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# FLUOKIT M24+

Installation Commissioning Operation Maintenance



## Instructions



AREVA T&D



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## **AREVA** at your service

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

If this is not the case, please refer to our Service Unit or 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 day</u>
Fax:	33 (0)3 85 29 36 30	-
or	33 (0)3 85 29 36 43	Free

s per week/ 24 hours per day

phone No: 0 800 40 27 62

#### 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 employers 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**

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## 2 With regards to this User Manual

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whether they be copyright or not, belong to their respective holders.

#### 2.1 Eco-design concept and revalorisation 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 ins-

tructions by the suppliers of cables and connection accessories during installation and fitting operations, - of any possible aggressive climatic conditions (humidity, pollution, etc.) acting in the immediate environment of the materials that are neither suitably adapted nor protected for these effects. This user manual does not list the locking-out procedures that must be applied. The interventions described are carried out on <u>de-energized equipment</u> (in the course of being installed) or <u>locked out</u> (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 -  $5^{\circ}$ C and hour period must not exceed  $35^{\circ}$ C. +  $40^{\circ}$  C.

\* Installation altitude

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

\* Atmospheric pollution

The ambient air must not contain any dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts. Beyond this, account must be taken of the decrease in dielectric withstand.

For these specific cases, contact the AREVA Sales Department

\* Permissible atmospheric humidity level

The average atmospheric relative humidity level measured over a 24-hour period must not exceed 95%. The average water vapour pressure over a period of 24 hours must not exceed 22 mbar.

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

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

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

All manipulations must be comple-

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).

The durations (for completing the

maintenance tables are purely an

indication and depend on on-site

conditions.

**Operation - Maintenance** 

**Operation - Maintenance** 

**Operation - Maintenance** 

operations mentioned) given in the

#### 2.4 Particular instructions for operations and interventions on energized equipment

ted once started.

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

#### 2.5 Other technical notices to be consulted

- AMTNoT017-02 BLR-BLRM Mechanical controls
   Operation Maintenance
- AMTNoT055-02 FP Circuit Breaker
   Installation Commissioning Operation Maintenance
- AMTNoT093-02 Civil Engineering Guide
- AMTNoT099-02 Standard mechanical interlocking by key locks
- AMTNoT100-02 C410-C410M Mechanical controls
- AMTNoT101-02 C430-C430M Mechanical controls
- AMTNoT102-02 C440-C440M Mechanical controls
- AMTNoT112-02 Fluokit M24+ Internal arc equipment
- AMTNoT121-02 Fluokit M24+ 'Disconnectable' functional unit Operation

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

- Electrician knife	
- Crowbar	
- Open-ended spanners size 10 ; 13 ; 16 ; 18 & 19 mm	<del>) —</del> Ç
- Ratchet handle + 150mm 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	<b>—</b>
	• 1 1
	Product code
- Dry cloth	
- Solvent (dielectric resistance > 30kV), excluding chlorine based products	_
- Electrolube 2 GX - electrical contact grease from Comindus	22

#### 2.7 Symbols & conventions



and marketed by AREVA - Tightening torque value Example: 1.6 daN.m





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

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

Your attention is drawn to a specific point or operation.

#### 2.8 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 fastener	s 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



#### 3.1 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 IEC60466. This product range also meets the requirements of NFC 13-100 and the Enterprise Specification HN 64-S-41 from EDF.

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

- Telecontrol compartment,
- Busbars,

Breaker switchgear or isolation switchgear, with an operating lever,
Cables.

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

Functional Units	PFA		ТМ		PGB - PGC				PBB or PGC 1250A
Width (mm)	375	500	375	500	750	875	1125	1250	1000
Overall Depth (mm)	1072	1072	1072	1072	1110*	1110*	1110*	1110*	1110
Height (mm) standard	1610	1610	1610	1610	1610	1610	1610	1610	1610
with deflector or LV box on the roof	1950	1950	1950	1950	1950	1950	1950	1950	1950
Space for manœuvres in front (mm)	800	800	800	800	1000	1000	1000	1000	1000
Approximate weight (kg)	115	125	195	210	410	460	510	610	600

\* Disconnectable Functional Unit in 1120 mm



#### 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 Earthing pin for installation of 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
- 28 ISR locked in 'Open' position
- 29 Upper plugging-in clamps
- 30 Lower plugging-in clamps
- 31 HV Fuse

#### IS (Switch-Disconnector)





## **PF - PFA (Fuse Protection)**



TM (Instrument Transformer)







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

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





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





PGB disconnectable (General Busbar Protection) + FP circuit breaker

## + 6 current transformers

+ 6 current transformers + 6 voltage transformers







# 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 for the 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.

#### 4.3 The accessories package

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

#### 4.4 Reception/Acceptance

- 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.



