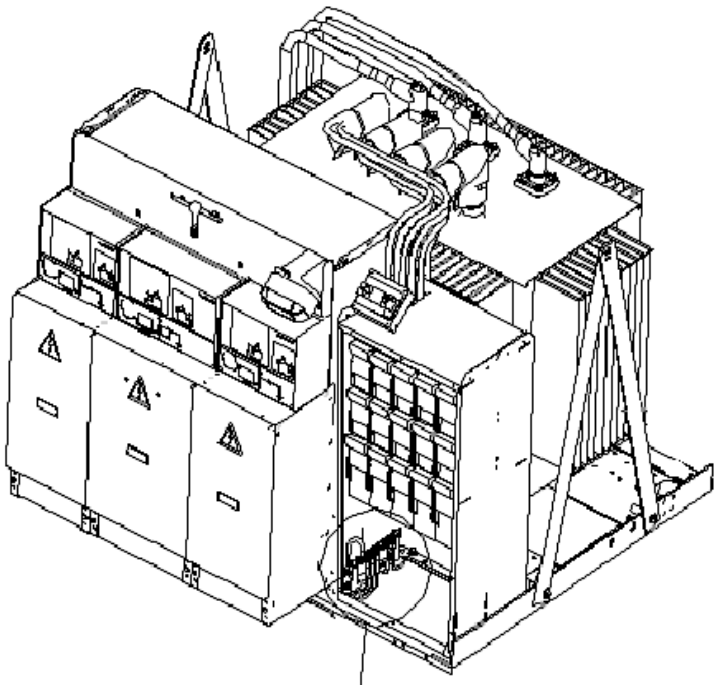
LIB	GENERAL INSTRUCTIONS	IG-130-GB

ASSEMBLY INSTRUCTIONS FOR THE MB 24 kV COMPACT TRANSFORMER SUBSTATION



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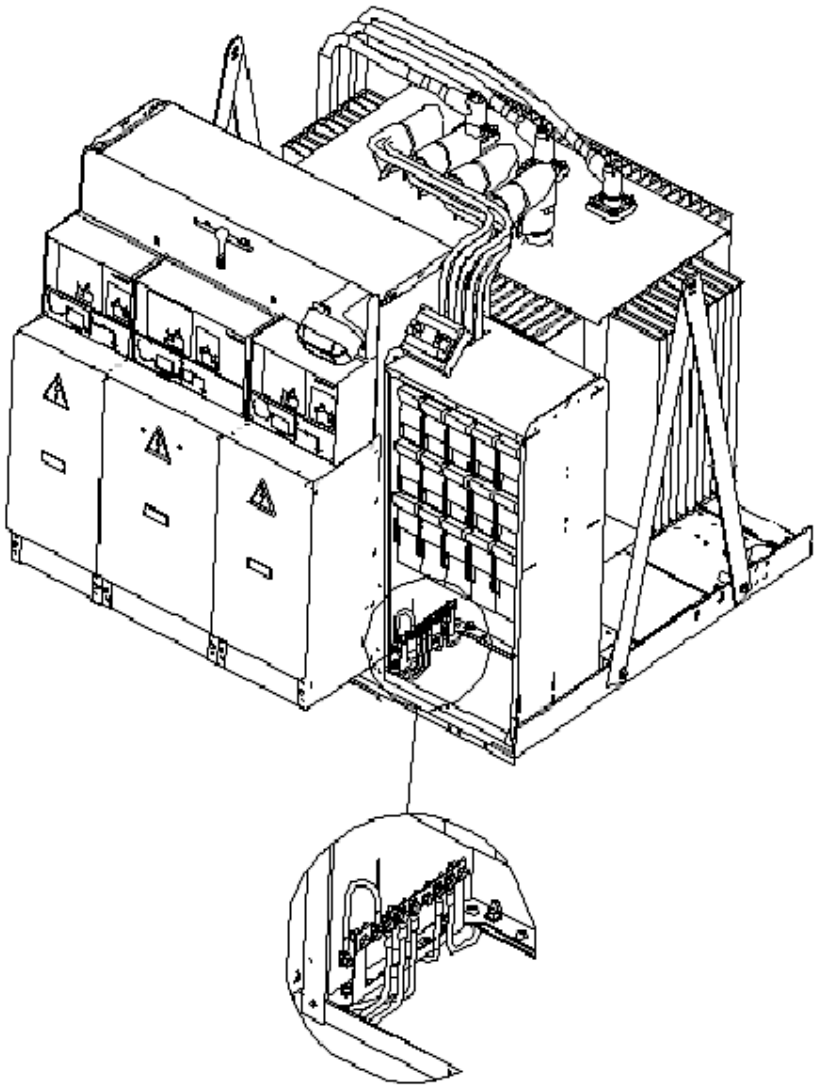
1. DESCRIPTION AND MAIN CHARACTERISTICS

The ORMAZABAL MB Compact Transformer Substation consists of the following main elements:

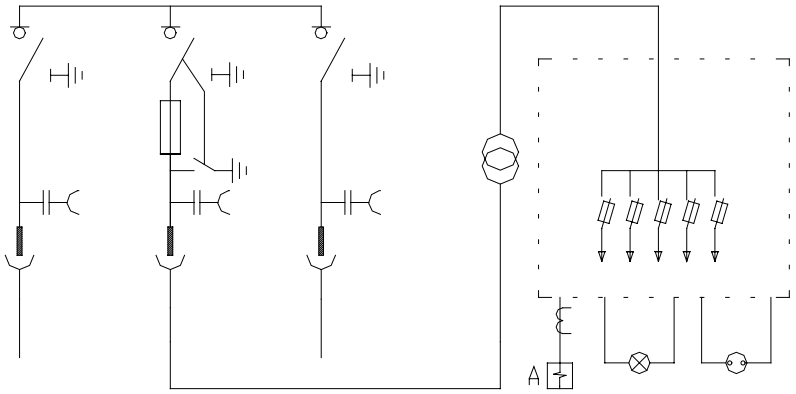
- SF_6 fully insulation compact MV switchgear, CGMCOSMOS-2LP system.
- MV/LV distribution transformer unit of 250, 400 or 630 kVA / 24 kV fully filled with oil.
- LV switch gear. Low Voltage Switchboard (LVS) with Control and Protection functional unit.
- Direct MV and LV cable connections.
- Earthing circuit.
- Lighting and auxiliary services.
- A rack.
- Raising system.



1.1 TECHNICAL CHARACTERISTICS OF THE COMPONENTS

MV/LV TRANSFORMER	
Rated power	250, 400 or 630 kVA
MV/LV no load voltage	Up to 24 kV / 420 V
Connection group	Dyn11
Short-circuit impedance at 75 ºC	4%
Cooling system	ONAN
Insulation Level:	
MV	Power Freq.: 50 / 60 kV Lighting Impulse: 125 / 145 kV
LV	Power Freq.: 10 kV Lighting Impulse: 20 kV
MV/LV SWITCHGEAR	
SF_6 Insulation	CGMCOSMOS
Insulation level	Power Freq.: 50 / 60 kV Lighting Impulse: 125 / 145 kV
Main busbars:	
Rated current	400 A
Short duration rated current	16 kA ef. (1 s)
Peak value	40 kA
Transformer protection function:	
Rated current	200 A
Switch-disconnector:	
Type	Rotating (category E3)
Rated current	400 A
Short duration rated current	16 kA ef. (1 s)
Peak value	40 kA
Short-circuit making capacity	16 kA / 40 kA
Earthing switch:	
Short duration rated current	16 kA ef. (1 s)
Peak value	40 kA
Short-circuit making capacity	16 kA / 40 kA (category B)
Earthing switch downstream of the fuse:	
Short-circuit making capacity	1 kA / 2,5 kA (category B)
LV SWITCH GEAR	
Insulation level	Power Freq.: 10 kV (p-n) / 2.5 kV (p-p) Lighting Impulse: 20 kV
Current assigned to general busbar	1000 A
Three-pole vertical bases:	
Rated current	400 A

Single wire diagram:



1.2 SIZE AND WEIGHT

The MB sets have the following maximum sizes:

SIZE [mm]	630 kVA	400 kVA	250 kVA
LENGTH	**1830**	**1830**	**1830**
WIDTH	**1742**	**1742**	**1742**
HEIGHT	**1466**	**1466**	**1466**
WEIGHT [kg]			
	2500	**2100**	**1700**

The following figure shows the general dimensions of the MB 24 kV / 630 kVA Compact Transformer Substation:

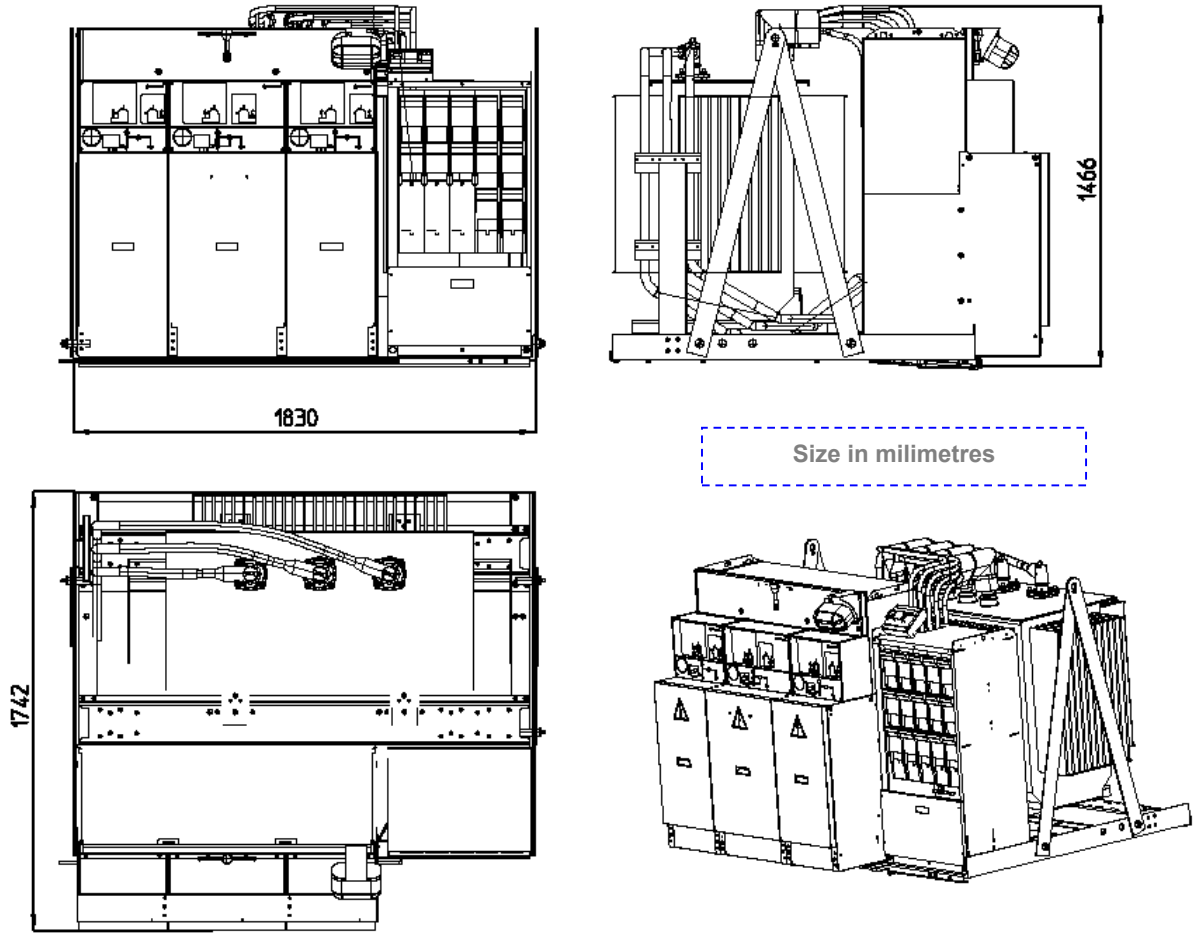


Fig. 1.2

2. HANDLING

WARNING:

WEIGHT (630 kVA): 2500 kg
WEIGHT (400 kVA): 2100 kg
WEIGHT (250 kVA): 1700 kg

Fig. 2.1

When operating with a crane use a rocker arm 1700 mm in length and a minimum load capacity of 2500 kg. Secure the snap rings to the holes provided for such purpose in the upper part of the two side plates attached to the frame. The load capacity of the slings must be at least 1500 kg.

In order to unload with forklift, always access from the side of the transformer.

Fig. 2.2

Remove the transportation supports.

Fig. 2.3

3. STORAGE

The **MB** is an assembly for indoor use. The equipment must be stored in such a way as to prevent rain water and sunshine affecting the compact assembly. Store in non aggressive environments.

Storage temperature: maximum 55º C, minimum –15º C.

Maximum height above sea level 1000 metres.

4. SERVICE CONDITIONS

The ORMAZABAL MB assembly has been designed to work under the following extreme environmental conditions:

- Ambient temperature:
  - Minimum: -5 ºC
  - Maximum: +40 ºC
  - Average maximum temperature: +35 ºC
- Average air humidity, measured during a 24 h period, must not exceed 95%.
- Height above sea level up to 1000 m.
- The transformers must comply with the specifications in 1.2.1 of standard UNE-EN-60076-1.
- The effects of external vibrations are not significant.

5. EARTH CONNECTION

The MB's protection earthing circuit, metalic parts, connected to earth or a metal structure is made from a naked 50 mm^2 gauge copper wire 3 m long. The earth feeder connects to the earth protection box located inside the Transformer Substation.

An earth collector is located under the lower lid of the LVS where the earthings of the MV bay meet at two points, transformer, LVS metal enclosure and platform via naked 50 mm^2 cross-section copper wire.

The casing's steel reinforcement is connected directly to the protection box.

The Transformer Substation project must include the section regarding the execution of the earth connection (check standard project of Utility), as well as the justification of its sizing. The Earthing Installations section of the Regulations regarding Power Stations, Substations and Transformer Substations (MIE-RAT 13) describes the requirements for this kind of facility.

The earthing installation must be connected to the LVS's zero-sequence bar.

VERY IMPORTANT

THE LVS's ZERO-SEQUENCE BAR IS NOT CONNECTED TO THE PROTECTION EARTHING BAR (METALIC PARTS).

The copper connector cross-section, the contact surface of terminals and tors must be suitable for a default current delimited by the Network protections. It is recommended to use an earth protection earth network of 50 mm^2 minimum cross-section of naked copper wire.

It is preferable to execute external earth connections at the same time. You are recommended to review the standard project for installation of Compact Transformer Substations available from the Utility that provides the service and is in charge of the safety of the earthing installation on site.

In the cases when it is not feasible to maintain the values of step and tauch voltages within the limits specified in Supplementary Technical Instruction MIE-RAT 13 of the Transformer Substation Regulations (R.D. 3275/1982 and updates), the owner of the facilities shall implement at least one of the additional safety measures provided in this instruction, in order to reduce the risks to persons and assets.

The tor for electrical connections to the earth network is defined in the following table.

METRIC	TOR [Nm]	
	Steel 8.8	Stainless A2
M-10	32	
M-12	56	

6. SEQUENCE OF OPERATIONS

6.1 COMMISSIONING

Once the MB has been placed on site, make the input and output connections to the MV cubicle feeder functions as well as the LV incoming lines.

Check that the MV voltage of the transformer is suitable for the installation project. It is specified in the transformer characteristics plate and in the test protocol.

Before powering the Transformer Substation, it is necessary to check that the transformer change-over switch is in the maximum rated voltage position and that it is locked. For multivoltage MV voltage transformers, check that the transformer rated voltage corresponds to the line service voltage. **The change-over switches must only be actioned when there is no voltage on the line.**

Power the functional unit of the CGMCOSMOS cubicle, while the transformer has no load (LVS fuse rails open).

When powering the Transformation Substation, check the service voltage from the LV side (fuse rails). If it does not match the established value, proceed as follows:

- Switch off the functional unit of the CGMCOSMOS cubicle. Open all LVS fuse rails.
- Verify the absence of voltage in the functional unit of the CGMCOSMOS cubicle and in the LVS.
- Next earth the functional unit of the CGMCOSMOS cubicle. Earth the transformer LV cable bushing.
- Unlock the regulation tap changer adapting it to the real supply voltage by reducing the position of the switch handle by one position.

Check the service voltage from the LVS, while the transformer has no load. Measure the voltage in the low voltage switch (LVS) to check proper connection and position of the regulation tap changer. If the service voltage is incorrect repeat these steps until the right voltage is obtained at the LVS.

Check the various user manuals for commissioning and operating the various functional units.

6.2 USE OF MV TRANSFORMER OPERATION AND PROTECTION FUNCTIONAL UNIT

The CGMCOSMOS system is an assembly of SF_6 fully insulated compact cubicles, designed for Medium Voltage electrical distribution applications up to 24 kV.

The cubicles mainly consist of the following compartments: the tank containing the busbars and the switching and breaking and break elements, the operation mechanism compartment, the cable compartment and that of the gas exhaust.

The metal enclosure provides mechanical stiffness that guarantees it will not lose its shape under the expected service conditions. The gas tank is made of stainless steel, the base and the rest of the components are made of galvanized steel.

In addition, all cubicles have a front cover to access the terminal area, and the synoptic diagram of the main circuit or MV ciecuit is displayed on the upper front of the cubicles.

The operation mechanisms compartment is where the switch operated using the actuation lever on two different shafts:

1. for the **switch - disconnector** (switching between connection and disconnection positions)
2. for the **earthing switch**, which switches between disconnection and earthing positions connecting the incoming lines of all phases and in the case of the fuse protection position, the six fuse rail clamps.

All these elements are operated independently, i.e.: the operation speed does not depend on the manual operation activation speed.

6.2.1 CGMCOSMOS-2LP

- **1.-** Switch compartment, earthing switches, fuse rails and busbars, sealed and filled with gas.
- **2.-** Operation mechanisms compartment.
- **3.-** Cable compartment.
- **4.-** Gas exhaust compartment.
- **5.-** Cable compartment access cover (and/or fuserail compartment).
- **6.-** Cable support.
- **7.-** Earth bus.
- **8.-** Synoptic diagram.
- **9.-** Earthing switch operation area.
- **10.-** Switch operation area.
- **11.-** ekorVPIS voltage presence indicator.
- **12.-** Pressure gauge.
- **13.-** ekorRPT protection, measuring and control unit (optional).
- **14.-** ekorSAS earthing prevention unit

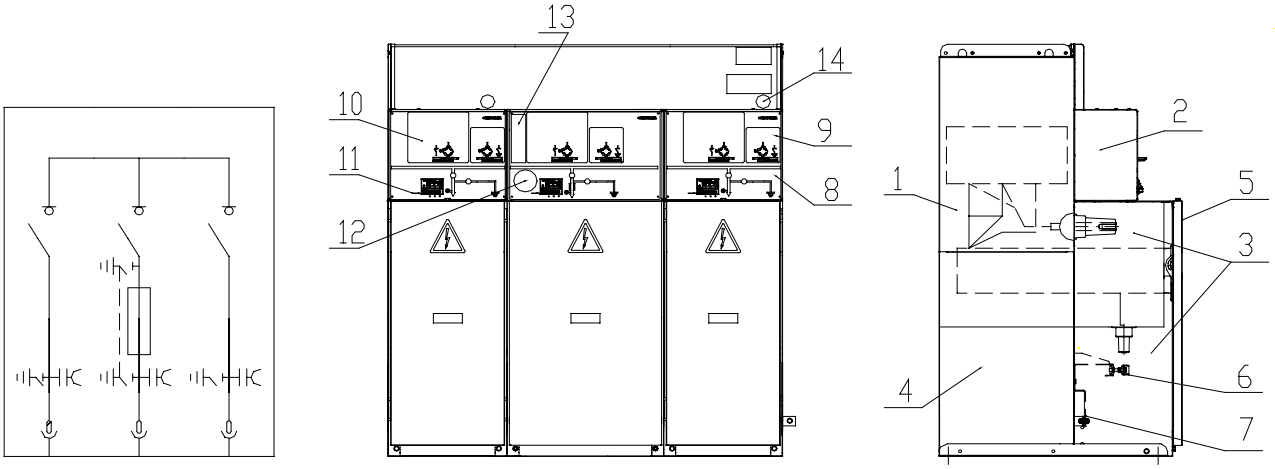


Fig. 6.1

6.2.2 ekorVPIS Integrated Voltage Presence Indicator

The ekorVPIS voltage presence indicator device displays three signals. These correspond with each one of the phases, an display the presence of voltage in each one of them through the indicators lighting.

The ekorVPIS voltage indication is guaranteed for the operating range specified in the IEC 61958 standard.

