FBX

Installation
Commissioning

Instructions

AMTNoT131-02

AREVA

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1 AREVA at your service

Operations and maintenance may only be carried out by personnel who have received suitable authorisation for the operations and manœuvres they are responsible for performing.

If this is not the case, please refer to our Service Unit or Training Centre.
All locking-out operations must be performed according to the

”General Safety Instructions booklet for Electrical Applications”
UTE C 18 510
(or its equivalent outside FRANCE).

1.1 Our Service Unit: our specialists, and suitably adapted services...

- Guarantee extension contracts in relation to the selling of new equipment,
- Supervision of HVA switchgear installations,
- Technical advice, diagnoses of the facilities, expertise,
- Maintenance contracts adapted to operational constraints,
- Systematic or conditional preventive maintenance,
- Corrective maintenance in case of partial or complete failure,
- Supply of spare parts,
- Overhauling of equipment and requalification of installations in order to benefit from new technologies and extend the life of your switchgear by limited investments.

Contact the AREVA Service Unit for diagnoses and advice:
Working hours

☎ 33 (0)3 85 29 35 00
🖷 33 (0)3 85 29 36 30
or 33 (0)3 85 29 36 43

1.2 AREVA T&D Technical Institute: Together, let us develop our skills...

We can place at your disposal all of our trainers’ expertise, our teams’ pedagogical experience and the wealth of our equipment, to help you face the challenge of encouraging the personal development of each individual through the optimisation of their skills.

From a few hours up to several weeks, AREVA T&D Technical Institute has the control over all of the teaching processes in order to meet the needs of each customer.

- Specific training, directly operational with practical work on real machines.
- Small groups to facilitate communication.
- Balance between theory and practice.
- Evaluation and management of the skills: Measurement and optimisation of the trainees’ knowledge.

Faced with the direct and indirect training costs of the operational stoppages and shutdown, training is a real investment

AREVA T&D Technical Institute Aix-les-Bains
1 rue Paul Doumer - BP 601 - F-73106 Aix-les-Bains Cedex
☎ 33 (0)4 79 34 76 70 🖷 33 (0)4 79 34 76 76 ✉ training.aix@areva-td.com

2 With regards to this User Manual

2.1 Responsibilities

Our devices are quality controlled and tested at the factory in accordance with the standards and the regulations currently in force.

Apparatus efficiency and apparatus life depend on the compliance with the installation, commissioning and operation instructions described in this user manual. Non respect of these instructions is likely to invalidate any guarantee.
Local requirements especially about safety and which are in accordance with the indications given in this document, must be observed.

AREVA declines any responsibility for the consequences:
- due to the non respect of the recommendations in this manual which make reference to the international regulations in force.
- due to the non respect of the instructions by the suppliers of cables and connection accessories during installation and fitting operations,
- of any possible aggressive climatic conditions (humidity, pollution, etc.) acting in the immediate environment of the materials that are neither suitably adapted nor protected for these effects.

This user manual does not list the locking-out procedures that must be applied. The interventions described are carried out on de-energized equipment (in the course of being installed) or locked out (non operational).

2.2 Reminder concerning normal service conditions (in accordance with IEC 60694)

***** Permissible ambient temperature

The ambient air temperature should be comprised between - 15°C and + 40° C.

The mean measured value for a 24 hour period must not exceed 35°C.

* Installation altitude

HV equipment is defined in accordance with European Standards and can be used up to an altitude of 1,000 m.

Beyond this, account must be taken of the decrease in dielectric withstand.

For these specific cases, contact the AREVA Sales Department.

* Atmospheric pollution

The ambient air must not contain any dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts.

* Permissible atmospheric humidity level

The average atmospheric relative humidity level measured over a 24-hour period must not exceed 95%.

The average water vapour pressure over a period of 24 hours must not exceed
22 mbar.

The average atmospheric relative humidity value measured over a period of one month must not exceed 90 %.

The average water vapour pressure over a period of one month must not exceed 18 mbar.

Condensation may appear in case of any sharp variation in temperature, due to excessive ventilation, a high atmospheric humidity level or the presence of hot air. This condensation can be avoided by an appropriate lay-out of the room or of the building (suitably adapted ventilation, air driers, heating etc.).

Whenever the humidity level is higher than 95 %, we recommend that you take appropriate corrective measures. For any assistance or advice, contact the AREVA After-Sales department (See § 1.1).

2.3 Particular instructions for operations and interventions on energized equipment

When commissioning and operating the equipment under normal conditions, the General safety instructions for electrical applications must be respected, (protective gloves, insulating stool, etc.), in addition to standard operating instructions.

All manipulations must be completed once started.

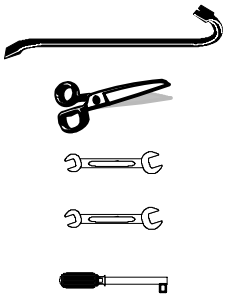
The durations (for completing the operations mentioned) given in the maintenance tables are purely an indication and depend on on-site conditions.

2.4 Other technical notices to be consulted

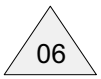
- AMTNoT110-02 FBX Guide to Civil Engineering Work
- AMTNoT132-02 FBX Operations - Maintenance
- AMTNoT137-02 FBX Handling - Storage
- AMTNoT140-02 FBX Motor-controlled mechanical commands
- AMTNoT150-02 FBX Assembly on an internal arc channel
- AMTNoT153-02 FBX Mechanical key-type interlocking Assembly-operation
- AMTNoT161-02 DPX-1 Self Powered Relay
- AMTNoT164-02 FBX-E Handling of Coupled Functional Units
- AGS531751-01 IVIS and IVIS-F Voltage Detection Systems
- AGS531753-01 MS100 Phase Comparator

2.5 Tools and products *(not supplied)* required for the operations described in this notice

- Crowbar
- Scissors
- Open-ended spanners sizes 7, 13 and 17
- 2 x open-ended spanner - size 16
- Ratchet handle + extension with socket sizes 8, 10, 13 and 16 mm
- Torque wrench



2.6 Symbols & conventions



- Code for a product recommended and marketed by AREVA

- Tightening torque value
  Example: 1.6 **daN.m**

- Mark corresponding to a key

CAUTION! Remain vigilant! Precautions to be taken in order to avoid accidents or injury

FORBIDDEN! Do not do it! Compliance with this indication is compulsory, non compliance with this stipulation may damage the equipment.

INFORMATION - ADVICE
Your attention is drawn to a specific point or operation.

2.7 Tightening torque values for standard assemblies (nut + bolt)

Diameter	Zinc plated steel fasteners without grease (daN.m)		Stainless steel fasteners with grease (daN.m)
	Class 6.8	Class 8.8	A2-70
M 6	0.7	0.9	0.7
M 8	1.6	2.1	1.6
M 10	3.2	4.3	3.2
M 12	5	6.6	5
M 14	8.7	11.6	8.7
M 16	13.4	17.9	13.4

3 Presentation

This manual covers FBX-C and FBX-E switchboards for 12, 17,5 and 24 kV networks.

3.1 Identification of the FBX

The technical data ranges give the individual characteristics of the switchboard.

FBX-C / 24-16 / C-C-T1

Switchboard

Type :
C = Compact
E = Extendable

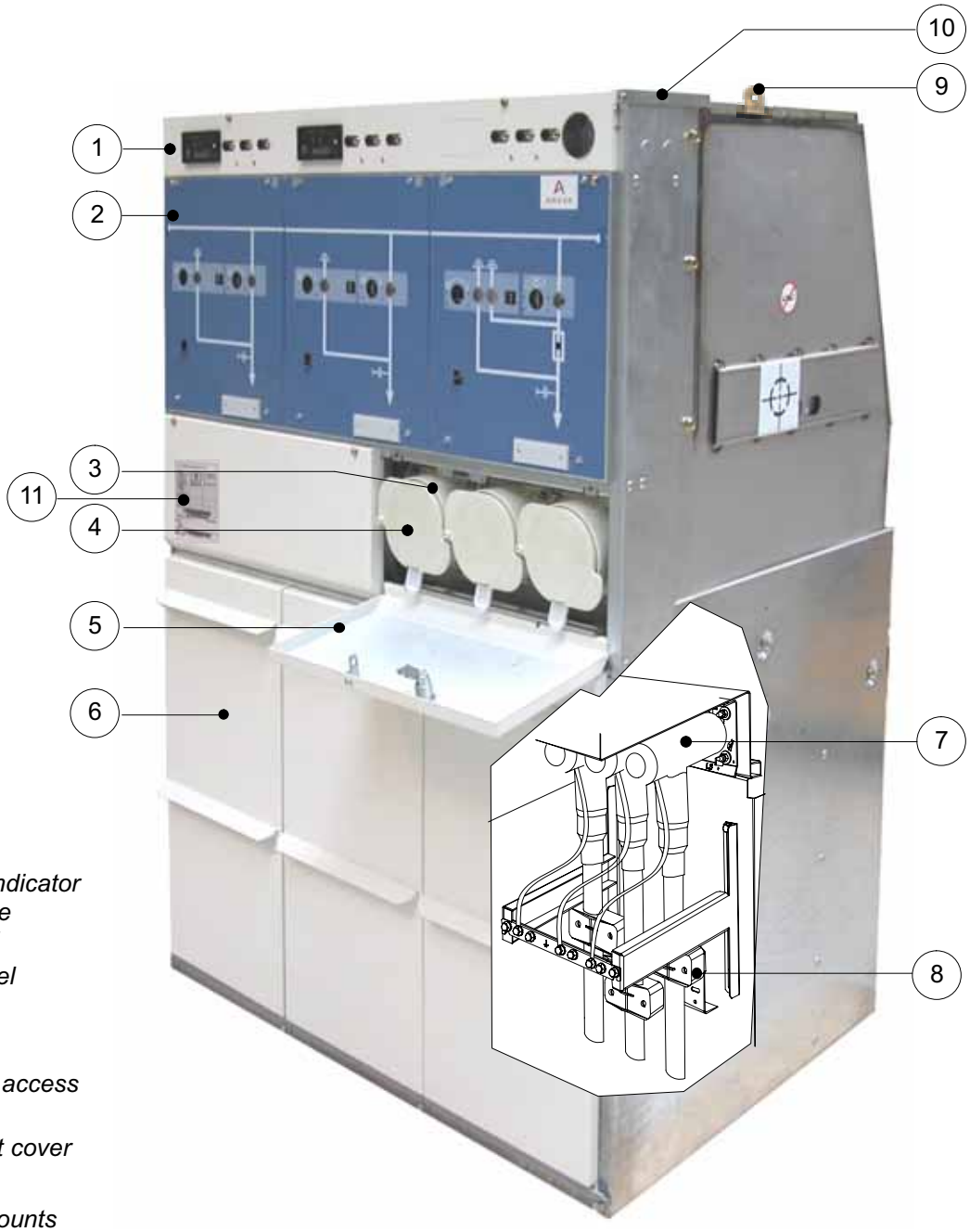
Rated voltage
24kV

Short circuit current
rated 16kA

Functions making up the switchboard

C = Load-break switch
T1 = Combinated or associated fuse and load-break switch
T2 = Transformer protection circuit breaker
R = Direct linkage
RE = Direct incoming feeder with earthing switch
M1 = Measurement with cable connections
M2 = Measurement - for RHS extension
M3 = Measurement - for LHS extension
M4 = Measurement - for extension (Left or Right)
Sb = Busbar disconnector

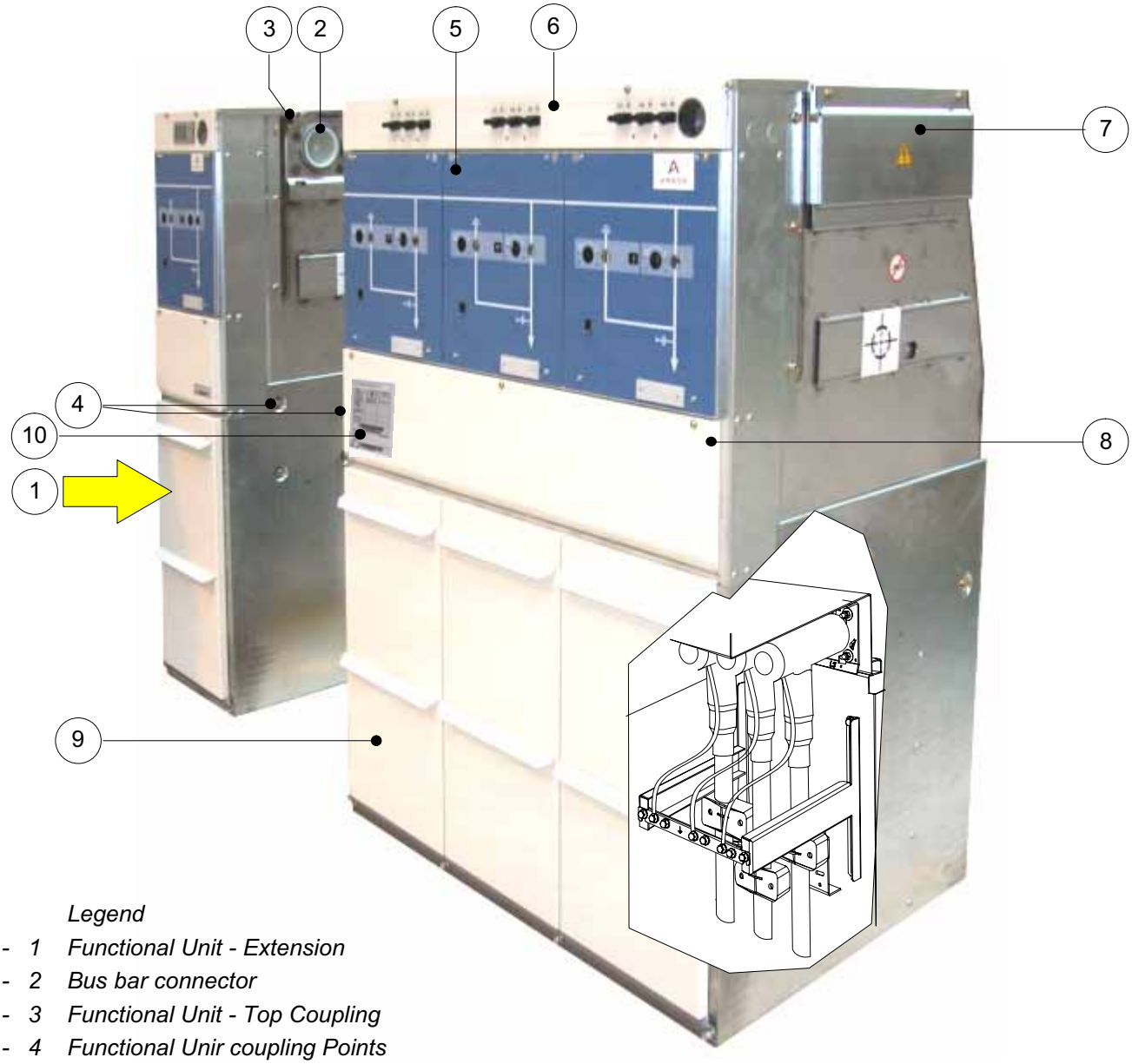
3.2 Presentation of the FBX-C (non-extendable model)



Legend

- *1 Voltage presence indicator light and low voltage compartment panel*
- *2 Mimic diagram panel*
- *3 Fuse compartment*
- *4 End plug*
- *5 Fuse compartment access panel*
- *6 Cable compartment cover*
- *7 HVA connections*
- *8 Adjustable cable mounts*
- *9 Lifting ring*
- *10 Removable top panel - low voltage connections*
- *11 Technical data rating plate*

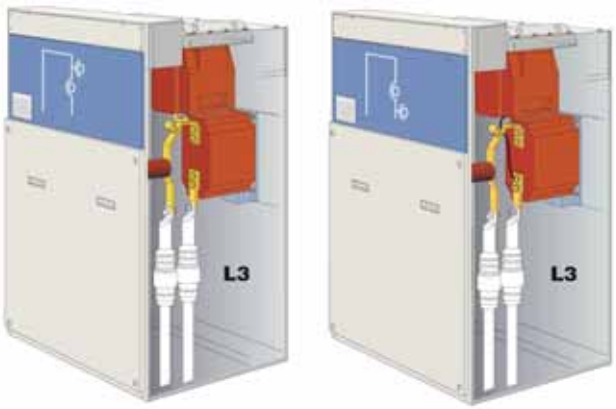
3.3 Presentation of the FBX-E (extendable model)



Legend

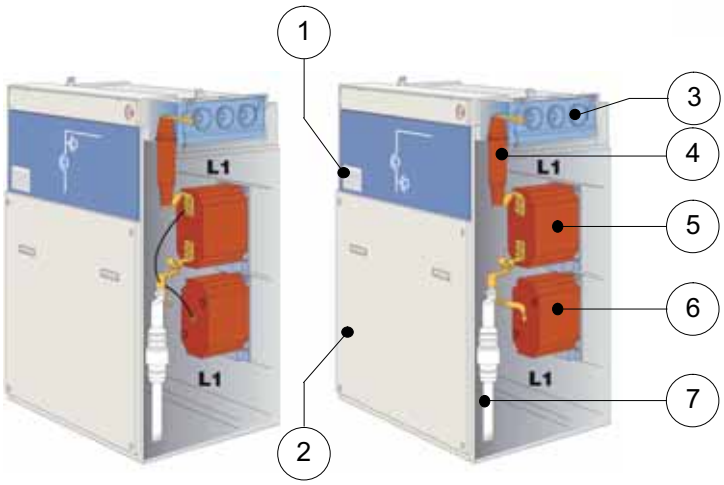
- *1 Functional Unit - Extension*
- *2 Bus bar connector*
- *3 Functional Unit - Top Coupling*
- *4 Functional Unir coupling Points*
- *5 Mimic diagram panel*
- *6 Voltage presence indicator light and low voltage compartment panel*
- *7 Extension system access panel*
- *8 Blanking panel*
- *9 Cable compartment cover*
- *10 Technical data and rating plates*