 The packaging of a Functional Unit for air and maritime transport:

- under a heat-sealed cover with bags of desiccant,

- packed in wooden crates.



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

• Check the characteristics shown on the name and rating plates, in relation to the initial order (see § 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.





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

#### 4.6 Handling



- Road and rail packaging (500 kg max.): with the aid of a hand-operated lift truck.
- It is **imperative** that the forks of the truck are fully engaged across the entire width of the Functional Unit.
- Move the Functional Unit, by always taking account of its centre of gravity (marked on the packaging).



- Air and maritime transport packaging: 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.
- Move the Functional Unit, by always taking account of its centre of gravity (marked on the packaging).



- 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.

+50° C

- 25° C

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

The area 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			S
Operations carried out by the Customer			
Operations requiring specific training, carried out by an approved third party			
Work to be carried out <u>exclusively</u> by AREVA			3

ii

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

. Packaged under a plastic covering	1	2	3
Periodically carry out an inspection of the packaging	Х	Х	Х
When unpacking, check the mechanical operation by carrying out several operations*	Х	Х	Х

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

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

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

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

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



# 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 greater than 2 mm per metre. 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. The overall flatness of the support surface should not show up any deflection greater than 6 mm throughout the length of the switchboard.

#### 5.2 Unpacking the Functional Units

	Tools required:	
Proceed with unpacking the Functio-	- Knife for road and rail	Llas quitable protective glaves for
nal Units only where they are to be	transport packaging	ose suitable protective gloves for
installed on site.	- Crowbar for air and sea	any handling operation.
	transport packaging	

#### 5.3 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.

For the PGB and PGC Functional Units, remove the wooden base <u>without extrac-</u> ting the circuit breaker.

• Special case of Functional Units without an earthing switch.



 Remove the mechanical control hood (see the corresponding manual § 2.5).



- Loosen the 2 CHC bolts.
- Pivot the lug towards the right.
- Remove the front panel.



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



- Place the Functional Unit on the ground.
- Replace the front panel



4 slings each one capable of

Respect the minimum carrying

height as shown on the above

supporting 1,000 kg.

diagram.

•

•

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



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

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

#### 5.4 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.

#### 5.5 **Installing Functional Units**

For a switchboard composed of 1 to 8 Functional Units, it is advisable to begin installing the equipment on the side of the room opposite the entrance.

#### 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.

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

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



#### 6.1 Installation of each Functional Unit

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



- To each far end Functional Unit fix the blanking off side panel.
- Position the first Functional Unit.
- Verify that it is upright.

The coupling of the Functional Units requires dismantling of certain parts to be fitted back in place again. Organise the arrival of the Functional Units in accordance with the single-line diagram.



- Mark out the coupling points:
   7 distributed over the front facing panel,
  - 2 on the lower cross-bar,
  - 2 on the upper cross-bar,
  - 3 at the rear, in the cable compartment.

As an example, here is the wiring cover placed in the upper left-hand corner, at the front.



- Place the second functional unit alongside the first.
- Align the front panels.
- Interconnect the Functional Units using all the fixing points (H M8x20 bolts and nuts).
- Continuing with the assembly.



- Unscrew the fixing bolt on the metal cover (10 mm spanner).
- Lift up then remove the cover.
- Carry out coupling.



• Replace the cover by inserting its upper part <u>behind</u> the busbar reinforcement.



- Engage the snug into the slot.
- Lower the cover.
- Screw in the fixing screw.

#### 6.2 Functional units with internal arc withstand protection

Before setting in place, each functional unit must be individually fitted with its rear deflector (2 x HM6x16 screws).

During assembly, the deflectors must also be interconnected (HM8x16 bolt and nut).

#### 6.3 Fixing the Functional Units to the floor

Fix the Functional Units to the ground, by 2 points at the front and



(Fasteners not supplied).

2 points at the rear (H M12x30 screws and flat washers with an out side diameter of 32mm) or 2 points at the centre (PGC and PGB).