The correct operation of the ekorVPIS voltage indicator system is guaranteed for temperatures between -25 ºC and 40 ºC.

RATED CHARACTERISTICS			
Rated voltage U_r	kV	12	24
Indicator thresholds	kV	5/12	5/24
Indication frequency at U_r	Hz	>1	>1
Maximum voltage test point	V	200	200
Phase-to-ground voltage at test point	V	110	150
Phase-to-phase voltage at test point in concordance (different modules)	V	<10	<20
Phase-to-phase voltage at test point in discordance	V	>100	>150
Reliability (MTBF)	h	$3 \cdot 10^5$	$3 \cdot 10^5$

The system presents the following indications:

L1, L2, L3: highlight each one of the indicator phases. The numbering matches the order of phases, left to right, viewed from the front of the cubicle. Each phase presents a test point to perform the concordance of phases between cubicles.

⏚ Earthing test point. To be used exclusively for phase concordance.

↯ Voltage presence signalling. The flashing light means there is voltage in the phase.

Fig. 6.2

The purpose of the test points of the three phases and of the ground is to facilitate the phases concordance between cubicles. Hence, this requires the ekorSPC specific phase comparator from Ormazabal[1].

In order to perform a voltage indicator test, connect the indicator to 230 V_{ac}. This requires disconnecting the cubicle and applying voltage terminals between the test point of the phase to verify and the ground test point using 4mm. It has no polarity at the 230 V_{ac} connection, hence it can be connected to the phase and zero-sequence earth regardless. The indicator works correcty if there is an intermittent signal. This verification should be performed on all three phases in order to confirm the correct operation of the indicator.

The display from the voltage presence indicator is not sufficient to confirm the system has no voltage. Before entering the cable compartment check that the line is earthed.

6.2.3 ekorSAS Earthing Prevention Sound Alarm

The ekorSAS earthing prevention sound alarm device consist of an acoustic signal that indicates voltage. It works in association with the ekorVPIS indicator and the earthing operation lever. The alarm is activated when there is voltage on the line and the lever is inserted into the earthing switch shaft. A sound indicates there may be a short-circuit or a zero on the line if the operation i sperformed.

The operation of the ekorSAS is guaranteed for the same range of operation as the ekorVPIS voltage detection system it is related to.

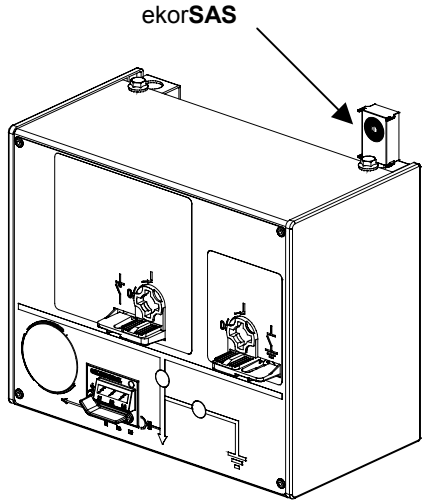


Fig. 6.3

[1] In general, other universal phase comparators complying with the IEC 61958 standard can also be used.

6.2.4 Voltage Presence Verification and Concordance Between Phases

In order to check for voltage on the cables, look at the ekorVPIS indicators of each cubicle. The presence of voltage in each phase will be indicated by the blinking of the ekorVPIS led.

In order to verify the correct connection of MV cables, use the ekorSPC phase comparator. First connect the ekorSPC cables to the same phase test points for each one of the functions to compare, and the black cable to the earth test point. This operation shall be repeated for all phases L1, L2 and L3. The led of the comparator should **NOT** light up. Next connect the ekorSPC to different phases of the cubicles to compare. The led of the comparator **SHOULD** light up.

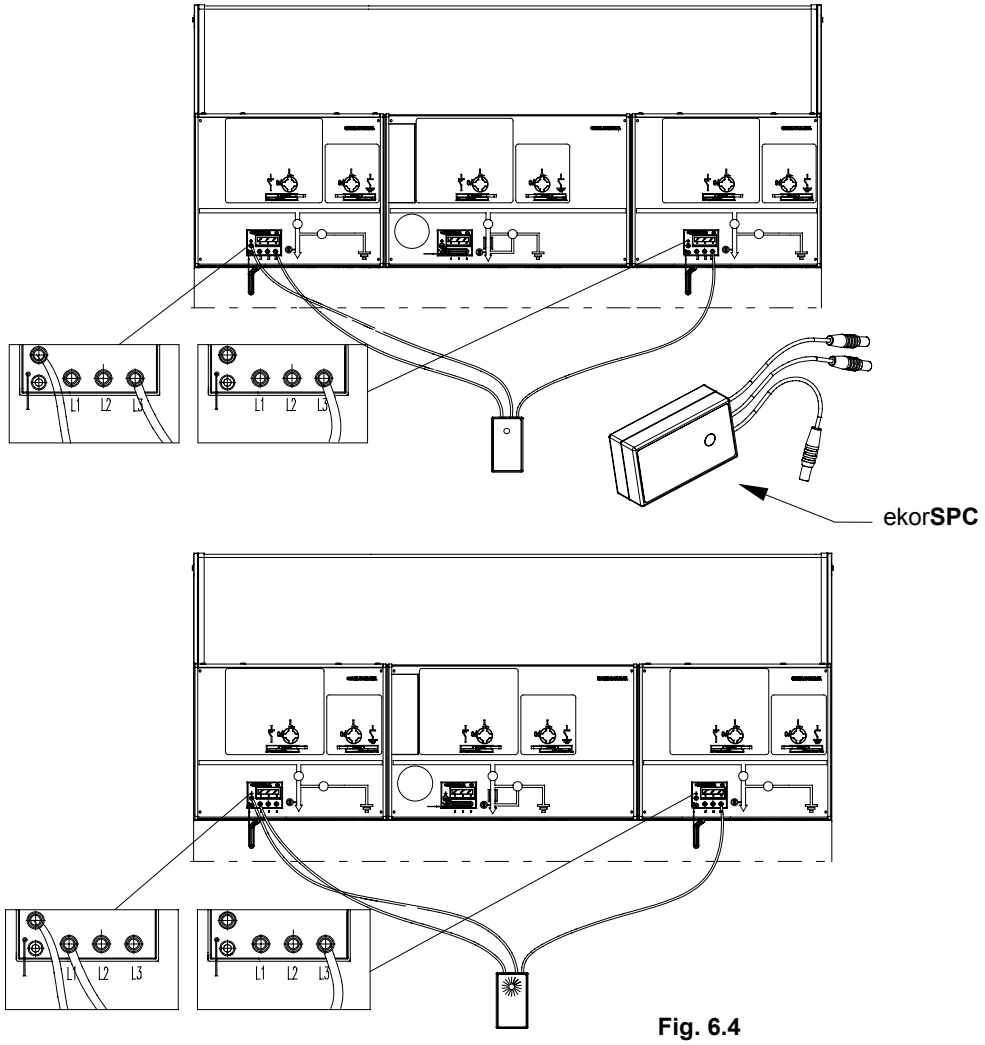


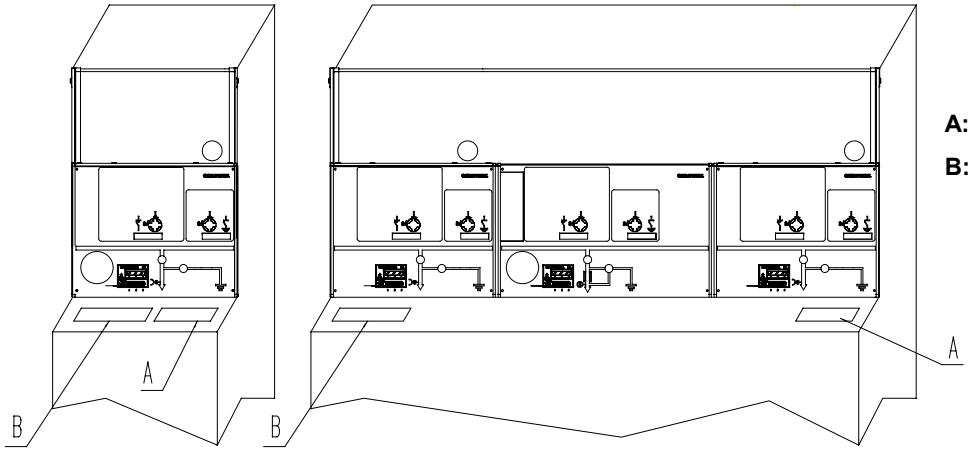
Fig. 6.4

6.2.5 Commissioning of the ekorSAS Earth Prevention Alarm

The correct operation of the ekorSAS can be verified connecting the ekorVPIS voltage presence indicator to 230 V_{ac} with 4 mm terminals that will, to be placed in the indicator between the earth test point and L1 phase test point. It is feed with the battery during 5 min and then the lever is placed in inserted into the earthing switch shaft to operate; the alarm will go off and ring least 30 s. Remove the lever.

6.2.6 Characteristics Plates and Operation Sequence

CGMCOSMOS-L/P/S **CGMCOSMOS-2LP**



A: Characteristics plate

B: Operation sequence plate

Fig. 6.5

6.2.7 Cable Connection

The incoming lines of the MV cubicle feeder functions is carried out with cables. The connections of these cabes with the corresponding bushings in the CGMCOSMOS cubicles can be performed either with simple connecting points (plug-in) or reinforced (bolted on).

The process for connecting wires is as follows:

Frontal Horizontal Connection

1. Connect the earthing switch.
2. Remove the cable compartment access cover.
3. Connect the terminals to the frontal bushing and secure the cables through the cable support and its clamp.
4. Connect the earth connectors of the terminals, if available, and those of the cable screens.
5. Put the cable compartment cover in its initial position.

