



## FLUOKIT M24+

Installation  
Commissioning  
Operation  
Maintenance



**Instructions**





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# 1 AREVA at your service

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

If this is not the case, please refer to our Service Unit or to our 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 the 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.



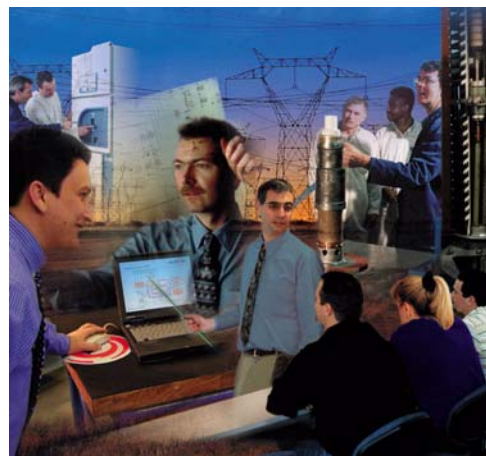
Contact the AREVA Service Unit for diagnoses and advice:

### Working hours

|           |                     |                                          |
|-----------|---------------------|------------------------------------------|
| Phone No: | 33 (0)3 85 29 35 00 | <u>7 days per week / 24hours per day</u> |
| Fax:      | 33 (0)3 85 29 36 30 |                                          |
| or        | 33 (0)3 85 29 36 43 | Free phone No: <b>0 800 40 27 62</b>     |

## 1.2 AREVA T&D Training Centre: your training partner

- A wide field of expertise:
  - study and design of networks and installations,
  - operation and maintenance of LV, HVA and HVB equipment,
  - application themes (electrical generating sets, diesel motors etc.),
  - electrical safety enabling the employer to give suitable authorisation to the people in charge of the operations and interventions on electrical equipment,
- training sessions in our centres or on site, defined according to your objectives and constraints,
- qualified trainers and experts in their field,
- practical work on real machines which represent more than 50% of the training period,
- an FIEEC Quality Training Charter member organisation and certified ISO 9001 version 2000.



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

### **AREVA T&D Training Centre**

130, Rue Léon Blum - BP 1321 - F-69611 Villeurbanne Cedex  
Tel.: +33 (0)4 72 68 33 86 Fax: 33 (0)4 72 68 35 17 E-mail: [formation.dafep@areva-td.com](mailto:formation.dafep@areva-td.com)

## 2 With regards to this notice

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trademarks. The other brand names mentioned within this document, whether they be

copyright or not, belong to their respective holders.

### 2.1 Eco-design concept and revalorization of the materials used

The design and manufacture of our packaging are both in conformity with the French government decree

N° 98-638 of 20 July 1998, concerning the account that is

taken of environmental requirements.

### 2.2 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,

- 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).

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

#### \* Permissible ambient temperature

The ambient air temperature should be comprised between - 5°C and + 40° C.

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

#### \* Installation altitude

HV equipment are 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 atmospheric relative humidity value measured over a period of one month must not exceed 90 %.

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 layout of the room or of the building (suitably adapted ventilation, air driers, heating etc.).

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

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



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).

### 2.4 Particular instructions for operation and intervention with 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.), as well as the operating instructions.

All manipulations must be completed once started.

The durations for carrying out the operations mentioned in the maintenance tables are given purely as an indication and depend on the conditions on-site.

### 2.5 Other technical notices to be consulted

- |                |                                              |                                                        |
|----------------|----------------------------------------------|--------------------------------------------------------|
| • AMTNoT100-02 | C410-C410M Mechanical controls               | Operation - Maintenance                                |
| • AMTNoT101-02 | C430-C430M Mechanical controls               | Operation - Maintenance                                |
| • AMTNoT102-02 | C440-C440M Mechanical controls               | Operation - Maintenance                                |
| • AMTNoT017-02 | BLR-BLRM Mechanical controls                 | Operation - Maintenance                                |
| • AMTNoT055-02 | FP Circuit Breaker                           | Installation - Commissioning - Operation - Maintenance |
| • AMTNoT099-02 | Standard mechanical interlocking by keylocks |                                                        |
| • AMTNoT093-02 | Civil Engineering Guide                      |                                                        |

### 2.6 Tools and products (not supplied) required for the operations described in this notice

- Cutter
- Crowbar
- Flat blade spanners size 10 ; 13 ; 16 ; 18 & 19 mm
- Ratchet handle + extension with socket sizes 10 ; 13 ; 16 & 18 mm
- Torque wrench with sockets size 10 ; 13 ; 18 mm
- Magnetic screwdriver + 3mm Allen key tip
- Flat headed screwdriver
- Allen key for sizes 4 ; 5 ; 6 ; 8 mm

- A dry cloth
- Solvent (di-electric resistance > 30kV), excluding chlorine based products
- Electrolube 2 GX - electrical contact grease from Comindus

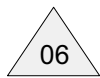
Product code

—

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22

## 2.7 Symbols & conventions



- Code for a product recommended and marketed by AREVA



- Torque value  
Example: 1.6 **daN.m**



- Mark corresponding to a key



**CAUTION!** Remain vigilant!  
Precautions to be taken in order to avoid any accident or injury



**FORBIDDEN!** Do not do it!  
The 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.

## 2.8 Tightening torque values for standard assemblies (nut + bolt)

Threaded fasteners without grease:  
assembly with ungreased washers.

Threaded fasteners with grease:  
mounted with the washer greased.

Use grease referenced:



| Dimensions | 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                                          |
| M 20       | 26.2                                               | 35        | 26.2                                          |

## >>> 3 Presentation

### 3.1 Description

FLUOKIT M24+ Functional Units are designed for indoor use.

The range meets the definition of switchgear of the type "under compartmentalised metal casing", in compliance with the design and construction rules mentioned in the Standards IEC 62271-200 and IEC 60466.

Each Functional Unit is divided into 4 separate compartments, separated by metal partitions:

- Telecontrol compartment,
- Busbar,
- Breaker switchgear or isolation switchgear, with an operating lever,
- Cables.

### 3.2 Dimensions and approximate weight of the Functional Units

| Functional Units                                                                | IS - PF - PFA |      | TM   |      | PGB - PGC |      |      |
|---------------------------------------------------------------------------------|---------------|------|------|------|-----------|------|------|
| Width (mm)                                                                      | 375           | 500  | 375  | 500  | 750       | 875  | 1125 |
| Overall Depth (mm)                                                              | 1026          | 1026 | 1026 | 1026 | 1100      | 1100 | 1100 |
| Height (mm)<br><small>standard<br/>with deflector or LV box on the roof</small> | 1610          | 1610 | 1610 | 1610 | 1610      | 1610 | 1610 |
|                                                                                 | 1950          | 1950 | 1950 | 1950 | 1950      | 1950 | 1950 |
| Approximate weight (kg)                                                         | 115           | 125  | 195  | 210  | 410       | 460  | 510  |

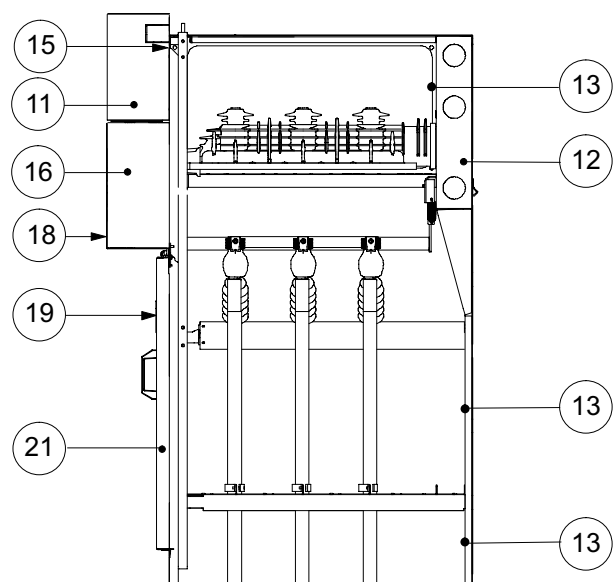
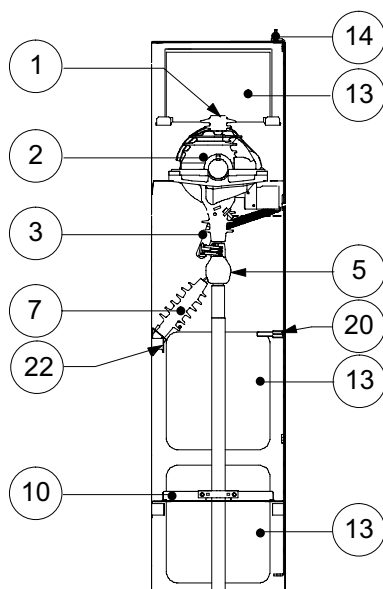


### 3.3 Presentation of the Functional Units

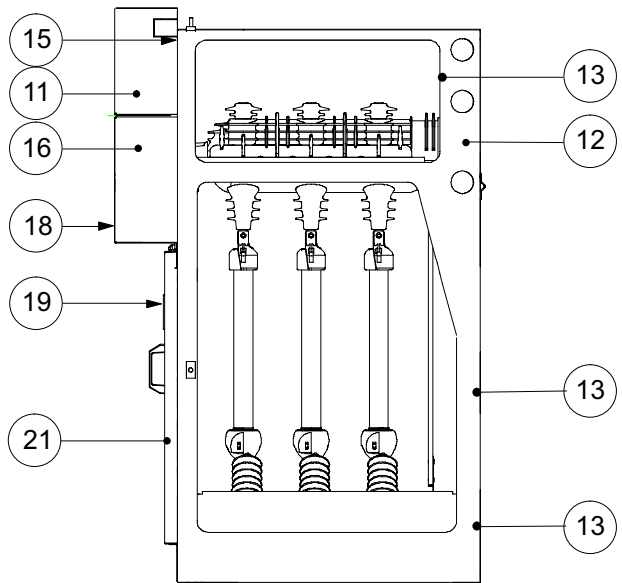
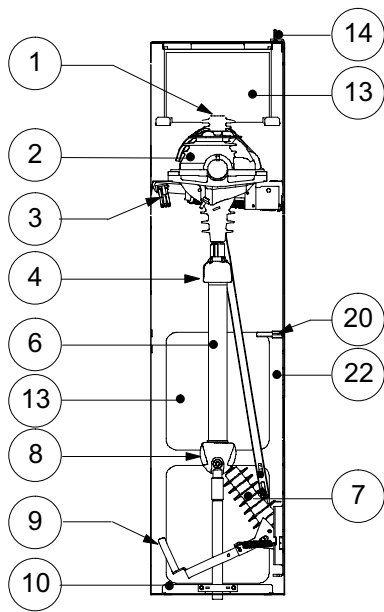
#### Key

- 1 Busbar connection plates
- 2 ISR switch-disconnector
- 3 Upstream Earthing Switch
- 4 Upper fuse support shell
- 5 Cable connections shell
- 6 MV Fuse
- 7 Capacitive insulator
- 8 Lower fuse holder shell
- 9 Downstream Earthing Switch
- 10 Base plate in 4 elements
- 11 LV casing
- 12 Exhaust shaft
- 13 Overpressure valves
- 14 Earthing bar connection point
- 15 Access panel to the busbars
- 16 Mechanical control mechanism for the switch
- 17 Circuit breaker mechanical control mechanism (BLR)
- 18 Voltage presence luminous indicators or interface for Voltage Detection System
- 19 Inspection window for checking the earthing switch position
- 20 Test pin for fitting the earthing block
- 21 Access panel to the cable compartment
- 22 ES location (LV capacitors)
- 23 Voltage transformers
- 24 Auxiliary contacts
- 25 Current transformers
- 26 Cable connection lugs
- 27 FP circuit breaker with interruption under SF6 gas

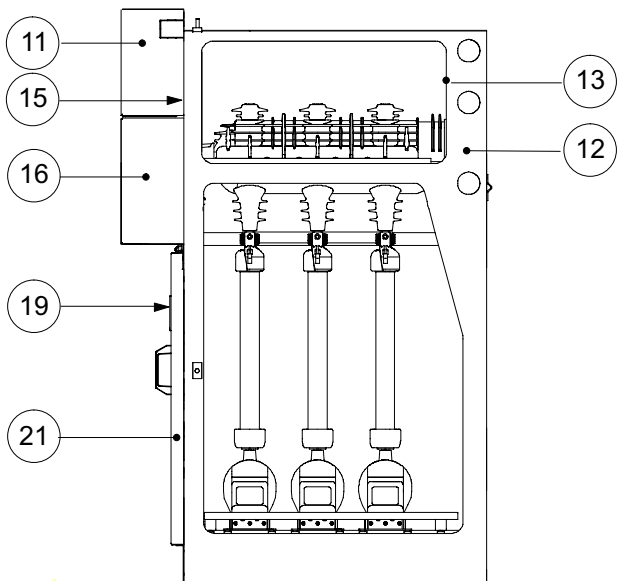
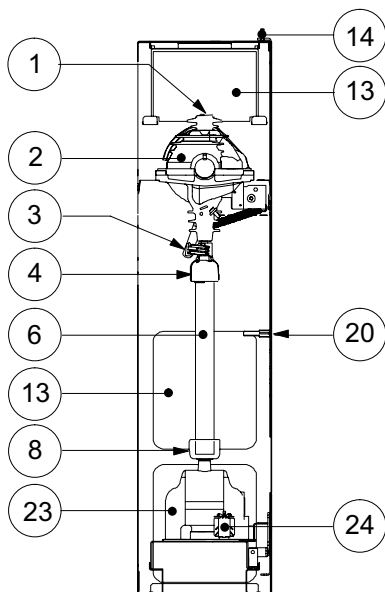
#### IS (Switch-Disconnecter)



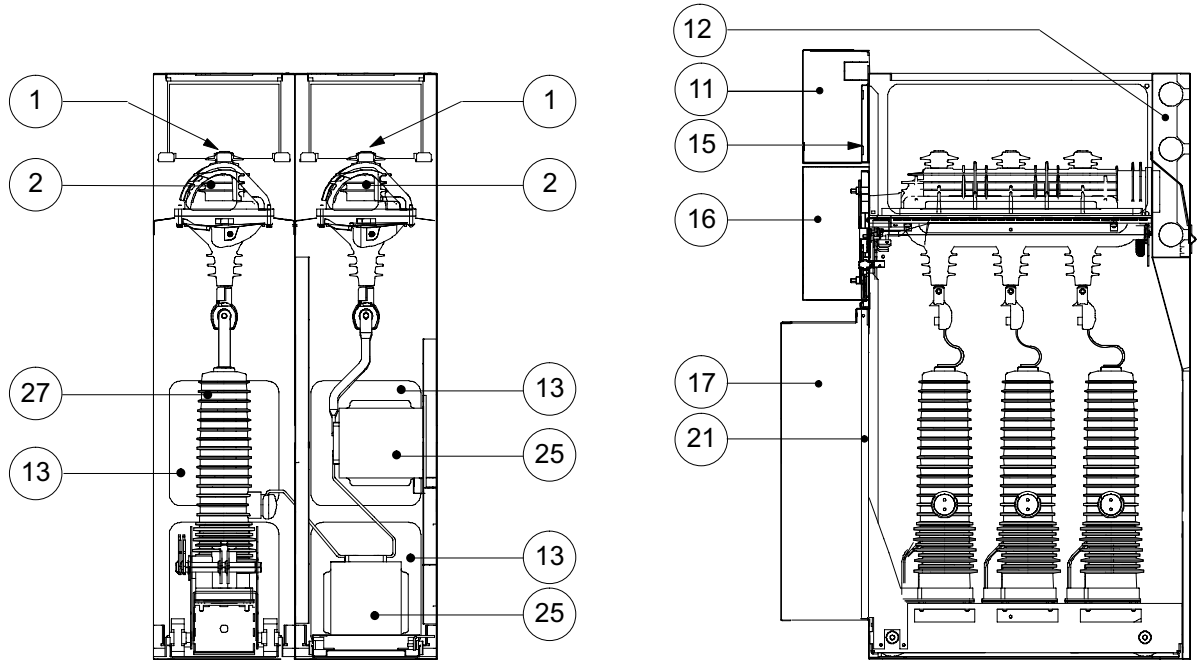
### PF - PFA (Combined Fuse Protection)



