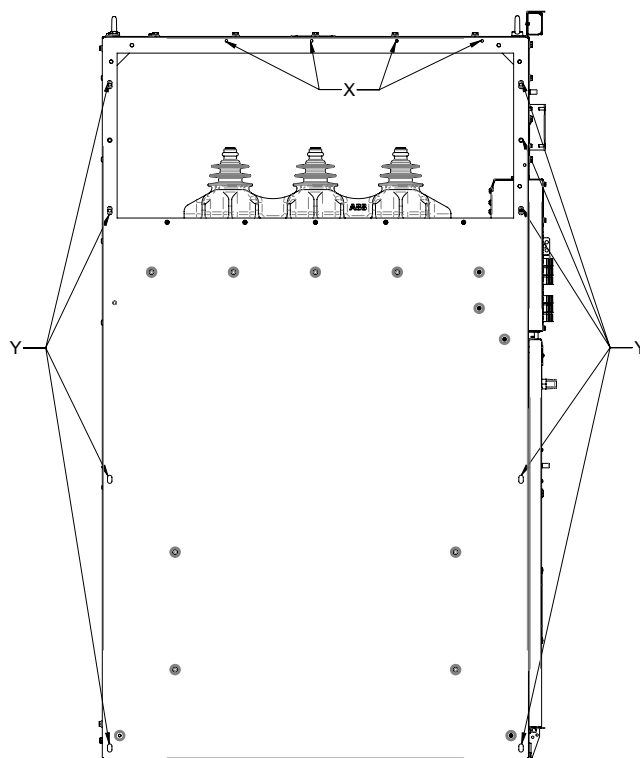


- move the second cubicle close to the first so that their sides touch each other;
- fit the M4 screws into the holes marked X and fully tighten the bolts into the adjacent cubicle;
- fit the fastening screw into the slot (1) and into the adjacent cubicle, then fully tighten the bolt.

Repeat these operations for the successive cubicles and after they have been joined together, fix the cubicles to the floor and fully tighten the screws.

Make sure that the sides of the cubicles are right against each other and that there are no gaps at the front towards the busbar compartment (5).

### Panels with structures 1,150 mm in depth



- position the first cubicle on a level with the holes in the floor;
- fit the fastening bolts into the floor and screw them in but without fully tightening them;
- move the second cubicle close to the first so that their sides touch each other;
- fit the M4 screws into the holes marked X and fully tighten the bolts into the adjacent cubicle;
- fit the M10 screws into the holes marked Y and fully tighten the bolts into the adjacent cubicle;
- Repeat these operations for the successive cubicles and after they have been joined together, fix the cubicles to the floor and fully tighten the screws.

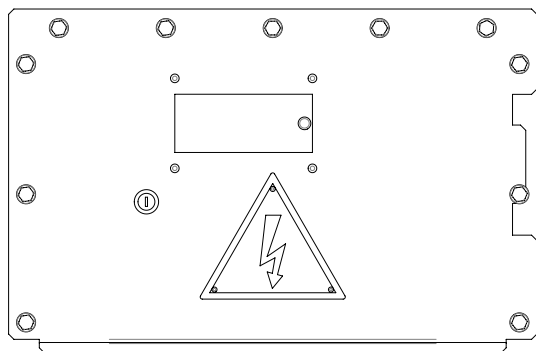
Make sure that the sides of the cubicles are right against each other and that there are no gaps at the front towards the busbar compartment.