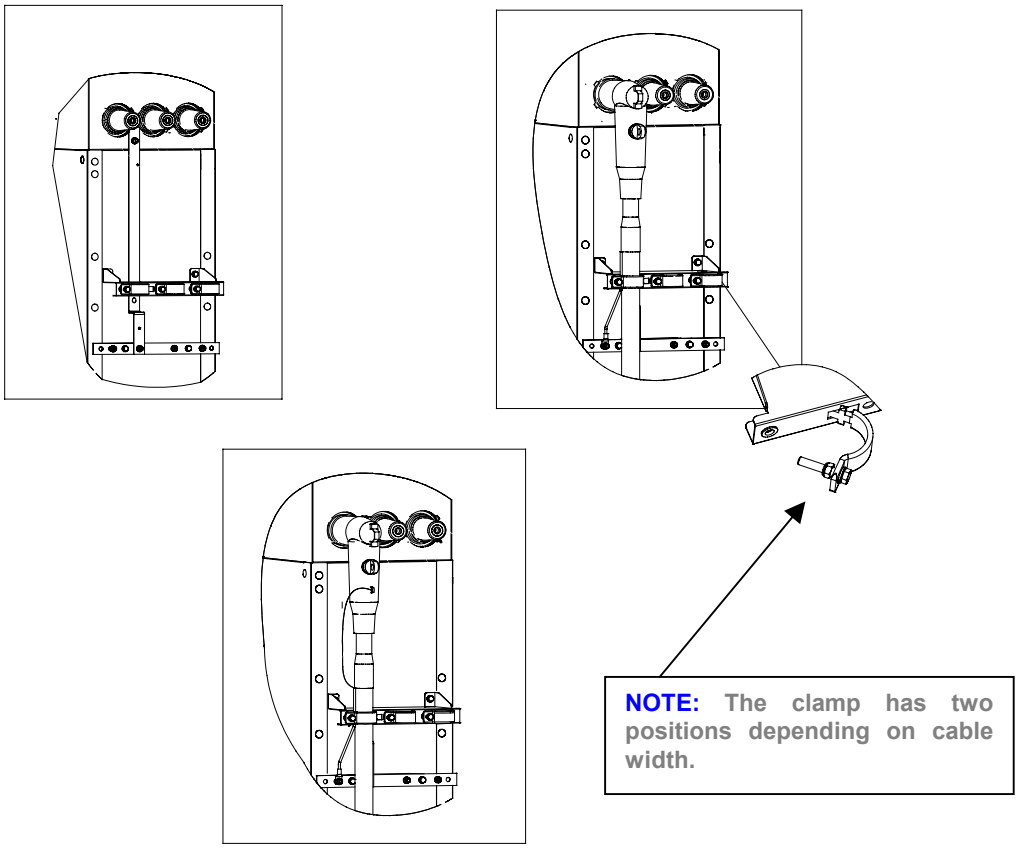


Fig. 6.6

2LP Multifunction Cubicle Protection Function

This is a factory-made connection. Do not handle without the manufacturer's consent.

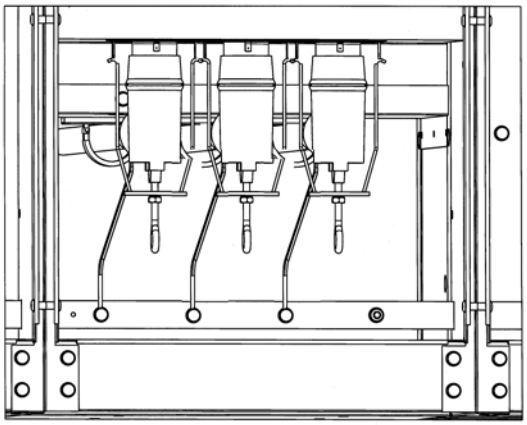


Fig. 6.7

POSSIBLE CONNECTORS (Frontal Horizontal Connection)

- For **400/630 A** bushings, in 12 and 24 kV, commercial shielded and unshielded connectors, both in dry wire and oil lined paper wrapped wire.

  Example for dry wire:

  - Shielded connector, in 12 kV, EUROMOLD 400LR type.
  - Shielded connector, in 24 kV, EUROMOLD K-400TB type.
  - Unshielded connector, in 12 kV, EUROMOLD 15TS type.
  - Straight connector, in 12 kV, EUROMOLD 152SR type.
  - Straight connector, in 24 kV, EUROMOLD K-152SR type.

  Examples for oil lined paper wrapped cable:

  - Shielded connector, in 12/24 kV, EUROMOLD K-400TB-MIND type.

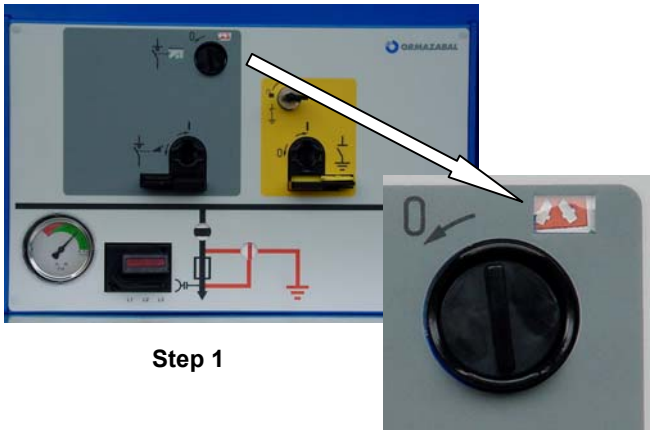
Note: **Contact Ormazabal Technical - Commercial Department for confirmation.**

6.2.8 Installation and Replacement of Fuses

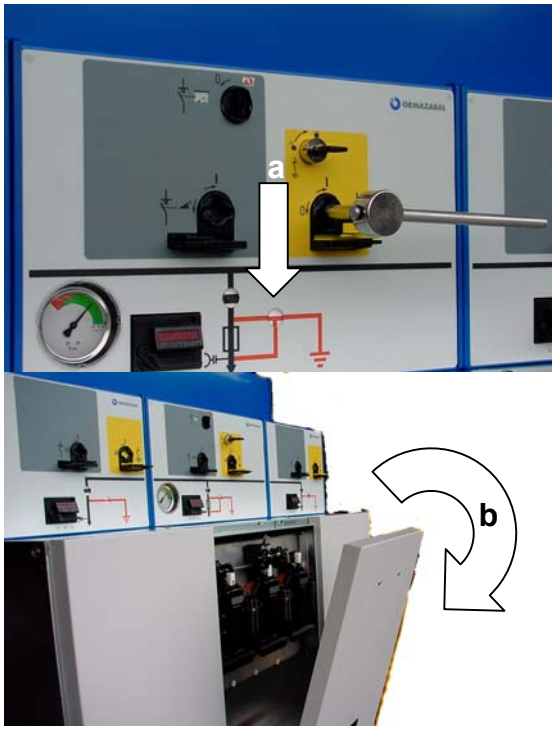
In order to access the fuse rails, remove the cable compartment cover, which **requires closing** the earthing switch.

Once the fuse rails have been accessed, follow the following steps (figures 6.8a and 6.8b):

1. Red indicator and open switch indicate fuse tripping.
2. Close the earthing switch (a) and remove the lower cover (b).
3. Lift the handle of the fuse rail cover to its horizontal position.
4. Press the security trigger.
5. Gently pull horizontally until the fuse rail is removed.
6. Put the fuse in place. Avoid placing the fuse rail trolley on any dirty surface that may dirty the seal or the contact.
7. Put the fuse rail trolley back, ensuring that the side slots fit with the support bushings.
8. Once the fuse rail trolley has been fitted in, push the lever down gently to the end, and finally place the lower cover.

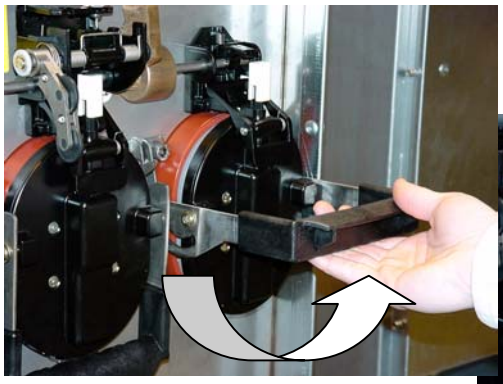


Step 1

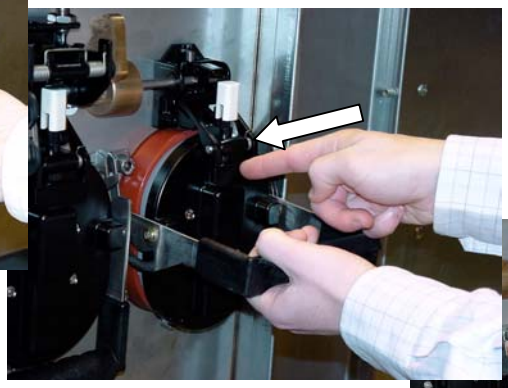


Step 2

Fig. 6.8a



Step 3

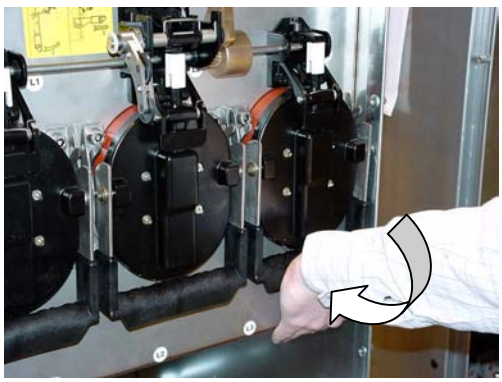


Step 4

Step 5

Step 6

Step 7



Step 8

Fig. 6.8b

6.3 LIST OF RECOMMENDED FUSES

Review the technical guides of the network protection system and regulations regarding the Utility choice of fuses.