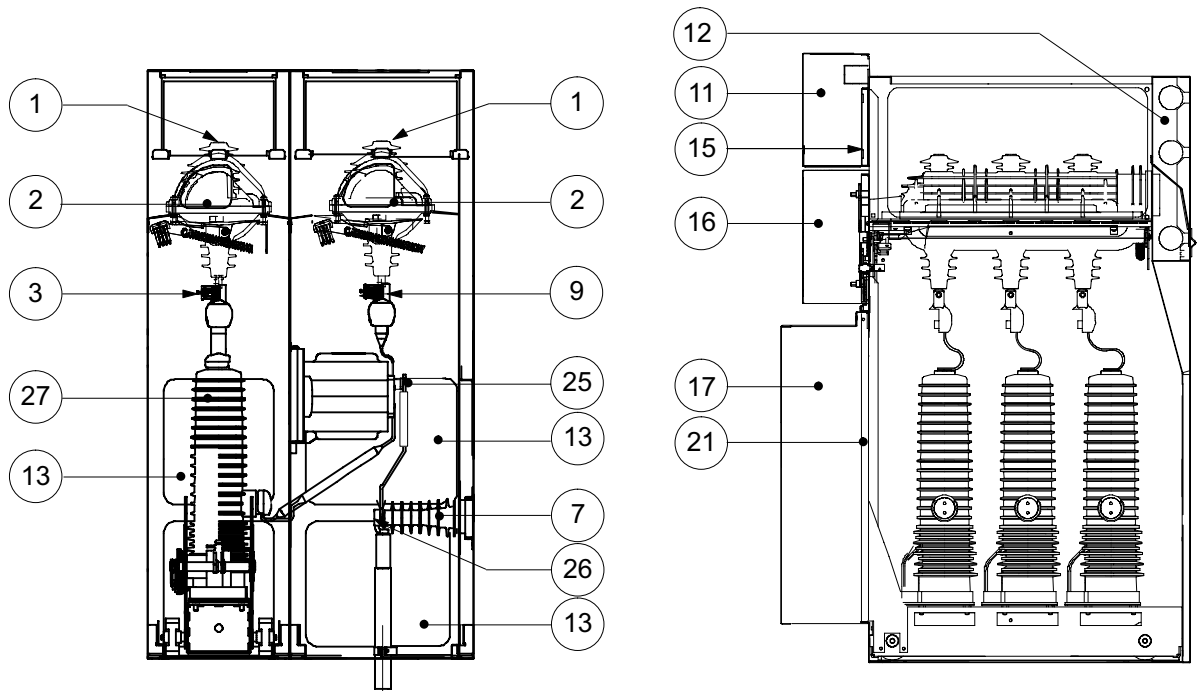
### TM (Instrument Transformer)



**PGB + current transformers + FP circuit breaker (General Busbar Protection)**



**PGC + current transformers + FP circuit breaker (General Cable Protection)**



# >>> 4 Packaging - Handling - Storage

## 4.1 Transport - Delivery

The conditions and methods of transport are defined with the customer, at the time of processing the contract.

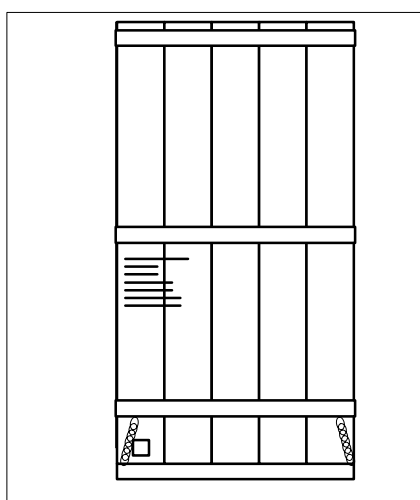
Packaging is dependent on the conditions of transport, storage and the nature of the product being transported.

 The Functional Unit must be handled and transported vertically (position shown below).

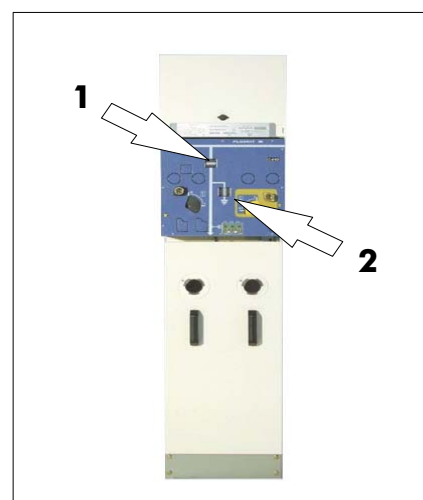
## 4.2 Packaging of Functional Units



- The packaging of a Functional Unit for road and rail transport:
  - fixed on to a wooden pallet or bound by hoops,
  - covered by plastic sheeting,
  - protection of the front face.



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



- Status of the equipment on delivery:
  1. Load break switch "Open"
  2. Earthing switch "Closed".

## 4.3 The accessories package

Contains all elements required for locating and connecting the Functional Units to busbar and cable connections.

## 4.4 Reception

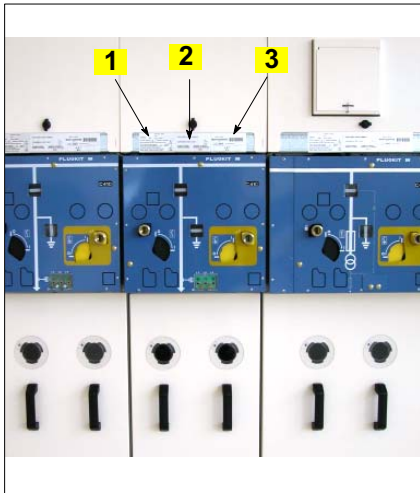
- Ensure that the material delivered is all there.
- Carry out a visual inspection of the Functional Units and moving parts.
- Verify that the accessories are present in accordance with the attached list.

- Check the characteristics shown on the name and rating plates, in relation to the initial order (voir § 4.5).

 In the event of an anomaly, inform and make the necessary reserves with the transporter.

 The Functional Unit must remain on its base, within its original packaging during any storage period and until it arrives at the location of its installation.

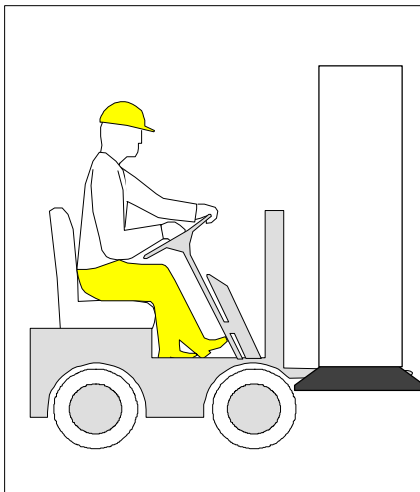
#### 4.5 Location of the technical data plates



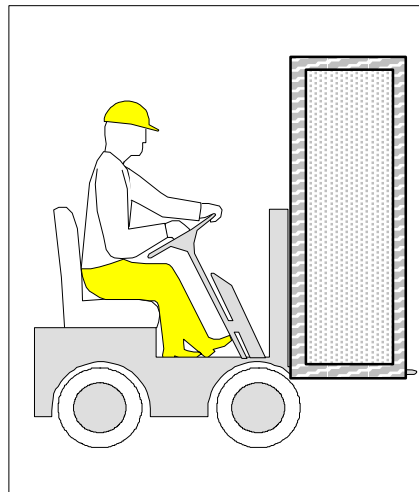
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | 2                                                                                                                                                                                |  | 3                                                                                       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------|--|
| <b>STANDARD NORME</b><br>FUNCTION / FONCTION: IS<br>TYPE:<br>WEIGHT / MASSE:<br>VOLTAGE / TENSION: 12 kV<br>FREQUENCY / FREQUENCE: 50 Hz<br>IMPULSE WITHSTAND VOLTAGE / TENSION TENUE AU CHOC: 125 kV<br>SHORT TIME WITHSTAND CURRENT / COURANT COURTE DUREE ADMISSIBLE: 16 kA<br>DURATION: 1 s<br>PEAK SHORT TIME WITHSTAND CURRENT / VALEUR CRETE COURANT COURTE DUREE ADMISSIBLE: 40 kA<br>NORMAL CURRENT / COURANT EN SERVICE CONTINU: 630 A |  | <b>ORDER NUMBER / NUMERO COMMANDE</b><br>CUSTOMER ID / REF. CLIENT:<br>UNIT / UNITE: 10<br>DIAGRAM NUMBER / NUMERO DE SCHEMA:<br>BUSBAR CURRENT / INTENSITE JEU DE BARRES: 400 A |  | <b>SERIAL / SERIE</b><br><b>M24+0340003</b><br>YEAR / ANNEE: 2003<br>CONFIGURATION:<br> |  |

- 1 - Technical characteristics.
- 2 - Identification plate.
- 3 - Allocation to AMT customer (references, order number, etc.).

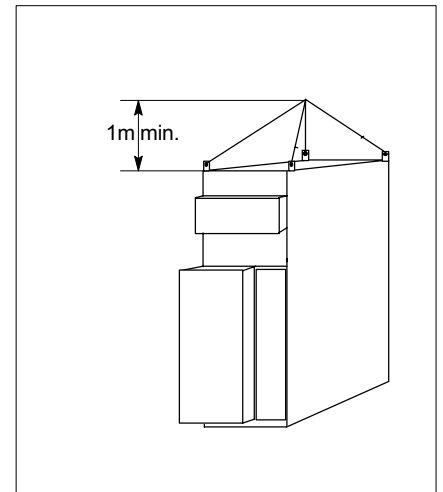
#### 4.6 Handling



- Road and Rail packaging (500 kg max.): using a fork lift truck.
- It is **imperative** to ensure that the forks of the truck are fully engaged throughout the entire width of the Functional Unit



- Packaging for air and maritime transport: Depending on the weight indicated on the crate.
- It is **imperative** that the forks of the truck are fully engaged throughout the entire width of the crate.



- Pass 2 slings, each one supporting **1,000 kg**.
- Remove the lifting parts after handling (4 screws, 13 mm spanner).



#### 4.7 Storage conditions

Ensure that the material is suitably packaged for the requirements of the planned storage period.

Preserve the equipment in its intact

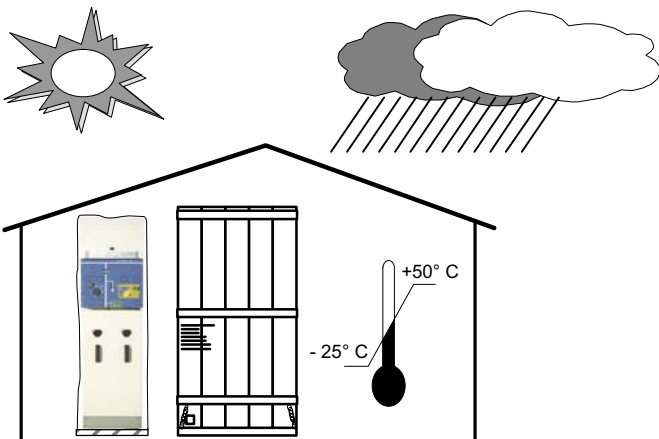
original factory packaging .

Avoid leaving the material where it is likely to be subjected to large, sudden temperature changes.

Ensure that there is a total absence of aggressive vapours [e.g. Sulphur Dioxide (SO<sub>2</sub>)].

The site chosen for storage must be capable of protecting the products against possible damage due to deterioration agents, such as:

- Water
- Water vapour
- Saline atmosphere
- All types of pollution
- Micro organisms.



Contact AREVA for any derogations to these criteria

#### 4.8 Intervention levels

| Description                                                                  | Levels |   |   |
|------------------------------------------------------------------------------|--------|---|---|
| Operations carried out by the Customer                                       | 1      |   |   |
| Operations requiring specific training, carried out by an agreed third party |        | 2 |   |
| Work to be carried out <u>exclusively</u> by AREVA                           |        |   | 3 |

#### 4.9 Specific recommendations for storage durations of less than 6 months

|                                                                                      | 1 | 2 | 3 |
|--------------------------------------------------------------------------------------|---|---|---|
| . Packaged under a plastic covering                                                  |   |   |   |
| Periodically carry out an inspection of the packaging                                | X | X | X |
| When unpacking, check the mechanical operation by carrying out about ten operations* | X | X | X |

#### 4.10 Specific recommendations for storage durations of between 6 and 12 months

|                                                                                                              | 1 | 2 | 3 |
|--------------------------------------------------------------------------------------------------------------|---|---|---|
| . Protected by a heat-welded sheet, with desiccant sachets                                                   |   |   |   |
| Periodically carry out an inspection of the packaging (check that, among other things, there are no holes)   | X | X | X |
| When unpacking: - check the operation of the switchgear by carrying out several operations*                  | - | X | X |
| - test the min. threshold level (AC, 85% rated Un; DC, 70% of Un ) for the electrical operation of the coils | - | X | X |

#### 4.11 Specific recommendations for storage durations of between 12 and 24 months

|                                                                                                              | 1 | 2 | 3 |
|--------------------------------------------------------------------------------------------------------------|---|---|---|
| . Protected by a heat-welded sheet, with a method of replacing the desiccant sachets                         |   |   |   |
| Periodically carry out an inspection of the packaging (check that, among other things, there are no holes)   | X | X | X |
| Periodically replace the desiccant sachets                                                                   | X | X | X |
| On removing the packaging: - light maintenance work                                                          | - | - | X |
| - check the operation of the switchgear by carrying out several operations*                                  | - | - | X |
| - test the min. threshold level (AC, 85% rated Un; DC, 70% of Un ) for the electrical operation of the coils | - | - | X |

\* The pressure for an SF6 circuit breaker having travelled by air must be re-established to its rated value before any mechanical operation test.

# >>> 5 Unpacking and installing the equipment

## 5.1 Type of Civil Engineering

The installation of a switchboard requires a sufficiently flat and even concrete structure.

The dressing of a top coat of cement using a rule should eliminate any surface irregularities.

A layout on iron supports for levelling off is ideal as they will also serve as a guide for the adjustment of the cement top coat.

## 5.2 Surface evenness values

Overall evenness : A 2m rule, moved along the base should not highlight any irregularity of greater than 5mm.

Local evenness : A 20 cm rule, moved along the base should not highlight any irregularity of greater than 2 mm.

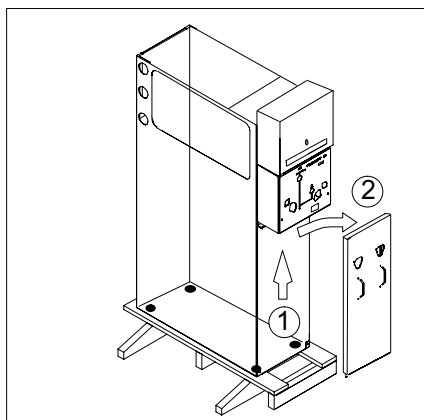
## 5.3 Unpacking the Functional Units

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.

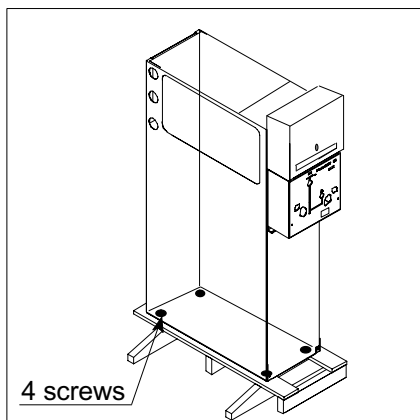
## 5.4 Handling the Functional Unit



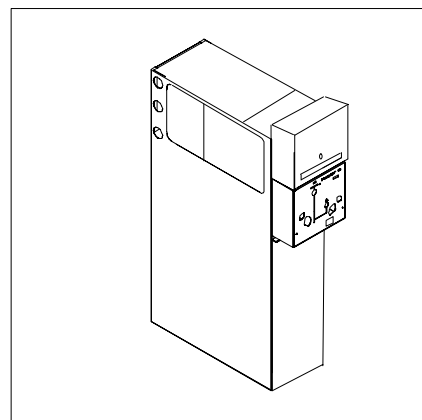
- Remove the protective plastic cover.
- Open the front panel:  
 1 - lift the panel  
 2 - pull the panel towards you.