Each functional unit must imperatively be anchored to the floor by its • four fixing points.

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





- Close-up of the connection.
- 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).

#### 6.5 General switchboard earthing connection to the earthing spike of the building

This connection is via the Functional Unit to the extreme right of the set (viewed from the front).



Connector point for the earthing spike linkage cable.

The copper connecting conductor must have a minimum cross section of 30 mm<sup>2</sup> (fasteners not supplied).



Remove the plastic blanking panel to connect the cable.



Pass the bolt through from the outside of the functional unit with the flat • washer already fitted to the head. Then, attach the cable, and from the inside of the functional unit ,the flat washer, the self-locking washer and finally the M12 Nylstop nut (fixings not supplied).

#### 6.6 Standard busbar connections

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



 Gain access to the busbar by removing the first roof panel (fixing by 7 H M6 screws). If the storage time has been long, ensure that there has been no trace of any knocks or oxidation.



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

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



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.



- Standard assembly of the bars on to the supply terminals.
- Under 630 A, provide for a copper shimming washer at the extremity.
  - For a greater number of Functional Units:
  - Fit the first and third flat bars,
  - Place the second bar on the first two,
  - Continue in this way.



Connection of the busbars between two Functional Units.



• Standard busbar connection.



- Position the 1250 A bars between the two contacts. At each extremity (as shown here), fit a shim in place of the second bar.
- When all of the bars have been fitted, tighten to the indicated torque.
- Clip on the extremity deflectors.

#### 6.8 Connection between 630 A and 1250 A busbars





- Fit the external contact, the internal contact, then the extra flat bars. Then fit the three Belleville washers and the CHC M10x70 bolts, without tightening them.
- Position the 1250 A bars between the two contacts.
- When all of the bars have been fitted, tighten to the indicated torque.

#### 6.10 Coupling of a Fluokit M24+ functional unit to a Fluokit M24 functional unit

The example given is for the coupling of a Fluokit M24+ functional unit on the right of a Fluokit M24 functional unit. The coupling plate is different according to whether the extension is on the right or on the left.



- Remove the door of the Fluokit M24+ functional unit to be coupled.
- Mount the end plate if needed (see § 6.1)



- Remove the end plate from the M24 functional unit.
- Move the Fluokit M24+ functional unit close to the switchboard.
- Fasten the coupling plate, on the Fluokit M24 side, from the inside of the functional unit [3].



- Fastening points on the plate: **1** - 4 fastenings by M6 nuts + washers
  - **2** fastenings by H M8x20 bolts
  - **3** fastenings by M6 nuts + washers



- Press the plate against the functional unit.
- Fasten the plate with 4 M6 nuts
   + washers [1] from the inside of the functional unit



- Remove the protective cover as indicated in § 6.6.
- Fasten the functional units to each other at the front [2].



• Fasten the functional units to each other at the back [2].



• Complete coupling by mounting the busbar and the earthing circuit as indicated in § 6.4 & 6.6.



# **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 brace (2 H M8x20 bolts and Nylstop nuts).



- 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 tension on 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
- Lift off the deflector, the H M12 nut and the two washers for each point.
- Connection is made by a round or rectangular lug. In this last case, axis of the hole must be 20 mm max. from the upper side de the lug.

- 4 Belleville Washer
- 5 Flat washer
- 6 Rectangular lug (50mm x 48mm max.)



#### 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.

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



### Rectangular lug connection

- Fit in place the spacer in copper.
- Position and 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



- The connecting point is to be found below the fuse's lower support.
- Begin the connections by the cable at the back.



- Proceed in the same way as for the IS unit (§ 7.4).
- Remove the H M8 nut and the two washers from each point.



- Connection is made by a round lug.
- There is no deflector.

#### 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.
- Re-assemble the lower front cross-brace.

For the Functional Units PF /PFA, ensure that the cables exert no traction on the support cross-brace. 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 M10 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

Prior to fitting, a fuse status test must be carried out.



- 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.

#### 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.

rings for delivery.

•

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

Example of the assembly of the

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



#### 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 Marking the functional unit on the LV box cover



 On the front panel, the cover may bear an ID plate – identifying the functional unit.



• If this is the case, this description must be noted on the label within the box.



The cover is thus permanently linked to a single functional unit.

•

### 8.2 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.

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

Material to be provided: Lugs for 6 mm diameter fixings, - 1.5 mm<sup>2</sup> cross section (TM), - 2.5 or 6 mm<sup>2</sup> cross section (PGB).