The choice of fuses shall be made according to the following table:

RAETED POWER in kV			RATED POWER OF NO LOAD TRANSFORMER (kVA)															
Network	Cubicle	Fuse	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000
			Rated Current of Fuse (A) IEC 60282-1															
10	12	6/12	6,3	10	16	16	20	20	25	31,5	40	50	63	63	80	100	160	200	250
13.5	24	10/24	6,3	6,3	10	16	16	20	20	25	31,5	40	50	63	63	80	100	-	-
15	24		6,3	6,3	10	16	16	16	20	20	25	31,5	40	50	63	80	80	160	-
20	24		6,3	6,3	6,3	10	16	16	16	20	20	25	31,5	40	50	50	63	80	125

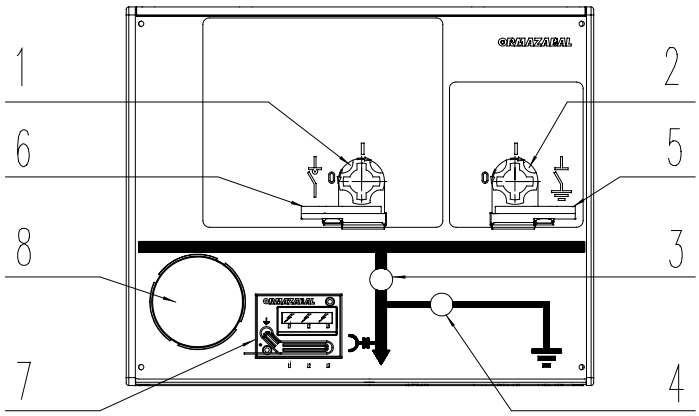
Notes:

- **Recommended fuses: SIBA brand with medium type striker pin, as per IEC 60282-1 (low power loss fuses).**
- **The table shows the values for combined fuses.**
- **The switch-fuse set has been tested at heat under normal service conditions as per IEC 60694.**
- **There is a fuse rail trolley adapted to 6/12 kV 292 mm fuse sizes.**
  For shaded fuse ratings, the size is 442 mm.
- **It is recommended to change the three fuses in the event that one of them blows.**
- **For transformer overload, contact our Technical Commercial Department.**
- **For other brands contact our Technical - Commercial Department.**

6.3.1 Operation Panel and Synoptic Diagram

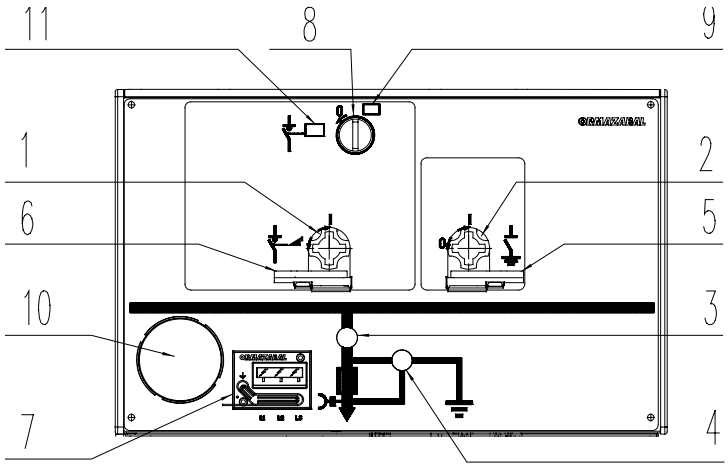
Feeder Function

- 1: Switch-disconnector operation.
- 2: Earthing switch operation.
- 3: Switch-disconnector status indicator.
- 4: Earthing switch status indicator.
- 5: Earthing switch padlock locking.
- 6: Switch-disconnector padlock locking.
- 7: ekorVPIS voltage presence indicator.
- 8: Pressure gauge window.



Protection Function

- 1: Switch-disconnector closing.
- 2: Earthing switch operation.
- 3: Switch-disconnector status indicator.
- 4: Earthing switch status indicator.
- 5: Earthing switch padlock locking.
- 6: Switch closing and loading operations padlock locking.
- 7: ekorVPIS voltage presence indicator.
- 8: Manual tripping, switch opening.
- 9: Fuse status indicator:
  - green (normal)
  - red (tripped striker pin).
- 10: Pressure gauge window.
- 11: Load indicator for opening the switch.
  - red (loaded)
  - green (unloaded)



6.3.2 Operations

WARNING

Before performing any kind of operation with voltage, it is advisable to check the pressure of the SF_6 gas using the pressure gauge.

The CGMCOSMOS cubicles are provided with a pressure gauge scaled in two colours (red and green), related to the ambient temperature scale.

In order to access the pressure gauge, remove the front upper cover of the cubicle, previously releasing the screws that hold it. The pressure gauge has a cap on top which should be in the open position to guarantee a correct reading. This is achieved by turning the key of the cap to the “OPEN” position.

During the installation the assemblies must be suitable for the existing atmospheric pressure, otherwise the needle may indicate an incorrect value (red scale), even if the indoor pressure is correct.

Note: In order to provide an accurate reading of the pressure gauge ensure that the key on the upper part is in the "OPEN" position.

Operation Sequence for Accessing Terminals or Fuses

1. Open the switch-disconnector and check the opening indicator.
2. Verify the presence of voltage in the cable incoming through the ekorVPIS voltage presence indicator, included in the cubicle.
3. Connect the earthing switch.
4. Verify the earthing switch closing indicator on the synoptic diagram.
5. Unlock the access cover.

Commissioning Operation Sequence

1. Place the cover.
2. Open the earthing switch.
3. Verify the earthing switch opening indicator on the synoptic diagram.
4. Close the switch-disconnector.
5. Check the presence of voltage (*)

(*) If applicable

Earthing Switch (ES)

❖ Feeder Function:

Opening of the ES

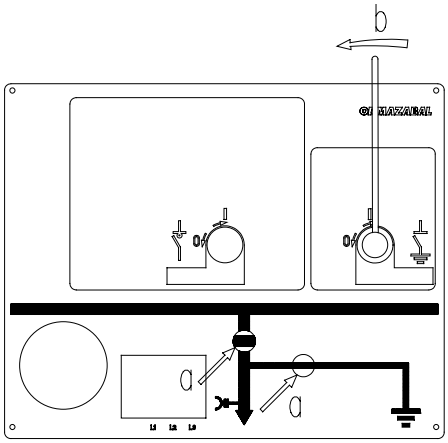


Fig 6.11

1: Start with the earthing switch closed and the switch (a)

2: Operate the lever in direction (b)

3: Final situation: (c)

Closing of the ES

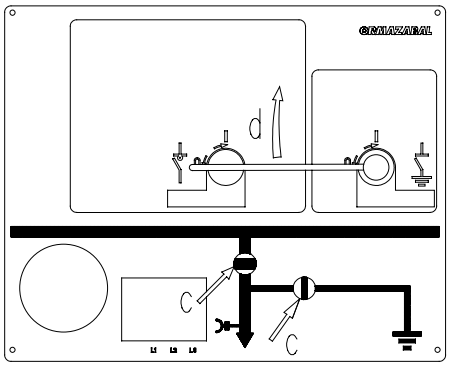


Fig. 6.12

1: Start with the switch and the earthing switch open (c)

2: Operate the lever in direction (d)

3: Final situation: (a)

❖ Fuse Protection Function:

Opening of the ES

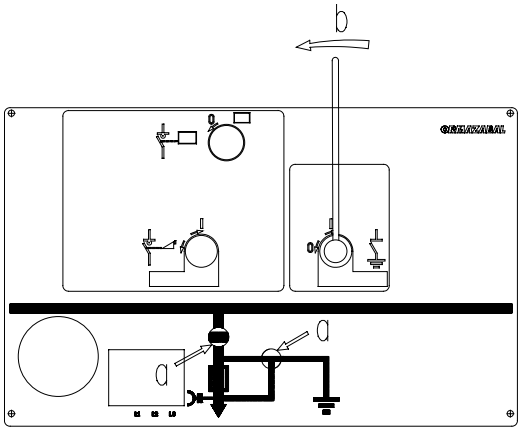


Fig. 6.13

1:Start with the earthing switch closed and the switch open (a)

2:Operate the lever in direction (b)

3: Final situation: (c)

Closing of the ES

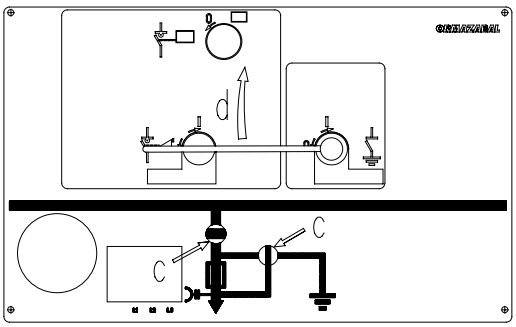


Fig. 6.14

1: Start with the switch and the earthing switch open (c)

2:Manoeuvre the lever in direction (d)

3: Final situation: (a)

B Driving Mechanism Switch-Disconnector

Closing

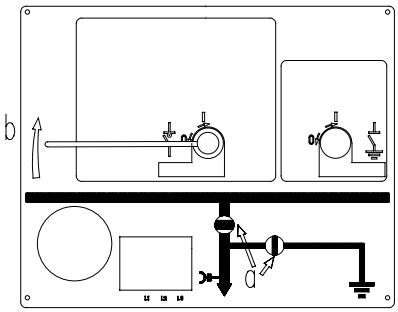


Fig. 6.15

1: Start with the switch and the earthing switch open (a)

2: Operate the lever in direction (b)

3: Final position: (c)

Opening

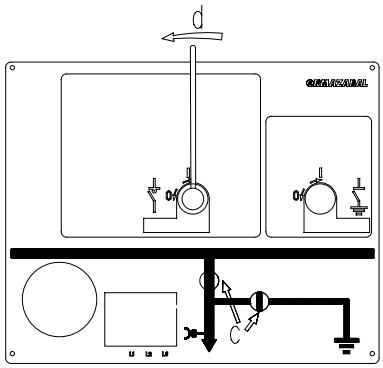


Fig. 6.16

1: Start with the switch closed and the earthing switch open (c)

2: Operate the lever in direction (d)

3: Final position: (a)

BR Driving Mechanism Switch-Disconnector

For fuse protection functions.

Step 1: Closing

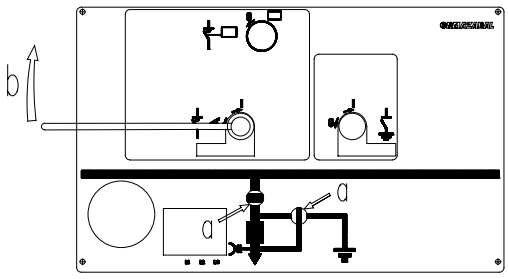


Fig. 6.16

1: Start with the switch and the earthing switch open (a)

2: Operate the lever in direction (b)

3: Final position: (c)

(*):The lever cannot be removed between Step 1 and Step 2

Step 2: Loading the springs

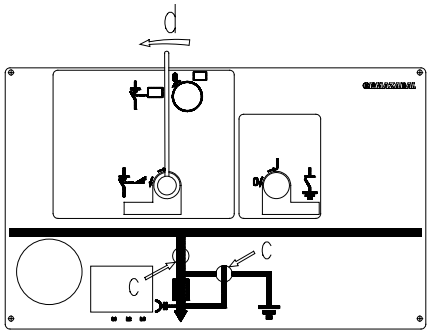


Fig. 6.17

1: Start with switch closed and the earthing switch open (c)

2: Operate the lever in direction (d)

3: Remove the lever

Step 3: Opening

1: Start with the switch closed, earthing switch open (e) and springs loaded

2: Open the switch turning the tripping handle. (f)

3: Final position: (a)

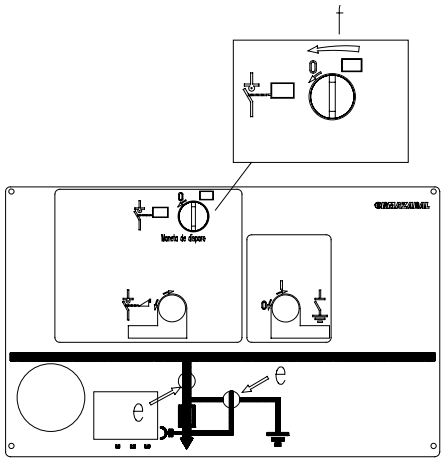


Fig. 6.18

6.4 INTERLOCKING

6.4.1 Padlock Locking

Each actuation shaft may be locked by up to three standard padlocks, with a maximum bar diameter of 8 mm.