3.4 Presentation of “Measurement” functions

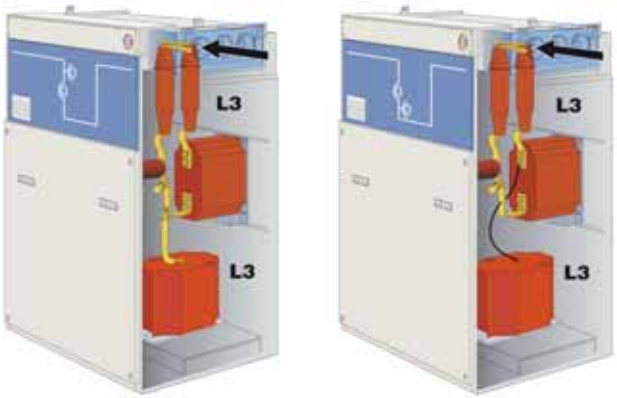


Function M1
Cable connection

Function M2
RHS Extension



Function M3
LHS Extension

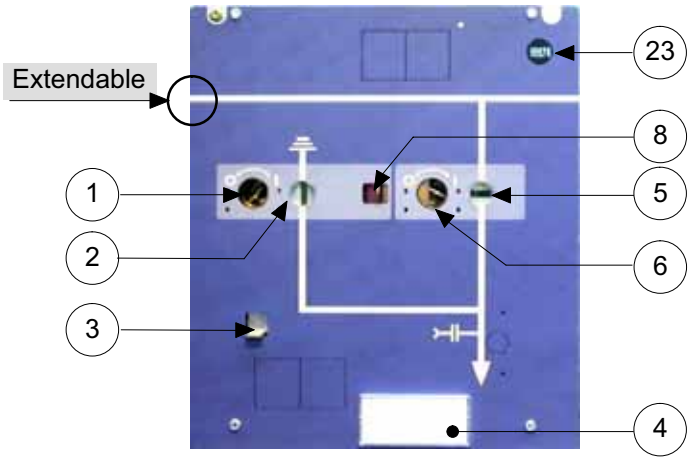


Function M4
Right or left hand side extension

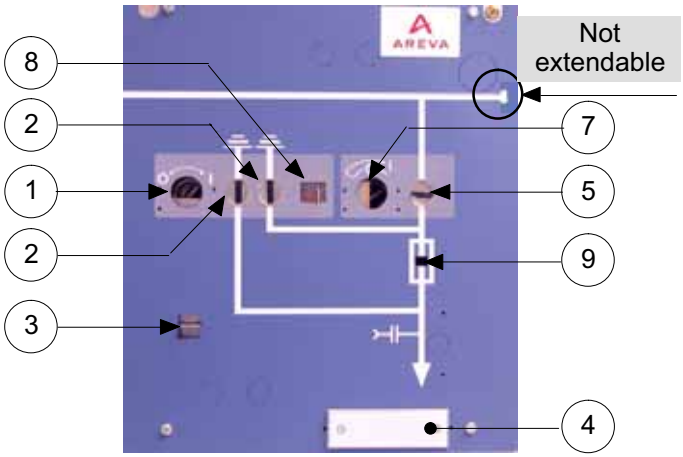
Legend

- *1 Technical data rating plate*
- *2 Bolted panel*
- *3 Bus bar connector*
- *4 Bushing*
- *5 Current transformer*
- *6 Voltage transformer*
- *7 HVA connections*

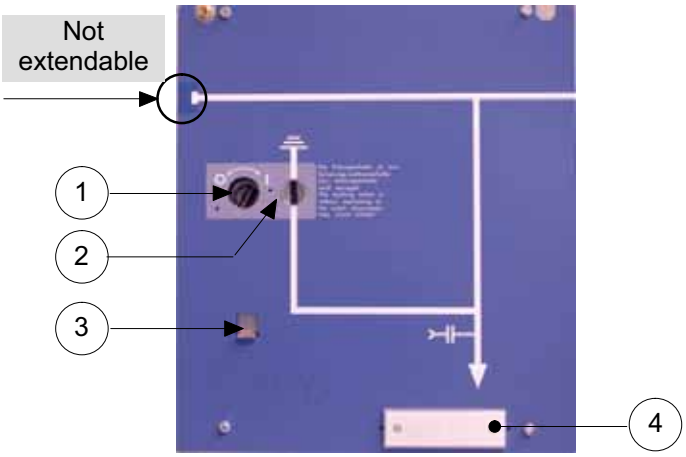
3.5 Presentation of mimic diagrams for manual controls



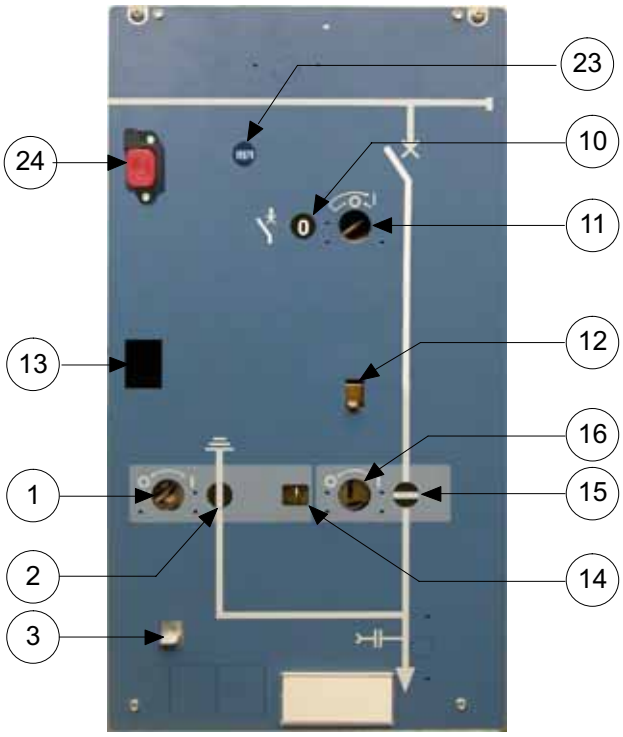
Function C “Extendable”



Function T1 “Non extendable RHS”



Function RE “Non-extendable LHS”

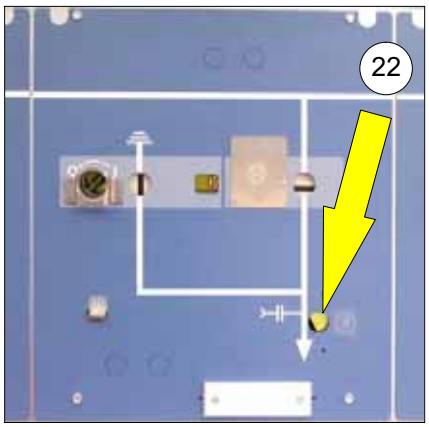


Function T2

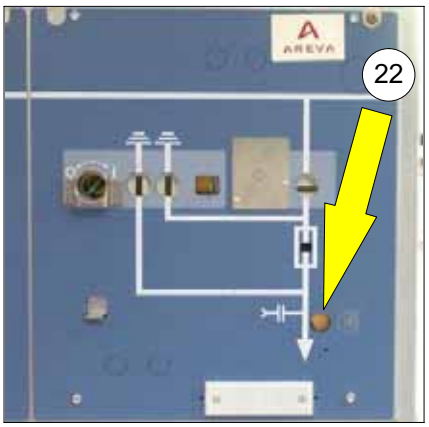
Legend

- *1 Lever socket for the earthing switch*
- *2 Earthing switch position indicator*
- *3 Cable compartment cover latch*
- *4 Descriptive plate*
- *5 Load-break switch position indicator*
- *6 Lever socket for the load-break switch*
- *7 Lever socket for the load-break switch*
- *8 Load-break switch or disconnector locking latch*
- *9 Fuse blown indicator*
- *10 Circuit breaker position indicator (O and I)*
- *11 Lever socket for the circuit breaker*
- *12 Circuit breaker locking latch*
- *13 Fault Trip indicator*
- *14 Disconnector locking latch*
- *15 Disconnector position indicator*
- *16 Lever socket for the disconnector*
- *17 Technical data rating plate*
- *18 Voltage transformers*
- *19 Current transformers*
- *20 Cable connections*
- *21 Busbar connections*
- *22 Location of the backup handle (load-break switch or circuit breaker)*
- *23 Operations counter (optional)*
- *24 Tripping push button (optional)*

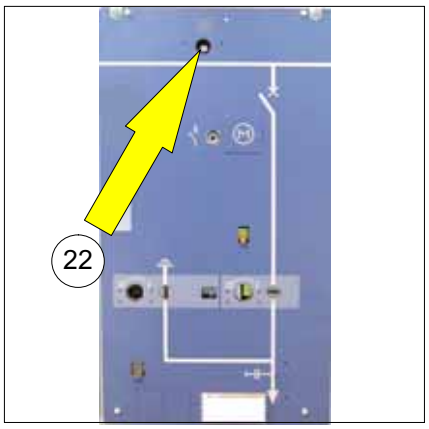
3.6 Presentation of mimic diagrams for motorised controls (See legend § 3.5)



- Function C 'Motorised': Socket to insert the emergency manual load-break switch operating handle.

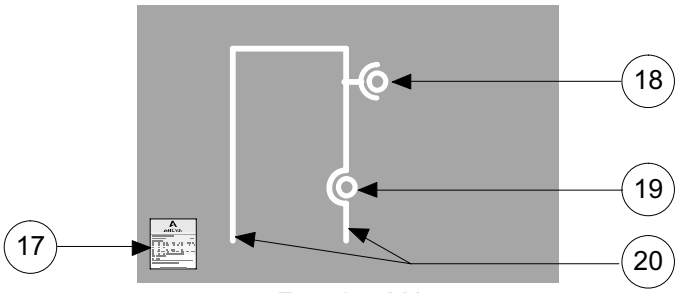


- Function T1 'Motorised': Socket to insert the emergency manual load-break switch operating handle.

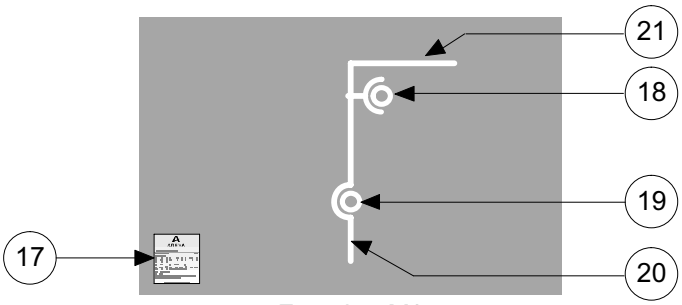


- Function T2 'Motorised': Socket to insert the emergency manual control for the circuit-breaker.

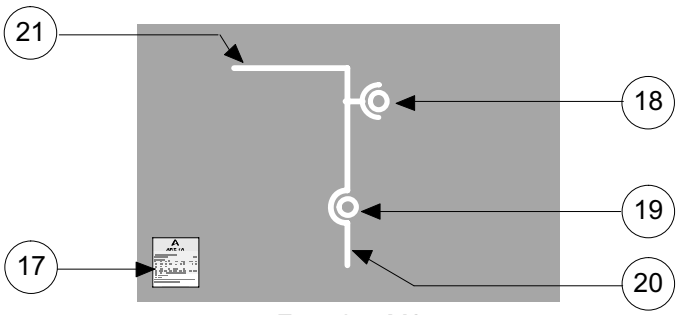
3.7 Presentation of the mimic diagrams used on 'Measurement' functions (See legend § 3.5)



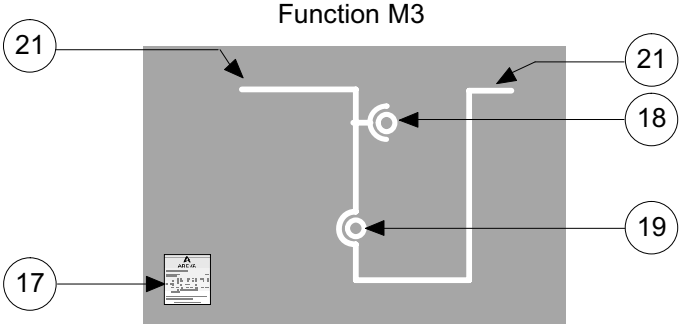
Function M1



Function M3

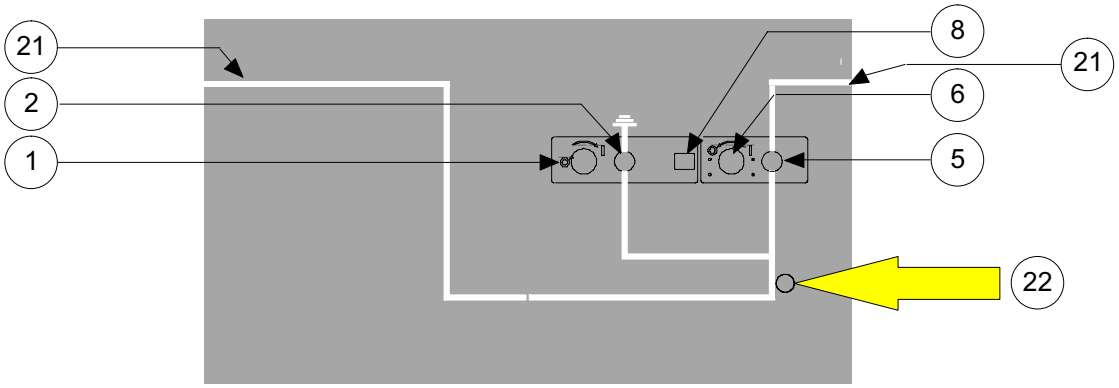


Function M2



Function M4

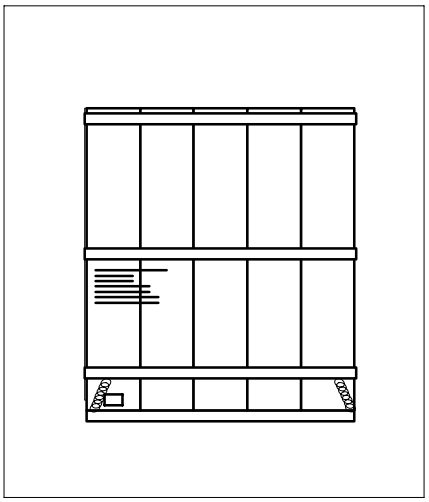
3.8 Presentation of the mimic diagram on the 'Sb' function (See legend § 3.5)



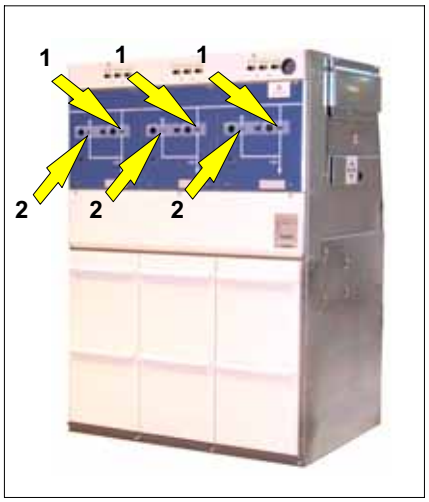
4 Storage - Packing

4.1 FBX switchboard packing

- For road and rail transport:
  - attached to the pallet using two plastic ribbon strips,
  - Covered by a protective plastic film.



- The packaging of a Functional Unit for air and maritime transport:
  - Under a heat-sealed cover with bags of desiccant,
  - packed in wooden crates.



- Status of the equipment on delivery:
  1. load-break switches, disconnectors and circuit breakers all ‘open’,
  2. Earthing switch ‘closed’.

4.2 Specific transportation requirements

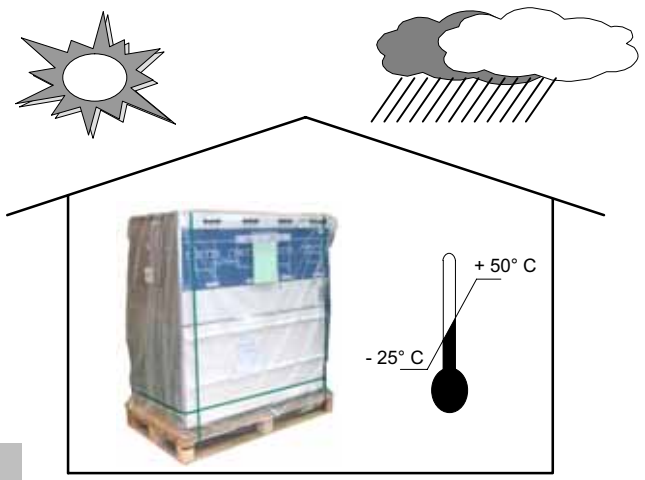
Ensure the FBX switchboard cannot slide or tip. If necessary, nail or chock the transport pallet in place on the truckbed.

Leave the FBX switchboard in its original packing until it arrives on-site ready for installation.

Respect the instructions given on the sheet attached to the front panel of the switchboard.

4.3 Temporary storage – less than 6 months

When the switchboard is not installed on delivery it can be stored for a period not exceeding 6 months under the following conditions:
. Preserve the equipment in its original factory packaging.
. Any parts unpacked for testing should then be repacked in their original packing.
. The site chosen for storage must be capable of protecting the material against possible damage due to: water, water vapour, saline atmospheres, all types of pollution, micro-organisms.



Contact AREVA for any derogations to these criteria or for storage durations of greater than 6 months

5 Handling and Unpacking

5.1 Reminder

The FBX switchboard must remain on its pallet, within its original packaging during any eventual storage period and until it arrives at the location of its installation.

5.2 Unpacking

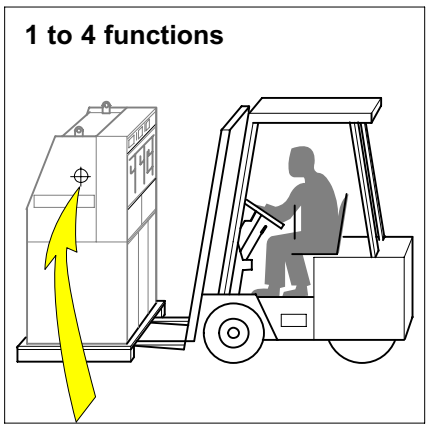
Proceed with unpacking the Functional Units only where they are to be installed on site.	Tools required: - Cutter for road and rail transport packaging - Crowbar for air and sea transport packaging	Use suitable protective gloves for any handling operation.