Mark each panel in accordance with the corresponding Functional Unit



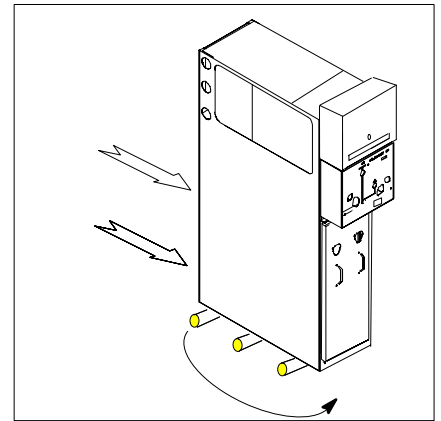
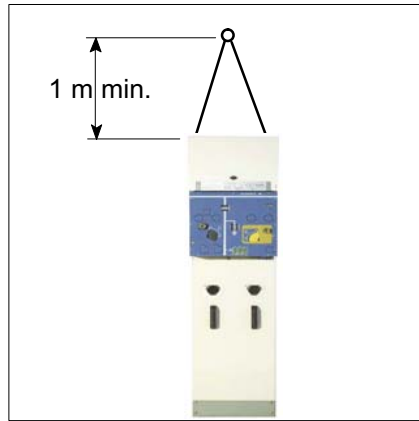
- Remove the 4 fixing screws (16 mm spanner) from the wooden base.
- Free the Functional Unit.



- Place the Functional Unit on the ground.



For the PGB and PGC Functional Units, remove the wooden base without extracting the circuit breaker.



- Four fixed slinging points are provided for on the roof of each Functional Unit.



These lifting lugs are to be removed when the Functional Units are in the immediate proximity of their definitive installation.

- Lift the Functional Unit by 4 slings each one capable of supporting 1,000 kg.
- Respect the minimum carrying height as shown on the above diagram.

- Slide the Functional Unit along, using three cylindrical rollers of 30 mm min. diameter.
- Thus moving it to its final installation place.

## 5.5 Installation of a switchboard

Please refer to the instructions in the Civil Engineering Guide (See § 2.5).

The limits of the civil engineering layout depends on the type and quantity of materials to be installed.

Position the cells whilst respecting minimum clearance distances in front of, behind and to each side of the switchboard.

## 5.6 Revalorizing packaging waste

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

# >>> 6 Installation

## 6.1 Installing Functional Units

For a switchboard consisting of 1 to 8 Functional Units, it is advised that installation of the materials

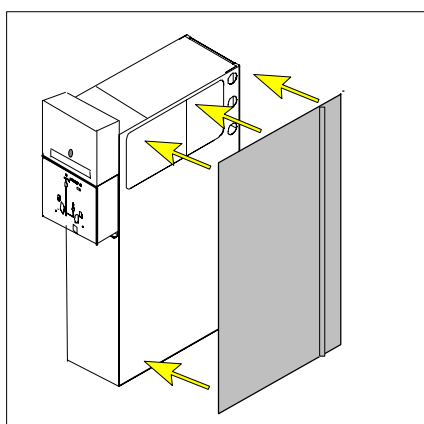
starts at the end of the room opposite the entrance.

For switchboards using more than 8 units, start by installing the equipment to the middle of the switchboard.

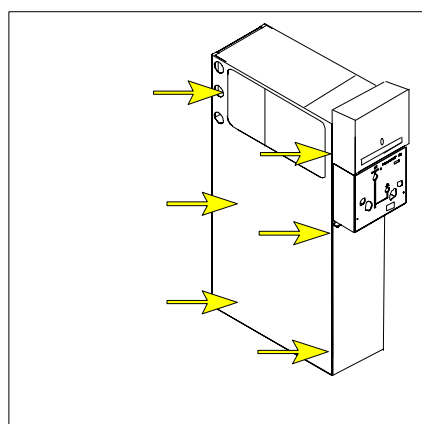
## 6.2 Installation of each Functional Unit

For all installation operations it is advised that you use suitable protective gloves.

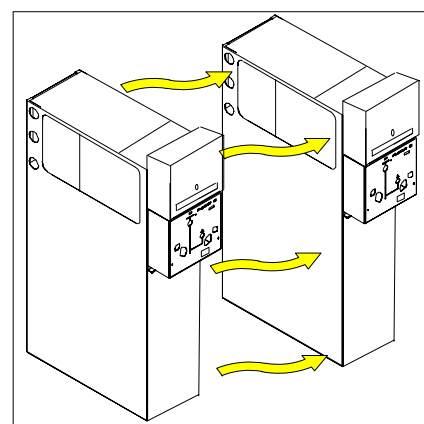
Organise the arrival of the Functional Units in accordance with the single-line diagram.



- To each far end Functional Unit fix the blanking off side panel.



- Position the first Functional Unit.
- Verify that it is upright.
- Mark out the 6 coupling points.



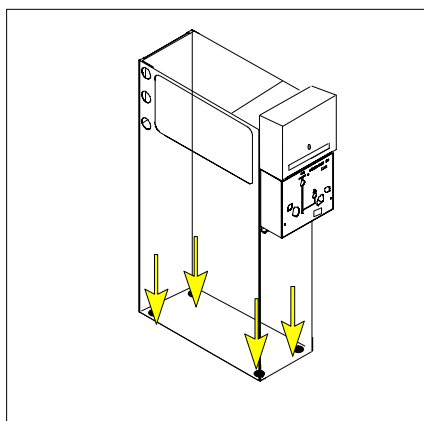
- Juxtapose the second Functional Unit.
- Align the front panels.
- Continue to install the Functional units whilst repeating the same checks each time.

## 6.3 Fixing the Functional Units

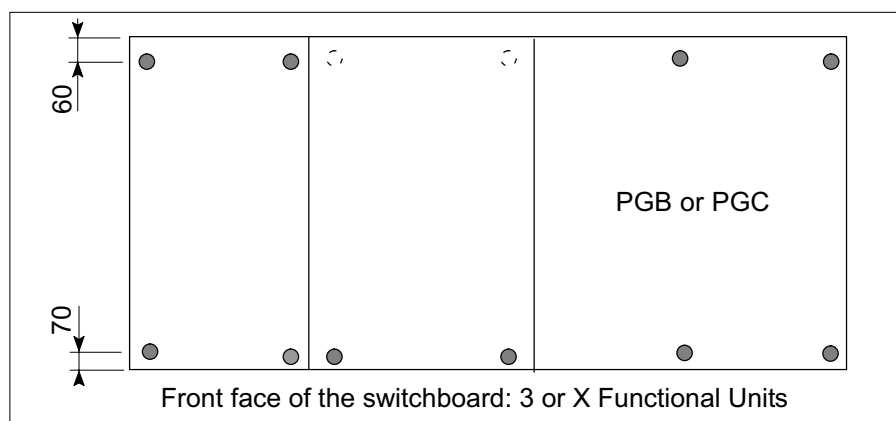
Fix the Functional Units to the floor, at two points in front and

2 points at the rear (H M12x30 bolts + flat washer Ø 32 exterior) or by 2 points in the centre for PGB and PGC.

Interconnect the Functional Units using the 6 fixing points (H M8x20 bolts).

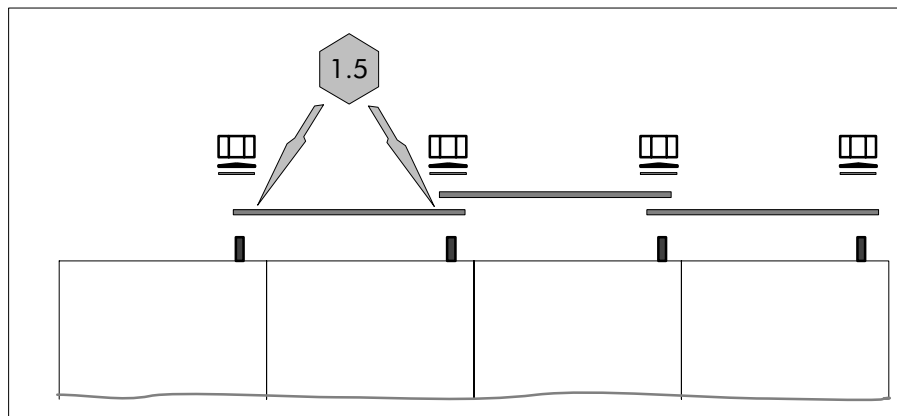


- 4 ground anchoring points (*Fasteners not supplied*).

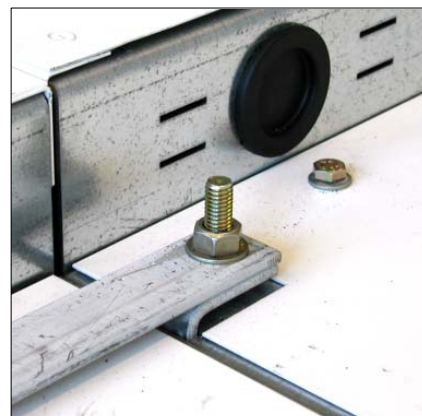


- The Functional Units at each end **must be anchored to the floor by their 4 fixing points**.
- With the exception of specific requirements (seismic resistance, vibration), it is possible to install just one of the Functional Units out of two at the rear.

## 6.4 Connection of the inter-Functional Units grounding circuit



- On the roof of the Functional Units, position and fix the earthing circuit bars (M8 washer + ES 8 washer + H M8 nut - 13 mm spanner).



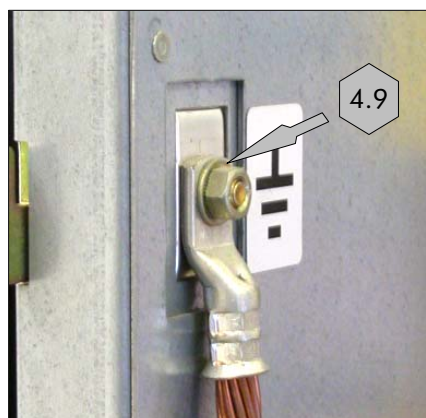
- Close-up of the connection.

## 6.5 Earthing the switchboard

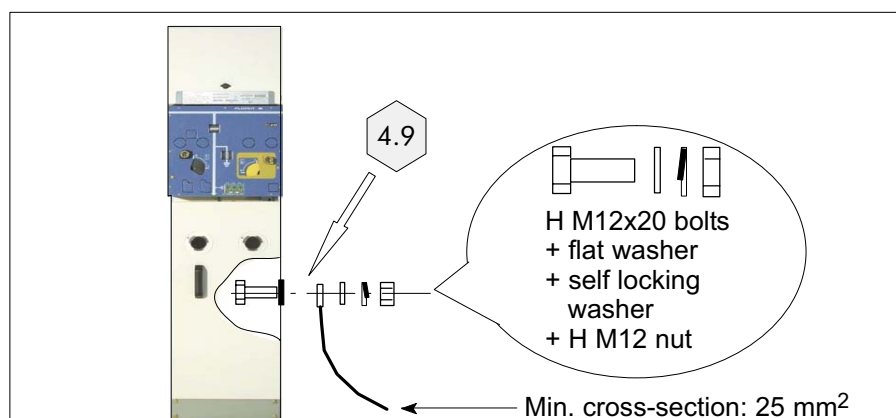
The general switchboard earthing connection to the ground electrode of the building is made via the Functional Unit to the extreme right of the set (viewed from the front).

The copper connecting conductor must have a minimum cross section of  $25\text{mm}^2$  (*fasteners not supplied*).

 Remove the plastic blanking panel to connect the cable.



- Connector point for the linkage cable to the ground electrode.



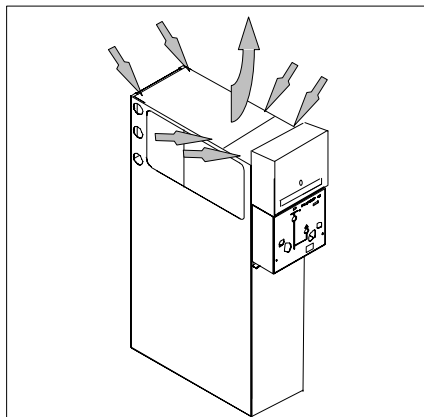
- Fit the bolt via the interior of the Functional unit, then attach the cable, the flat washer, the self-locking washer and finally the HM12 nut (*fasteners not supplied*).

## 6.6 Standard busbar connections

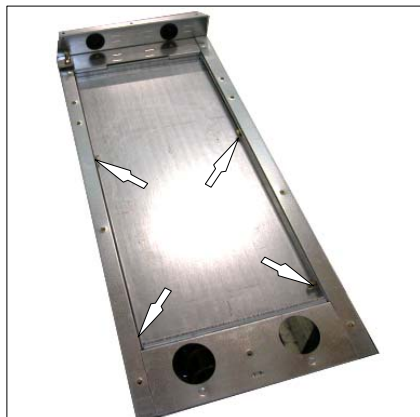
No preparation is required for the contact surfaces. A simple dusting down should be allowed for.

If the storage time has been long, ensure that there has been no trace of any knocks or oxidation.

In case of oxidation, lightly brush the parts with Vaseline, using a very fine metal brush.



- Gain access to the busbar by removing the first roof panel (fixing by 7 H M6 screws).



- Also remove the second panel (4 H M6x20 screws).

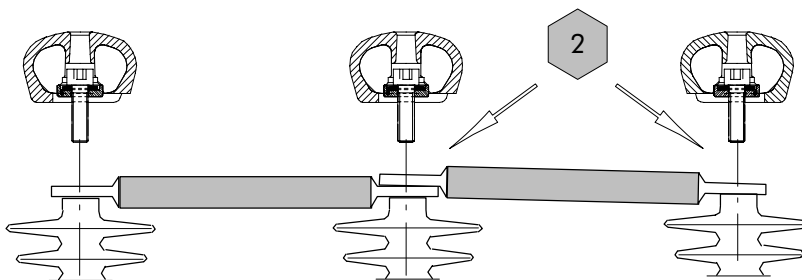


- The busbar assembly is accessible, as well as the front protection panel.



- Possibility of dismantling this panel to have access to the wires behind the LV box.

Use the deflector with a captive screw CHC, M10x35 (8 mm Allen key).



- Standard assembly of the bars on to the supply terminals.



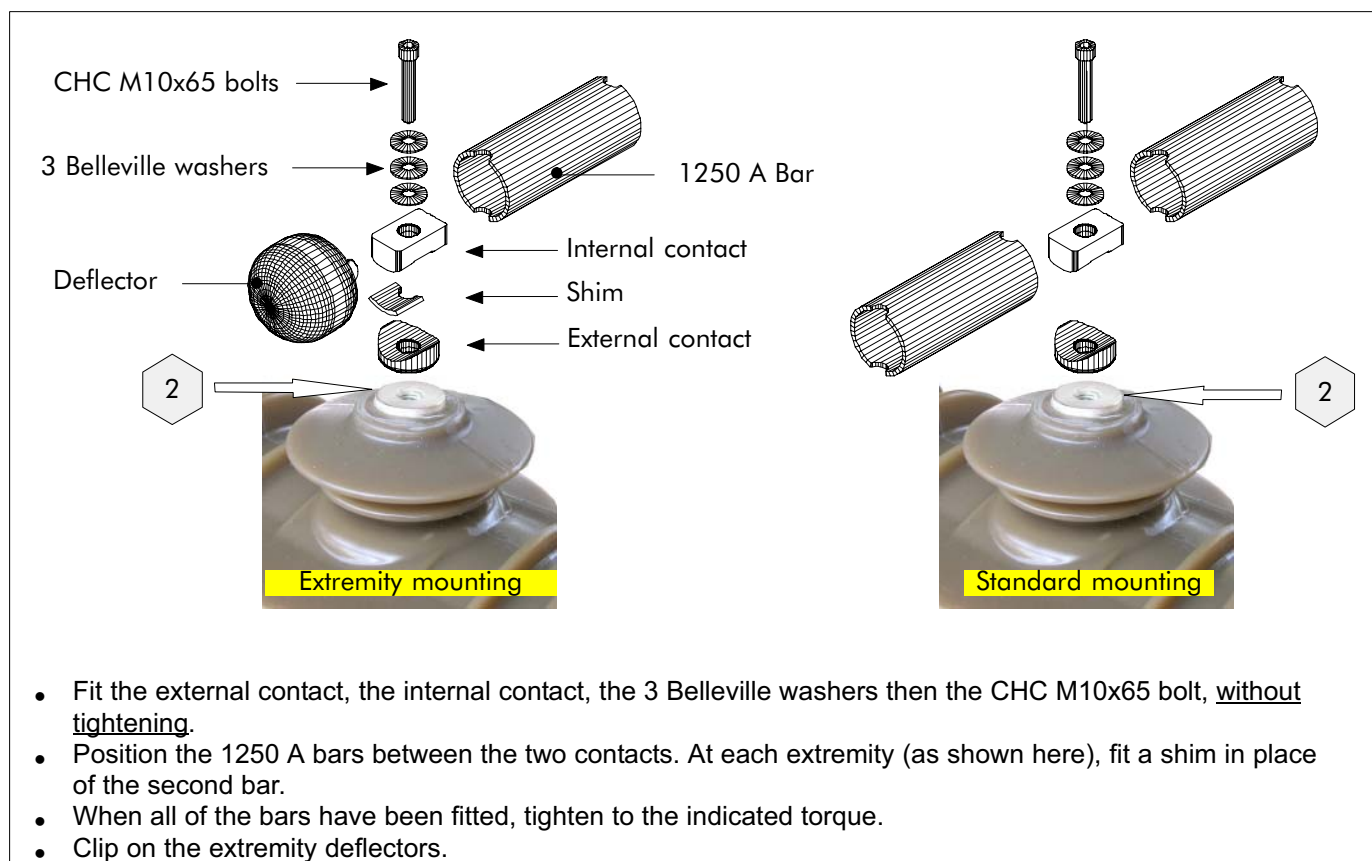
- Connection of the busbars between two Functional Units.