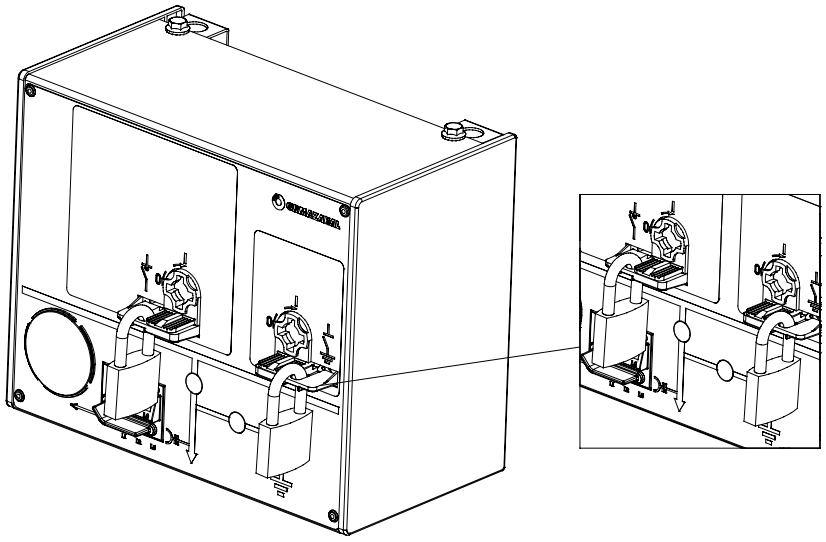


Fig. 6.19

6.4.2 Keylock Locking

The cubicles are prepared to incorporate keylocks, both when open and closed, in both actuation shafts (switch-disconnector and earthing switch).

7. MAINTENANCE

The operating mechanism of the CGMCOSMOS cubicles under service conditions specified in IEC 60694, does not require any kind of lubrication to function correctly.

7.1 ekorVPIS VOLTAGE INDICATOR

The ekorVPIS voltage presence indicator can be replaced if required. Simply remove the two screws located on the upper right side and lower left side of the indicator. The indicator can be disconnected from the base without switching off the line.

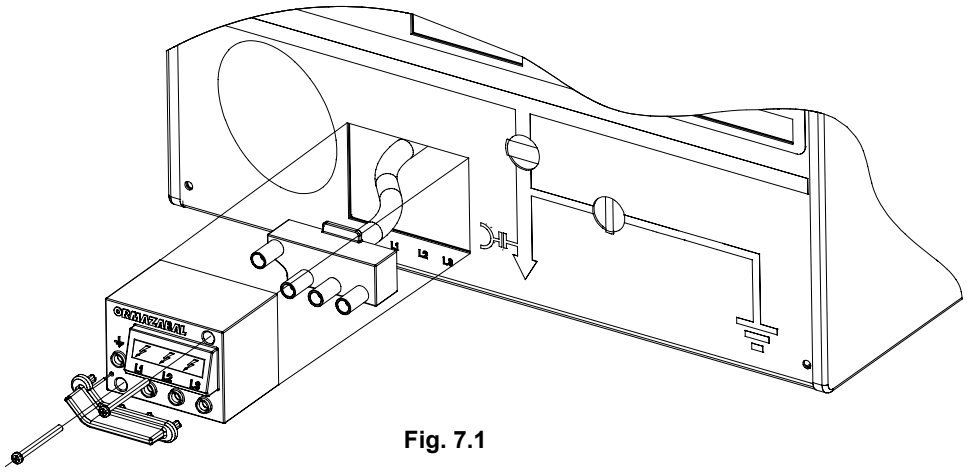


Fig. 7.1

7.2 ekorSAS SOUND ALARM SYSTEM

The ekorSAS can be replaced very easily as it is connected via associated elements through two connectors to the PCB that adjust by friction:

- 1 of 3 pins and polarized for the Voltage Presence Indicator
- 1 of 2 pins for the lever micro

➢ In Order to Replace the ekorSAS:

1. Remove the screws that hold the front cover.
2. Remove the front cover.
3. Remove the upper cover.
4. Press gently on the lower latches that hold the ekorSAS in order to remove it.
5. Release the two connectors and replace the broken down ekorSAS, connecting it to the lever micro (2 pin connector) and the voltage indicator (polarized 3 pin connector).

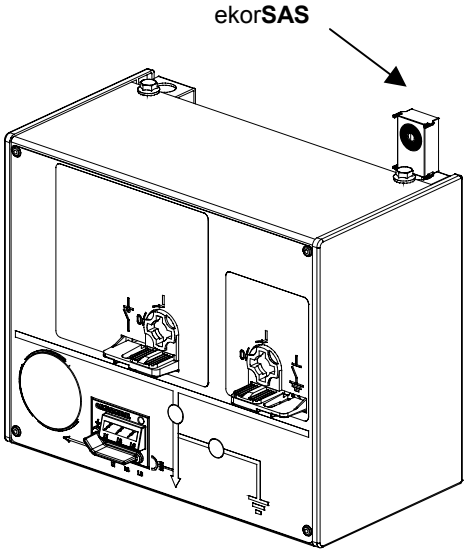


Fig. 7.2

➢ Connecting the ekorSAS:

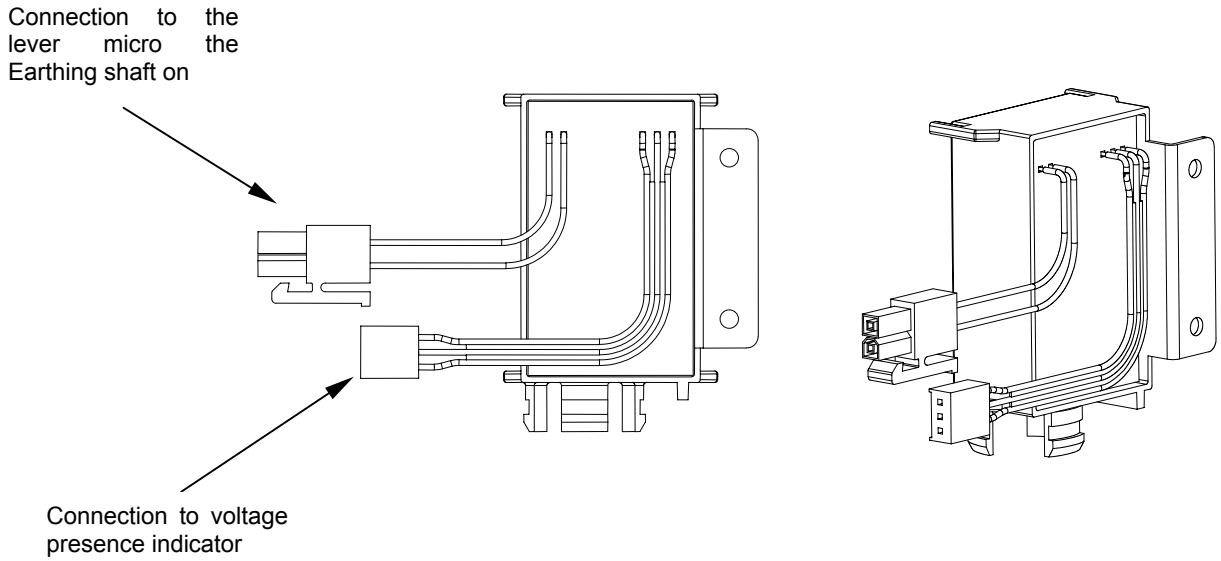


Fig. 7.3

7.3 CHANGING THE OPERATION DRIVING MECHANISM

The operation driving mechanism of the CGMCOSMOS system complies with the mechanical endurance specifications of the IEC 60265-1 standard. The motor driving mechanism supports 5000 close/open operation cycles, and the manual one 1000 cycles.

Manufacturing the driving mechanism from alloys that are highly resistant to oxidation, together with an anti-corrosion treatment, confers greater robustness against external agents and aggressive environments.

In addition, to increase performance, the operation driving mechanism can be replaced in any of the three earthing switch-disconnectorpositions. These positions can be locked through a fixing system, locked with a padlock, REGARDLESS OF WHETHER THE CUBICLE IS IN SERVICE OR NOT.

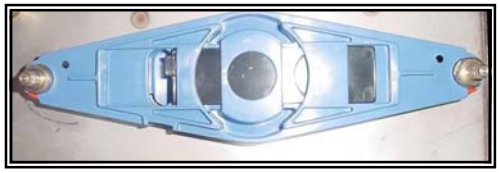


Fig. 7.4

NOTE: The replacement of an operation mechanism can only be performed by specialized personnel (contact our Technical - Commercial Department).