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



• Side face view: connection from the top.

 Location of the terminal block.
 Wiring to be carried out on site. Provide for an additional length of 4 m of wire.

#### 8.4 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.

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.



- 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.



## **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) or C440M (with double mechanical latching), and a voltage detection relay of the IPT 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 and 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.



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



#### 9.2 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



on the front face, on the box for each Functional Unit. It is padlockable in the open position and ensures the sectionalizing of the auxiliary power supply (+ 48 V, - 48 V).

Neutralization switch.

#### Operations to be carried out

1 - Beside the neutralizing switch, attach the UFB Double Shunt label above the other one.



Passing from UFA type to UFB type: • recover the labels supplied in the bag attached to the LV link.

2 - Modify the connector's foolproofing device (see § 9.1). 3 - On the connector itself, attach the UFB label above the one marked UFA.



#### 9.3 Mounting and connection of 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.

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.

Connecting the rings.

#### 9.4 Commissioning the double shunt layout

Ensure that the batteries are properly charged before the commissioning tests



Carry out replacement of these batteries every 4 years. Apply the commissioning instructions in chapter 16.



#### 10.1 Principle

This function provides an automatic transfer of the load from the "Normal" source to a "Backup" source in the event of a loss in voltage from the former. It will automatically return to the "Normal" source once the voltage has been definitively restored. Between the 2 Functional Units called Cable 1 and Cable 2, the selection of the "Normal" source is made by a selector switch. A mechanical function interlock prevents the 2 sources from being connected in parallel.

#### 10.2 Presentation



 IS Functional Units are coupled together and equipped with C440M mechanical control mechanisms.
 <u>N.B.</u>: Shown without the electrical energy unit.



 Front face of the LV box.
 1. "Normal" source selector switch. It is padlockable in the 3 positions and must be set to 0 before any maintenance operation.

2. Operations counter. Increments a unit whenever the Normal-Backup source carries out a complete operating cycle. When the operations counter is located between 2 units, the Normal-Backup operates on the "Backup" source.



- The LV box groups together the changeover automatic controls.
   3. Protection fuses.
  - **4**. Automatic changeover control relays.
  - 5. RPT voltage detection relays.
  - 6. Connections terminal block.



Protection fuses.



Changeover relays.
 The K4 relay is set for a minimum voltage disappearance time on the busbar = 0.3s. It is possible to adjust this time depending on the network's constraints.



 RPT voltage detection relays (one per Functional Unit). The reference voltage is taken on the L2 phase, at the voltage socket level.

#### **10.3** Mechanical interlocking forbidding connection in parallel



 The 2 Functional Units are supplied coupled together, connected by mechanical interlocking.



 Location of the passage of the linkage rods between the 2 mechanical controls.



- Covers removed.
- The two C440M mechanical control mechanisms are not interchangeable between each other.



## **11 Operating accessories and instructions**

#### 11.1 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.



• The accessories (fuses, levers) are stored in the wall storage rack (see § 11.2).



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

If cubicle **de-energized**: the wearing of gloves is not compulsory. If cubicle is **energised**: respect and apply the operating and safety instructions in force on the site.



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

## 11.2 Wall storage rack (optional)



 If necessary, cut out the upper part to house the box containing the fuses.



 Under the wall storage rack, fix the (optional) support for the rolling floor supplied in the case of a withdrawable PG Functional Unit.

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

See the instructions in the manual (See § 2.5).

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

See the instructions in the manual (See § 2.5).

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

See the instructions in the manual (See § 2.5).

11.6 Cable testing

- This test is to be carried out before commissioning the Functional Unit.
- Afterwards, it will also be carried out regularly 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.



- 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.

#### 11.7 Installing the removable earthing switch device





### 12.1 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 and lock it.
- There is a small pad in the top left hand corner used to apply a lead seal to the box.
- The rest of the manoeuvres are identical to those of the IS Functional Unit (refer to the instruction manual, see § 2.5).

# **13 Operating the PGB Functional Unit**

#### 13.1 Opening the upstream and downstream earthing switches



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

13.2 Closing the load break switch

• Insert the lever.



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



- The earthing switches are now open.
- Remove the lever.



- 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 of its extremities.
- Lower the lever towards the right.



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

#### 13.3 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.

### 13.4 De-energizing a PGB Functional Unit

Proceed with operations in the reverse order to those described in § 13.1 to 13.3.