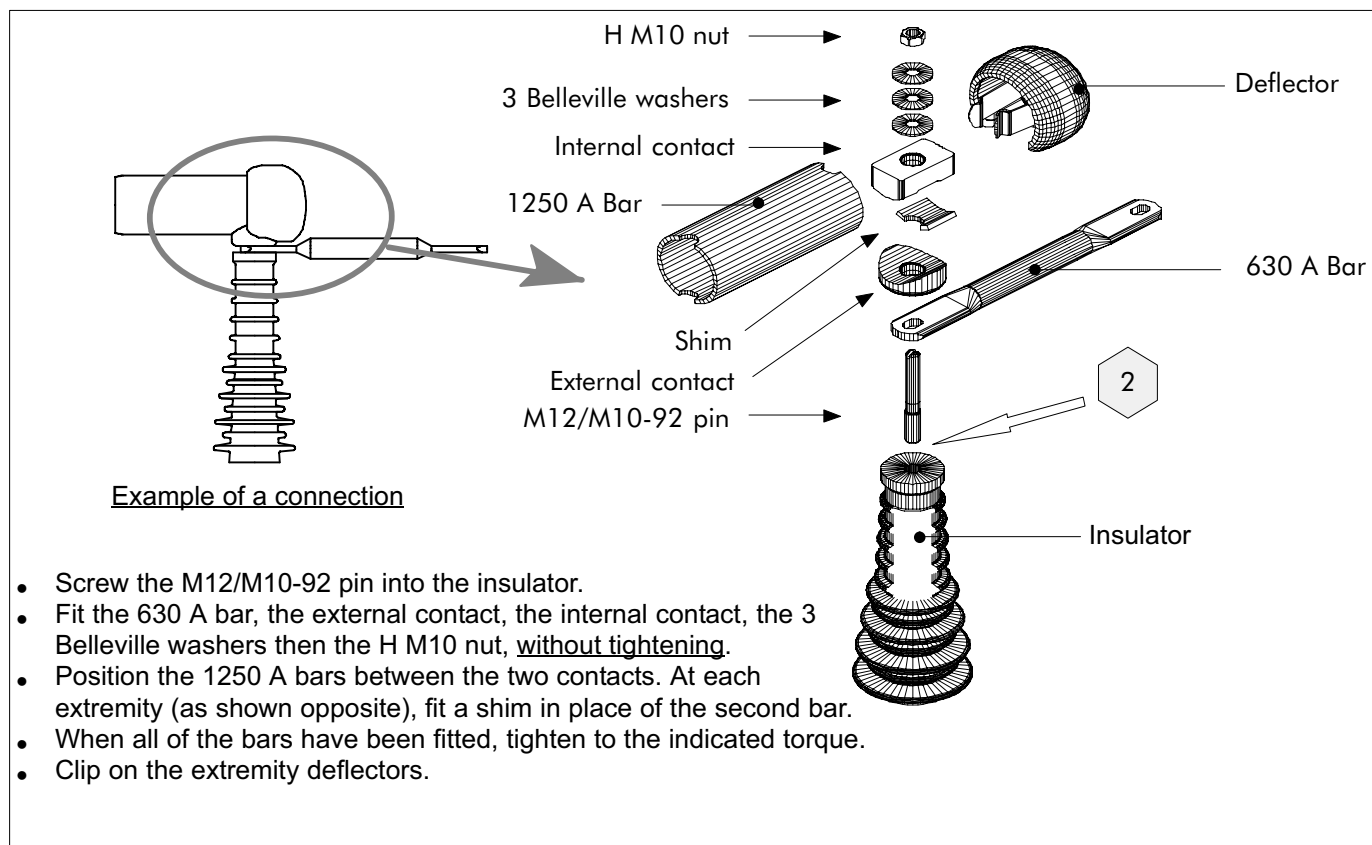
- Standard busbar connection



## 6.7 Connection of a 1250 A busbar



## 6.8 Connection between 630 A and 1250 A busbars

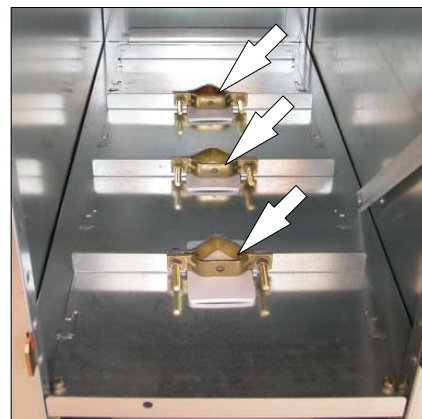


# >>> 7 Connection of the HV cables

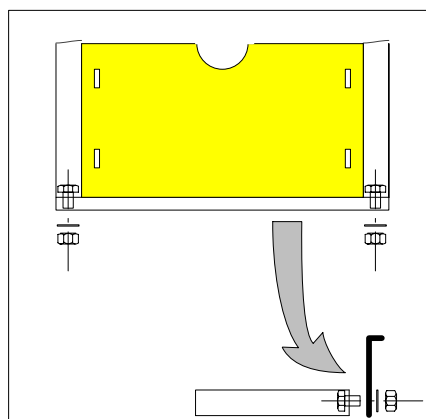
## 7.1 Preparation of the HV cable connections



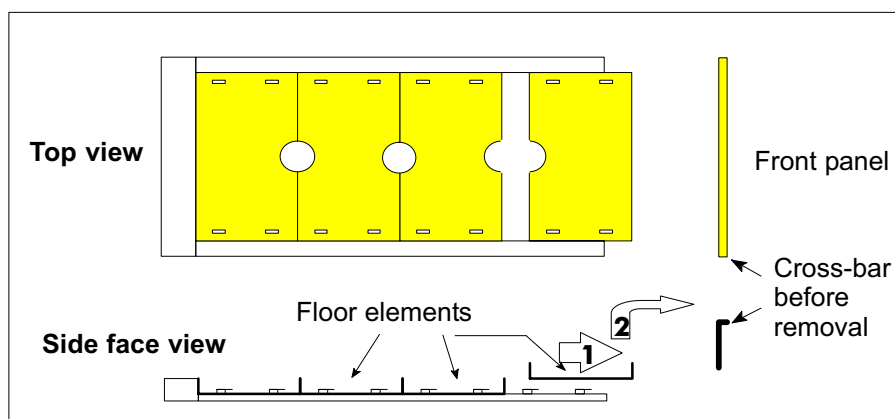
- State of the Functional Units after installation: all of the earthing switches are closed.
- Remove and mark the cable access panels in accordance with the Functional Units.



- Remove the upper cable tightening straps (2 H M8x50 screws).



- Remove the lower front cross-bar (2 H M8x20 bolts).



- 1 - Pull the first element towards the front.
- 2 - Lift up and extract this element.
- Proceed in the same way for the following two elements.



## 7.2 Connection instructions



- Use short cable terminations of the EUI-C type (with shells). They are compulsory for Functional Units PF - PFA - PGC

- The building of the extremity (*other than AREVA supply*) must be carried out in accordance with the manufacturer's instructions.

- The earthing braid for each cable must always exit above the bottom plate and the clamping collar.



- Leave 40mm of free clearance on the lug barrel for fitting the grounding clamp.

- Ensure the correct orientation of the contact plate before crimping it.

- There must be no stress tensioning the cable.



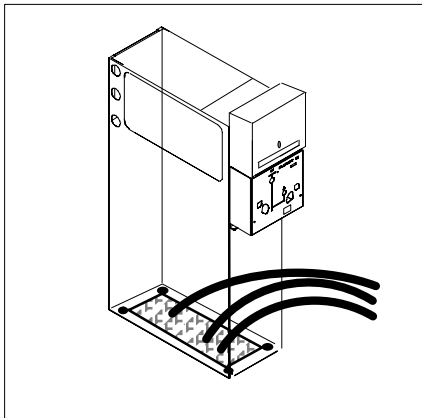
Never stick any phase markers to the cable end reassemblies

--> decrease in the dielectric strength and degradation over time.

- Never clamp the cable by its cable end.

- Never leave a washer in incompatible material between the lug and the connecting plate.

## 7.3 Preparation of the cables



- Pull out each cable from the opening via the front of the Functional Unit to make up the extremity.



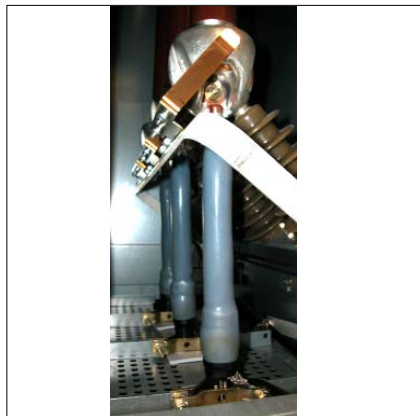
- Cut out each grommet to the diameter of the cable.



- Fit the grommet on to its cable.



- Example of a connection terminating in IS.



- Example of a connection terminating in PF.

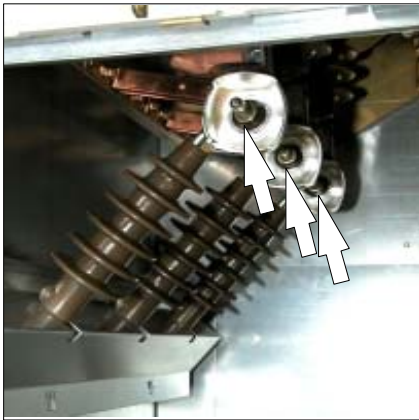
## 7.4 Connection of an IS Functional Unit

Legend for § 7.4 and 7.5

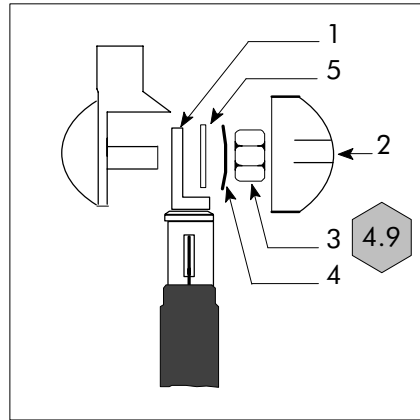
- 1 Round lug
- 2 Deflector
- 3 H M12 nut

- 4 Belleville Washer
- 5 Flat washer
- 6 Rectangular lug

- 7 Copper spacer (not supplied).
- 8 H M8 nut

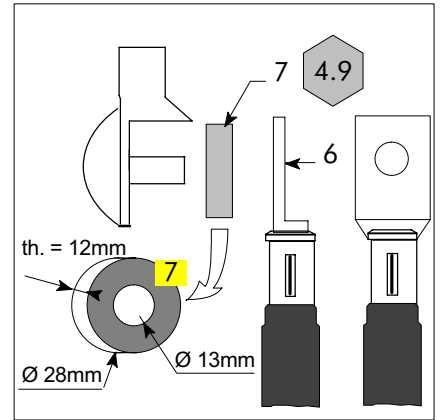


- Lift off the deflector, the H M12 nut and the two washers for each point.
- Connection is made by a round or rectangular lug.



Round lug connection

- Fit the lug which must hold firm against the contact plate.
- Fit the flat washer.
- Fit the Belleville washer.
- Screw in and tighten the nut to the indicated torque (18 mm spanner).
- Clip on the deflector.



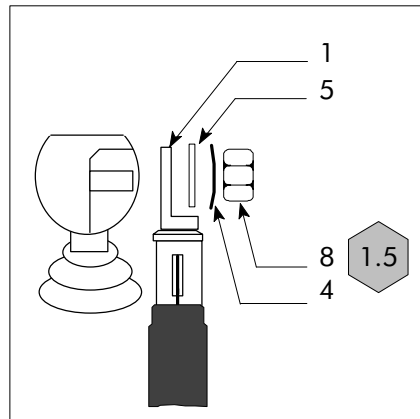
Rectangular lug connection

- Fit in place the spacer **in copper**.
- Position to hold firm the rectangular lug.
- Fit the flat washer.
- Fit the Belleville washer.
- Screw in and tighten the nut to the indicated torque (18 mm spanner).
- Clip on the deflector.

## 7.5 Connection of a PF or PFA Functional Unit

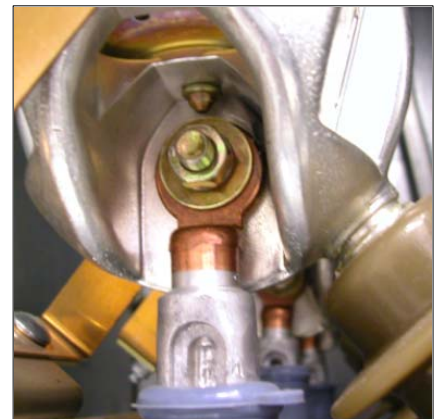


- Connection point.
- Begin the connections by the cable at the back.



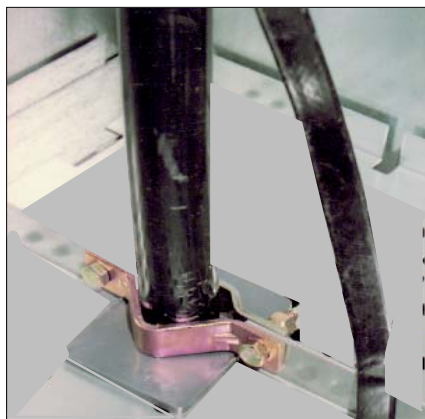
PF - PFA Connection

- Proceed in the same way as for the IS unit (§ 7.4).
- There is no deflector.

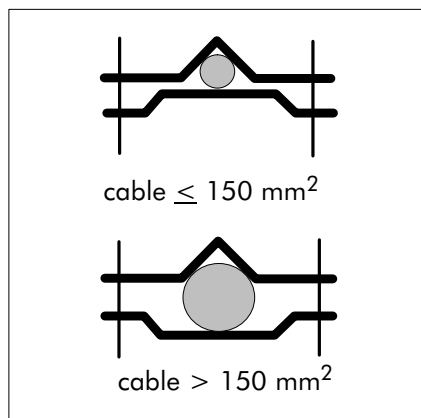


- Remove the H M8 nut and the two washers from each point.
- Connection is made by a round lug.

## 7.6 Clamping the cables and connection of the screen braids



- Place the second floor panel element.
- Fit the grommet firmly.



- Adapt the cable terminal straps (see further on) and tighten the nuts lightly (13 mm spanner).

- Repeat these operations for the other two cables.
- Remount the lower front cross-bar.

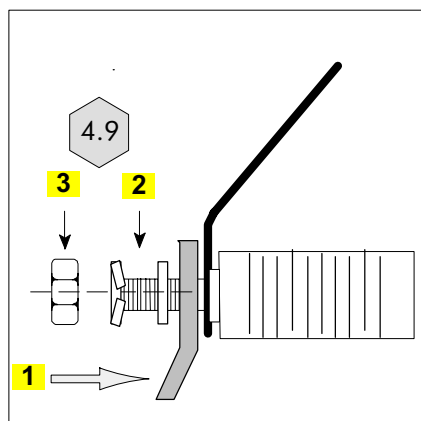


For the Functional Units PF /PFA, ensure that the cables exert no traction on the support cross-bar. Check that after installation the fuses can be correctly fitted in place, and that the contacts are sufficiently covered (See § 7.9).