7.4 SPARES AND ACCESSORIES

Although the cubicles have been designed for a service life as per IEC 60298 standard for various reasons, some elements can be replaced and implemented. These elements are:

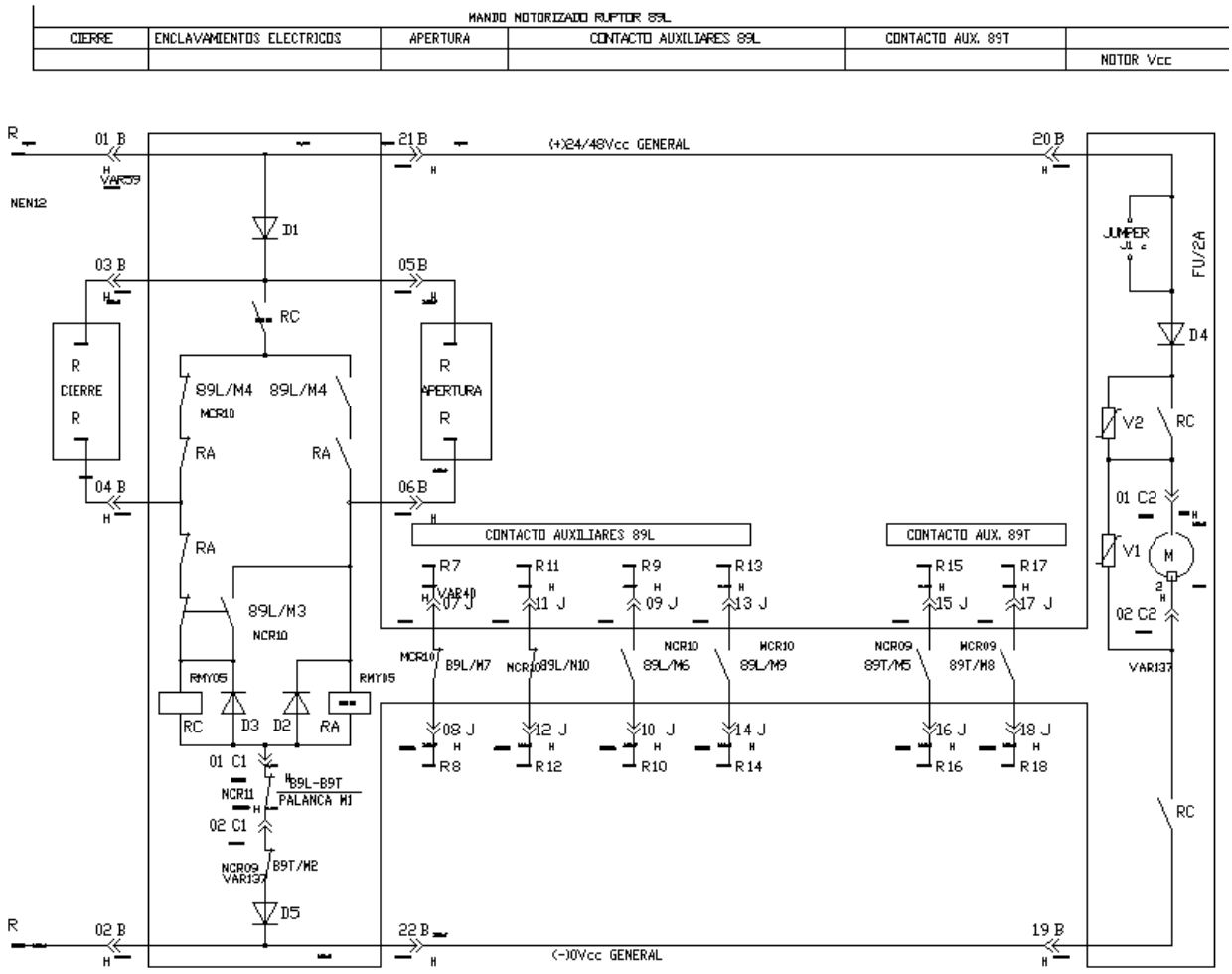
- ekorVPIS voltage presence indicators.
- Driving mechanism.
- Fuse rail trolleys.
- ekorSAS Earthing Prevention Sound Alarm.
- Pressure gauge.
- Coils.
- Microswitch panel.
- Microswitch control card.
- Motorization kit.
- Levers.
- Cable support.
- Covers and enclosures.

NOTE: Some of these spares must be replaced by specialized personnel. Contact our Technical - Commercial Department.

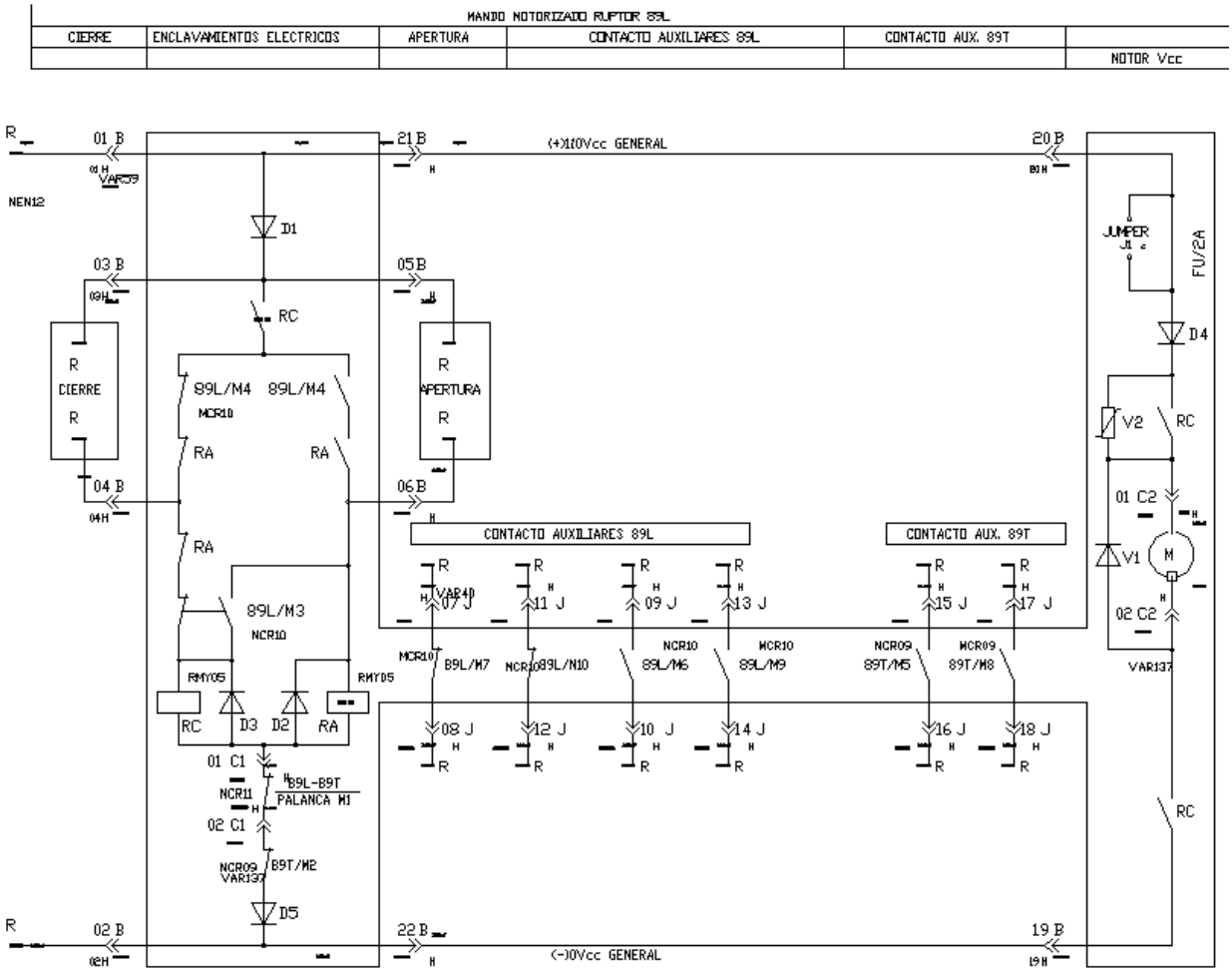
8. ADDITIONAL INFORMATION

8.1 ELECTRICAL DIAGRAMS

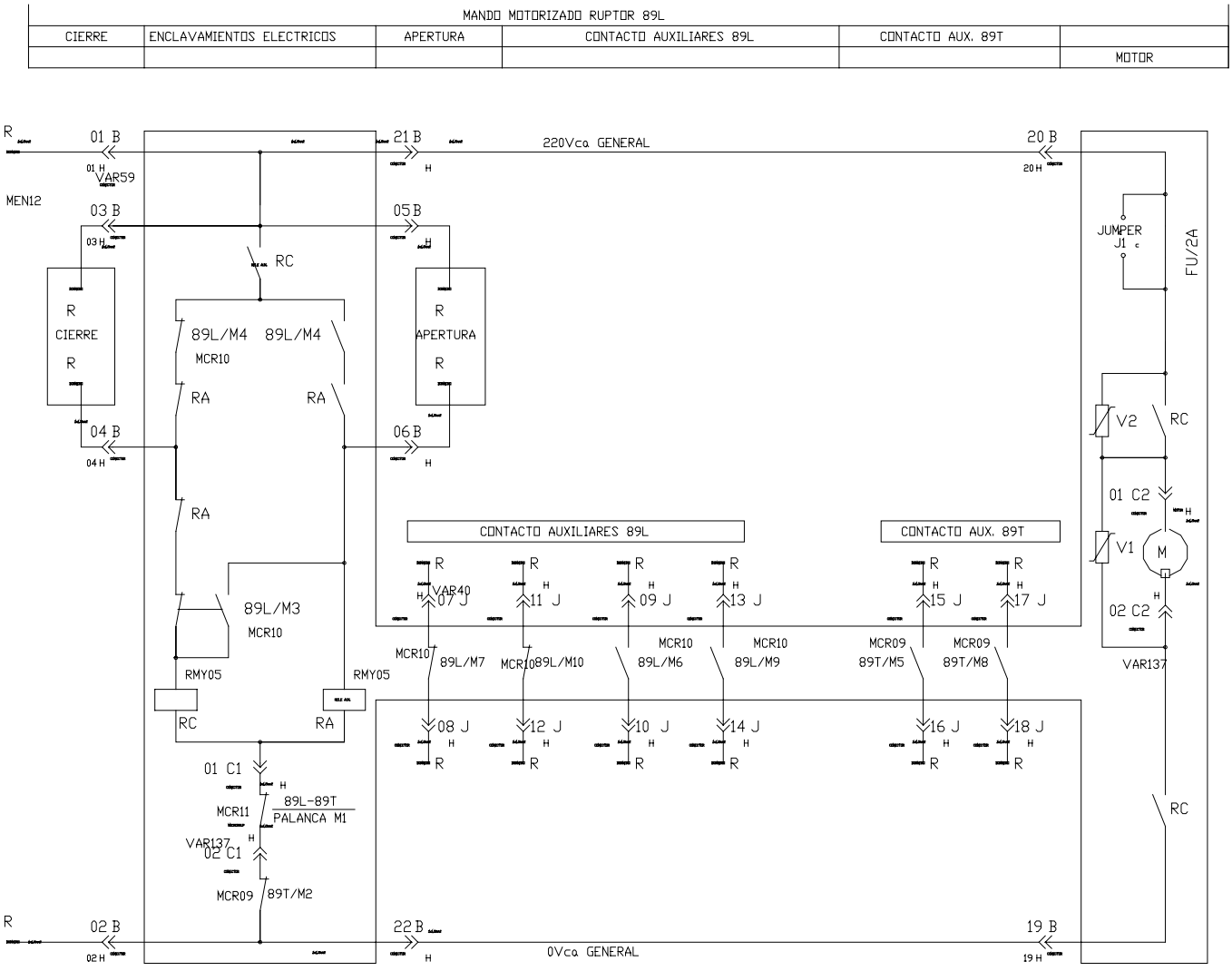
8.1.1 BM CGMCOSMOS 24 / 48 V_{DC} Motor Driving Mechanism Electrical