5.3 Revalorizing packaging waste

After unpacking, the materials remaining (cover, wooden floor panel, etc) should be sorted and sent to the appropriate recycling services.

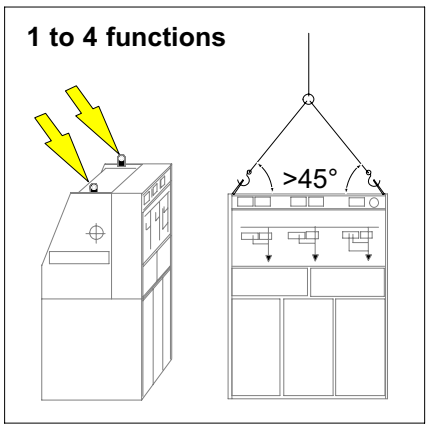
5.4 Handling

1 to 4 functions



When transporting on a pallet, do not tilt the switchboard.
Respect the location of the Centre of Gravity.

1 to 4 functions



When transporting using slings – always use the 2 lifting rings.

5 functions

This switchboard can be transported:
- either by slings using the 4 lifting rings,
- or by 2 hand trucks positioned at each extremity.

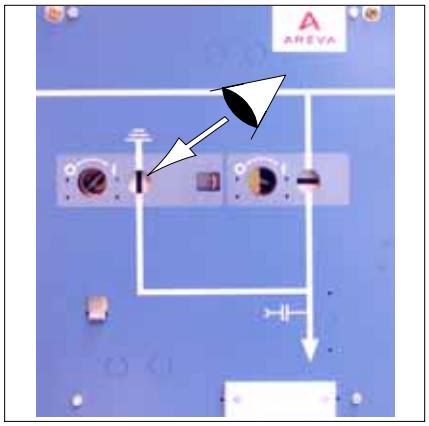
5.5 Packing

The standard pack includes the installation, user and maintenance manuals and the operating handles.

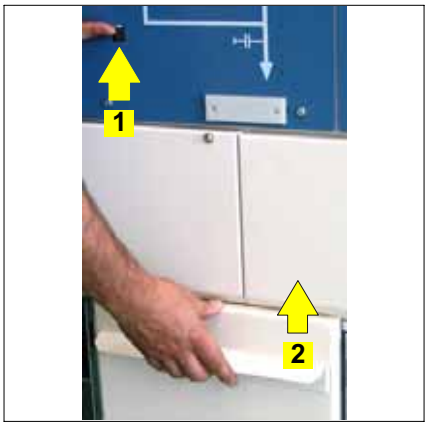
Other accessories may be included depending on the configuration of the switchboard itself (fuses, fixings, panels, etc.).

6 Fixing to the floor

6.1 Opening the cable compartment cover

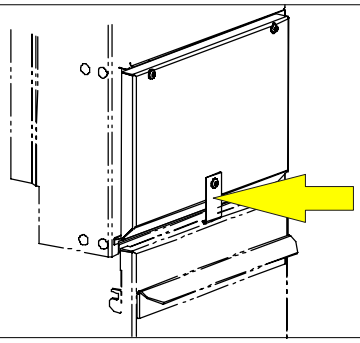


- The earthing switch must be closed (if not – see the operating manual - § AUCUN LIEN).



- 1 - Lift the latch.
- 2 - Lift and pull the cable compartment cover.

- 3 – Pull the panel towards yourself then extract it.



Exception for Functions R and Sb: Before removing the panel, remove the locking pin, fixed in place with an M6x16 CBHC bolt. When re-fitting the cable compartment cover, re-position this locking pin then attach it with the M6x16 CBHC bolt.

6.2 Fixing to the floor

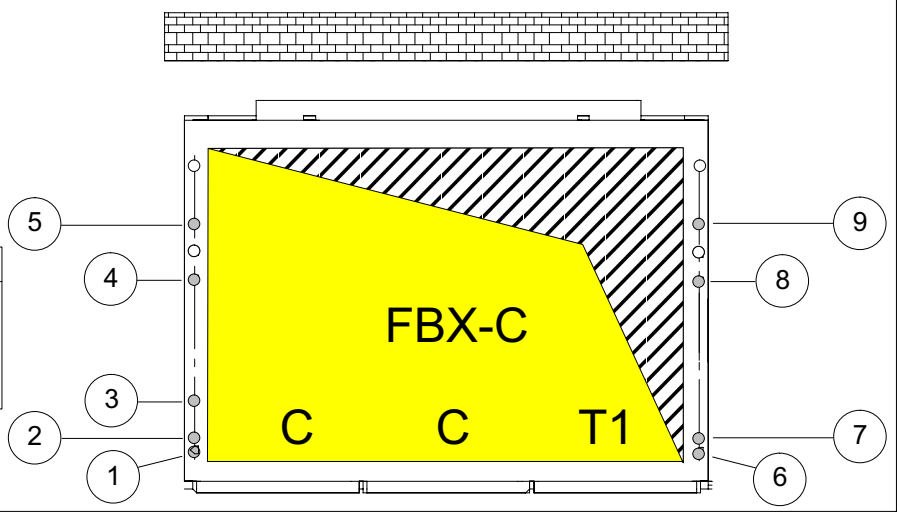
Position and fix the FBX switchboard to a concrete floor or supporting surface using 4 x M10 bolts (Class 8.8) with flat washers (exterior diameter – 30 mm, thickness – 3 mm). For rear fixings, there are two possible settings.

Ensure the unit is no way deformed when fixing to the floor. Chock it in place if necessary.

Top view

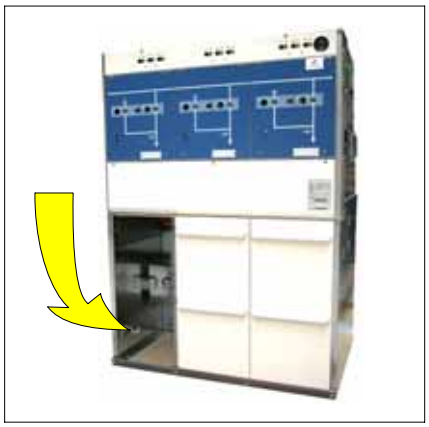
See Civil Engineering Guide (AMTNoT110-02).

Fixing	Fixing points	Tightening
Standard	1 or 3 ; 4 ; 6 ; 8	4
Optional	2 ; 5 ; 7 ; 9	
FBX-M	1 ; 4 ; 6 ; 8	



7 Earthing the FBX switchboard

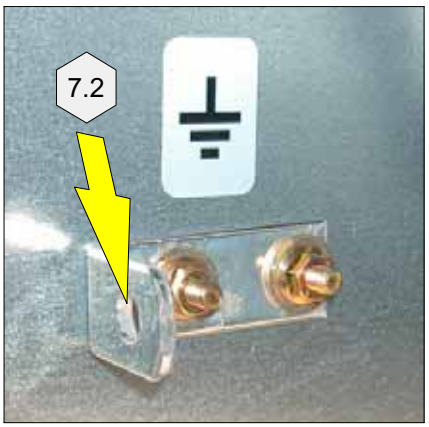
7.1 Location of the connector terminal



- The earthing connector terminal can be found in the FBX unit's cable compartment on the LHS side panel.

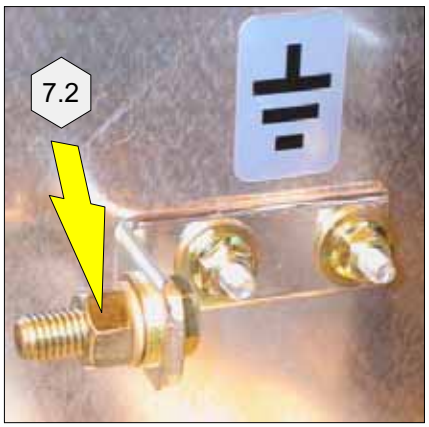
7.2 Connecting the earthing cable

- Lightly clean the contact surfaces.



- Connect the earthing terminal to the building's grounding network (HM12 bolt).

The grounding network connection cable and fixings are not supplied by AREVA.



- Optional: Supply of a H M12x35 bolt.

8 Connection of the HV cables

8.1 Standard equipment for the FBX – up to 24 kV

The FBX switchboard is fitted with plug-in cross members – Type PF250 or PF630.

C / T2 / T1 (optional):
Plug-in cross member PF630
NF-EN 50181, Connector - Type **C**
(Ir: 630 A ; ∅ M16 $^{0}/_{-0.04}$ mm)

T1 (basic):
Plug-in cross member PF250
NF-EN 50181, Connector - Type **A**
(Ir: 250 A, contact finger
∅ M7.9 $^{+0.02}/_{-0.05}$ mm)

8.2 Connection adapter cones for cross-members in accordance with NF-EN-50181.

Switchboard function	R/RE	C	T1	T2
Connection adapter cone – Type **A** (250 A)	...	...	**X**	...
Connection adapter cone – Type **C** (630 A)	**X**	**X**	**X**(optional)	**X**

8.3 Connection of the cables

The cable compartments can be accessed from the front.

Remove the cable compartment access panels (Chapter 6.1).

Before fitting, read and apply the appropriate safety instructions.

Fit insulating blanking plugs on any unused cross members.
Note: The red coloured plugs fitted to the switchboards when they are delivered are not isolating plugs.

8.4 General connection precautions

The manufacturer's installation instructions (and torque settings) must be scrupulously respected.

Clean the separable connectors and cross members using a dry cloth.

Apply the silicon grease supplied with the connectors.

8.5 Type A connection

Position and engage the cable into its clamping stirrup.

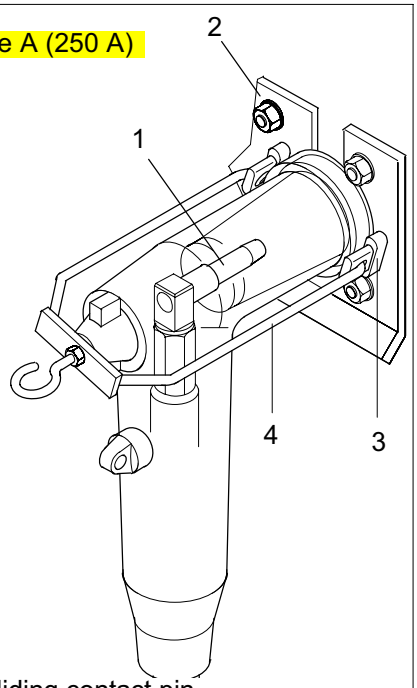
Plug in the connector without using tools then hand-tighten the fixing device. For the initial connection, and in accordance with the recommendations made by certain suppliers, it is standard to use the wires supplied with the connector to fill in the space between the cross member and the connector itself. During this connection operation, the cable must run freely and naturally into the bottom of its connector stirrup.

8.6 Type C connection

Please refer to the connector manufacturer's instructions, especially regarding the tightening torque value.

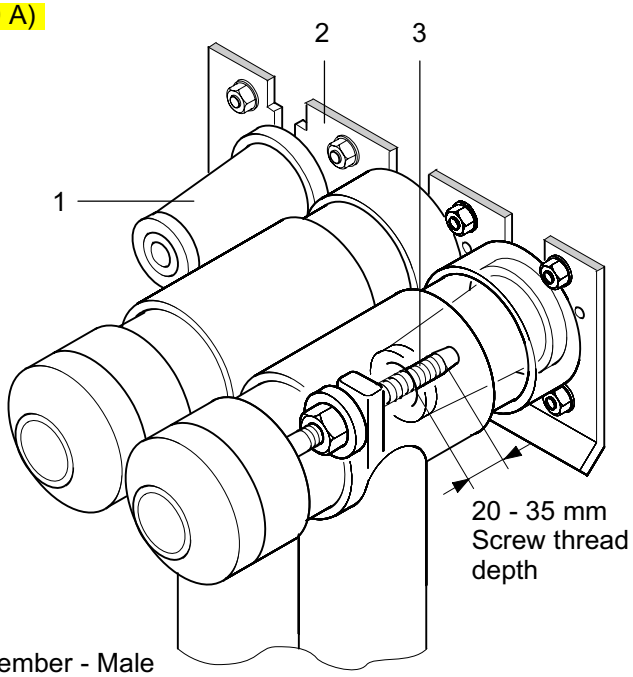
As an indicator, the maximum permissible tightening torques are 4 daNm for brass fasteners and 8.4 daNm for steel fasteners.

Type A (250 A)



1 - Sliding contact pin
2 - Support plate
3 - Mounting flange
4 - Mounting device

Type C (630 A)



1 - Cross member - Male
2 - Support plate
3 - Screw contact

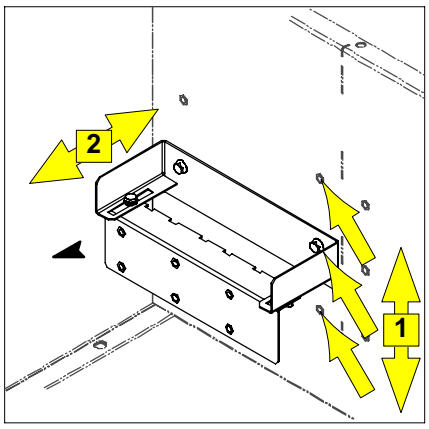
8.7 Attaching the cables and connecting the earthing braids

Position the adjustable cable mountings in accordance with the type of tightening (see below) and cable characteristics.

Adjustments are both horizontal and vertical.

Attach the cables using clamps or stirrups, ensuring that no stress or tensile forces are applied to the plug-in cross member.

Clip-fit clamps



- Assembly - 1 cable per phase:
  1- height adjustments using three fixed positions.
  2- Depth adjustment using the two lateral slides.

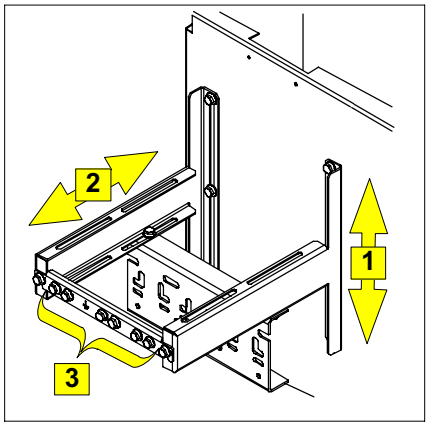
- Mountings for the cable supports for clip-on clamp fixing.
  3- Three M8 fixing screws for the cable earthing braids.

- Fitting the clip-on clamps.

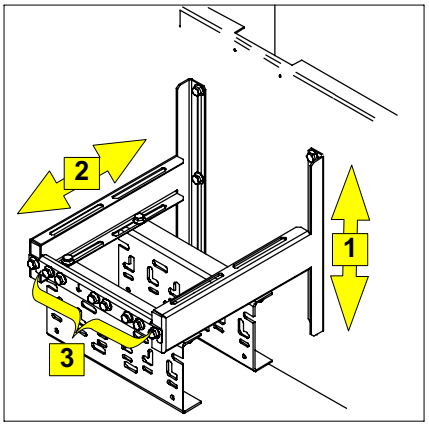
Screw-fit clamps

This clamping is obligatory for a 2 cable per phase (or 1 cable + surge arrestor) installation.

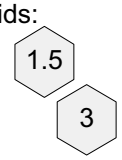
Pay careful attention to the choice of connectors as the compartment depth is extremely limited.



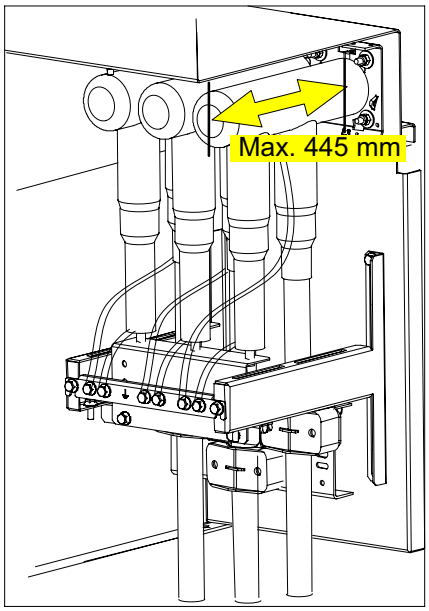
- Assembly - 1 cable per phase:
  1 - Height adjustments.
  2 - Depth adjustment.
  3 - Fixation points for the cable earthing braids:
  - Standard screw size: H M8
  - Optional screw size: H M10



- Assembly of 2 cables per phase:
  3 - Six M8 fixing screws for the cable earthing braids:
  Standard screw size: H M8
  - Optional screw size: H M10

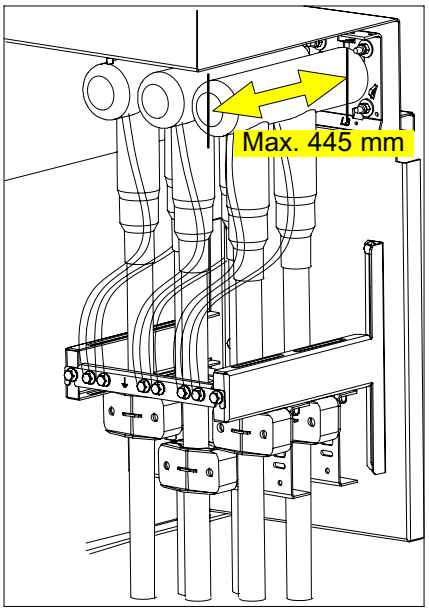


- Cable clamp for C function.



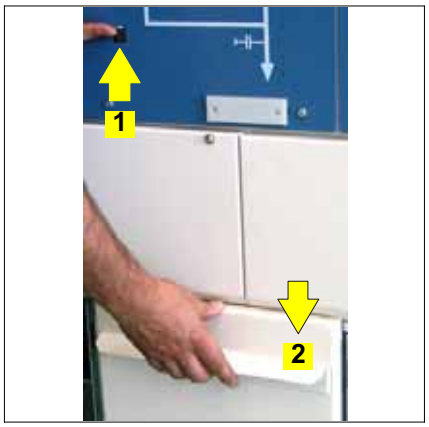
- Connection of single cables + surge arrestors.