**In case of end cubicle, screws and nuts must be placed in the proper seats to ensure IP3X protection degree.**

### Front panel that closes the busbar compartment

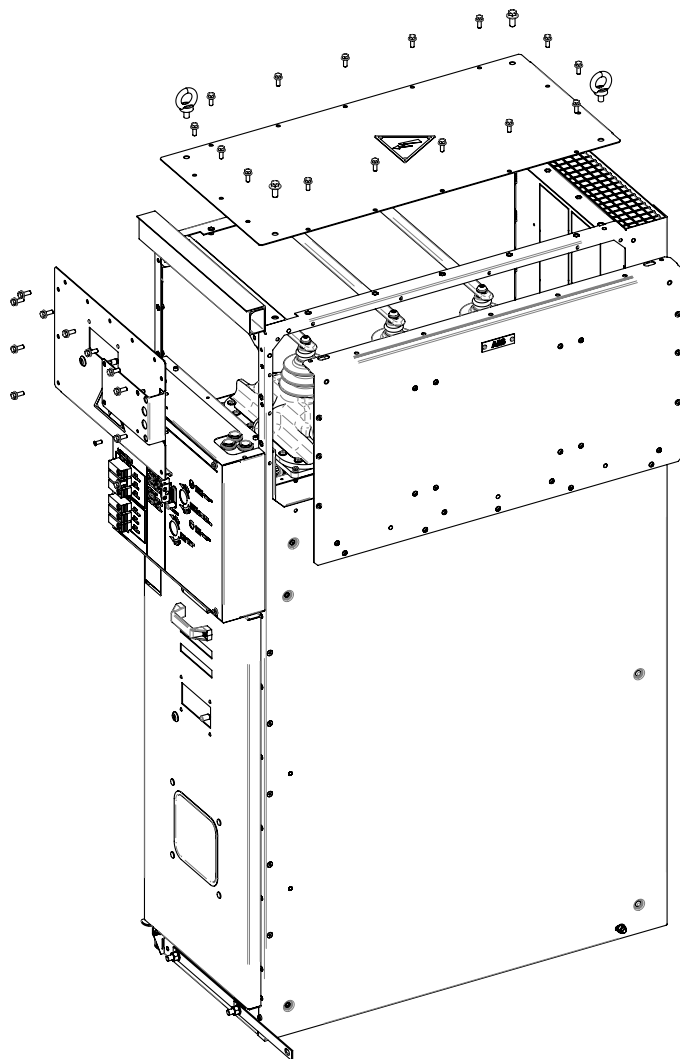
To fasten the panels, fit all the screws into the holes and fully tighten them with 34 Nm tightening torque.



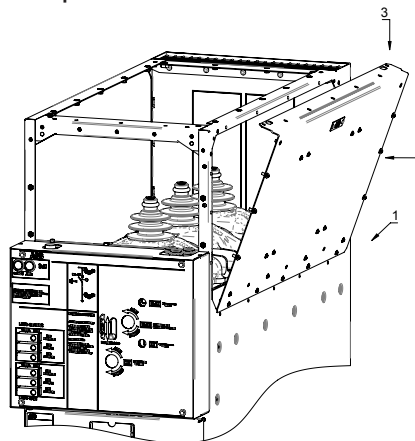
### Panel assembly sequence

Comply with the numbered sequence in the figures below to assemble the panels.