## 7.7 Connection in a PGC or IS Functional Unit equipped with current transformers

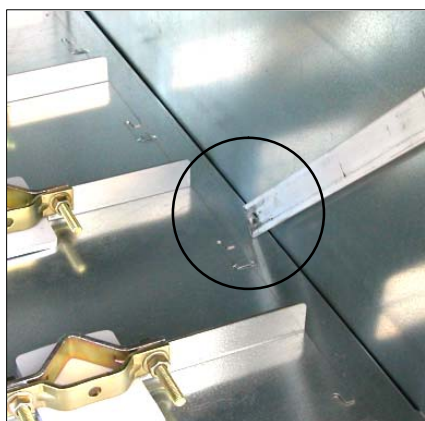


- State on delivery.



- 1 - Position the lug and the cable.
- 2 - Fit the flat washer, then the self-locking washer.
- 3 - Screw in and tighten the H M12 nut to the indicated torque.

## 7.8 Earthing the screen braids



- Connection point for the three HV cable screen braids.

## 7.9 Fitting the fuses on to the PF-PFA Functional Units



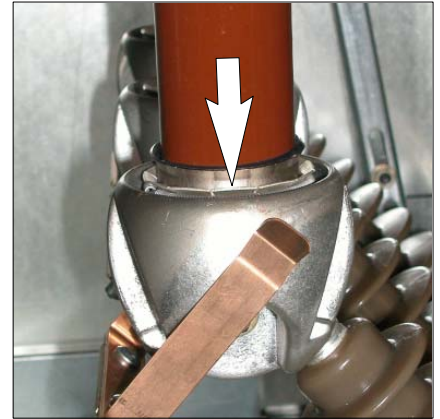
- For a striker fuse of the FN or FD type (DIN), remove the protective label.
- For FNw and FDw fuses this label must remain on.
- For other fuses, follow the manufacturer's instructions.



Position the striker towards the top.



- Lift the lid of the upper current supply terminal.
- Hold the fuse by its upper part.



- Fit the fuse into the lower shell.



- Push the fuse home into the upper current supply terminal.
- Ensure that the upper contacts are correctly covered. The 4 blades of the jaw must hold firm over all of their surface contact, on the fuse cup.



- Ensure the correct refitting of the lid and the position of the label: it must be visible from the front face panel.



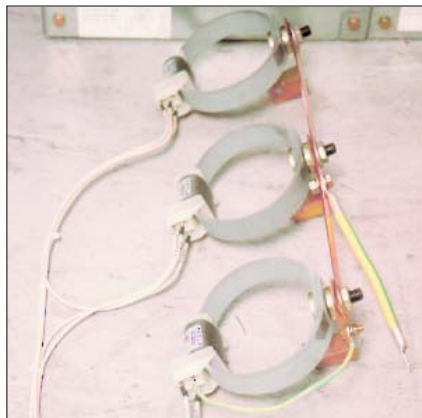
- The fuse is now in place.



## 7.10 The sensors (rings) for fault detection and signalling



- Sensor of the ring with blades type.



- Example of the assembly of the rings for delivery.

## 7.11 Mounting the rings

Position and fit each ring, centred perpendicularly to the cable.

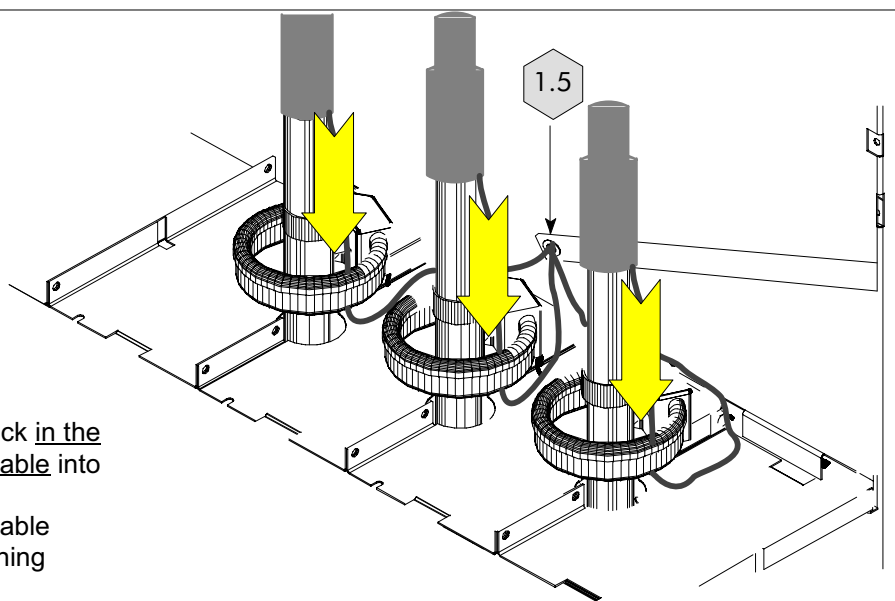


The rings must be positioned below the cable end of each cable. Under no circumstances must they be on the cable end.

Insulate the earthing braid.

Pass the braid back, in the reverse direction to the cable, into the ring

Connect together the 3 cable screen braids, on to the earthing circuit (H M8x30 screw, 13 mm spanner).



- Each braid must pass back in the reverse direction to the cable into the ring.
- Connect together the 3 cable screen braids to the earthing circuit.

## 7.12 Special instructions at the end of the connections



After any work in the cable compartment, replace the front face panel.



Ensure that all of the connections, busbar couplings, cables, earthing circuits and low voltage circuits have been correctly carried out.



Ensure that the fuses have been correctly fitted in place, and the presence of access panels to the interior of the Functional Units.

## 8 Connection of the low voltage circuits

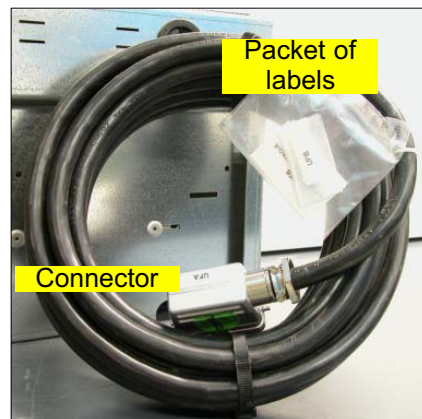
### 8.1 Motorised remote control interface for the switches [option]



- Front face of the box.



- Neutralization switch marked UFA.



- The cable connection is delivered with a connector marked UFA, and a packet of labels.

### 8.2 Foolproofing of the remote control connector [Public Distribution]

| 10 pin male connector - Type H.an 10A (seen from pin side)                                                |     |     |     |     |     |     |     |
|-----------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| UFA                                                                                                       | UFB | UFC | UFD | UFE | UFF | UFG | UFH |
|                                                                                                           |     |     |     |     |     |     |     |
| Screw     Dowel     Pin     Journal    Foolproofing is made by journals screwed into the female connector |     |     |     |     |     |     |     |

### 8.3 Identification and function of the pins [Public Distribution]

| Pin N° | Remote Control Function (RC) |  | Pin N° | Remote Control Function (RC)    |
|--------|------------------------------|--|--------|---------------------------------|
| 1      | -48V                         |  | 6      | +48V                            |
| 2      | HVA closing command          |  | 7      | Command neutralised             |
| 3      | HVA opening command          |  | 8      | Presence/absence of HVA voltage |
| 4      | HVA switch "Open"            |  | 9      | Reserved                        |
| 5      | HVA switch "Closed"          |  | 10     | Reserved                        |

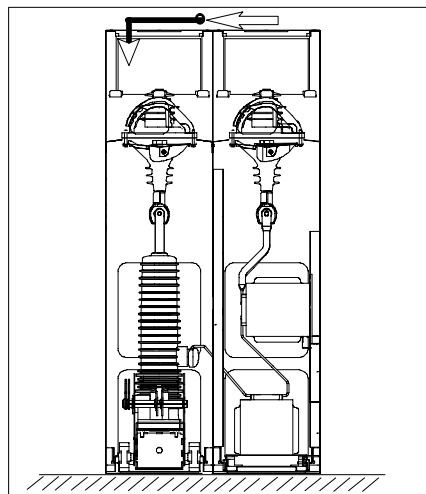
## 8.4 Connection of the "Metering" low voltage wiring to the PGB Functional Unit

Material to be provided:

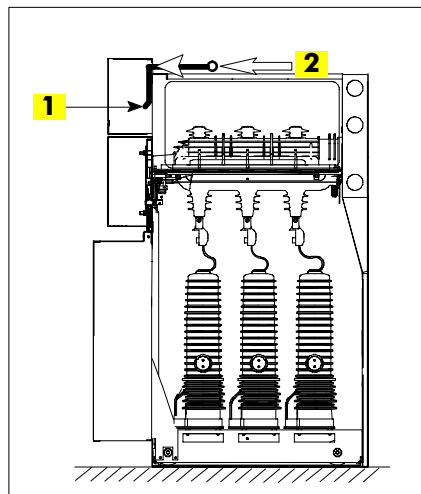
- lugs for fasteners, 6 mm in diameter,

- 1.5 mm<sup>2</sup> in diameter wire (TM),

- 2.5 or 6 mm<sup>2</sup> in diameter wire (PGB).

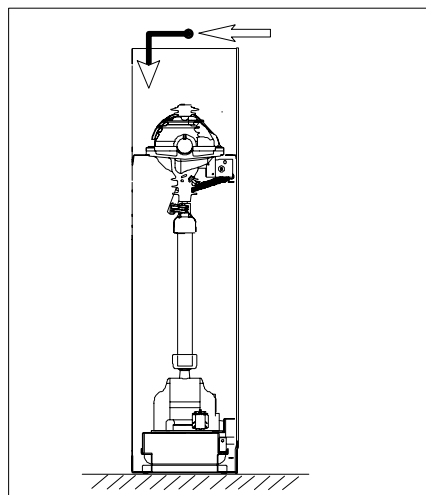


- Front view: Connection is made from the top, via the rear of the LV box.

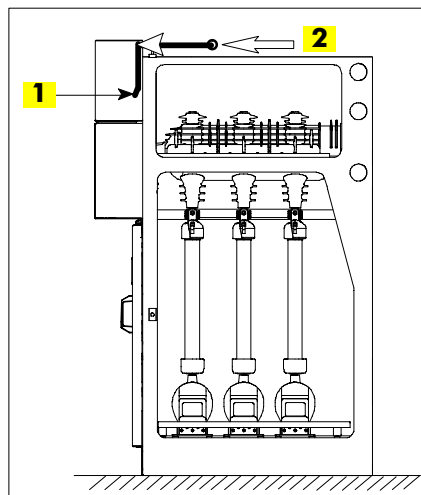


- Side face view: connection from the top.  
1 - Location of the terminal block.  
2 - Wiring to be carried out on site. Provide for an additional length of 4 m of wire.

## 8.5 Connection of the "Metering" low voltage wiring to the TM Functional Unit



- Front view: Connection is made from the top, via the rear of the LV box.



- Side face view: connection from the top.  
1. Location of the terminal block.  
2. Wiring to be carried out on site. Provide for an additional length of 4 m of wire.

**i** An extremity blanking piece for the terminal block cover is delivered mounted on each IS Functional Unit. It can be dismantled then reassembled on to another Functional Unit, depending on the layout of the switchboard.



## 9 Double shunt layout function

This enables the manual or automatic transfer of the load from a source chosen as a normal power supply (cable 1) to a second source called a "backup" (cable 2).

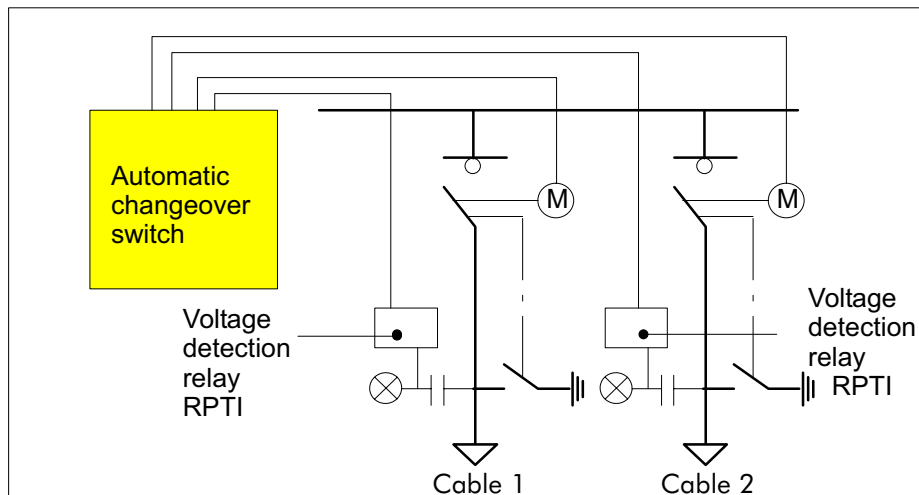
The double shunt layout function comprises two IS each of which is equipped with a C410M mechanical control mechanism (without mechanical latching) and a voltage detection relay of the RPTI type.

1 - The double shunt layout function without any detection of an HV fault comprises: 1 automatic changeover box with four 12 V batteries, 2 cables marked Cable A et Cable B of 5 or 10 metres each.

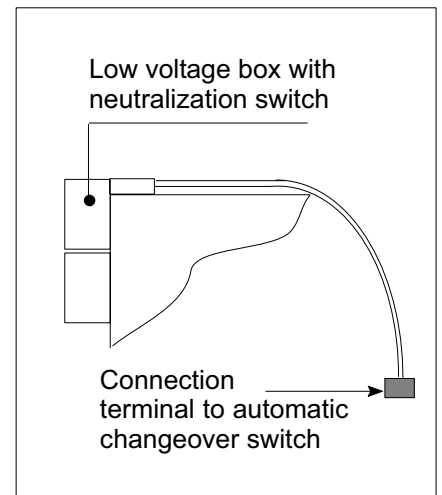
2 - The double shunt layout function with detection of an HV fault comprises: 1 PASA automatic changeover box with four 12 V batteries, 2 cables marked Cable A

and Cable B of 5 or 10 metres each, 6 opening rings equipped with connectors, 2 cables for the connection of the rings equipped with connectors of 7 or 12 metres each.

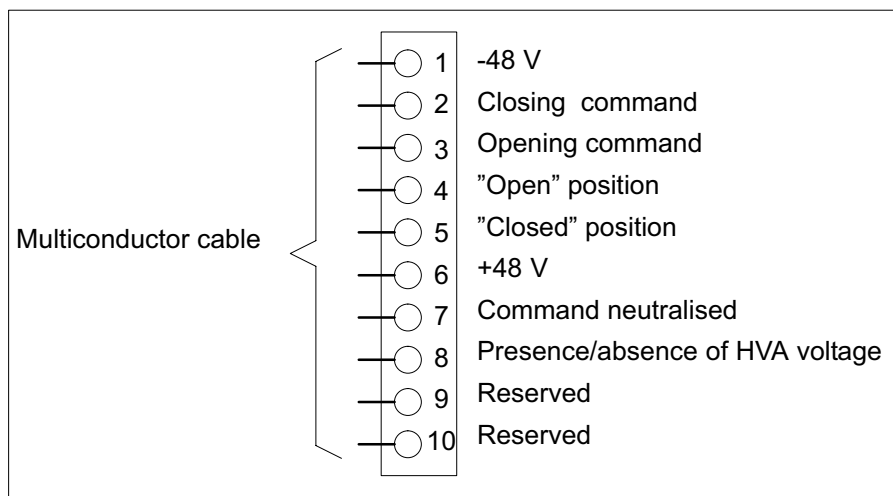
 For the installation of the automatic changeover switch, refer to the instruction notice "PASA Box" Ref. AREVA N° 896 A.



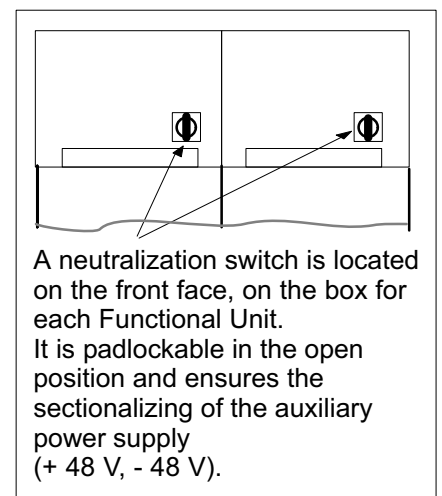
- Schematic diagram for the double shunt function without fault detection.