Mounting plates are required for the fitting of the surge arrestor fixings and cable supports.



- Connection of two cables per phase.

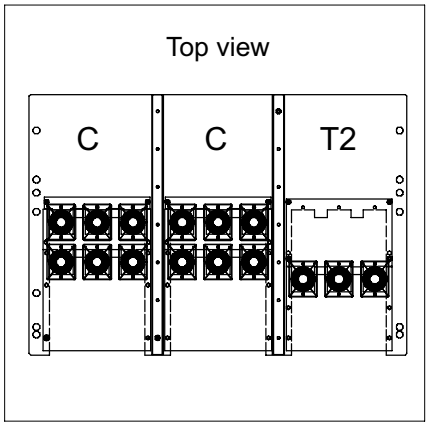
These plates can be ordered from AREVA.



- To replace the cable compartment cover:
  1 - The tab of the interlock has to be in its upper position.
  2 - Replace the cover in the holes provided and then push down, make sure the tab of the interlock drops down again.

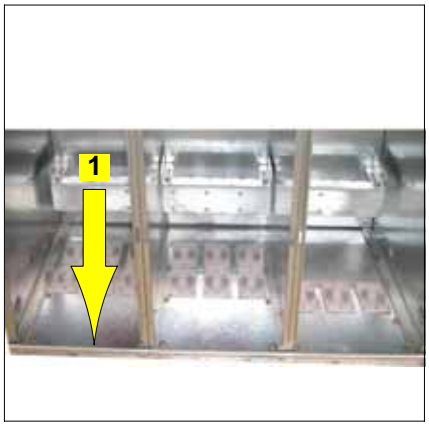
Reminder: The clamps are sufficient to resist the electro-dynamic forces generated by the passage of a short circuit current but are not guaranteed to provide sufficient support to authorise operators to handle them once connected.

8.8 Fitting of cables with a blanking-off flooring (optional)

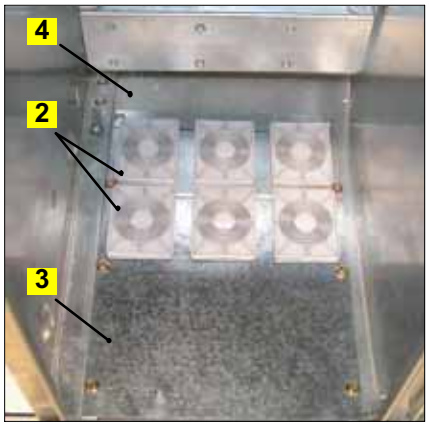


- Place the complete flooring on the ground, at the switchboard's definitive location (represented here by 2 cables per phase for the C Functional Units).

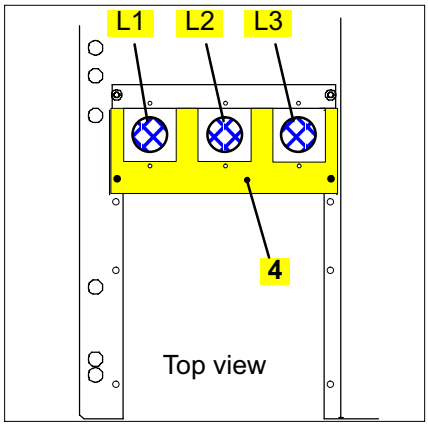
- Position the FBX switchboard on the flooring.
- Fix the switchboard (and the flooring) on to the ground (see § 6.2)



- Remove the lower (**1**) front cross member (4 H M8 bolts).

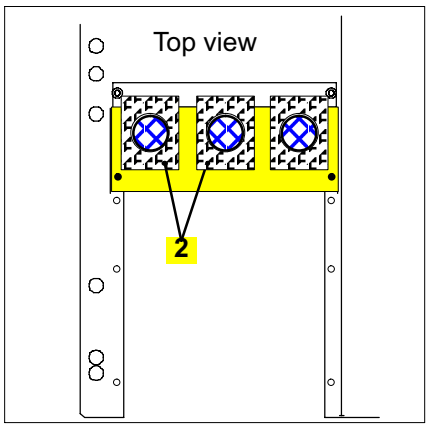


- At the bottom of the first C Functional Unit, remove:
  - the 6 blanking panels (**2**),
  - the front plate (**3**),
  - the rear plate (**4**).

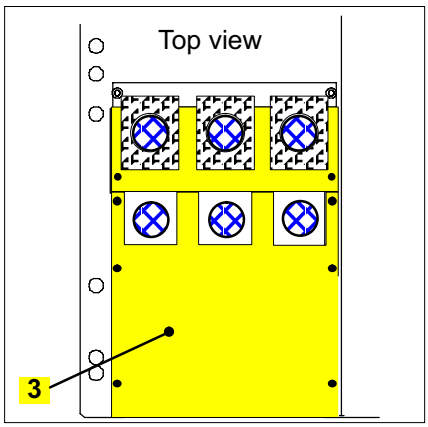


- Pass the 3 cables of the first Functional Unit to be connected.
- Position and fix the plate (**4**) in accordance with the marks on the cables.

- Cut the cables to the required length.
- Cut and fit each grommet on to its cable.



- Fit the plug-in connectors.
- Connect and strap the cables.
- Clip the blanking pieces (**2**) into their housings.

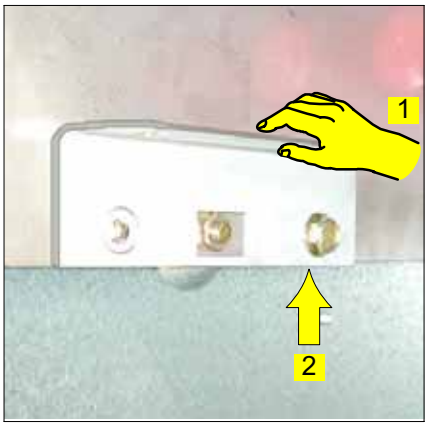


- Pass the following 3 cables.
- Position and fix the front plate (**3**) in accordance with the marks on the cables. (6 H M6 bolts).

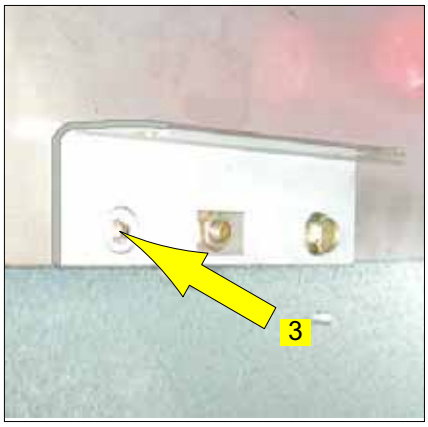
- Proceed in an identical way for the connection of the first 3 cables.
- Fit the cross member (**1**) in place.

8.9 Assembly of 3 cables per phase (optional)

- Parts kit for the plug-in connectors mounting.



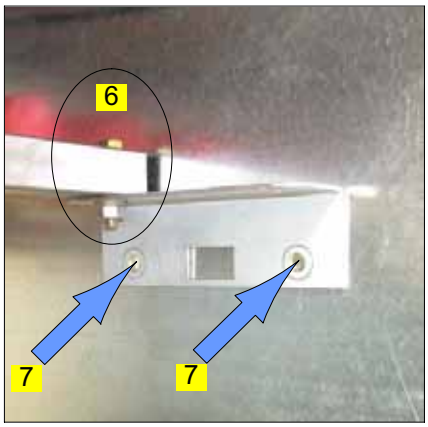
- 1. Position an angle bracket, horizontally, on the left-hand side.
- 2. Slide a notched nut between the plate and the wall.
- Screw in and tighten the first threaded bolt.



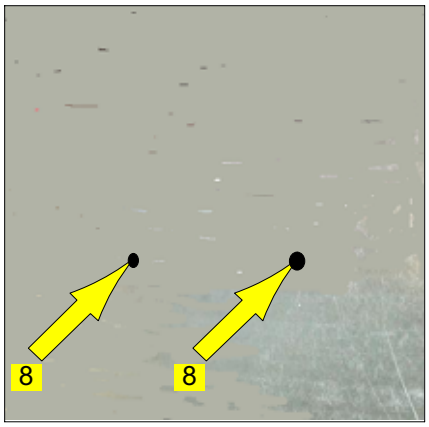
- Position the angle bracket horizontally.
- 3. Drill the plate through the second hole (drill bit Ø 8.5mm).

- 4. Slide a notched nut between the plate and the wall.
- Screw in and tighten the second threaded bolt.

- 5. Fix the bar on to this angle bracket (H M8x40 bolt).

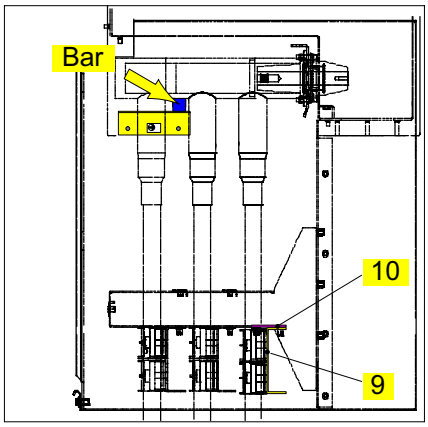


- 6. Fix the second angle bracket.
- Position this angle bracket in the same way as the one facing it.
- 7. Mark the 2 holes.



- Remove the angle bracket.
- Ensure that the adjacent compartment is accessible and not obstructed.
- 8. Drill the 2 holes (drill bit Ø 8.5mm).

- Reposition the angle bracket.
- Engage the threaded bolts by the compartment on the adjacent Functional Unit.
- Screw on and tighten.
- Remove the bar.



- Position and fix the support (9) by the spacers (10).
- Note: this mounting support is inverted in relation to the two others.
- Connect the cables.
- Fit the bar after connecting the second cable per phase.

9 Switchboard extensions (FBX-E series)

9.1 Intervention levels

Levels	Description
1	Operations as noted as instructions in the ”Operation - Maintenance” notice, carried out by trained personal capable of intervening whilst respecting the rules of security.
2	Complex operations, requiring specific expertise and the use of support equipment in accordance with the constructor’s procedures. These are carried out by the constructor himself or by a specialised technician who has received regular training by the constructor (See § 1.2) as part of the implementation of procedures and who is equipped with specific equipment.
3	All preventive and corrective maintenance, all renovation and reconstruction work is carried out by the constructor.

Extensions may be put together by personnel qualified in HVA equipment and HVA/LV substation interventions, equipped with this manual.

Apart from mechanical assembly skills, the electro-technical knowledge required for the connections is similar to the skills required for the connection of a separable HVA connector.

9.2 Intervention Instructions

Intervention	Busbar	Cables	Load-break switches	Earthing switches
Level 1	De-energized	De-energized	Open	Closed

Locking out the Functional Unit Apply the general safety instructions for electrical locking-out operations and the special rules for the network concerned	Tools required: - Scissors - Open-ended spanner - sizes 13 & 17 - 2 x open-ended spanner - size 16 - Ratchet wrench and extension + 13 mm socket - Torque wrench	Parts required: - 1 x FU Extension - 1 set of coupling fittings (See § 9.5)

9.3 FBX switchboard lockout

The switchboard must be de-energised, all load-break switches opened and earthed. All earthing switches must be closed.

During the intervention, the time during which the female bushings are not covered by their blanking plugs must be reduced to a minimum.

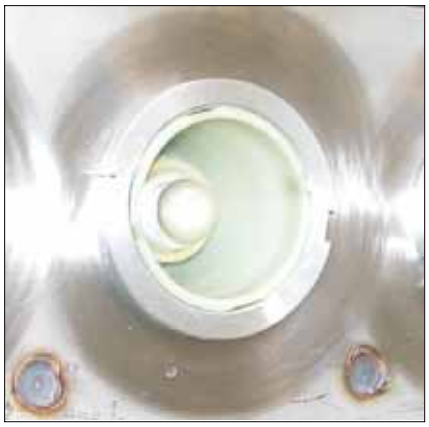
If, for whatever reason, the installation operation is interrupted for more than 24 hours, the blanking plugs must be re-fitted and the cover screwed into place.

9.4 Reminder on the use of blanking plugs.

One must be careful when using blanking plugs as there are two different types:

Insulated Plugs: When these are used the switchboard can be energised. A protective cover holds these plugs in place.

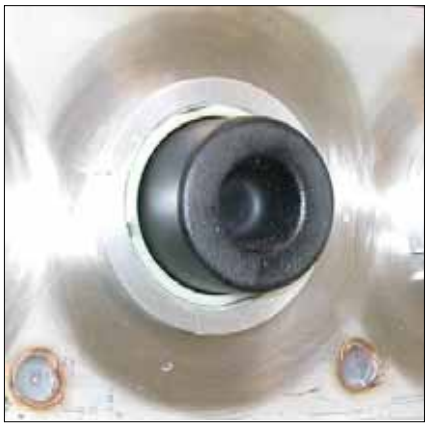
(Plastic) Protective Cover: Fitted to cross members to be connected on-site. This cover is only to be used to protect the bushing against dust.



- View of a bushing <u>without protection</u> – just prior to connection.

- Plastic protective cover.

This cover should never be fitted to an energised switchboard.



- Insulated blanking plugs are <u>compulsary</u> for sealing off bushings on an energised switchboard.

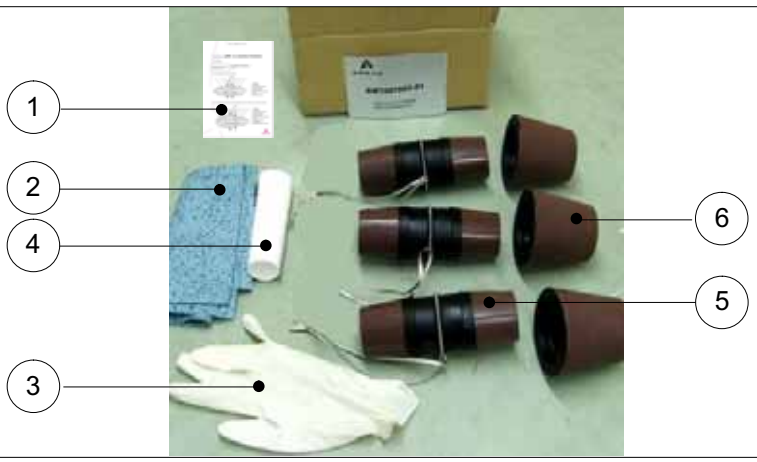
The plug in the photograph is shown without the cover plate used to compress it in place.

9.5 Coupling accessories

A box, containing:

Legend

- *1 Assembly Manual for extensibility kit*
- *2 Cleaning wipe*
- *3 Glove*
- *4 Tube of grease*
- *5 3 Extension connectors*
- *6 3 Adapters (optional)*



Additional supplies

- *7 Foam strip seal*
- *8 1 bag of fasteners, including:*
  - *2 spacers,*
  - *2 guide pins + 4 M10 nuts,*
  - *2 H M8x60 bolts plus washers and nuts,*
  - *1 H M8x20 bolt plus washers and nut.*

9.6 Equipment for the Functional Unit extension (See § 9.5)

The earth is on the extendable switchboard. There is no independent earth on the extension unit.

Position the extension unit a short distance (approximately 50 centimetres) from the extendable switchboard unit on steel shims.

- Attach a guide pin (8) to the front of the unit using two M10 nuts.

- Fix an identical guide pin (8) to the rear of the unit.

- Tighten using two 16 mm spanners.

- Remove the cable compartment cover (See § 6.1).

- Remove screw **1** and store carefully.
- Loosen screw **2** by a few turns.

- Tap the head of screw **2** with a hammer to remove the internal nut insert.

9.7 Extendable switchboard equipment (See § 9.5)

- Remove the cable compartment cover (See § 6.1).

- Remove screw **1** from the side panel and use it to fix a spacer (8) in its place, passing the screw through from the inside of the compartment.
- Tighten, without locking.

- Loosen screw **2** a few turns then tap the screw head with a hammer to remove the internal nut insert.
- Remove the screw **2** completely and store carefully.

- Attach the second spacer (8) using the screw **2**.
- Tighten, without locking.

- Attach the self-adhesive strip vertically along the edge.

- At the bottom, cut off any excess material.

Preparation the existing extensible unit (Version after 03/2008)

- Loosen, alternately, the two fixing bolts of the insulated end cap compression plate.

Light pressure is applied by the insulated blanking plugs to this plate.

- Remove the plate.

- Wear gloves to remove the plugs.
- Apply an alternative side to side force on each plug, so that air can progressively enter into the plug-crossmember interface whilst pulling towards the rear.

- Clean the inside of the three bushings with a cleaning cloth (2).

- Put on the glove (3) to cover the insides of the bushings with a thin coating of grease (4).

Preparation and installation of the insulated extension connectors (5)

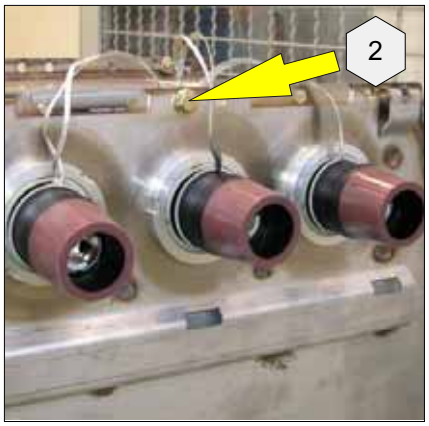
- Clean each extension connector (5) with the cleaning cloth (2).

- Put on the glove (3) and cover them with a thin coating of grease (4).