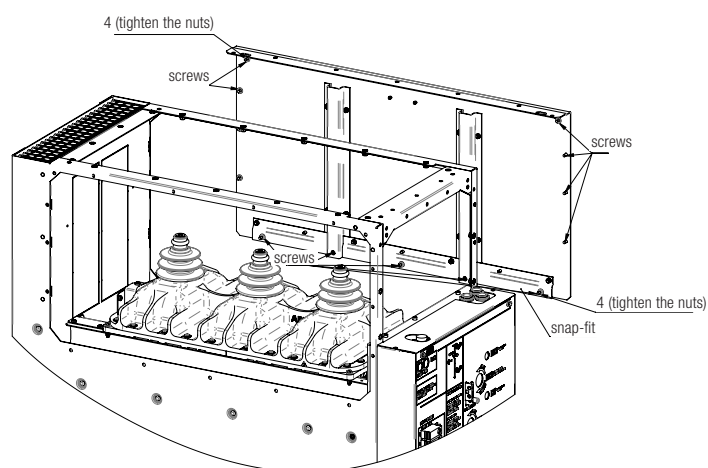
#### Overall view



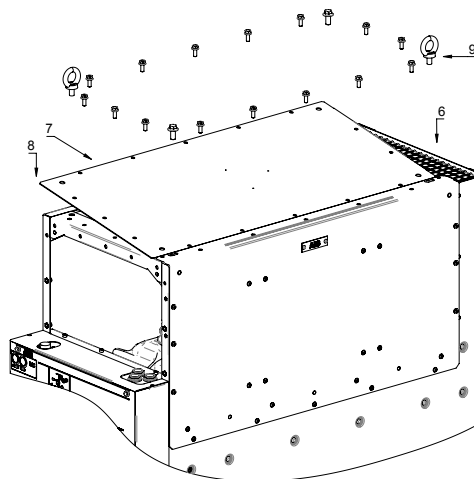
### End panel



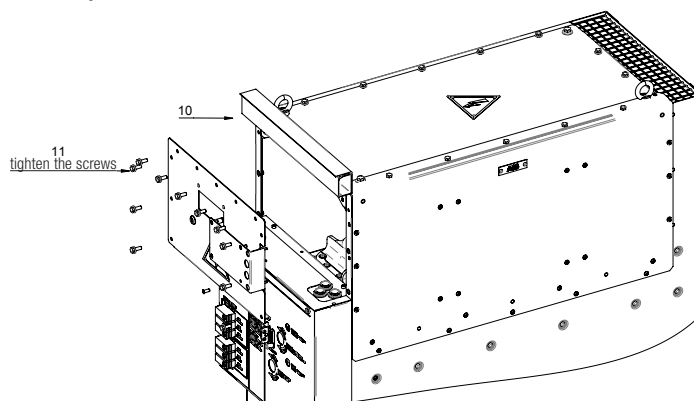
### Upper cover panel



### End panel fixing points



### Front panel



## 7.7 Connections

### General warnings

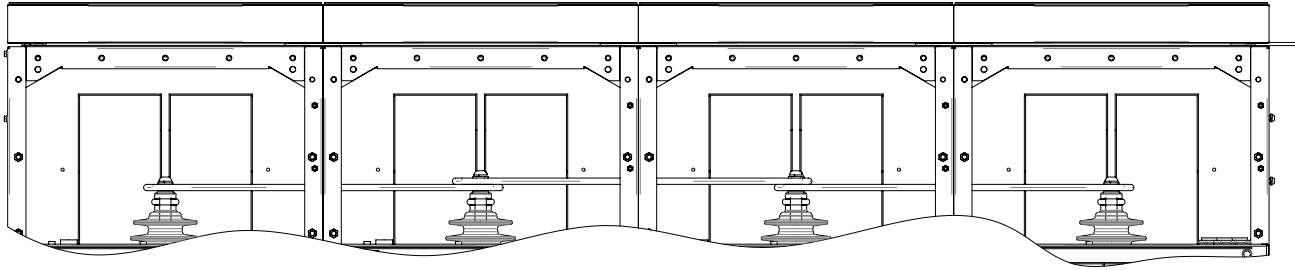


**Make sure that the fixed couplings of the switchgear and the connections (cable terminals, busbar connections) are clean and free from any deformation caused by shocks received during transport or storage.**

**Eliminate all traces of oxidation with a fine file or emery cloth.**

### 7.7.1 Power circuit

Make sure that the contact area of the busbars and supporting insulators is perfectly clean and degreased. Assemble all the busbars by placing them on the contact zone of the apparatus. Tighten all the screws by hand and then tighten them with a torque wrench. Apply max. 60 Nm tightening torque. Repeat the operation for all three phases.



Tightening torque max 60 Nm

### MV cable connections

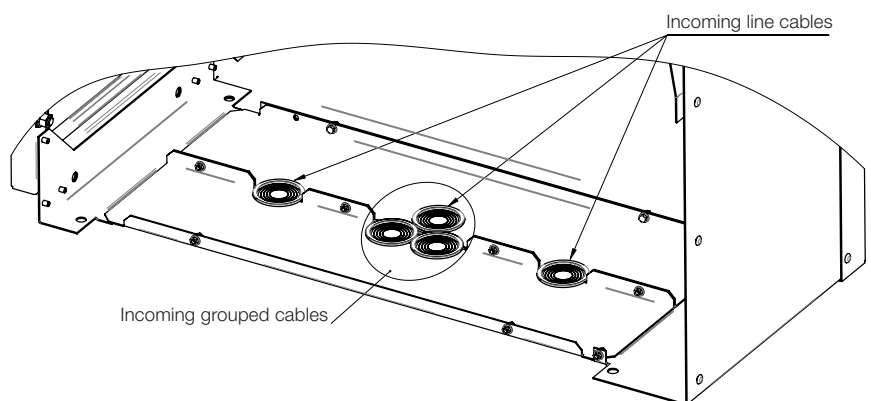
Use M12 screws and 62 Nm tightening torque to connect the cables to their pre-engineered connection points in the switchgear.