#### 14.1 Opening the downstream 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 of its extremities.
- Lower the lever towards the left.



The earthing switch is now open.
 The door panel is now. locked.

#### 14.2 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 of its extremities.
- Lower the lever towards the left.



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

#### 14.3 Closing the load break switch



Using the left hand, turn the • padlockable button and maintain it there.

14.4 Closing the circuit breaker

Insert the lever.



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



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



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.

#### 14.5 De-energizing a PGC Functional Unit

Proceed with operations in the reverse order to those described in § 14.1 to 14.4.



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15 Locking-out and locking operations

#### 15.1 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> <li>Between the cable access panel and the earthing switch</li> </ul>	• It is impossible to completely open the earthing switch if the door panel is not in place.	<ul> <li>The fitting of the access panel to the cable compartment unlocks the earthing switch.</li> </ul>
	• Earthing switch open, it is impossible to remove the cable access panel.	- The opening of the earthing switch locks the door panel in place.
• Between the earthing switch and the load break switch	<ul> <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 ear- thing switch (door panel in place) authorises the operation of the load break switch.</li> </ul>	<ul> <li>Whenever the cable access panel is removed, it is impossible to open the earthing switch, but a mechani- cal interlock forbids operating the switch.</li> <li>The presence of the panel frees this interlocking.</li> </ul>
	• Load break switch closed, it is impossible to close the earthing switch.	- A mechanical interlock forbids this operation.

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



• De-energize the LV auxiliaries power supplies before padlocking the switch (C410 or C430 mechanical control) in 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.

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

#### 15.3 Locking-out by key locks

For all locking operations by key locks, consult the instructions manual "Instructions for the installation of standard locks by key locks" (see § 2.5).



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

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



#### 16.1 Reminder

and electrically tested.

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

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

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

Prior to shipping, FLUOKIT M24+

Functional Units are mechanically

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

#### 16.3 Pre-commissioning information

Respect the General Safety Instructions booklet for Electrical Applications and the particular regulations for the network concerned with regard to locking-out procedures. 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. Also check the leaktight sealing in the room and the cable troughs.

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

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

#### 16.4 Final checks before commissioning

Date	Remarks	Signature
Date	Remarks	Signature
Date	Remarks	Signature
	Date	Date Remarks Date Remarks Date Remarks Date Remarks Date Remarks

State of the switchgear	Date	Remarks	Signature
<ul> <li>Ensure that <u>all</u> 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>			

### 16.5 Energising the "Incoming" Functional Unit



The "voltage presence" indication is ensured in conformity with the instructions in IEC61958.

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.

Energise the busbar. To do this, close the load break switch (See § 11).

## 16.6 Energising 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 § 16.7) prior to commissioning.

16.7 Control of phase balance with a VPIS voltage presence indicator (in accordance with IEC61958)



 Connect the two phase comparator cables to the 2 phases of a single functional unit.

The light should light up: the comparator is now working.

The Fluokit M24+ phase comparator is an optional extra. If no comparator is available, as a secondary measure, use the Fluokit M24 phase comparator for an equivalent voltage.

### 16.8 Energizing the switchboard

Close the breaking devices on the "Incoming" functional units.



• Ensure the phase balance using a phase comparator <u>checked</u> If the phases are out of sequence, inspect the cable connections.

Energize the "Outgoing" Functional Units.

Close the corresponding breaking devices.



#### 17.1 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 (see § 1.2) 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

### 17.2 Preventive maintenance for the mechanical control mechanisms

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

### 17.3 Preventive maintenance of the functional units

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

• During the initial AREVA maintenance operation the torque levels of all HV connector points must be systematically verified.



- This test is certified by the application of a small label – stuck onto the ID plate.
- Then, a simple visual inspection is required.

#### Specific case – switchboards assembled by AREVA

A label stuck onto the ID plate is used to certify the torque of the busbar (See § 17.4).

It is not necessary that the busbar be checked again.

Every 3 operations, it is there-

fore necessary to replace all

On the other hand, the other connector points should still be checked.

#### Specific case - request for systematic verification of torque levels (vibration, etc.)

of the threaded fasteners .

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

#### 17.5 Greasing of the contact surfaces

Intervention	Duration	Busbar	Cables	Load Break 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 rules for the network concerned for 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.