Installation of the insulated extension connectors (5)

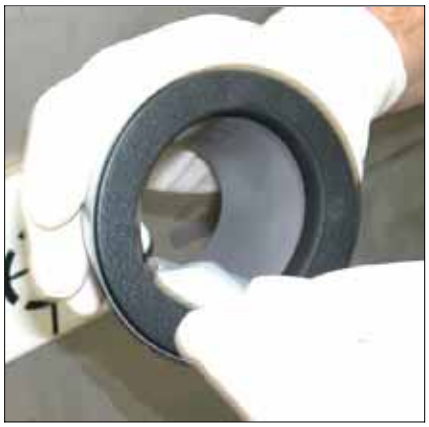
- Firmly push each extension connector onto its contact assembly.

- Link together the three earthing braids.
- Position the cable ends as shown above.



- Fix and tighten the braids using 1 x H M8x20 screw + flat washer + locking washer + nut.

Preparation the existing extensible unit (Version before 04/2008)



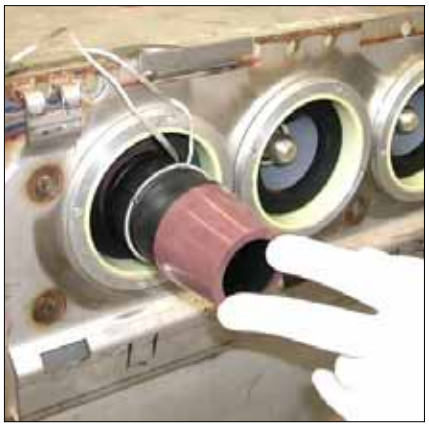
- Clean the internal and external surfaces of the adapter (6).
- First apply a light coating of grease to the internal surface.

- Then apply a light coating of grease to the external surface.

- Place an adapter into each of the bushings.

- Assure each adapter is pushed to the base of the bushing.

- The three adapters in position.



- Firmly push each extension connector onto its bushing contact.

- The three extension connectors in position.

- Link together the three earthing braids.
- Position the cable ends as shown above.

- Fix and tighten the braids using 1 x H M8x20 screw + flat washer + locking washer + nut.

Preparation of the extension unit

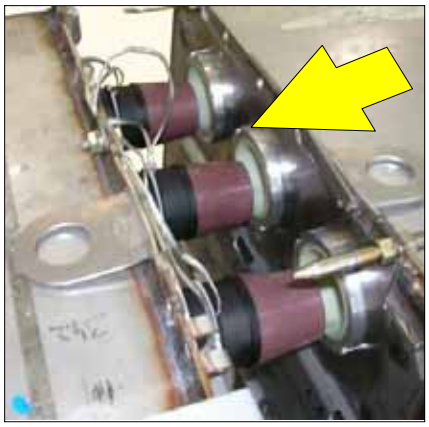
- Remove the three white plastic covers.

- Clean inside the three bushings with a cleaning cloth (2).

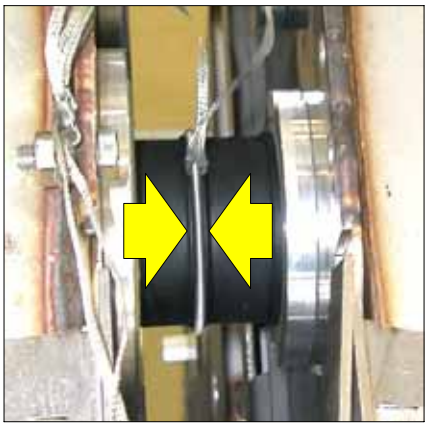
- Put on the glove (3) and apply a thin coating of grease (5) to the insides of the bushings.

9.8 Switchboard assembly

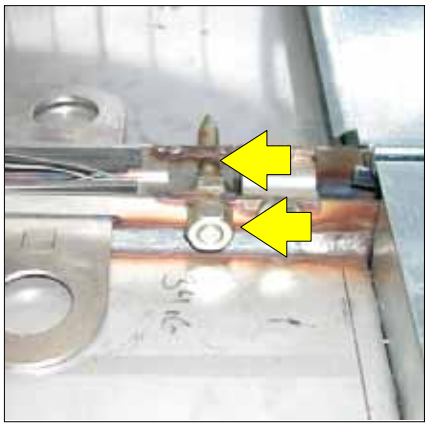
The pins (8) are used to guide the insulated tubes and ensure the holes are lined up to bolt together the upper section of the switch-board.



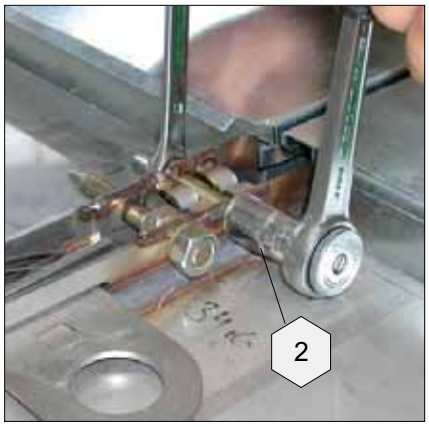
- Gently push the extension unit towards the existing extendable switchboard unit.



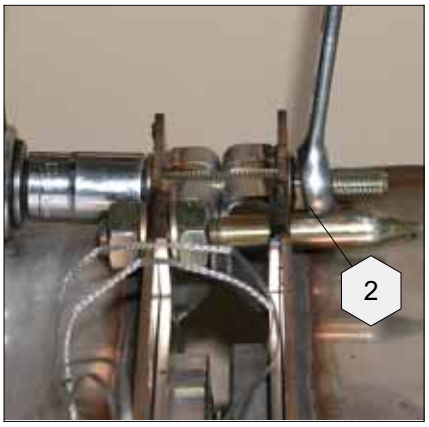
- Ensure that the earthing connection is correctly centred in the middle of the extension connector.



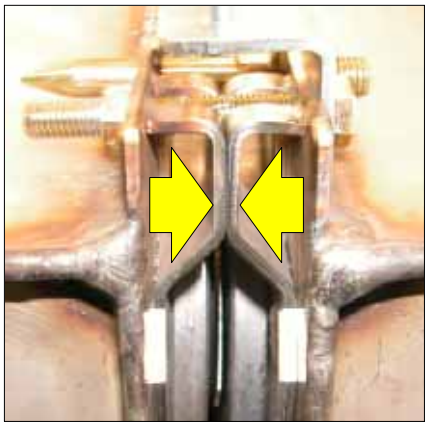
- Align the pins to the holes.
- Push the extension unit towards the existing extendable switchboard unit.



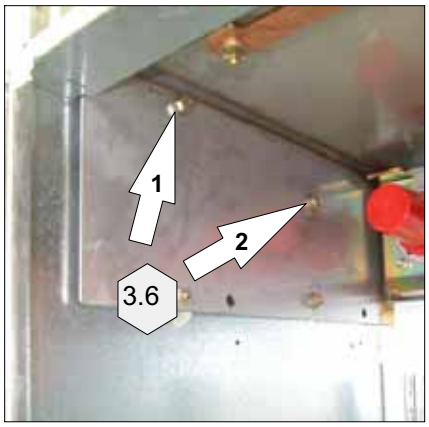
- At the front, fit the first bold (H M8x60 + locking washer + nut).
- Tighten a few turns.



- At the rear, fit the first bold (H M8x60 + locking washer + nut).
- Tighten a few turns.



- Continue to alternate between tightening the front and rear nuts until the two reference faces touch each other.



- Screw into each spacer using 1 x H M8x12 screw through the inside of the cable compartment on the extendable switchboard.

Once assembly has been completed, wait <u>15 minutes</u> before energizing the installation.

Fixing to the floor and connecting

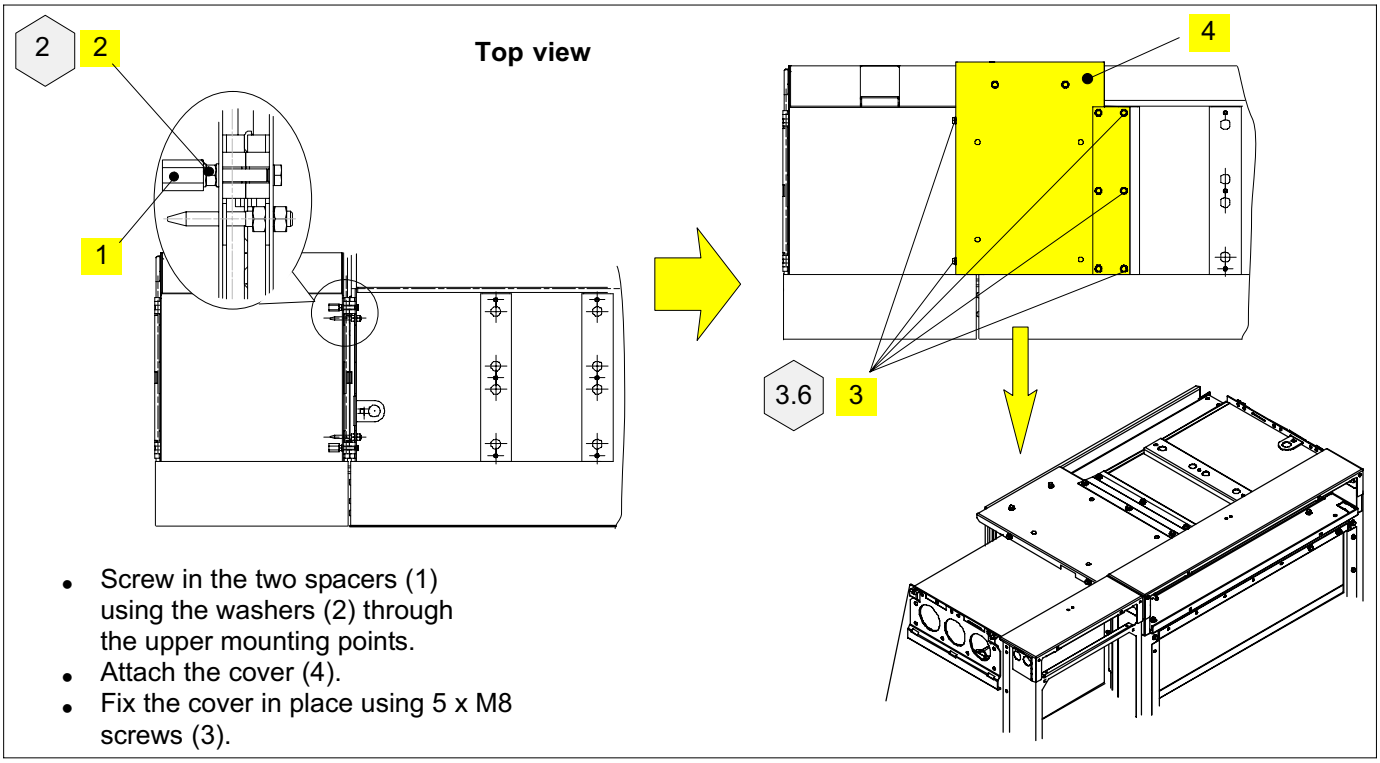
The extension unit must be attached to the floor in accordance with the instructions given in chapter 6.

Pay careful attention to avoid stressing the extension unit when fixing to the floor (chock in place if necessary).

Proceed with the connection of the cables as described in chapter 8.

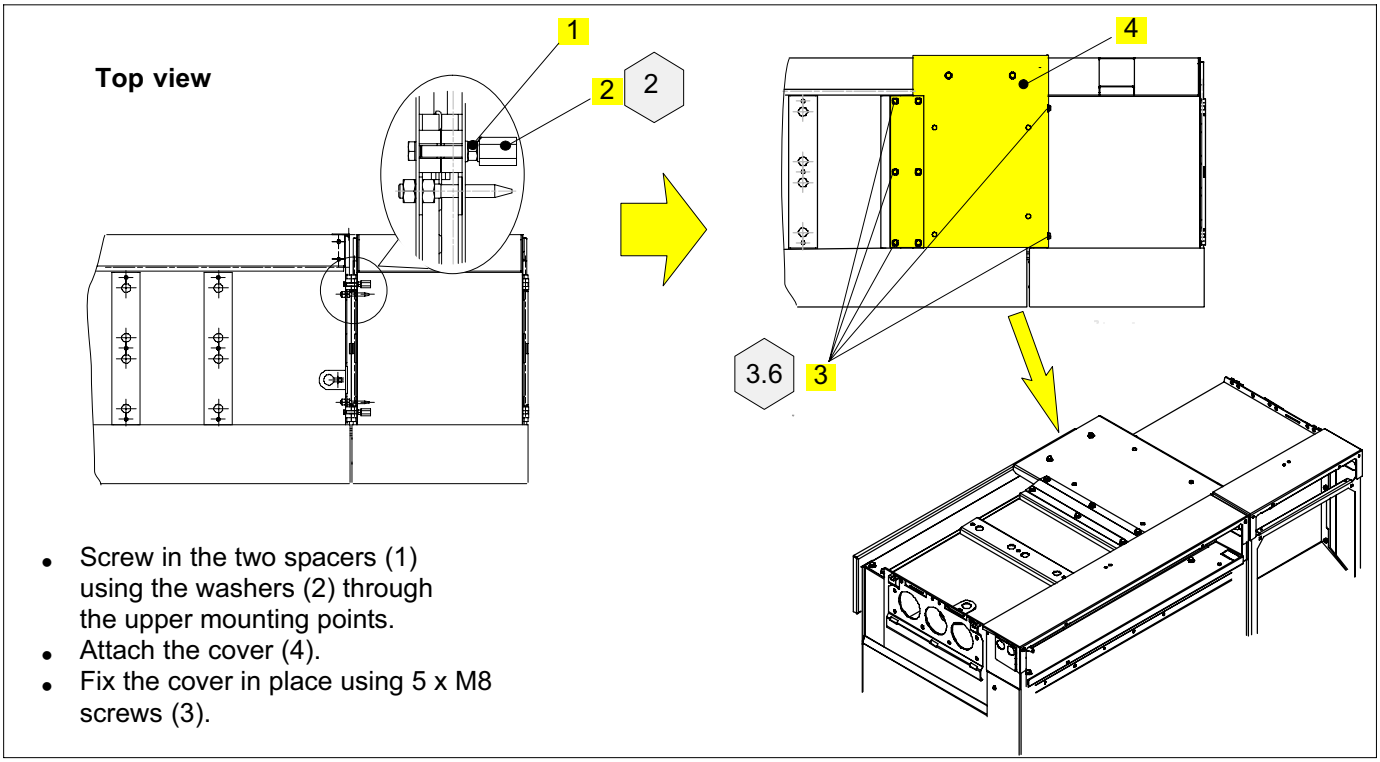
10 Fitting a protective cover (Function M Only)

10.1 For a LHS coupling



- Screw in the two spacers (1) using the washers (2) through the upper mounting points.
- Attach the cover (4).
- Fix the cover in place using 5 x M8 screws (3).

10.2 RHS coupling



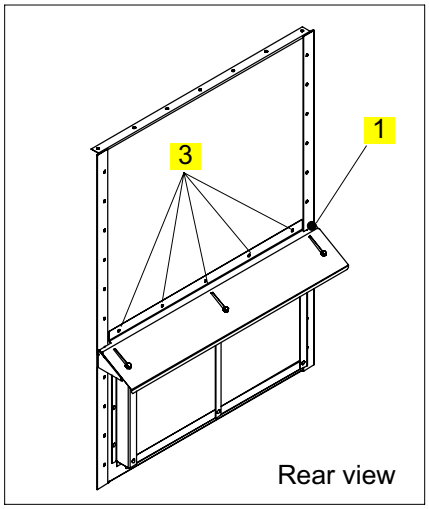
- Screw in the two spacers (1) using the washers (2) through the upper mounting points.
- Attach the cover (4).
- Fix the cover in place using 5 x M8 screws (3).

11 Fitting a rear deflector to a Function M

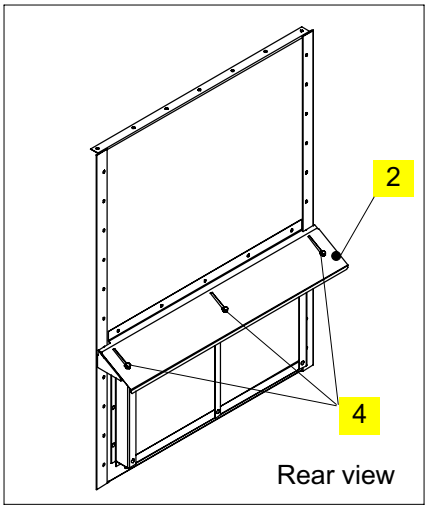
11.1 When required

The internal arc deflector is compulsary when the unit is installed within a room with a ceiling height of ≥ 2m and < 2.4m.

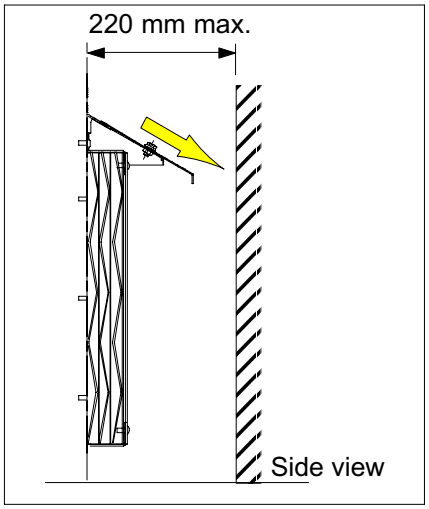
11.2 Fitting the deflector to the rear of the Function M



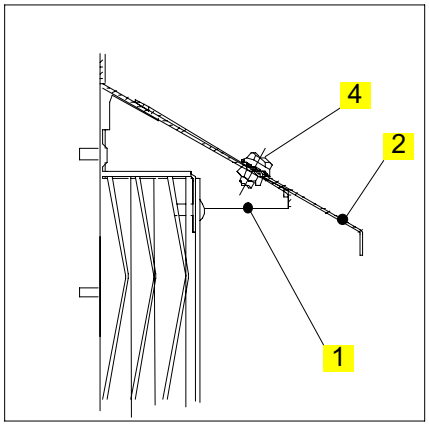
- Attach the rear deflector mounting (1) to the five M8 nuts (3) on the rear of the unit.
- Position the FBX in its definitive location.
  NB: The distance, with respect to the rear partition, must not exceed 220 mm.