Bracket the cables to prevent electrodynamic stress caused by the short-circuit current of the installation from warping the terminals and connections. Connect the cable screens.

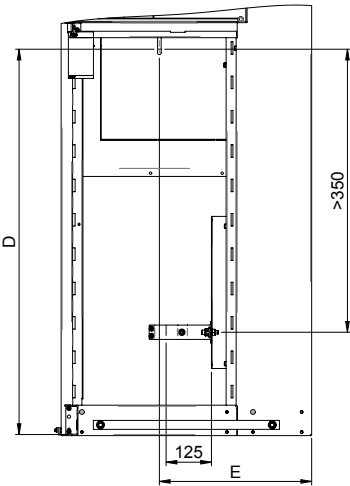
Cables can enter through the bottom of the line cubicle (DY803/2 and DY803/9) in two ways: cables in line with the phases and grouped cables.

The cables can only enter transformer protection cubicles in line with the phases.

The maximum cable diameter is 65 mm.

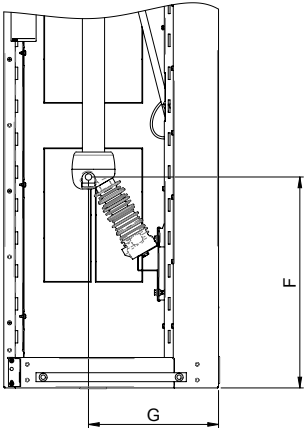


Line cubicles



	DY803/2	DY803/9
D [mm]	1060	1090
E [mm]	275	425,5

Transformer protection cubicles

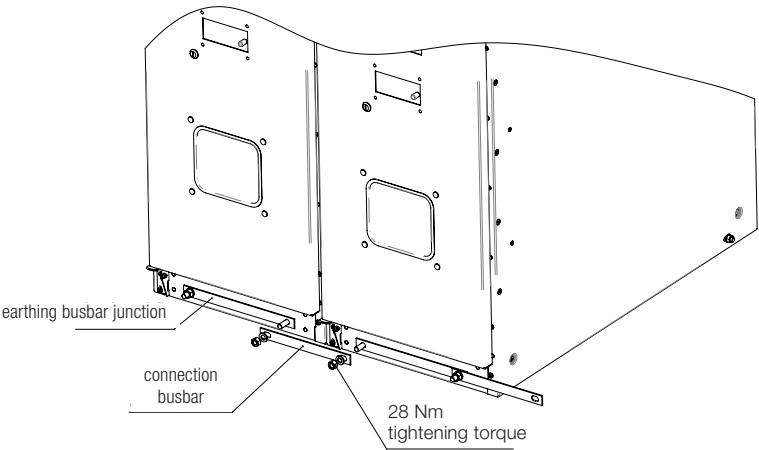


	DY803/3	DY803/10
F [mm]	589	620
G [mm]	363	414

7.7.2 Earthing busbars

The earthing busbar is routed longitudinally along the lower part of the switchgear. There are copper alloy bolts at its end for connecting to the earthing network of the installation. The screws and bolts must be tightened to the prescribed tightening torque value (28 Nm) so as to prevent vibrations during operation from working them loose. The earth conductor must be sized to withstand the forecast maximum earth fault current. Generally speaking, the section of the earth conductor must not be less than that of the earthing busbar of the switchgear. All cubicles are normally

equipped with an earthing busbar whose section guarantees a current density of  $> 200 \text{ A/mm}^2$ . The earthing busbar junction must be made on a level with the points in which the switchgear cubicles join together. Remove any traces of oxidation from the contact surface of the busbars beforehand, using emery cloth. Lock the earthing busbar junction in place with its screws, flat and spring washers and with the nut and its respective washer. Fix the busbars as shown in the figure.



### 7.7.3 Connection of the auxiliary circuits

There are auxiliary circuits in the LE and IM cubicles.

The wiring inside the switchgear is installed in the factory.

The conductors are routed from a fixed connector on the switchgear panel.

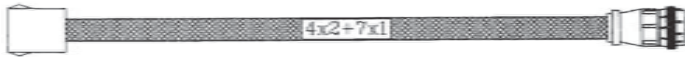
The external connection between the motor-operated control and telecontrol extension unit is made with multicore cable equipped with flying connectors.