- Connection of the command control to the PASA box.



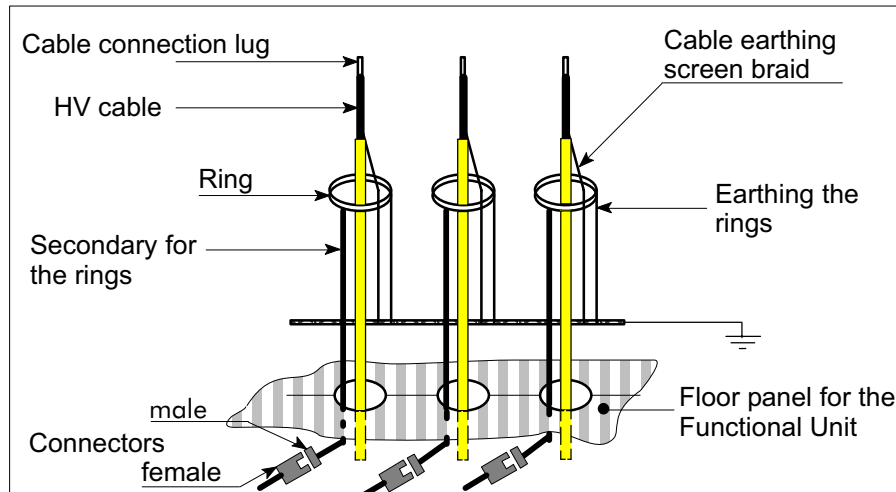
- Layout of the connection terminal with the terminal markings.



- Neutralization switch.



## 9.1 Mounting and connection of the rings



- Connecting the rings.

- Mount the rings which are inside the Functional Unit.
- Lower the LV cable for each ring (equipped with a female connector) through the floor panel, via the HV cable trough.
- Below the floor panel, connect each female connector to the male connector on the cable bundle coming from the automatic changeover switch.

**i** The screen braids for the cables absolutely must pass through each ring, in the reverse direction to the HV cable, before being connected to earth.

## 9.2 Commissioning the double shunt layout

Ensure that the batteries are properly charged before the commissioning tests.

**i** Carry out replacement of these batteries every 4 years.

Apply the commissioning instructions in chapter 16.

# 10 Operating accessories and instructions

## 10.1 Reminder

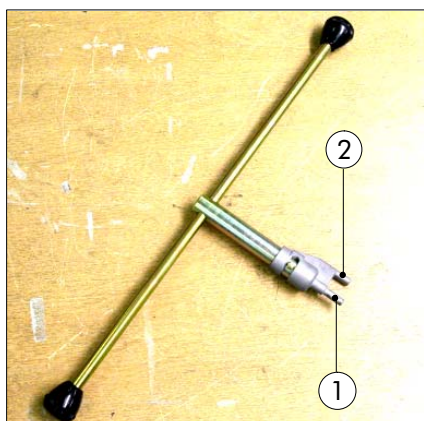
The Functional Unit is delivered with the:

- load break switch "Open,"
- earthing switch "Closed".

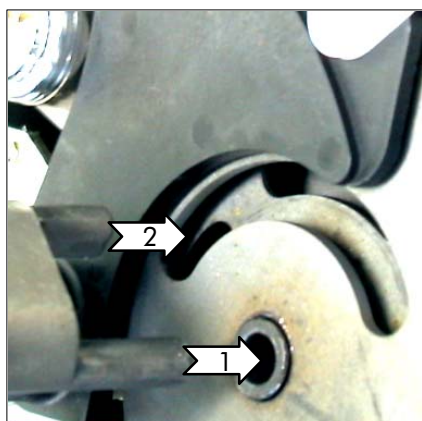
The manoeuvres for manual operation are made without any special effort.

If cubicle **de-energised**: the wearing of gloves is not compulsory.

If cubicle is **energised**: Respect and apply the operating and safety instructions in force on the site.



- A single operating lever, for the load break switch and the earthing switch.



- Place the lever in position:
  - 1 - Lever pin in the main shaft for manoeuvring,
  - 2 - Secondary pin in the notch.

## 10.2 Operation of a Functional Unit equipped with a C410-C410S-C410M control

See the instructions in the AMTNoT100-02 manual.

## 10.3 Operation of a Functional Unit equipped with a C430-C430M control

See the instructions in the AMTNoT101-02 manual.

## 10.4 Operation of a Functional Unit equipped with a C440-C440M control

See the instructions in the AMTNoT102-02 manual.

## 10.5 Cable testing

- This test is carried out before commissioning the Functional Unit.
- Afterwards, it will also be regularly carried out by the Safety Organisations.
- The load break switch must be open, the earthing switch closed.

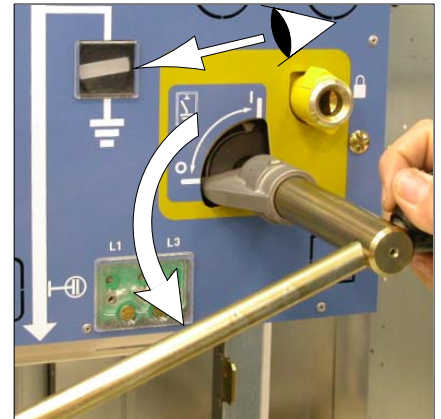
 The opening of the earthing switch, door panel removed, **is forbidden**, by the internal mechanical locks:

"function":

- The closing of the switch,
- The recovery of the key for locking the earthing switch "open".



- Remove the door panel.
- Using the right hand, turn the padlockable button and maintain it there.
- With the left hand, insert the operating lever.



- With both hands, grasp the lever by its extremities.
- Lower the lever towards the left. The earthing switch is now open.
- After the tests, close the earthing switch again and replace the door panel in position.

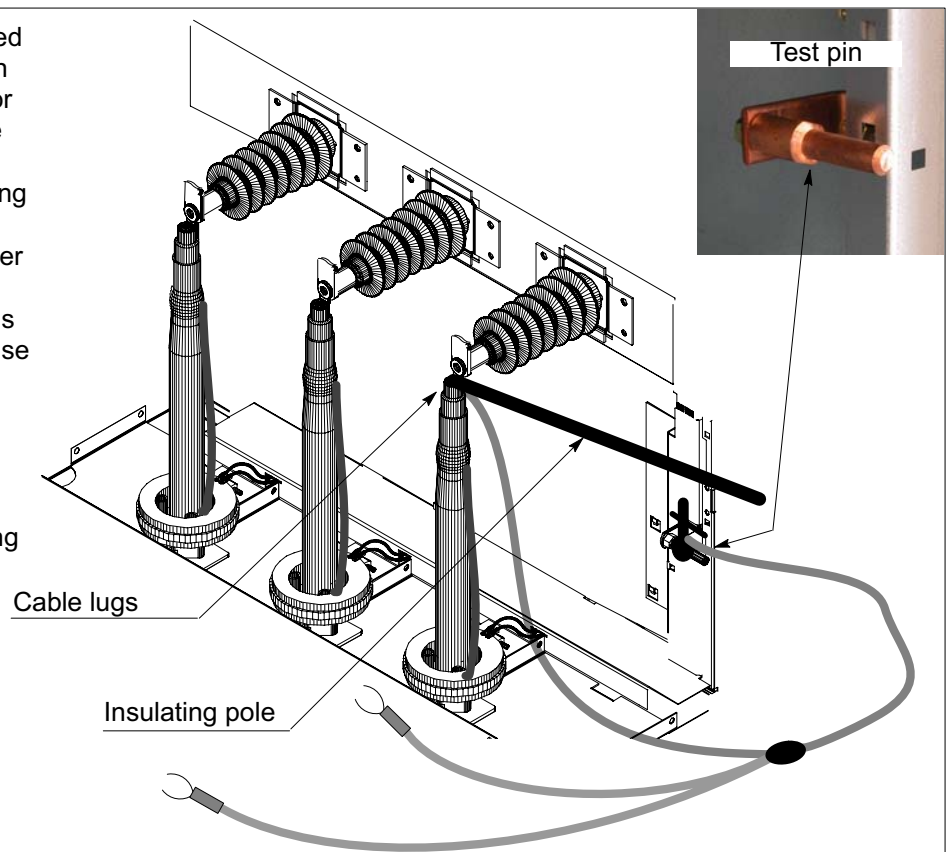
## 10.6 Installing the removable earthing switch device

- The earthing switch being closed and the door panel having been removed (see § 10.5), check for the absence of voltage with the voltage detection pole.
- Fix the main jaws of the earthing block to the earthing pin
- Fit in place and tighten, one after the other, the earthing block's clamps to the cables' lug barrels (40 mm of space in reserve). Use the insulating pole provided for this.

 The position of the earthing block should forbid the refitting in place of the door panel.



After the tests, remove the earthing switch device, and replace the door panel in position.

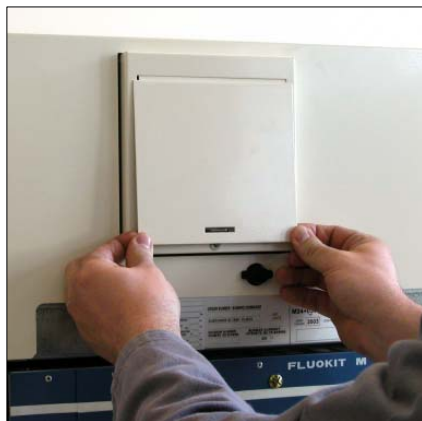


# >> 11 Operating the TM Functional Unit

## 11.1 Operating manoeuvres for the TM Functional Unit



- Door panel in place and locked, close the fuses of the secondary circuit for the voltage transformers.



- Fit the protective cover in place again.

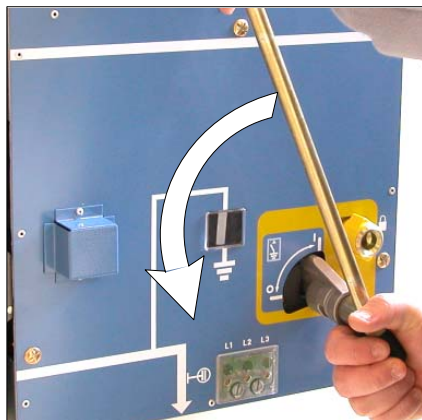
- The rest of the manoeuvres is identical to those of the IS Functional Unit (refer to the instructions on the AMTNoT100-02 manual).

# >>> 12 Operation of the PGB and PGC Functional Units

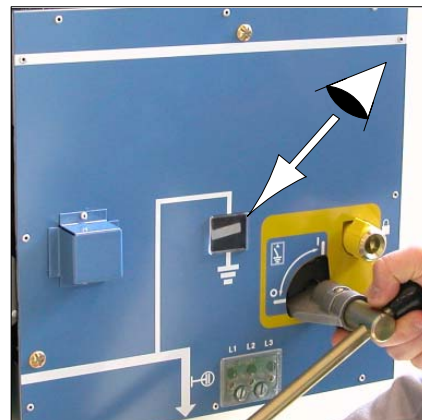
## 12.1 Opening of the downstream earthing switch (only for PGC)



- Using the left hand, turn the padlockable button and maintain it there.
- Insert the lever.



- Make the rod slide upwards then grip the lever by both its extremities.
- Lower the lever towards the left.

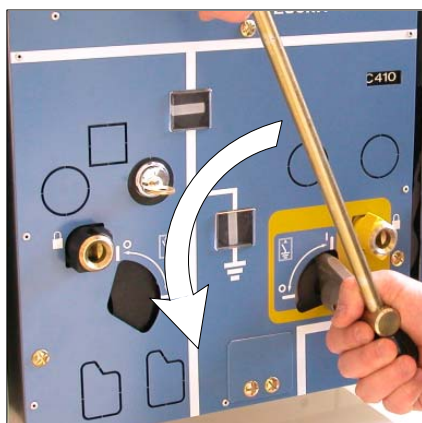


- The earthing switch is now open.
-  For the PGC, the door panel is now locked.

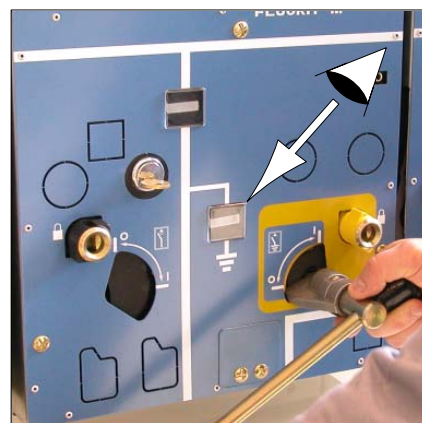
## 12.2 Opening the upstream earthing switch



- Using the right hand, turn the padlockable button and maintain it there.
- Insert the lever.



- Make the rod slide upwards then grip the lever by both its extremities.
- Lower the lever towards the left.



- The earthing switch is now open.
- Remove the lever.



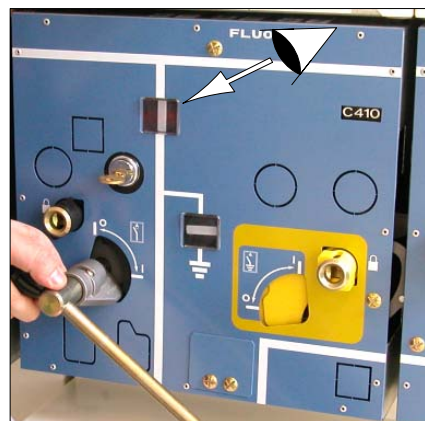
### 12.3 Closing the earthing switch



- Using the left hand, turn the padlockable button and maintain it there.
- Insert the lever.



- Make the rod slide upwards then grip the lever by both its extremities.
- Lower the lever towards the right.

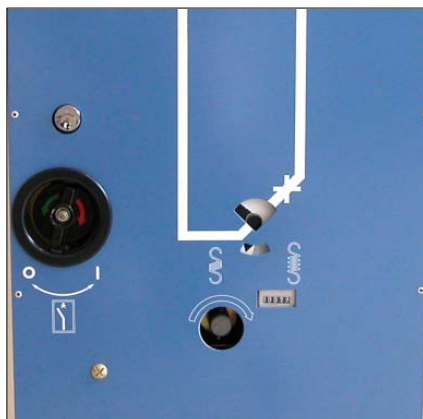


- The switch is now closed.
- Remove the lever.

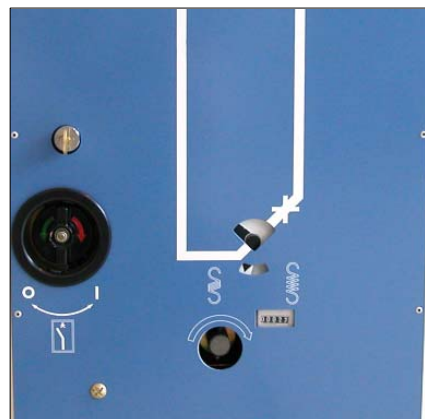
### 12.4 Closing the circuit breaker



- Lock the load break switch and remove the key.



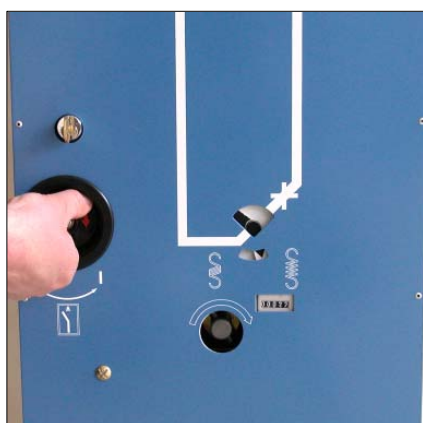
- The circuit breaker is locked in the "tripped" position.



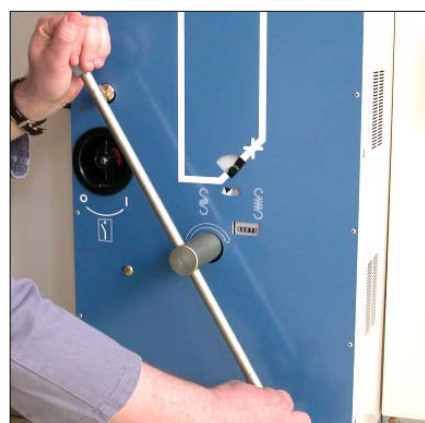
- Insert the key and turn it: The circuit breaker is now unlocked.