- Loosen the 3 fixing screws (4) for the removable blanking plate (2).



- Lower the removable plate until it touches the partition.
- Tighten the 3 fixing screws (4).



- Details of the assembly.

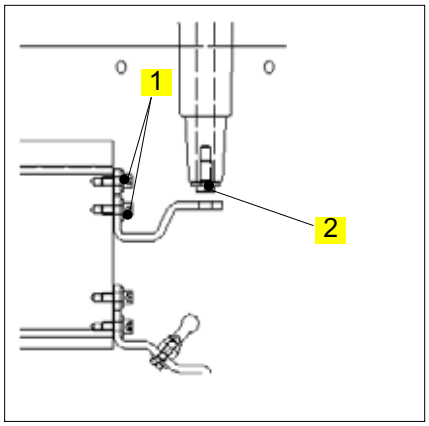
12 Connecting transformers within Measurement Functional Units

12.1 General

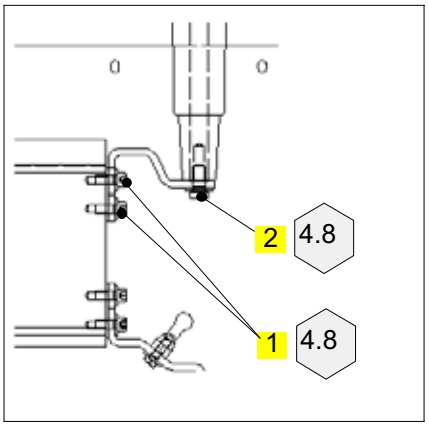
To avoid any damage, the transformers and cross members are not connected in the factory. Final assembly should be carried out on-site.

Within the cable compartment, the order of the phases, from left to right, is:
- M2: L1, L2, L3
- M3: L3, L2, L1

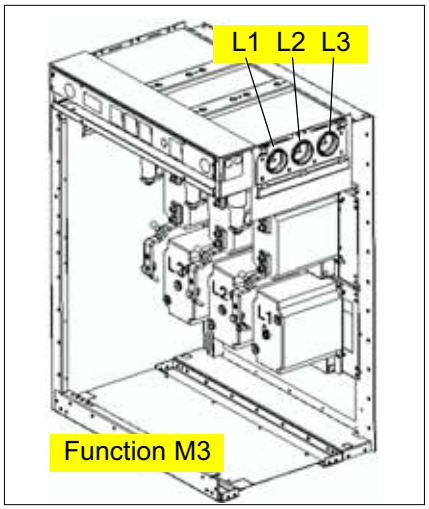
12.2 Connecting transformers in a type M2 or M3 functional unit



- State on Delivery: The upper connection is not established.
- Unscrew the two screws (1).
- Unscrew the upper mounting screw (3) on the cross member.
- Pivot the connection through 180°.

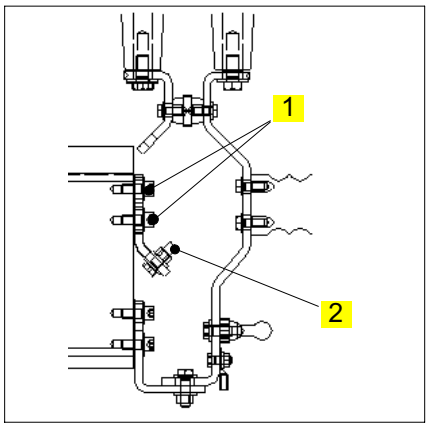


- Fix the connection to the transformer using 2 x M12 screws (1).
- Fix the end of the connection to the cross member using an M16 screw (2).

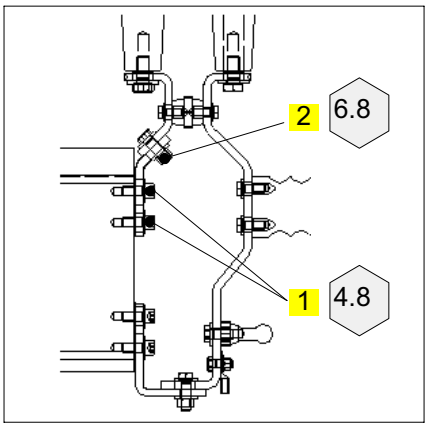


The order of the phases is inverted from those in the M2 functional unit.

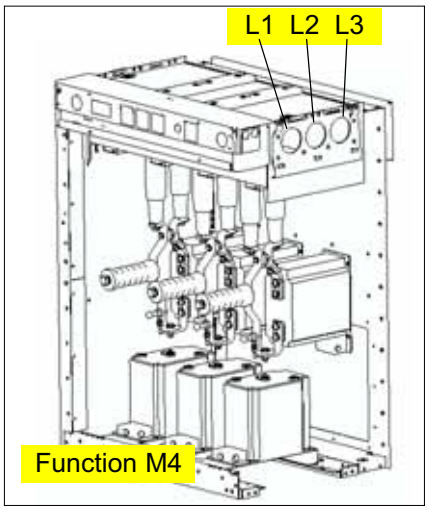
12.3 Connecting transformers in a Type M4 fonctional unit



- State on Delivery: The upper connection is not established.
- Unscrew the two screws (1).
- Unscrew the bolt (3).
- Pivot the connection vertically through 180°.



- Fix the bottom of the connection to the transformer using 2 x M12 screws (1).
- Fix the other end of the upper connection using an M12 bolt (2).



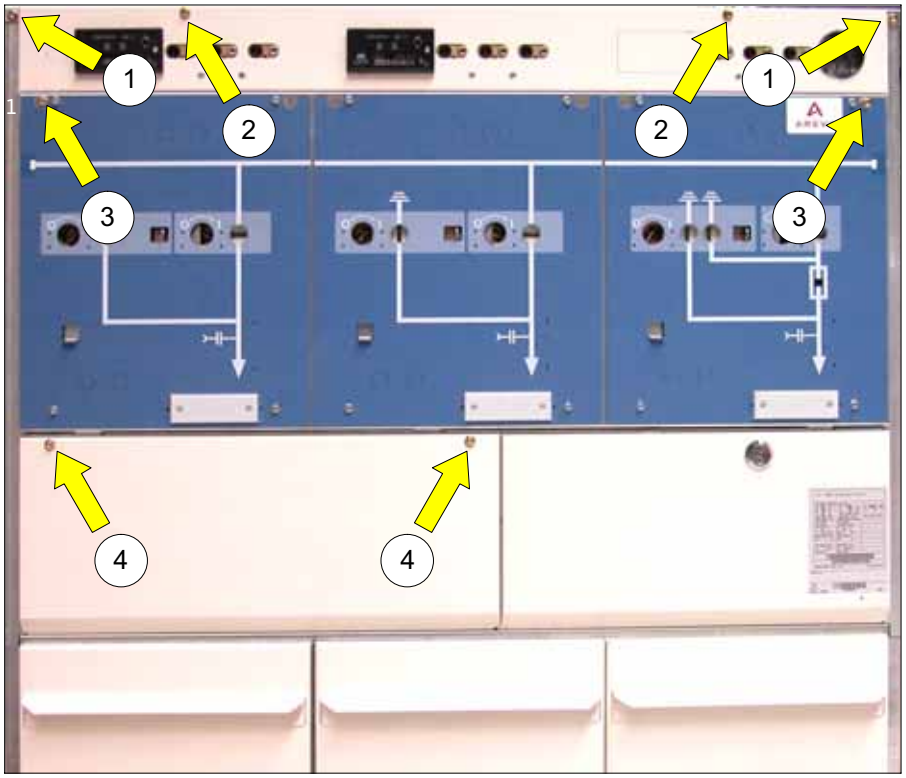
- Sectional view of the M4 functional unit.

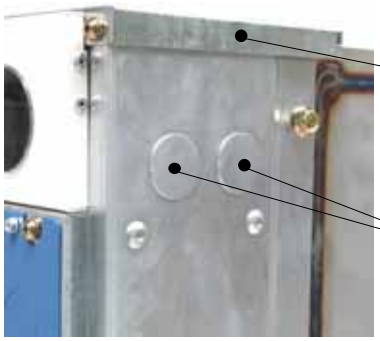
13 Low Voltage Connections

13.1 Intervention conditions (see § 9.1)

Intervention	Busbars	Cables	Interrupters	Earthing switches
Level 1	de-energized	de-energized	open	closed

13.2 Connection of the low voltage wiring





Loosen the two holding screws (3) and remove the mimic diagram panel.

Unscrew the two screws (2) from the indicator light protection panel then lift off by pivoting.

Unscrew and remove the upper roof panel, attached using two screws (1).

Unscrew the blanking panel below the mimic diagram (loosen 2 screws) (4).

Remove the cable compartment cover.

Route the external control cables (6) through and connect them to the flat terminals (5) as shown in the wiring diagram provided with the order (see § 13.3).

Refit the panels

Once the low voltage wiring has been connected, continue with the refitting of the other panels in reverse order of fitting.

Other possible connections

The low voltage wiring connections can also be passed through the knock-out panels on the left or right hand side of the switchboard (see image on previous page).

To avoid damaging the wiring, the oblong holes must be fitted with cable glands or edge-protection.

13.3 Circuit diagrams

The following diagrams are given as examples only.

Please refer to the diagrams delivered with the equipment.

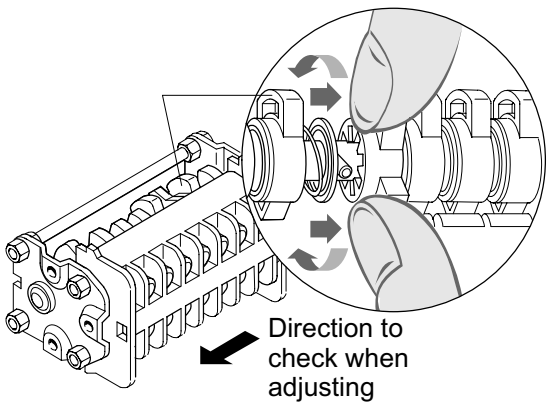
13.4 Switch position contacts [-Q11]

These have positive actions, operated by the corresponding load-break switch in parralel to the mechanical 'Closed'-'Open' indicator.

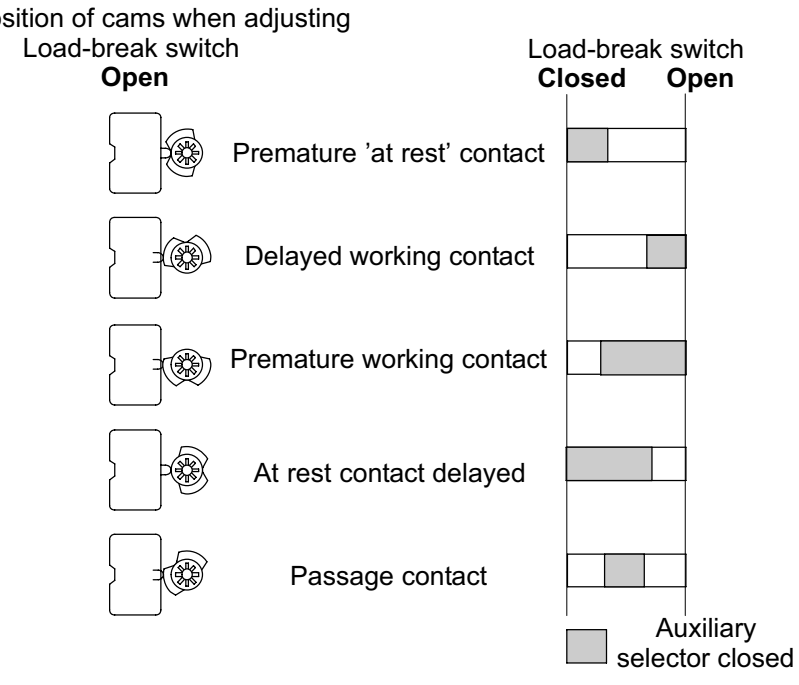
The auxiliary load-break switches are adjusted in accordance with the diagram supplied with the order (other settings are possible - see below).

The wiring diagrams (electrical connections) are supplied with the switchgear's documentation.

- Adjusting the cams on the auxiliary load-break switch



- Auxiliary selector-switch settings available (selector programme)

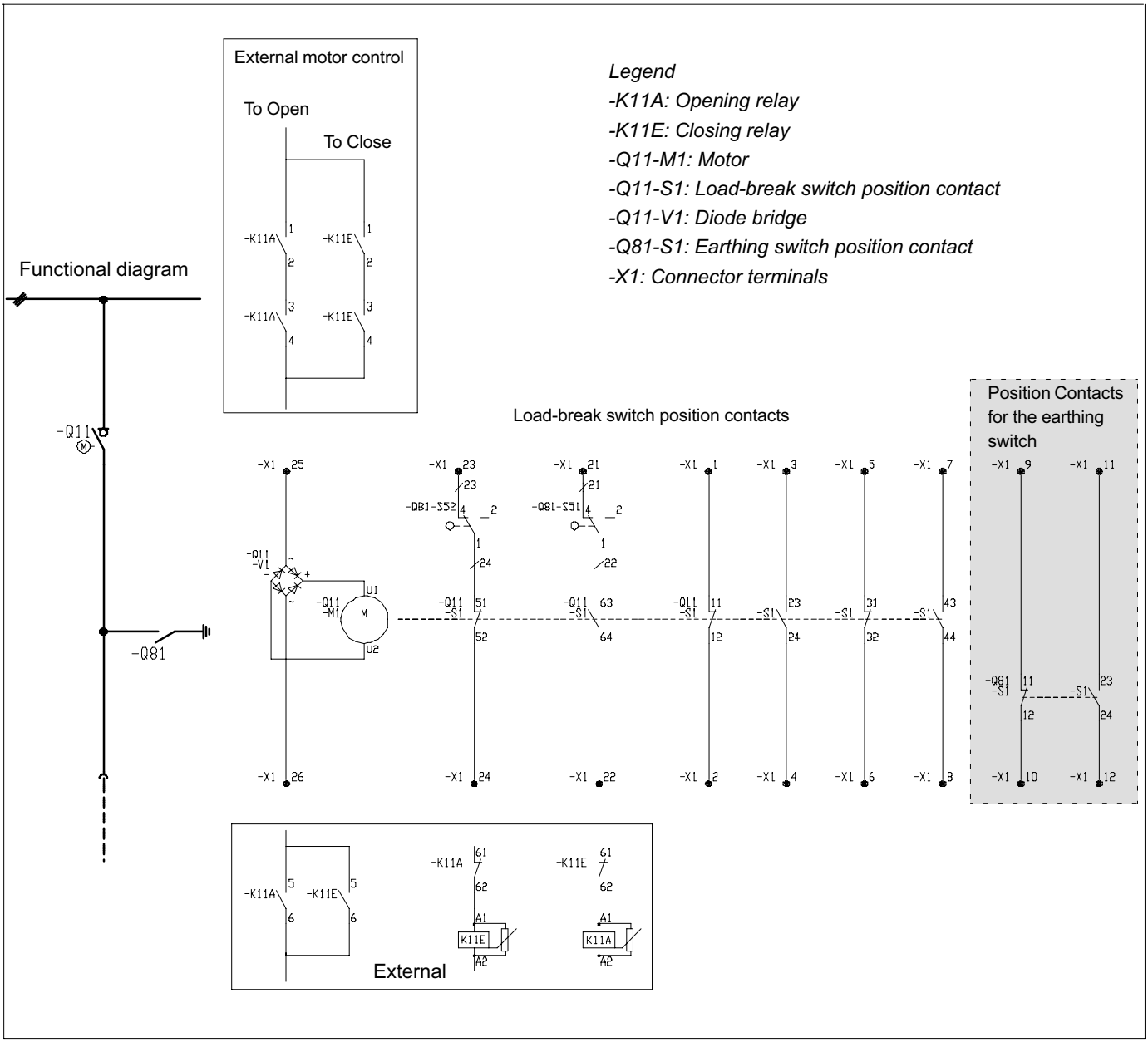


13.5 Earthing switch position contacts [-Q81]

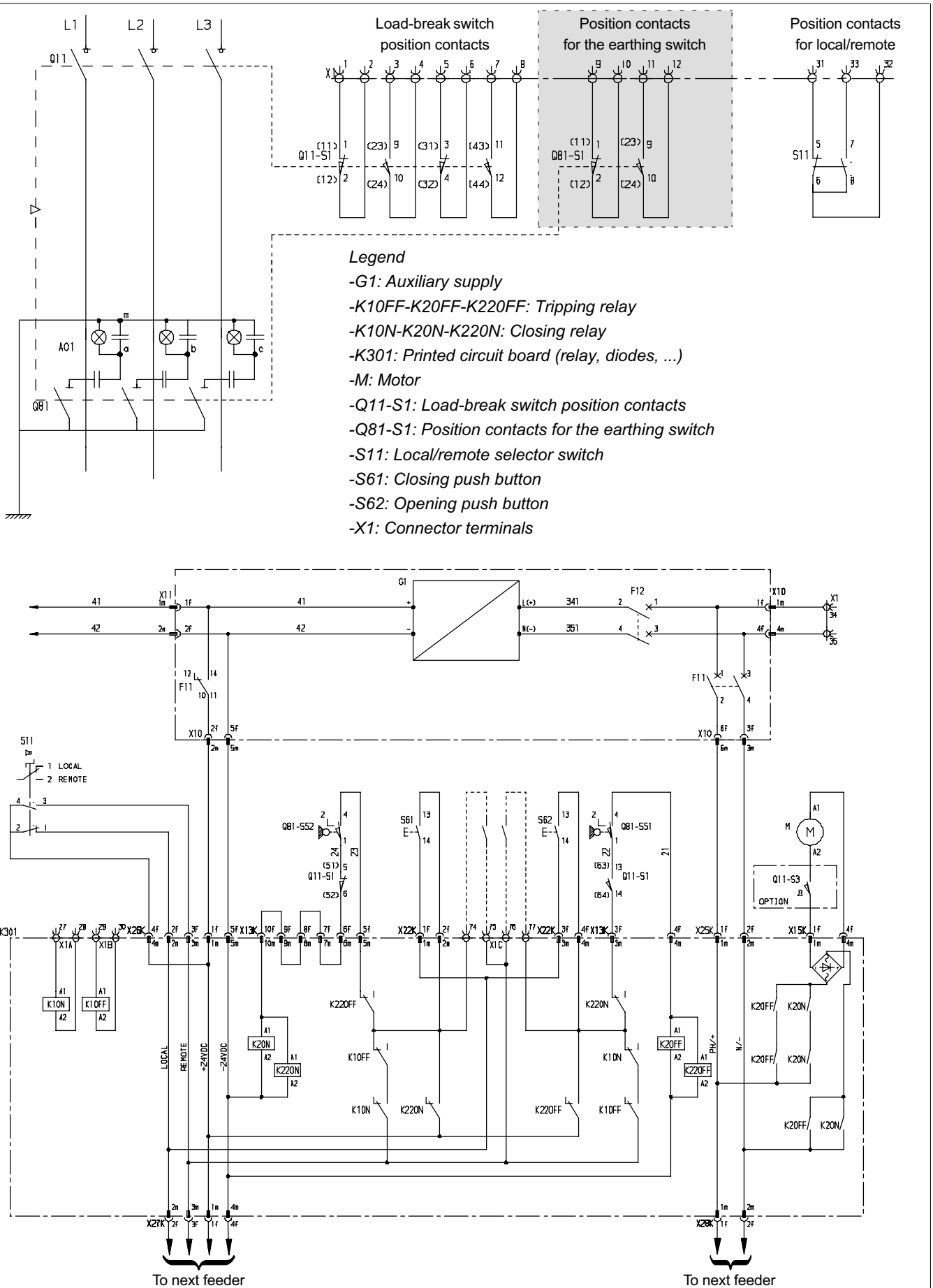
These also have positive actions, operated by the corresponding earthing switch in parrallel to the mechanical 'Closed' - 'Open' indicator.