The figure below illustrates the route inside the cubicle of the cables that connect the current transformers, the toroidal transformer for homopolar protection and the RG apparatus.



Fixed connector on the cubicle

External multicore connection cable

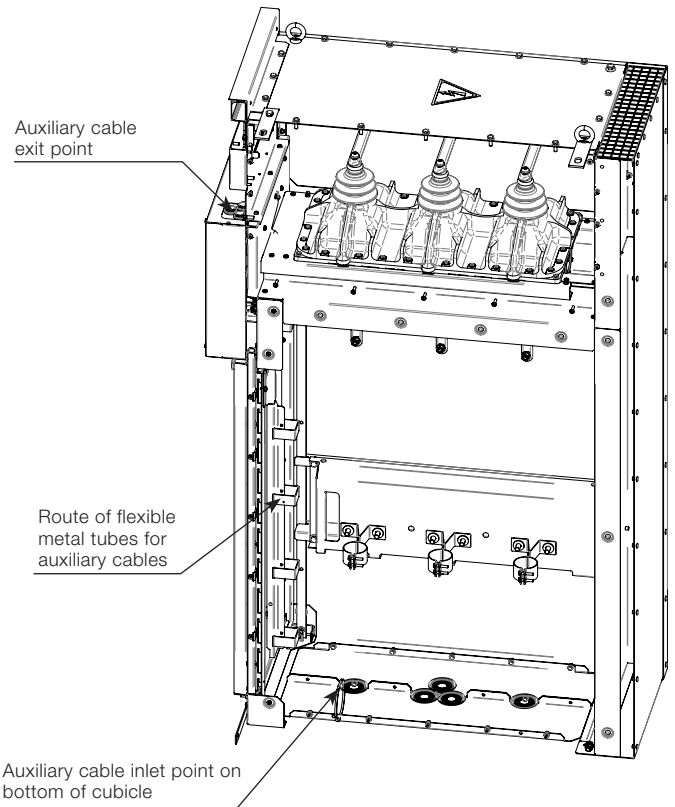


Connector that connects to the telecontrol extension unit

Connector that connects to the cubicle

### Cable route inside the cubicle

Flexible metal tubes inside the cubicles allow the auxiliary cables to be routed from the cable compartment to the upper part of the housing of the operating mechanism near the support of the protection device.



### Motor protection

Motor protection is provided by a timer which starts at each operation. The remaining time resets once the operation has terminated.

If the operation continues for a longer period of time, the relay reaches the end of its time setting, energizes and shuts off the power supply.

The time setting of the timer is 4 s.



## 8. Cable tests

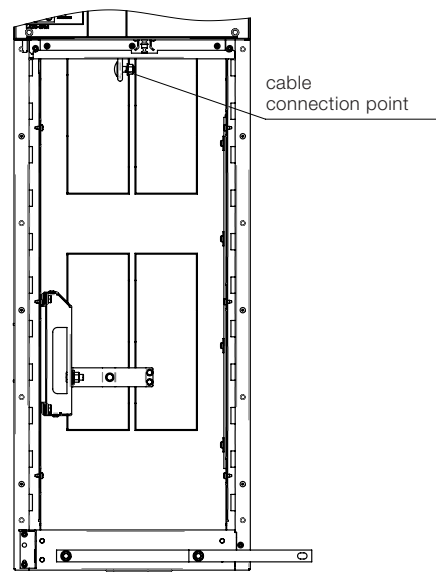
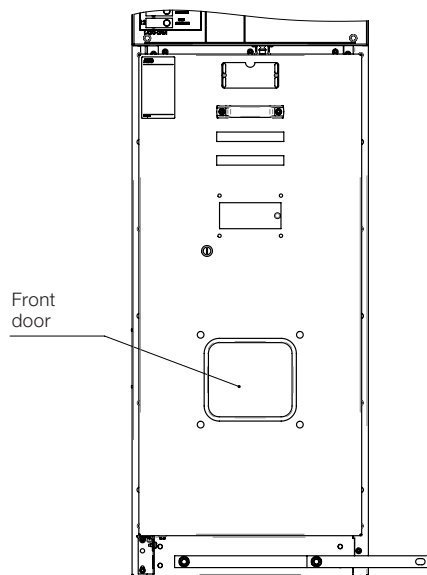


- Before proceeding, ensure that the part of the installation in which the work must be performed is in a safe condition.
- Connection of cables for test purposes (applied voltage and troubleshooting) alters the characteristics of the switchgear. Those who do this must ensure compliance with the correct procedures in order to guarantee safe conditions for the workers.
- Obligatory conditions when performing tests on the cables or troubleshooting:
  - earthing switch ST must be open
  - the IMS must be open (isolated position)

The maximum voltage applicable in the point in which the cables connect to the switchgear for the insulation test or for locating faults in the cables, is 50 kV DC.