- Using the crank handle, reset the BLR mechanical control mechanism.



- Turn the handling button to close the circuit breaker.



- Circuit breaker closed, reset the BLR so as to have a reserve of energy available.

### 12.5 De-energizing a PGB or PGC Functional Unit

Proceed with operations in the reverse order to those described in § 12.1 to 12.4.

# >>> 13 Locking-out and locking operations

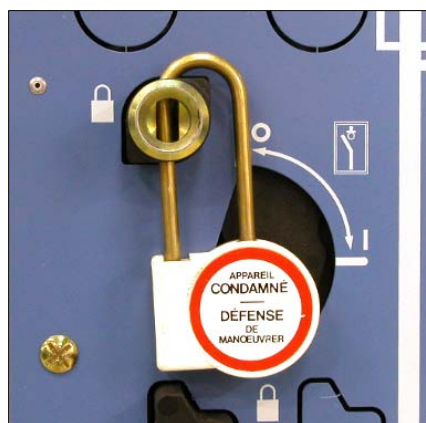
## 13.1 Functional mechanical interlocks

M24+ functional interlocks are equipped with internal mechanical interlocks, called "functional", intended to avoid any kind of operating error.

It is necessary to know these interlocks in order to operate the switchgear correctly.

| INTERLOCKING                                                                                             | FUNCTION                                                                                                                                                                                                                                                                                      | FUNCTIONING                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Between the cable access panel and the earthing switch</li> </ul> | <ul style="list-style-type: none"> <li>It is impossible to completely open the earthing switch if the door panel is not in place.</li> </ul>                                                                                                                                                  | <ul style="list-style-type: none"> <li>The fitting of the access panel to the cable compartment unlocks the earthing switch.</li> </ul>                                                                                                                          |
|                                                                                                          | <ul style="list-style-type: none"> <li>Earthing switch open, it is impossible to remove the cable access panel.</li> </ul>                                                                                                                                                                    | <ul style="list-style-type: none"> <li>The opening of the earthing switch locks the door panel in place.</li> </ul>                                                                                                                                              |
| <ul style="list-style-type: none"> <li>Between the earthing switch and the load break switch</li> </ul>  | <ul style="list-style-type: none"> <li>The partial opening of the earthing switch (door panel removed) forbids the closing of the load break switch.</li> <li>The complete opening of the earthing switch (door panel in place) authorises the operation of the load break switch.</li> </ul> | <ul style="list-style-type: none"> <li>Whenever the cable access panel is removed, it is impossible to open the earthing switch, but a mechanical interlock forbids operating the switch.</li> <li>The presence of the panel frees this interlocking.</li> </ul> |
|                                                                                                          | <ul style="list-style-type: none"> <li>Load break switch closed, it is impossible to close the earthing switch.</li> </ul>                                                                                                                                                                    | <ul style="list-style-type: none"> <li>A mechanical interlock forbids this operation.</li> </ul>                                                                                                                                                                 |

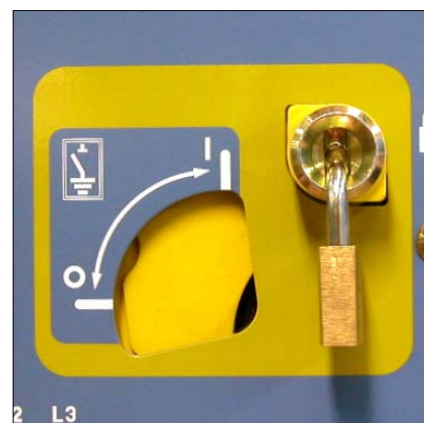
## 13.2 Locking-out by padlock (not supplied)



- Padlocking of the switch on a C430 mechanical control mechanism in either the open or closed position.

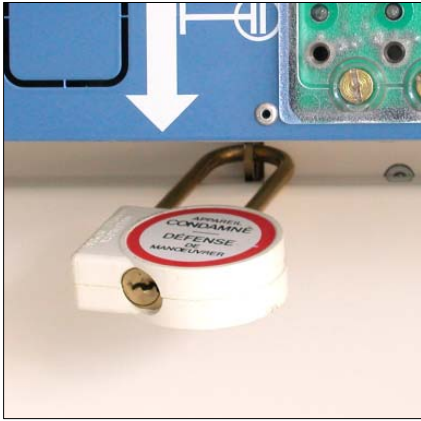


- Padlocking of the earthing switch in either the open or closed position.



- Other padlocking devices for the earthing switch or load break switch in the open or closed position, with a short shackle padlock.





- Padlocking the door panel.

**i** All of the passage holes are designed for padlock shackles of  $\varnothing$  6 to 8 mm.

### 13.3 Locking-out by keylocks

For all locking operations by keylocks, consult the instructions manual "Instructions for the installation of standard locks by keylocks" (AMTNoT099-02).



- Padlocking of the tripping button on a C430 mechanical control mechanism.

**i** The fitting of several padlocks at a single point requires the use of an accessory that is not supplied.

# 14 Commissioning

## 14.1 Reminder

Prior to shipping, FLUOKIT M24+ Functional Units are mechanically and electrically tested.

If the equipment has been stored in a damp location, it is recommended that the room be heated and the heating coils be energized for a period of 24 hours prior to installation of the switchboard.

Also check the leaktight sealing in the room and the cable troughs.

## 14.2 Inventory of tools and accessories on completion of work

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

Return the Functional Unit's and Circuit Breakers' operating accessories to their respective storage positions.

Attach the M24+ technical instruction manual in a visible location within the room.

## 14.3 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.

Record the serial numbers and identifying marks on equipment and switchgear while they are accessible. Tests and inspections have already been carried out in the factory.

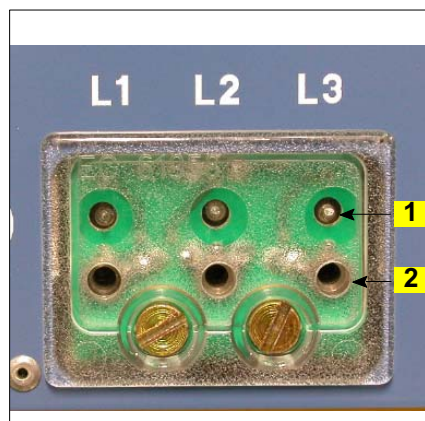
Refer to the drawings and diagrams supplied with the equipment. They describe the functionalities employed to carry out the level of operation required.

## 14.4 Final checks before commissioning

| Visual inspection                                                                                                                                                                                                                                                                                                                                                         | Date | Remarks | Signature |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|-----------|
| <ul style="list-style-type: none"> <li>- Ensure there are no foreign bodies inside the switchboard</li> <li>- Check the external appearance (for absence of blows, scratches on the paint): carry out touch-ups if necessary.</li> <li>- Check the conformity with the Protection Index (leaktightness of the Functional Units, various blanking panels, etc.)</li> </ul> |      |         |           |
| "Mechanical" checks                                                                                                                                                                                                                                                                                                                                                       | Date | Remarks | Signature |
| <ul style="list-style-type: none"> <li>- Operating and interlocking tests on the access doors and removable panels.</li> <li>- Key-locked system tests.</li> <li>- Inspection of mechanical tightening torques, (electrical jointing, power and earthing circuits, etc.).</li> </ul>                                                                                      |      |         |           |
| Handling operations carried out on the switchgear: <ul style="list-style-type: none"> <li>- Closing and opening the load break switches and earthing switches,</li> <li>- Arming, closing and tripping the circuit breakers.</li> </ul>                                                                                                                                   |      |         |           |
| Inspections and tests                                                                                                                                                                                                                                                                                                                                                     | Date | Remarks | Signature |
| <b>Dielectric tests (at 80% of the test value)</b> <ul style="list-style-type: none"> <li>- Whilst taking <u>all precautions necessary</u>, carry out a dielectric test on the HV equipment and LV cabling.</li> </ul> <u>NB:</u> : These tests must be carried out prior to electrical testing.                                                                          |      |         |           |
| <b>Electrical tests</b> <ul style="list-style-type: none"> <li>- Check the continuity of the earthing circuit.</li> <li>- Check the connections on the LV links.</li> <li>- Test the correct functioning of the LV switchgear.</li> <li>- Record the relay parameters.</li> </ul>                                                                                         |      |         |           |

| State of the switchgear                                                                                                                                                                                                                                                                                                                                                | Date | Remarks | Signature |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|-----------|
| <ul style="list-style-type: none"> <li>- Ensure that <b>all</b> the load break switches, circuit breakers and earthing switches are open and the access panels to the cables and the busbars are in place.</li> <li>- In accordance with the fuse supplier instructions, ensure that the striker covers on the voltage transformer fuses have been removed.</li> </ul> |      |         |           |

#### 14.5 Energizing the "Incoming" Functional Unit



The "voltage presence" indication is ensured in conformity with the instructions in IEC161958.

To each of the 3 phases L1, L2 and L3 there is a corresponding flashing indicator [1].

A connection point [2], for each phase, is accessible on the front face of the luminous indicator in order to connect the phase comparator.

The indication of a VPIS, by itself, is insufficient to ensure that the system is de-energized: if the operating rules demand it, then the appropriate voltage detectors must be used to that effect, in compliance with IEC61243-5.

Energize the busbar. To do this, close the load break switch (See § 10).

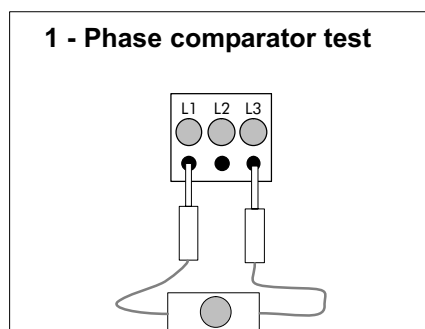
#### 14.6 Energizing a second 'Incoming' Functional Unit, supplied from the same source.

Energize the cables.

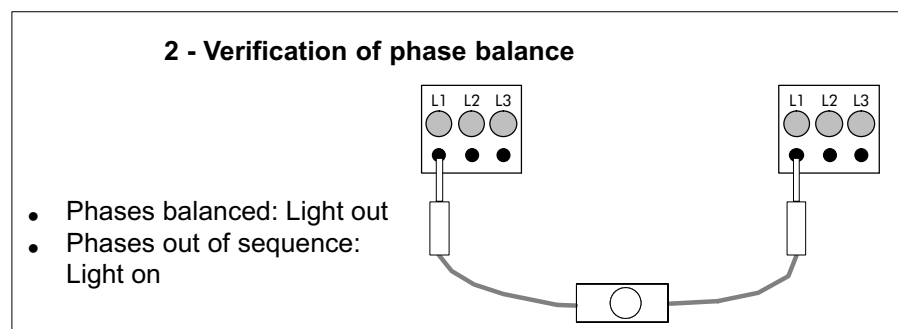
Check that the neon lights of the voltage presence indicator light up.

Check the phase balance (See § 14.7) prior to commissioning.

#### 14.7 Control of phase balance with a VPIS voltage presence indicator (in accordance with IEC 61958)



- Connect the 2 phase comparator plugs (*optional*) to 2 phases of the same Functional Unit.  
The light should light up:  
Showing the comparator is working.



- Ensure the phase balance using a phase comparator checked  
If the phases are out of sequence, inspect the cable connections.

#### 14.8 Energize the switchboard

Close the breaking devices on the "Incoming" Functional Units.

Energize the "Outgoing" Functional Units.

Close the corresponding breaking devices.

# 15 Maintenance

## 15.1 Levels of maintenance

| Description                                                                                                                                                                                                                                                                                                             | Levels |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Operations recommended in the instructions manual "installation - operation - maintenance", carried out by suitably qualified personnel having received training allowing them to intervene whilst respecting the safety rules.                                                                                         | 1      |
| Complex operations, requiring specific expertise and the implementation of support equipment in accordance with AREVA's procedures. These are carried out by AREVA or by a specialised technician, trained by AREVA (Training Centre) in the implementation of procedures, and who is equipped with specific equipment. | 2      |
| All preventive and corrective maintenance, all renovation and reconstruction work is carried out by AREVA.                                                                                                                                                                                                              | 3      |

## 15.2 Preventive maintenance for the mechanical control mechanisms

Please refer to the specific instruction manuals (See § 2.5).

## 15.3 Preventive maintenance of the Functional Units

| PREVENTIVE MAINTENANCE                                                                        | Frequency |         | Levels |   |   |
|-----------------------------------------------------------------------------------------------|-----------|---------|--------|---|---|
| <i>Operations recommended at the Functional Unit level</i>                                    | 3 years   | 6 years | 1      | 2 | 3 |
| Verification of the presence and condition of accessories (levers, etc.)                      | X         | -       | X      | X | X |
| Visual inspection of the exterior (cleanliness, absence of oxidation, etc.)                   | X         | -       | X      | X | X |
| Cleaning of external elements, with a clean, dry cloth.                                       | X         | -       | X      | X | X |
| Checking the tightness to torque (covers, wiring ducts, connections, etc.)                    | X         | -       | X      | X | X |
| Checking the mechanical controls by carrying out a few operations                             | X         | -       | X      | X | X |
| Checking the positioning of the status indicators (armed, open and closed)                    | X         | -       | X      | X | X |
| Control of the status and the functioning of the locking by key locks                         | X         | -       | X      | X | X |
| Dusting and cleaning the internal mechanical elements (without solvent)                       | X         | -       | -      | X | X |
| Inspection of the tightening of the threaded fasteners and presence of internal stop elements | -         | X       | -      | - | X |
| Dusting and cleaning the internal mechanical elements (with solvent)                          | -         | X       | -      | - | X |
| Lubrication and greasing of mechanical elements (with recommended products)                   | -         | X       | -      | - | X |
| Monitoring the general appearance of the mechanical components and connections                | -         | X       | -      | - | X |
| Testing the "function" mechanical interlocks                                                  | -         | X       | -      | - | X |

## 15.4 Systematic preventive maintenance

A systematic check of all High Voltage connections tightening points may be requested by the customer.



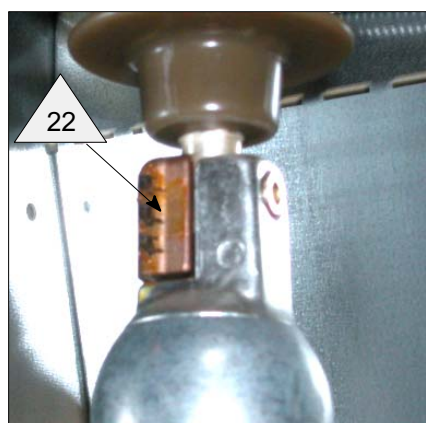
Every 3 operations, it is therefore necessary to replace all of the threaded fasteners.

## 15.5 Greasing the contact surfaces

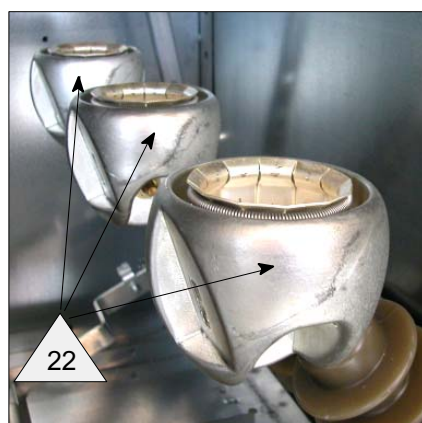
| Intervention | Duration | Busbar       | Cables       | Switch | Earthing switch |
|--------------|----------|--------------|--------------|--------|-----------------|
| Normal       | 1 h 00   | de-energized | de-energized | open   | closed          |
| Possible     | 1 h 00   | energized    | de-energized | open   | closed          |

Apply the General Safety Instructions for Electrical Applications and the particular regulations for the network concerned for the locking out procedures.

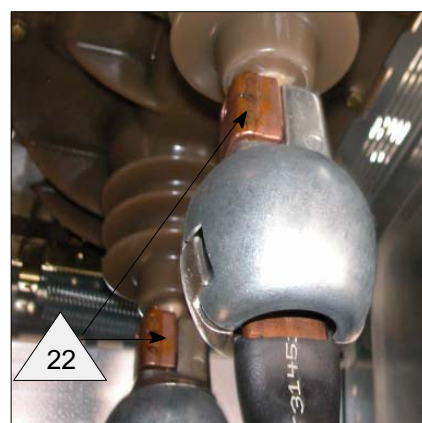
**Greases:** (See § 2.6)



- Clean and apply a film of grease to the plugging-in studs on the earthing switch.