The auxiliary load-break switches are adjusted in accordance with the connections diagram (other settings are possible - see above).

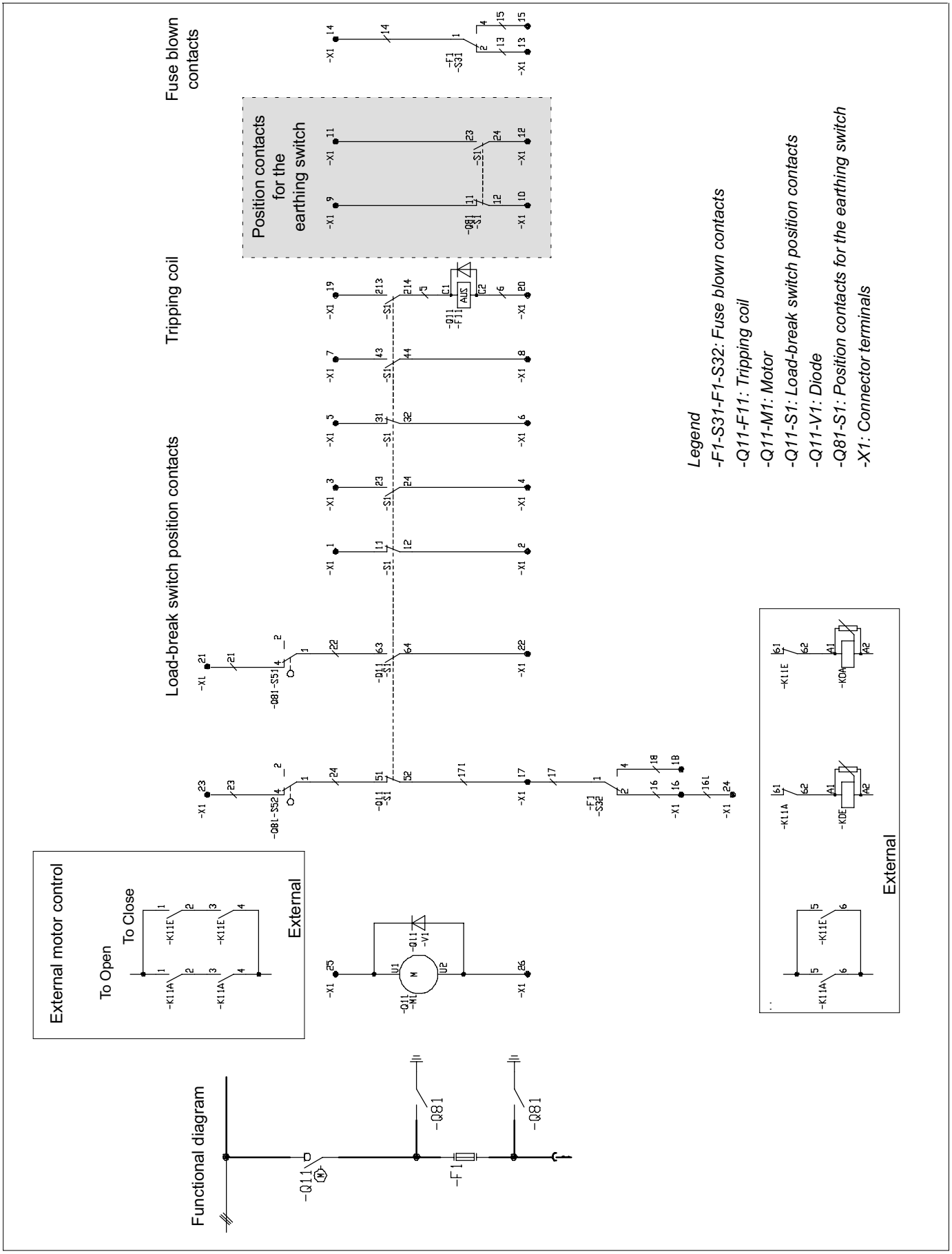
13.6 Standard diagram for motorised control (type AB2 - alternating current) for Function C



13.7 Standard diagram for motorised control (type AB3) for Function C

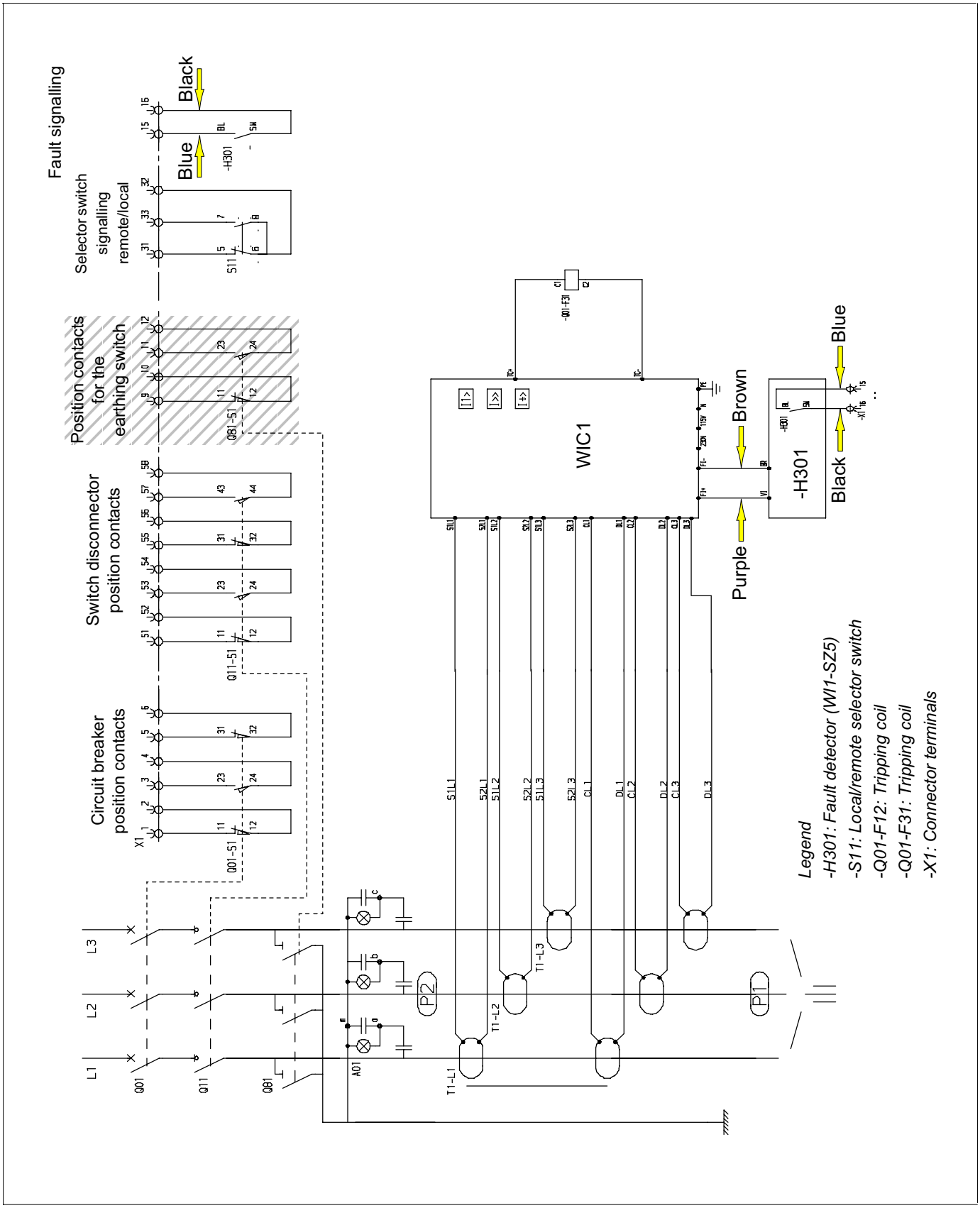


13.8 Standard diagram for motorised control (type AB2) for Function T1

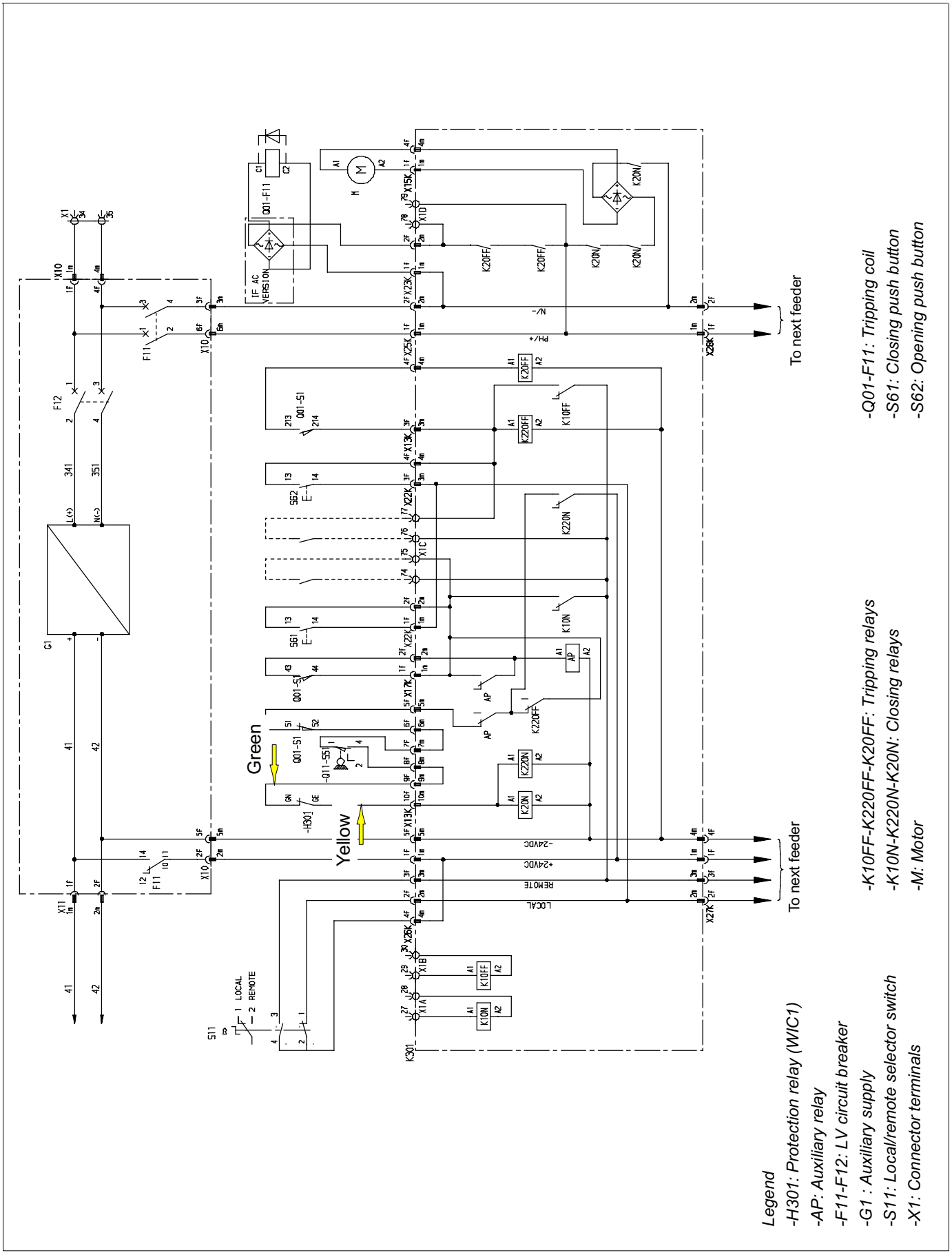


13.9 Standard diagram of a WIC1 protection (type AB3) for Function T2

“Measure - protection - signalling” part



“Control” part

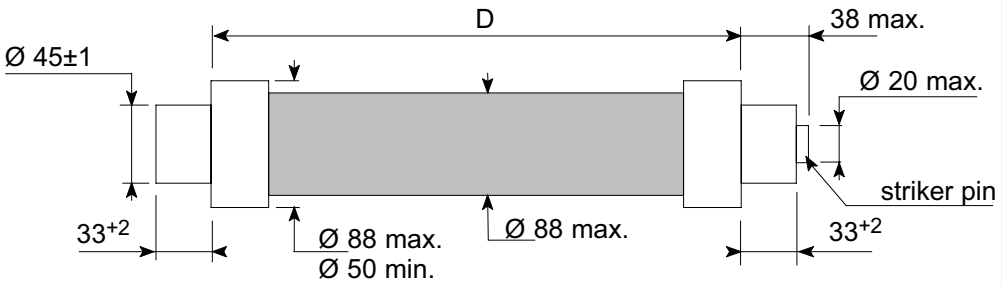


14 Fitting the HV fuses

14.1 Dimensions (mm) of the fuses – in accordance with standards CEI60282-1 and 62271-105

Voltage	D (mm)
upto 12kV*	292
17.5 kV	442
24 kV	442

* Possible also in 442 mm



14.2 Fitting of an adapter for fuses of upto 12 kV

14.3 Selection table for AREVA fuses (FDwT) with integrated strikers (for Function T1)

Un (kV)	Power of the transformer (kVA)																
	25	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600
	Fuses (A)																
3/3,3	10	16	25	25	31,5	40	50	63	80	100	125 (2)	160 (1) (2)	-	-	-	-	-
5,5	6,3	10	16	16	25	25	31,5	40	50	63	80	100	125 (2)	160 (1) (2)	-	-	-
6/6,6	6,3	10	16	16	25	25	31,5	40	50	63	80	100	125 (2)	160 (2)	160 (1) (2)	-	-
10/11	6,3	6,3	10	10	16	16	25	25	31,5	40	50	63	80	100	125	125	160
13,8	6,3	6,3	6,3	10	10	16	16	16	25	31,5	31,5	40	50	50	63	-	-
15	6,3	6,3	6,3	10	10	16	16	16	25	31,5	31,5	40	50	50	63	80	-
20/22	6,3	6,3	6,3	6,3	10	10	16	16	16	25	25	31,5	40	63	63	63	-

1) With optional mechanical delaying mechanism on the controls (80 ms)
2) Length 442 mm

14.4 SIBA fuse selection table

Type of Fuses	Un (kV)	Power of the transformer (kVA)												
		100	160	200	250	315	400	500	630	800	1000	1250	1600	2000
		Uk = 4%								Uk = 6%				
Siba HH-DIN	6	25	40	-	50	63	80	100	125	100	125	160	-	-	-
	10	16	25	-	32	40	50	63	80	63	80	100	100	160	160
	15	16	20	-	32	32	40	50	63	50	63	63	80	-	-
	20	10	16	-	20	25	32	40	40	40	40	50	80 (2)	100 (1)(2)	125 (1)(2)

1) With optional mechanical delaying mechanism on the controls (80 ms)
2) Specific type SSK fuses with 'slow' breaking curves

14.5 Fitting a fuse

The earthing switch must be closed
(See the operating manual - § 2.4).

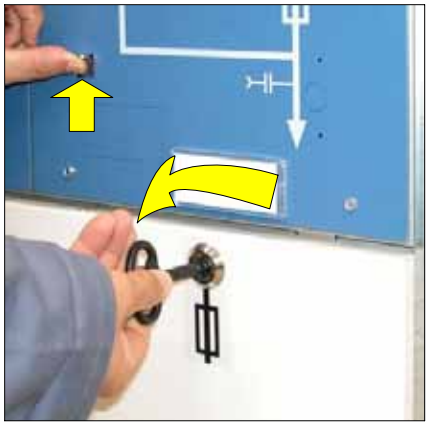
Open the access cover to the standard fuse holders

- Unlock the fuse compartment using the appropriate key.

- Lift the latch and open the panel.

- The end plugs of the fuse holders are now accessible.

Opening of the access cover to the leaktight fuse holders (by key or handle)



- Lift up the lock.
- Introduce the corresponding key and turn it to the left.

- Pull the cover towards the front until it stops.
- Turn the key in the reverse direction to unlock it.

- Open the cover completely to gain access to the leaktight fuse holders' plugs.

Fitting the fuses in place

- Pull the plug forwards without turning it.

- Remove the plug.

- Insert the new fuse into the housing and lightly tighten the small screw.