The tests must be performed with the door closed, by routing the cables from the front shutter on the door.

Check compliance with the safety distances from live parts, taking into account the value of the test voltage applied.



## 9. Putting into service



- Only use the supplied panic operating lever.
- All the operations for putting into service must be carried out by our personnel or by the customer's sufficiently qualified personnel with detailed knowledge of the apparatus and installation.
- If the operations are obstructed, do not force the mechanical interlocks and check that the operating sequence is correct.
- Before opening the door, always check the position of the feeder disconnecter and earthing switch by means of the mechanical signals and through the relative windows.
- Only energize the switchgear with the apparatus open and the doors closed.
- Do not put the equipment into service if the test result is negative. Consult us if necessary.

Perform the operations in the following table before putting the switchgear into service.

After the operations described above have terminated, make sure that everything has been restored to its original conditions.



The inspections are only acceptable if all the listed tests have terminated with a positive result.

## Inspections prior to putting into service

Tested part	Operations	Notes
Cubicles	Visually check inside and outside the cubicle to make sure that there is no evident damage. Remove any foreign bodies (e.g. tools, test connections inadvertently left in place after installation).	
	Carefully clean the insulating parts. Remove all traces of moisture and dust with a clean, dry cloth.	
	Make sure that all screws have been properly tightened.	
	Check that all end plates and those included in the configuration have been installed correctly.	
	Make sure that all panels for protection against accidental contact have been installed correctly.	
	Check that the interlocks function correctly and that the keys (if any) are correctly joined with a welded ring if these are required for the interlocks.	
	Check that the mechanical operating mechanisms can be operated by applying $\leq 200$ Nm moment of force.	
	Check the mechanical signals and windows to make sure that the apparatus is positioned properly.	
	The force interlocks withstand 400 Nm maximum moment of force.	
Power circuit connections	Make sure that the connections are well tightened.	
Earthing busbar and relative connections	Check tightness and continuity.	Check earthing efficiency in accordance with the accident-prevention regulations.
Insulation	Measure the insulation resistance of the power circuits (line-to-line and line-to-earth) with a 2500 V Megger and the insulation resistance of the auxiliary circuits with a 500 V Megger. The values gauged for each cubicle must be at least 1000 M $\Omega$ for the power circuits and over 2 M $\Omega$ for the auxiliary circuits. The insulation resistance must remain constant over time, even after voltage tests have been performed.	The value of the insulation resistance can be affected by the ambient conditions.  Install temporary preheaters if the low insulation resistance value is due to humidity in the environment. Disconnect the MV cables when measuring.
	The applied voltage test is performed in the factory. It is not required by standard CEI 17-6 after installation. If the user considers it necessary, it must be performed at 80% of the value indicated in point 7.1 of Standard IEC 62271-1 and only in alternating current. Keep the MV cables disconnected during the test.	Example: – 24 kV rated voltage of switchgear – Required test voltage 50 kV for approx. 1 min (performed in factory) – Test voltage after installation $0.8 \times 50 = 40$ kV for 1 min.
Switch-disconnector, earthing switch and operating mechanism	Carry out several operations on each apparatus to make sure that this latter and the interlocks operate correctly.	Make sure that the apparatus and locks function correctly.
Auxiliary circuits	Check functionality of spring loading motor.	

## 10. Routine inspections



- The routine inspections must be performed by our personnel or suitably qualified customer's personnel with in-depth knowledge of the apparatus.
- Before proceeding with any operation, always make sure that the apparatus is in the open position with the springs discharged.
- Before opening the door, always check the position of the feeder disconnect and earthing switch by means of the mechanical signals.
- The apparatus is guaranteed to be maintenance-free for the first 36 months from delivery.