- Clean and apply a film of grease to the lower cups on the PF-PFA, for contact with the earthing switch.



- Clean and apply a film of grease to the contact plates on the downstream earthing switch for a PGC.

## 15.6 Corrective maintenance

| CORRECTIVE MAINTENANCE                            |  |  |  |             | Levels |   |   |
|---------------------------------------------------|--|--|--|-------------|--------|---|---|
| Replacements or modifications                     |  |  |  | See chapter | 1      | 2 | 3 |
| Replacement of the three fuses                    |  |  |  | 15.7        | -      | X | X |
| Replacement of the VDS (Voltage Detection System) |  |  |  | 15.8        | -      | X | X |

## 15.7 Replacement of the three MV fuses

| Intervention | Duration | Busbar       | Cables       | Switch | Earthing switch |
|--------------|----------|--------------|--------------|--------|-----------------|
| Normal       | 0 h 30   | de-energized | de-energized | open   | closed          |
| Possible     | 0 h 30   | energized    | de-energized | open   | closed          |

**Locking out the Functional Unit**  
All locking-out operations must be performed according to the particular rules for the network concerned.

**Tools required:**  
- leather gloves

**Parts required:**  
- 3 fuses with the same reference (verify values in accordance with the transformer power)

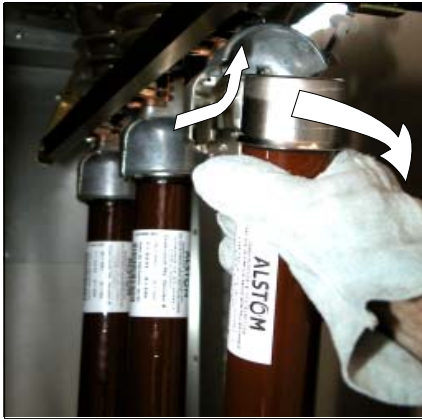
 The body of a fuse can become very hot following a short circuit. Take standard precautions (wear work gloves).

 For an apparently single phase fault, it is **imperative** that all 3 fuses be replaced.

- Open the load break switch.
- Ensure that there is an absence

of voltage.

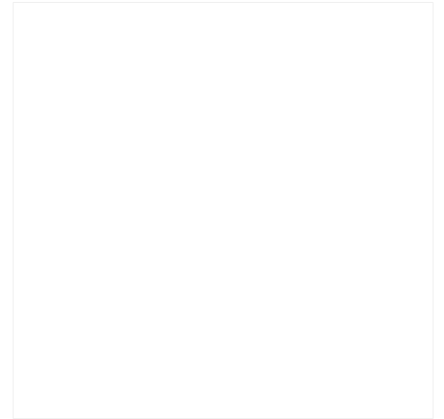
- Close the earthing switch.
- Remove the cable access panel.



- Take hold of the fuse by the upper part.
- Pull the fuse towards the front. This causes the upper current supply terminal shell to open. The latter will remain open.



- Lift the fuse up to free it from the lower current supply terminal.
- Similarly remove all 3 fuses.



- Fit the replacement fuses by carrying out the instructions in § 7.9.

### 15.8 Replacement of the VDS (Voltage Detection System - LV capacitors)

| Intervention | Duration | Busbar       | Cables       | Switch | Earthing switch |
|--------------|----------|--------------|--------------|--------|-----------------|
| Normal       | 0 h 30   | de-energized | de-energized | open   | closed          |
| Possible     | 0 h 30   | energized    | de-energized | open   | closed          |

#### Locking out the Functional Unit

All locking-out operations must be performed according to the particular rules for the network concerned.

#### Parts required:

- 1 VDS

- The VDS is located in the cross-bar which supports the capacitive insulators (See § 3.3).
- Example under IS: Extract the VDS via the front, disconnect it and replace it.



## 15.9 Possible anomalies and remedies

| SYMPTOM                                                              | ORGAN                  | PROBABLE CAUSE                         | REMEDY                                                                                                                                                                                                  |
|----------------------------------------------------------------------|------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unusual noises when energized, crackling, vibrations                 | Voltage presence box   | Plug badly connected to the conductors | Check connections                                                                                                                                                                                       |
|                                                                      | Capacitive insulator   | Accidental destruction                 | Replace the voltage divider                                                                                                                                                                             |
|                                                                      | Insulators             | Insulating parts polluted or degraded  | Clean the insulating components or call our After-Sales Department (see § 1.1).                                                                                                                         |
|                                                                      | Cable ends             | Excessive humidity                     | Install a heating element                                                                                                                                                                               |
| Abnormal force required when operating the breaking switchgear       | Control for the switch | Safety interlocks                      | Check the position of the breaking switchgear                                                                                                                                                           |
|                                                                      | Earthing switch        | Safety interlocks                      | Check the position of the breaking switchgear and the door panel                                                                                                                                        |
| Voltage presence indicator extinguished (with switchboard energized) | HV Fuses               | Fuse blown                             | Replace the three fuses                                                                                                                                                                                 |
|                                                                      | Voltage indicators     | Deterioration of a component           | Replace the indicator(s)                                                                                                                                                                                |
| Abnormal heating at the connection points                            | Connections            | Badly tightened                        | 1 - Clean the connecting plate connections<br>2 - Replace the damaged fasteners<br>3 - Retighten to appropriate torque                                                                                  |
|                                                                      |                        | Badly assembled                        | 1 - Clean the connecting plate connections<br>2 - Eliminate all material of a different nature, placed in the point of the current flow<br>3 - Retighten to appropriate torque                          |
| Inappropriate tripping operations                                    | Rings                  | Badly connected                        | 1 - Insulate the earthing screen braids for the cables<br>2 - Pass these grounds into the ring, in the reverse direction to the cable, before connecting them again to the switchboard's earthing point |

# >>> 16 Spare parts

## 16.1 The spare part

Describes a part that is designed to replace a corresponding one with a view to re-establishing the original function.

 The replacement of these parts can only be carried out by a person who is suitably qualified and trained for this operation.

| Programmed replacement                                                                                                                                                                   | Denomination    | Replacement every | Levels |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|--------|---|---|
|                                                                                                                                                                                          |                 |                   | 1      | 2 | 3 |
| This concerns wearing parts, designed to be replaced after a predetermined number of uses.<br><u>Use:</u> Maintenance stock, necessary for optimum maintenance procedures every 6 years. | HV fuses (by 3) | 20 years          | X      | X | X |
|                                                                                                                                                                                          | Heating element | -                 | X      | X | X |
|                                                                                                                                                                                          | Batteries       | 4 years           | X      | X | X |

| Non-Programmed replacement                                                                                                                                                                                                               | Denomination            | Levels |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------|---|---|
|                                                                                                                                                                                                                                          |                         | 1      | 2 | 3 |
| Describes spare parts whose replacement intervenes in the course of corrective maintenance.<br><u>Use:</u> Parts that are changed during a corrective maintenance operation, outside the scope of normal preventive maintenance actions. | Heating element         | X      | X | X |
|                                                                                                                                                                                                                                          | VPIS luminous indicator | X      | X | X |

| Exceptional replacement                                                                                                                                                                      | Denomination                                          | Levels |   |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------|---|---|
|                                                                                                                                                                                              |                                                       | 1      | 2 | 3 |
| Describes the spare parts or assemblies whose foreseeable service life is at least equal to that of the equipment.<br><u>Use:</u> Spare parts or sub-assemblies conserved in a safety stock. | Grommet (IS/PF)                                       | -      | X | X |
|                                                                                                                                                                                              | Grommet (PGC)                                         | -      | X | X |
|                                                                                                                                                                                              | Busbar deflector                                      | -      | X | X |
|                                                                                                                                                                                              | Cable connection deflector (IS)                       | -      | X | X |
|                                                                                                                                                                                              | Current transformers or rings (phase)                 | -      | X | X |
|                                                                                                                                                                                              | Voltage transformers (roof or cable compartment)      | -      | X | X |
|                                                                                                                                                                                              | Lightning arresters for the SP or LP Functional Units | -      | X | X |
|                                                                                                                                                                                              | Operating lever                                       | -      | X | X |
|                                                                                                                                                                                              | Circuit breaker                                       | -      | X | X |
|                                                                                                                                                                                              | Complete equipped pole                                | -      | X | X |

## 16.2 Identification of the equipment (See § 4.5)

 For all orders for spare parts, it is necessary to enclose the equipment characteristics form.

### 16.3 Storage conditions

The components should be stored away from dust, humidity or sun. In order to facilitate the search, they

must be marked by the AREVA reference number. Certain components are fragile, they should

preferably be stored in their original packaging.

### 16.4 Maintenance Department

Designates the products necessary for maintenance (See § 2.6).



## 17 End of the equipment service life

### 17.1 Valorization of the equipment

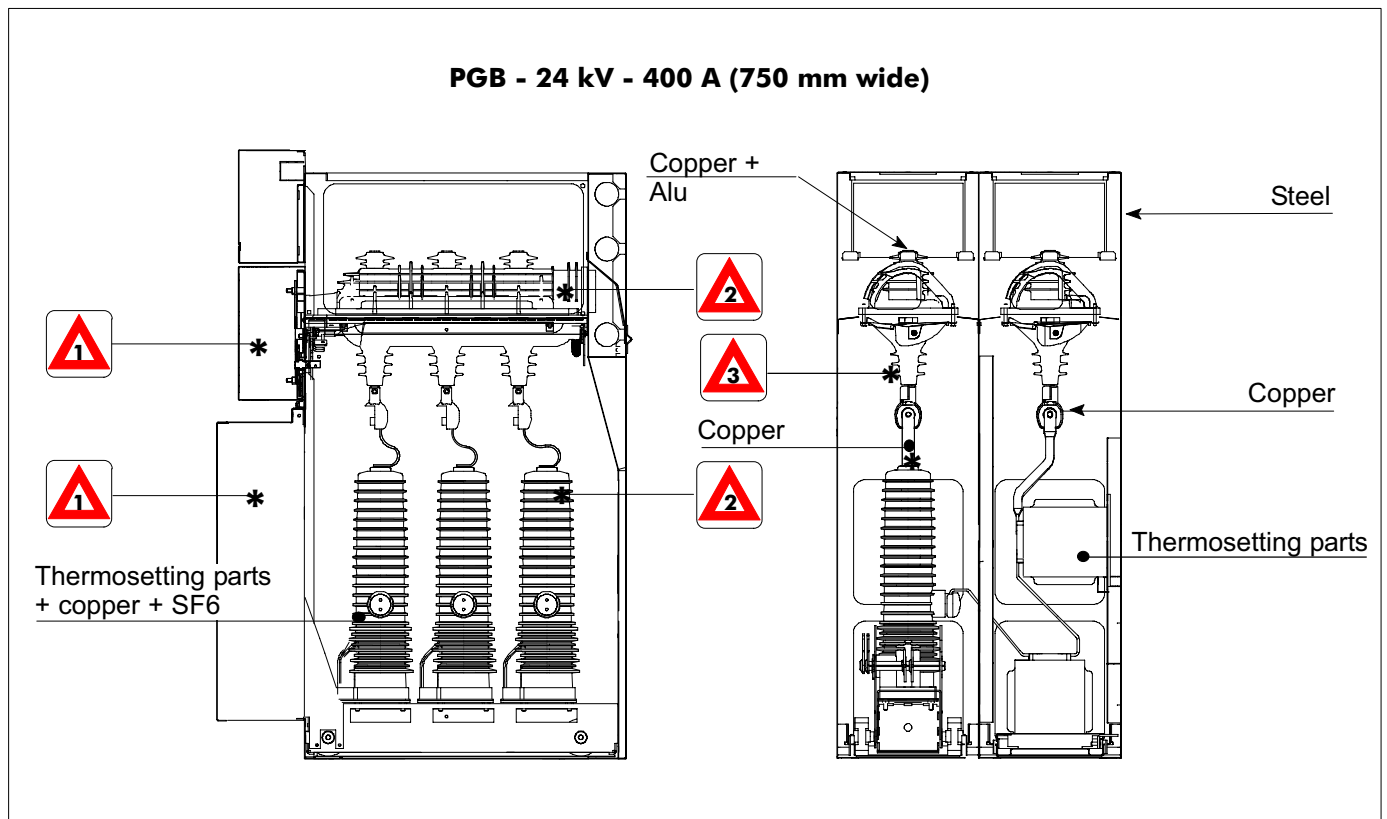
Our Functional Units are composed of recyclable elements.

The tables (§ 17.5) give information and figures for the types of materials, their quality and their methods of valorization.

They enable the following:

- Calculation to be made of the capacities for valorization,
- Optimising the valorization process,
- Evaluating the cost of valorization.

The indications given in tables (§ 17.5) facilitate co-operation between users and companies specialised in elimination to valorize the product at the end of the product's service life.



### 17.2 Safety instructions

 Do not dismantle the mechanical control mechanism springs without the releasing device.

 Do not open the poles without first having recovered the SF6 gas using the appropriate tools.

 Do not dismantle the earthing switch's springs without the releasing device.

### 17.3 Dismantling of the equipment service

Consult AREVA or a suitable company for all decommissioning services.

- Remove all electrical equipment (coils, motors, etc.).
- On disassembly, the materials must be sorted and sent on via the appropriate recycling channels.

#### 17.4 Specific recommendations for the "SF6 gas" type circuit breaker and load break switch



Recuperate the SF6 gas using a recuperation unit.

- Dismantle the interrupting poles with the specific tools, compulsory protections, and all this in a specific room.
- Clean the components before their elimination.
- On disassembly, the materials must be sorted and sent on via the appropriate recycling channels.

#### 17.5 Distribution and valorization of the materials used for PGB (See § 17.1)

Total weight: Functional Unit + FP circuit breaker + 6 CT RKF24 + MiCOM P124 relay = **459 kg**.

| Materials including inserts             | Weight (kg)  | % of Materials | Valorization      |
|-----------------------------------------|--------------|----------------|-------------------|
| Steel                                   | 253          |                | <b>Yes (100%)</b> |
| Stainless steel                         | 0            |                |                   |
| Copper and copper-based alloys          | 49.1         |                |                   |
| Aluminium and aluminium alloys          | 15           |                |                   |
| Other non-ferrous metals                | 0            |                |                   |
| <b>Total metals (including inserts)</b> | <b>317.1</b> | <b>69</b>      |                   |

| Materials                           | Weight (kg) | % of Materials | Valorization                                                        |
|-------------------------------------|-------------|----------------|---------------------------------------------------------------------|
| Epoxy Resin*                        | 71.3        |                | <b>Cannot be valorized</b><br>(sent to<br>Technical Burial Centres) |
| Glass fibre reinforced polyester    | 0           |                |                                                                     |
| Others                              | 0           |                |                                                                     |
| <b>Total Thermosetting Products</b> | <b>71.3</b> | <b>15.6</b>    |                                                                     |

\* mainly silica

| Materials                   | Weight (kg)  | % of Materials | Valorization               |
|-----------------------------|--------------|----------------|----------------------------|
| PC                          | 2.92         |                | <b>Cannot be valorized</b> |
| PTFE                        | 0.26         |                |                            |
| PVC                         | 0            |                |                            |
| PPO                         | 0.9          |                |                            |
| PU                          | 60           |                |                            |
| Others (PMMA, PA, PBT)      | 2.5          |                |                            |
| <b>Total Thermoplastics</b> | <b>66.58</b> | <b>14.51</b>   |                            |

| Materials  | Weight (kg) | % of Materials | Valorization               |
|------------|-------------|----------------|----------------------------|
| Elastomers | <b>0.4</b>  | <b>0.09</b>    | <b>Cannot be valorized</b> |
| Paints     | <b>0.13</b> | <b>0.03</b>    |                            |

| Gas | Weight (kg) | % of Materials | Valorization                     |
|-----|-------------|----------------|----------------------------------|
| SF6 | <b>0.58</b> | <b>0.13</b>    | <b>Yes (100%)</b> (regeneration) |

| Other materials     | Weight (kg) | % of Materials | Valorization               |
|---------------------|-------------|----------------|----------------------------|
| <b>Total others</b> | <b>2.91</b> | <b>0.64</b>    | <b>Cannot be valorized</b> |



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:

Fax: 33 (0)3 85 29 36 36



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