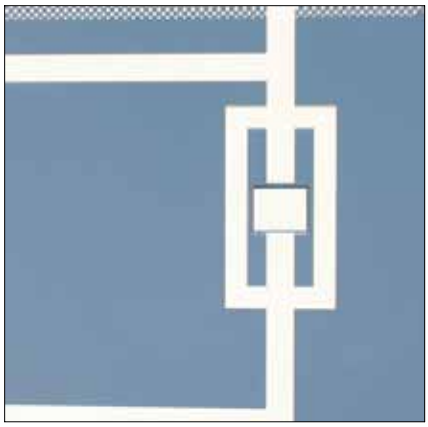
- Insert the fuse cartridge into its housing.

- Insert the fuse support lug into the slot in the insulated tube and press firmly.

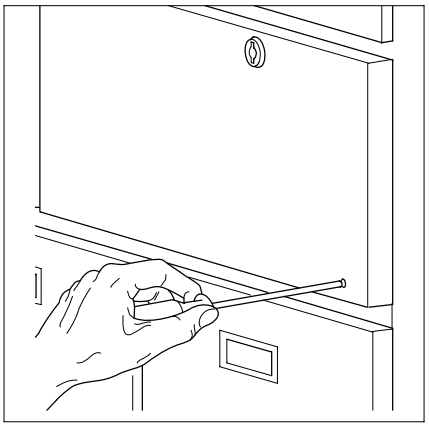
- Reclose the fuse access cover.
- Lift the latch and push the panel fully open.
- Lock the panel with the key.

14.6 Mechanical trip test on blown fuse

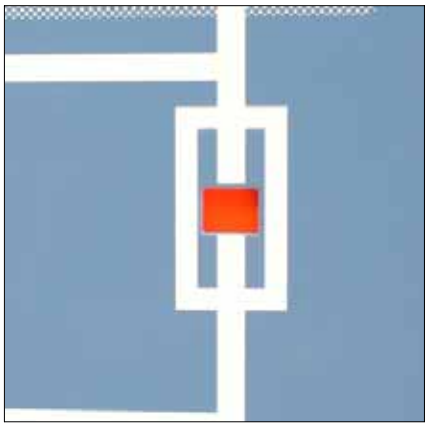
It is possible to test the mechanical trip mechanism activated by a blown fuse



- Check the tripping mechanism with the load-break switch ‘closed’.



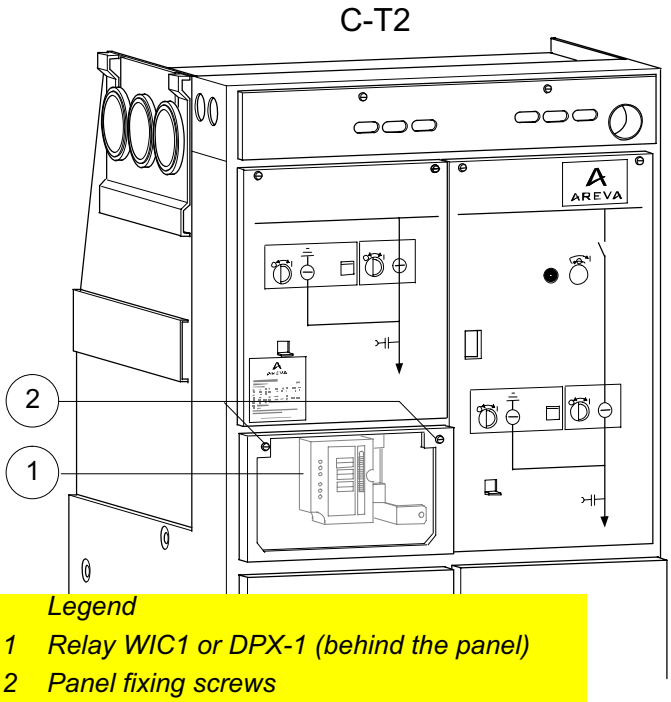
- Insert a Ø 2.1mm rod, W > 80 mm into the hole created for this purpose.

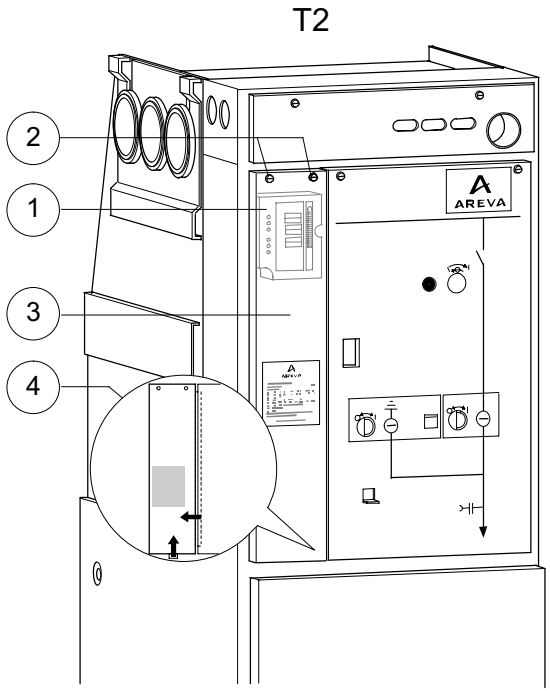


- Push it until it stops.
- Check that the fuse symbol is displayed red.

15 Protection Relays WIC1 or DPX-1

15.1 Location of the protection relays





0 Legend
- 1 Relay WIC1 or DPX-1 (behind the panel)
- 2 Panel fixing screws
- 3 Front panel

15.2 Access to the relays of a single T2 function (See markings in § 15.1)

- Remove the 2 screws (2) which hold the front panel (3).

- Lift the panel slighty and then slide to the left (4).

- The relay (1) is now accessible.

15.3 Setting of the protection relays

The relays are delivered set to their maximum values by default.

For the setting of the relays please refer to the instructions delivered with the equipment.

15.4 The protection relays WIC1 & DPX-1

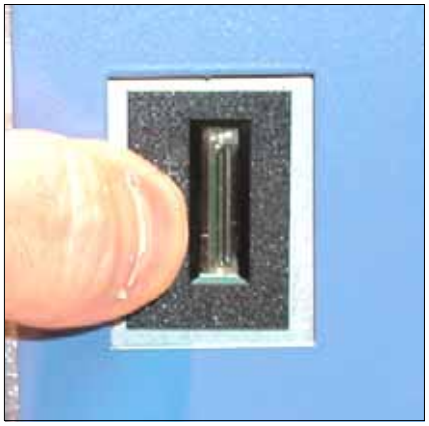
- **WIC1**: Stand alone protection relay (without earth fault detection).
  Option: with earth fault detection.

- **DPX-1**: Stand alone protection relay with earth fault detection and LED indicator:
  - Flashing green LED: OK
  - Permanent green LED: problem with the relay
  - Permanent red LED: detection of fault current.

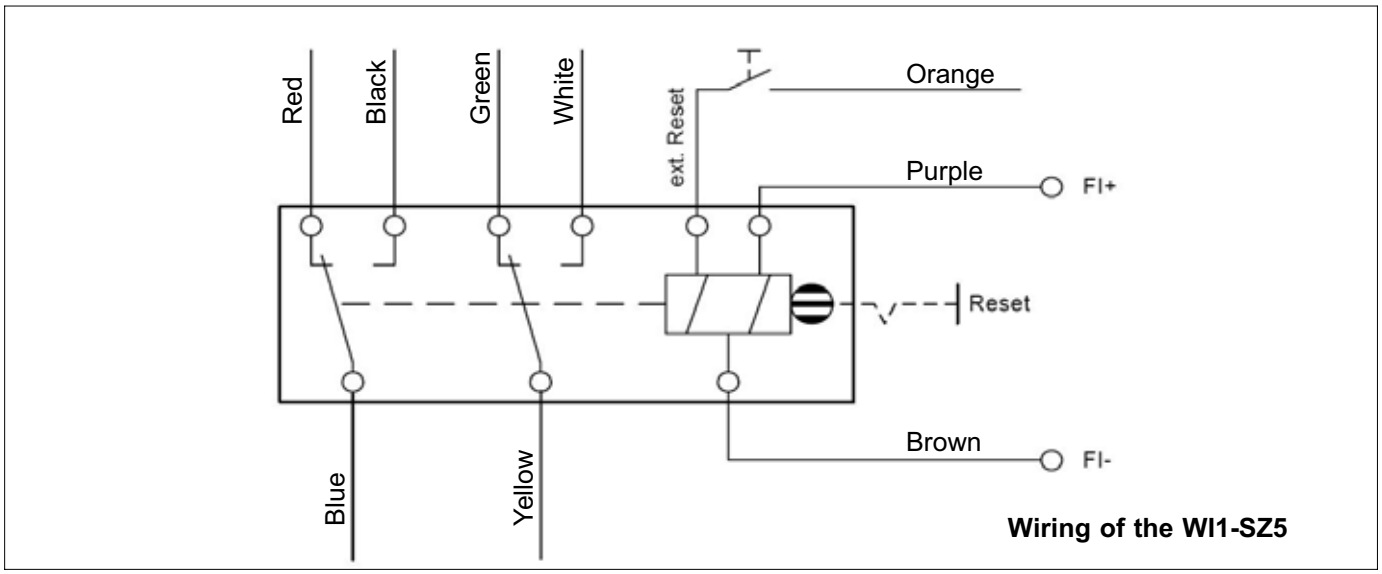
15.5 Fault indicator WI1-SZ5

- Normal indicator view (no fault).

- Indicator showing a fault (red).



- Push the green button to reset the indicator.



Wiring of the WI1-SZ5

16 Commissioning

16.1 Reminder

Prior to dispatch, FBX Switchboards are mechanically and electrically tested.

Also check the leaktightness of the room, the cable troughs, ventilation, etc.

16.2 Carry out an inventory of all tools and accessories on completion of the work

Recover, verify and tidy away all assembly tools and objects not required in the switchboard.

Store away, in their respective location, the operating accessories for the switchboard.

Attach the FBX technical notice in a visible location within the room.

16.3 Pre-commissioning information

Respect the General Safety Instructions booklet for Electrical Applications and the particular regulations for the network concerned with regard to locking-out procedures.

Check and record the serial numbers and identifying marks on equipment and switchgear while they are accessible.

Refer to the drawings and diagrams supplied with the equipment. They describe the functionalities employed to carry out the level of operation required.

16.4 Principle pre-commissioning checks

Visual inspections	Date	Remarks	Signature
- Ensure there are no foreign bodies inside the switchboard - Check the external appearance (no signs of blows, scratches on the paintwork) -- > carry out touch-up repairs if needed. - Check the conformity with the Protection Index (leaktightness of the Functional Units, various blanking panels, etc.). - Ensure that the insulating blanking plugs are fitted on extendable switchboards.			

Tightening torque verifications	Date	Remarks	Signature
- Inspection of mechanical tightening torques, (assemblies, electrical connections, earthing circuits, cables, etc.).			

Operational verifications	Date	Remarks	Signature
- Repeat a couple of operations to check the functioning of the system for the circuit breaker and the earthing switch. - Verify, after each operation, the status of the position indicator			

16.5 Energizing the FBX switchboard

Before commissioning, the load-break switches, disconnectors and earthing switch must all be ‘open’.

When the switchboard incoming feeders are energise the voltage present indicators should flash or come on (depending on the equipment).

HR System (High Resistance)

The voltage (or total absence of voltage) is detected by a separate VDS – in accordance with IEC 61243-5.

The three phases must, in all cases, be verified.

Use the recommended voltage present indicators.

- The measurement plugs are fitted to each function of the FBX switchboard and blanked off during normal operations.

- Horstmann Luminous Indicators (HR-ST).

- Luminous Indicator (DSA2).

IVIS (Intelligent Voltage Information System)

The IVIS, with its integrated indicators, can be used to check for the absence of voltages in accordance with IEC 61243-5.

The lightning bolt symbol signifies that a voltage is present.

The IVIS unit does not require initial operating tests prior to detecting a voltage.

The IVIS unit does not need an external power source.

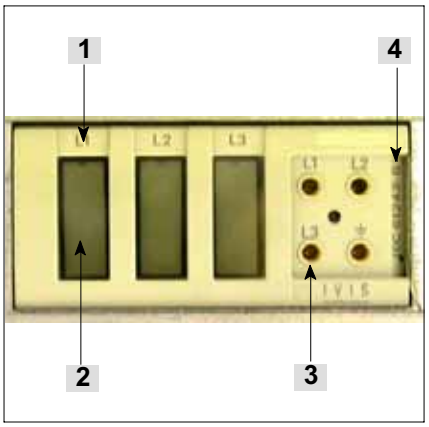
It is an electronic unit in a sealed box, insensitive to climatic conditions and completely maintenance-free.

For phase comparison, use an MS100 device.

See the corresponding manual for the use of the IVIS (See § 2.4).

Verification of phase concordance (for IVIS)

- IVIS display



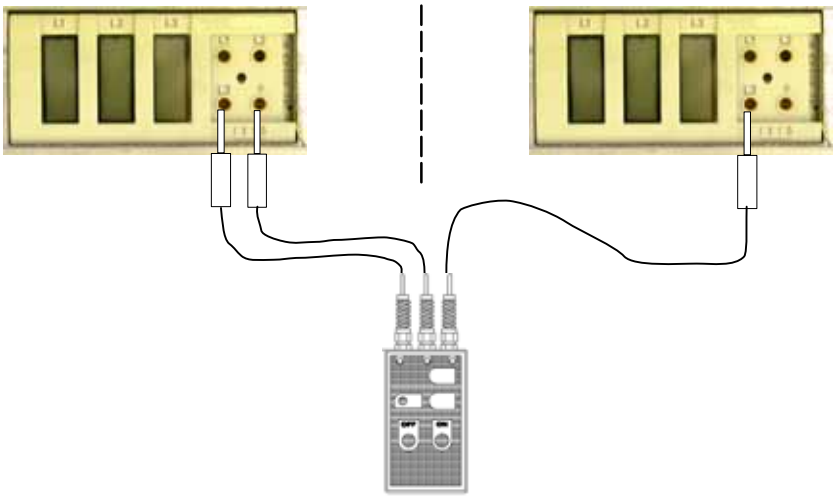
- Lift off the small protective cover to gain access to the terminals (**3**) and to visualise the indication of the standard (**4**).

This voltage indicator system is guaranteed in accordance with IEC 61243-5 (**4**).

For each of the phases L1, L2 and L3 [**1**] there is a corresponding indicator in the form of a bolt of lightning [**2**].

For each phase there is a connector terminal [**3**], accessible from the front panel, used to connect the phase comparator.

- Ensure the proper phase balance with the aid of an MS100 device.
  If the phases seem to be out of balance, check the cable connections.



Capdis KRIES

16.7 VPIS (Voltage Present Indicating System)

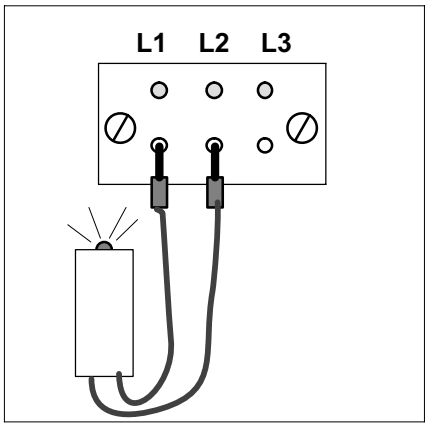
The VPIS unit is an integrated voltage detection system in accordance with IEC 61958. Used to indicate that a voltage is present across the cables.

This equipment cannot be used to check for an absence of voltage.

Voltage Present Indications verifications with a standard unit

- Standard unit (15-20 kV).

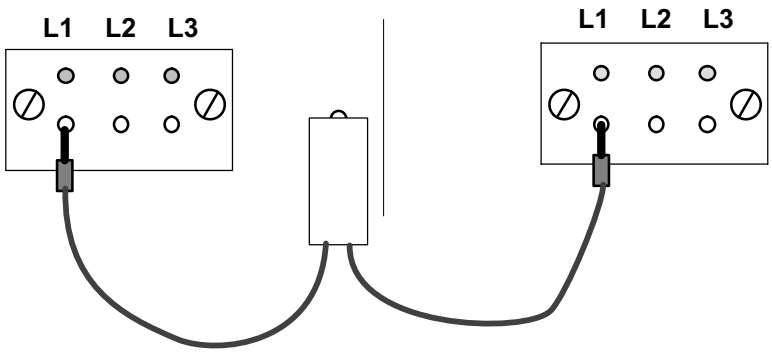
- Phase concordance can be verified with a specific phase comparator.



- Check the comparator between 2 phases of a voltage present indicator light: The lamp should light up.

Check phase concordance

- Connect the now verified comparator between the L1 phases on the two switchboard incoming feeder functions.
- Phases balanced:
  The lamp on the unit is extinguished.
- Phases out of sequence:
  The lamp on the unit is lit.
- Repeat operation for L2 and L3.



Voltage Present Indications verifications with a Kries unit

- VOIS + (Kries) unit

- Kries Phase Comparator.

- See the manual provided with the comparator for operating instructions.

16.8 Starting up the switchboard

Close the breaking devices on the 'Incoming feeder' functions.

Close the load-break switch on the 'Transformer outgoing feeder' function.

See the specific instructions given in the appropriate manual (See § 2.4).

16.9 Short-circuit indicators (optional)

The switchboard may be fitted with short circuit indicators

In principle, there are two possible uses for short-circuit indicators:
- The short circuit indicators are attached directly to the HV cables. In this case, the cable compartment must be fitted with an inspection port (optional).
- The short-circuit indicators are integrated into the LV compartment. The three phases are displayed separately.

The short circuit indicators can be used with various functions:
- with manual reset,
- with automatic reset,
- with remote reset,
- with remote visualisation contact,
- with earthing fault indicator.

See the instructions supplied by the manufacturer of the short circuit indicators.

- Horstmann short circuit indicator.

17 Notes

If you have any comments on the use of this document or on the use of the equipment and services that are described in it, please send us your remarks, suggestions and wishes to:

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