#### 17.6 Corrective maintenance

CORRECTIVE MAINTENANCE			Levels	
Replacements or modifications	See chapter	1	2	3
Replacement of the three HV fuses	17.7	Х	Х	Х
Replacement of the VDS (Voltage Detection System)		-	Х	Х

#### 17.7 Replacement of the three HV fuses

Intervention	Duration	Busbar	Cables	Load Break Switch	Earthing switch
Normal	30 mins.	de-energized	de-energized	open	closed
Possible	30 mins.	energized	de-energized	open	closed

For an apparently single

Open the load break switch.

that all 3 fuses be replaced.

phase fault, it is imperative

Tools required:

- leather gloves

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

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

work gloves).



- 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.
- Ensure that there is an absence
  - Lift the fuse up to free it from the lower current supply terminal.
  - Similarly remove all 3 fuses.

Parts required:

- 3 fuses with the same reference (verify values in accordance with the transformer power)

of voltage.

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

- Fit the replacement fuses by carrying out the instructions in § 7.9.
- 17.8 Replacement of the VDS (Voltage Detection System LV capacitors)

Intervention	Duration	Busbar	Cables	Load Break Switch	Earthing switch
Normal	30 mins.	de-energized	de-energized	open	closed
Possible	30 mins.	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: - 10 mm open-ended spanner Parts required: - 1 VDS of the same reference <u>NB</u>: The calibre of the VDS is dependent on the voltage range.



• The VDS is located in the cross-brace which supports the capacitive insulators (See § 3.3).



• Example under IS: Dismantle the trough in the lower right hand corner, fixed in place by 1 x HM10 bolt.



• Extract the VDS via the front, disconnect it and replace it.

#### 17.9 Possible anomalies and remedies

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



#### 18.1 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. For an explanation of the levels of maintenance, please refer to § 17.1.

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

Non Brogrammod raplacement	Denomination		Levels		
Non-Programmed replacement			2	3	
Describes spare parts whose replacement intervenes in the course of corrective maintenance.	Heating element	x	x	x	
<u>Use</u> : Parts that are changed during a corrective maintenance operation, outside the scope of normal preventive maintenance actions.	Voltage presence indicator box	x	x	x	

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

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

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

#### 18.3 Storage conditions

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

#### **18.4 Maintenance Consumables**

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

search, they must be marked by the AREVA reference number. Certain components are fragile; they should preferably be stored in their original packaging.



#### 19.1 Valorisation of the equipment

Our Functional Units are composed of recyclable elements.

The tables (§ 19.5) give information and figures for the types of materials, their quality and their methods of valorisation. They enable the following: - Calculation to be made of the

capacities for valorisation,

- Optimising the valorisation pro-

cess,

- Evaluating the cost of valorisation.

The indications given in tables (§ 19.5) facilitate co-operation between users and companies specialised in elimination to valorise the product at the end of the product's service life.



#### 19.2 Safety instructions







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

#### 19.3 Dismantling of the equipment service

Consult AREVA 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.

#### 19.4 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.
- 19.5 Distribution and valorisation of the materials used for PGB (See § 19.1)

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

Materials including inserts	Weight (kg)	% of Materials	Valorisation
Steel	253		Yes
Stainless steel	0		
Copper and copper-based alloys	49,1		Yes
Aluminium and aluminium alloys	15		
Other non-ferrous metals	0		
Total metals (including inserts)	317,1	69	

Materials	Weight (kg)	% of Materials	Valorisation
Epoxy Resin*	71,3		Cannot be valorised
Glass fibre reinforced polyester	0		(sent to
Others	0		Technical Burial Centres)
Total Thermosetting Products	71,3	15,6	

### \* mainly silica

Materials	Weight (kg)	% of Materials	Valorisation
PC	2,92		
PTFE	0,26		
PVC	0		
PPO	0,9		Yes
PU	60		
Others (PMMA, PA, PBT)	2,5		
Total Thermoplastics	66,58	14,51	
Materials	Weight	% of Materials	Valorisation

Materials	(kg)	% of Materials	Valorisation
Elastomers	0,4	0,09	Connet be valerieed
Paints	0,13	0,03	Cannot be valorised
Gas	Weight (kg)	% of Materials	Valorisation
SF6	0,58	0,13	<b>Yes</b> (regeneration)
Other materials	Weight (kg)	% of Materials	Valorisation
Total	2,91	0,64	Cannot be valorised



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

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