### 10.1 General information

During normal service, the switchgear is maintenance-free. Any interventions required basically depend on the severity of the service conditions, i.e. on various different factors such as the frequency of the operations, the interrupted current values, the relative power factor and the installation site. For precautionary reasons, an inspection schedule is given in the table in the following section, along with the frequency with which the apparatus must be checked. It is advisable to comply with the indications in the table for the first interventions.

Optimal time limits for carrying out successive operations can be established on the basis of the results obtained during the routine inspections.

It is advisable to record all the operations performed in detail on a maintenance card and service book, along with the date, description of the fault and reference data allowing the device to be identified (see chap. 2).

Refer to article 10 of standard IEC 62271-1 if further details are required.

It is always a good idea to inspect the apparatus (screw and bolt tightness - abnormal heating, etc.) a few months after it has been put into service. Do not hesitate to call us if you encounter any problems.

The following table gives the indicative frequencies with which inspections should be made.

## 10.2 Inspection schedule

Part liable to inspection		Intervals	Operation required
1	Perform a few mechanical closing and opening operations.	3 years.	Make sure that the operating and transmission levers function correctly. The apparatus must operate regularly without stopping in intermediate positions. The torque applied must not exceed 200 Nm.
2	Visual examination of the insulating parts.	3 years, or depending on the degree of pollution in the environment.	The insulating parts must be free from built-up dust, dirt, cracks, traces of surface discharges or damage. Remove the dust and dirt with a vacuum cleaner and clean, dry cloths.
3	Auxiliary contacts.	5 years.	Make sure that operation and the signals are correct.
4	Auxiliary circuit conductors.	5 years.	Check whether any of the wiring fasteners are slack or broken and make sure that the connections are well tightened.
5	Interlocks.	5 years.	Make sure that the devices function correctly.
6	Measurement of the insulation resistance.	5 years.	See sect. 9 (table).
7	Operating mechanism.	3 years.	Check that the operating mechanism is clean.



**Do not put the apparatus into service if the test result is negative. Call us if necessary.**

# 11. Spare parts and accessories



**All assembly operations of spare parts/ accessories must be carried out following the instructions enclosed with the spare parts, by ABB personnel or by suitably qualified customer personnel with in-depth knowledge of the apparatus (IEC 60694) and of all the Standards aimed at carrying out these interventions in safe conditions. Should the maintenance be carried out by the customer's personnel, responsibility for the interventions remains with the customer. Before carrying out any operation, always make sure that the switch-disconnector is open, the spring discharged and that it is not energised (medium voltage circuit and auxiliary circuits).**

## 11.1 List of spare parts

- Voltage presence signalling lamps
- Interlocks
- Single and double spring operating mechanism
- Operating lever
- Push-buttons, motor operator, circuits and auxiliary contacts
- Medium voltage cable terminal
- Medium fuse-carrier clamp
- Medium voltage cable supports

To order switchgear spare parts/accessories, refer to the ordering sales codes indicated in the technical catalogue and always state the following:

- type of switchgear
- serial number of the circuit-breaker.

For availability and to order spare parts, please contact our Service office.

## 12. Product quality and environmental protection

The switchgears 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 14 001.

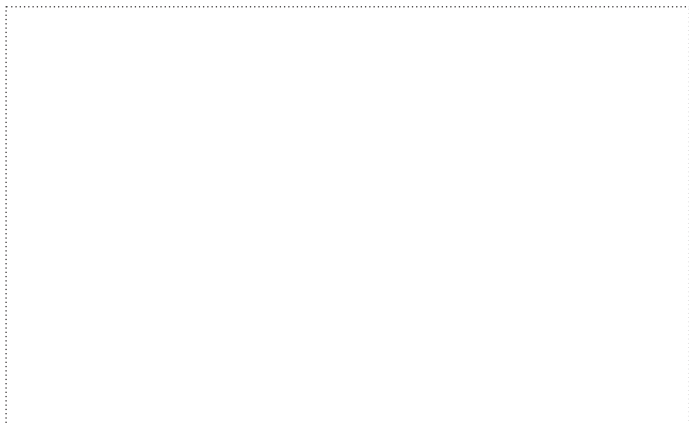
### 12.1 End of life of product

The ABB company is committed to complying with the relevant legal and other requirements for environment protection according to the ISO 14 001 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.

### 12.2 Methods of disposal

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

Raw materiale	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



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