8.1.2 BM CGMCOSMOS 110 V_{DC} Motor Driving Mechanism Electrical



8.1.3 BM CGMCOSMOS 220 V_{AC} Motor Driving Mechanism Electrical



Note: Contact our Technical Commercial Department for other voltage values

8.2 ELECTRICAL CHARACTERISTICS OF LOW VOLTAGE ELEMENTS

8.2.1 Coils (Optional)

The electrical characteristics of the coil and the switch position signalling contact are as follows:

TRIP COIL	Rated voltage	24 V_{dc}, 48 V_{dc} 220 V_{ac}	110 V_{dc}
	Maximum consumption	80 W	
	Internal insulation	2 kV	
SIGNALLING CONTACT	Switch position signalling contacts	1 NOC 3 NOC	2 NOC
	Rated voltage	250 V_{ac}	
	Nominal current	16 A	

The BR driving mechanism can include up to 2 NO contacts + 2 NC contacts, for signalling the circuit breaker and 2 NO contacts for signalling the earthing.

8.2.2 Motorizations (Optional)

The electrical characteristics are as follows:

MOTORIZATIONS	Rated voltage	24 V_{dc}, 48 V_{dc} and 110 V_{dc} 220 V_{ac}
	Peak current	<5 A
	Average consumption	<2 A
	Motor operation time	<5 s
SIGNALLING CONTACTS	Switch signalling contacts	2 NO + 2 NC
	Earthing signalling contacts	2 NO
	Rated voltage	250 V_{ac}
	Nominal current	16 A

8.3 USER GUIDE OF THE DISTRIBUTION TRANSFORMER UNIT IN DIELECTRIC LIQUID

8.3.1 Design, Manufacture and Tests

The transformer has been designed and built to comply with Mandatory Standards, as per High Voltage Electrotechnical Regulations, effective on the date of the manufacture and tests, as well as the Customer Specification.

In order to confirm the above, the following individual or routine tests have been performed:

- Coil resistance measuring UNE-EN 60076-1
- Transformer ratio measuring and verification of connection group UNE-EN 60076-1
- On load loss measuring and short circuit voltage at main feeder UNE-EN 60076-1
- Losses and current with no load measurings UNE-EN 60076-1
- Voltage test applied to power frequency UNE-EN 60076-1
- Induced voltage test

As per Max MV insulation level UNE-EN 60076-1

8.3.2 Test Protocol

All the information regarding the tests carried out on the transformer is included in the Test Protocol supplied with the transformer. This document is unique and specific to each transformer.

8.3.3 Reliability

The transformer that, as proven by the tests, leaves the factory free of defects, is prepared for providing service during its whole service life.

In order to maintain this level of reliability, it is necessary that the appropriate checks are performed during its handling, storage, transportation and commissioning and to consider the protections established in HV Regulations are taken into consideration. The maintance guidelines described later must be followed.

Furthermore, the necessary measures to protect the personnel usually or occasionally, working around the installation must be taken and preventing any other person coming near.

8.3.4 Construction Details

Fully filed transformer. The transformer is equipped with an expansion system consisting of an elastic tank that adapts to the oil volume which varies depending on its temperature.

The upper layer of the dielectric may reach 115 ºC.

8.3.5 Reception of the MB

The MB Compact Transformer Substation is supplied fully assembled and prepared for connection to MV and LV incoming lines.

On reception of the MB, either at the customer warehouse or the site, the following shall be carefully reviewed:

- That the transformer characteristics, specified in the Characteristics Plate, coincide with the Test Protocol ones, and these in turn with the order ones.
- The general condition of the assemby.
- Absence of knocks, especially on transformer cooling fins.
- The status of the paint, checking there is no chips, scratches, etc.
- Check all accessories included with the transformer. Should any damage be noticed or any parts missing during transportation, notify the shipper and the manufacturer immediately in order to determine the responsibility and estimate the costs that may be involved.

IMPORTANT:

- **Verify that the transformer seals are complete and have not been tampered with. The manipulation or breaking of a seal voids the transformer warranty and the manufacturer's responsibility.**
- **In the event of any anomaly, contact the manufacturer immediately. If the manufacturer does not receive an anomalys or defect report, within 15 days it is understood that the transformer is in perfect condition and the manufacturer shall not be responsible for any incidents with the transformer during its operation nor their consequences.**

8.3.6 Installation

The conditions of the site, its design, for technical reasons as well as for protection and safety of persons and assets, are defined in the Spanish Law's High Voltage Regulations and the Autonomous Community Regulations in effect at this time.

Furthermore, it is necessary to consider the assembly instructions of the Utility which knows the regulations and the specifics of the system that the transformer will be connected to.

If the transformer is installed inside a building, ensure there is proper ventilation and that the air intake and exhaust has been correctly designed.

Furthermore, the transformer must be at a minimum distance from the cubicle sides and its bushings have to keep the safety distances to the walls and ceiling, depending on the voltage.

Avoid:

- Ambient temperature exceeding the conditions specified in the standards.
- Installing the transformer in small areas with ventilation grilles exposed to sunlight.
- Taking or expelling the air to cool the transformer the same premises where the transformer is installed.
- Install the transformer in premises destined for other purposes; especially those that include devices working at high temperature: boilers, steam generators, etc. If the transformer cannot be installed in premises with sufficient natural ventilation, install forced ventilation.

8.3.7 Revisions Before Commissioning

The transformer is provided finished and ready for installation. The thermometer, if supplied, is calibrated for alarm and trigger.

Before connecting the transformer to the feeder, check the dielectric liquid and, in sealed transformers, its protection system.

Check that the seals are complete and have not been tampered with. The manipulation or breaking of a seal voids the transformer warranty and the manufacturer's responsibility.

8.3.8 Noise Prevention

When connecting the Compact Transformer Substation to the network, check that the position of the feeder exchange and the connection to the MV coil, if applicable, correspond to the service voltage. Otherwise, the magnetic circuit may be overloaded and notably increase noise.

Do not attach grilles or protections to the transformer's metal sides.

8.3.9 Maintenance

General Criteria

The dielectric liquid level only has to be checked in the event of leaks. Also check for leaks in bushings, valves, etc.

This inspection must be performed on all transformers, and for those that are ten years, in contact with the manufacturer, who must be informed of the results in order to recommend corrective actions.

In addition, the requirements established by the current legislation on Transformer Substations shall be complied, in order to protect persons, as well as the integrity and functionality of assets that may be affected by these facilities.

Precautions

The following precautions required by the current legislation should be implemented. We recommend the following as the most important ones.

Before examining or maintaining the transformer:

- disconnect the MV and LV switches, leaving the transformer shutdown.
- Short circuit and earth the bushings.

Revision of the Dielectric Liquid Status

This check is not required transformers, because the dielectric liquid is not in contact with the air. If, for any exceptional reason it were required to take a sample or replenish the liquid, this operation shall not be performed without contacting the manufacturer, who must provide the corresponding instructions.

In the event of having to replenish the dielectric liquid in the transformer, the new oil should be dry in accordance with the effective UNE standard and compatible with the oil in the transformer. As a reference, the factory fill was performed at atmospheric pressure and a temperature of 20 ºC.

Status of Paint

Check there is no chips, scratches and rust. If there wasany, sand down the affected area until the white metal is reached and then proceed to its repainting with antirust paint, in order to then apply standardized paint layers.

Temperature Verification

The transformer's load must be checked frequently and therefore the temperature of the dielectric liquid.

In the event of an abnormal temperature when the transformer is in operation, the most probable reasons will be:

- Installation premises: insufficient ventilation or high temperature, in both cases, the premises ventilation must be checked.
- LV Network: may be overloaded in which case the possible power increases should be verified and the transformer's load reduced.

Accessories

The transformer is equipped with the following accessories in accordance with the UNE standard.

- Characteristics plate.
- Two earth terminals.
- Filling device.
- Emptying and sample device.
- Device for hosting the temperature sensor.

8.4 USER MANUAL OF THE LV CIRCUITS PROTECTION MEASURING AND DISTRIBUTION UNIT FUNCTIONAL

8.4.1 Overview

The LV distribution switchboard consists of a metal enclosure with IP-20 rating, in compliance with UNE 20324 standard. Furthermore, it supports an IK08 Ip rating, in compliance with standard UNE-EN 50102, except in the space between the lower part of the bases and the lower cover.

The LVS consists of the following functional units:

- **Incoming functional unit**
  made up of three phase bars and one zero-sequence bar of 60x5 mm^2 cross-section, responsible for distributing electricity from the transformer.
- **Busbar functional unit**
  made up of three phase bars and one zero-sequence bar of 60x5 mm^2 cross-section, responsible for distributing electricity from the incoming unit.
- **Protection functional unit**
  made up of five vertical three-phase bases in the 630 kVA and three in the 400 kVA with short circuit fuses, of 400 A single-phase on load opening BTVC-2 type.
- **Control functional unit**
  made up of a box of insulating material that includes the elements described in figure 8.5 diagram.

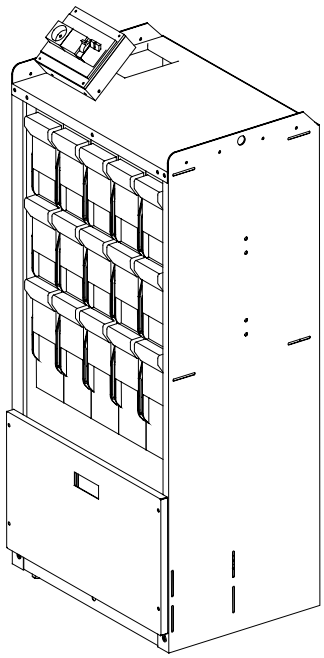
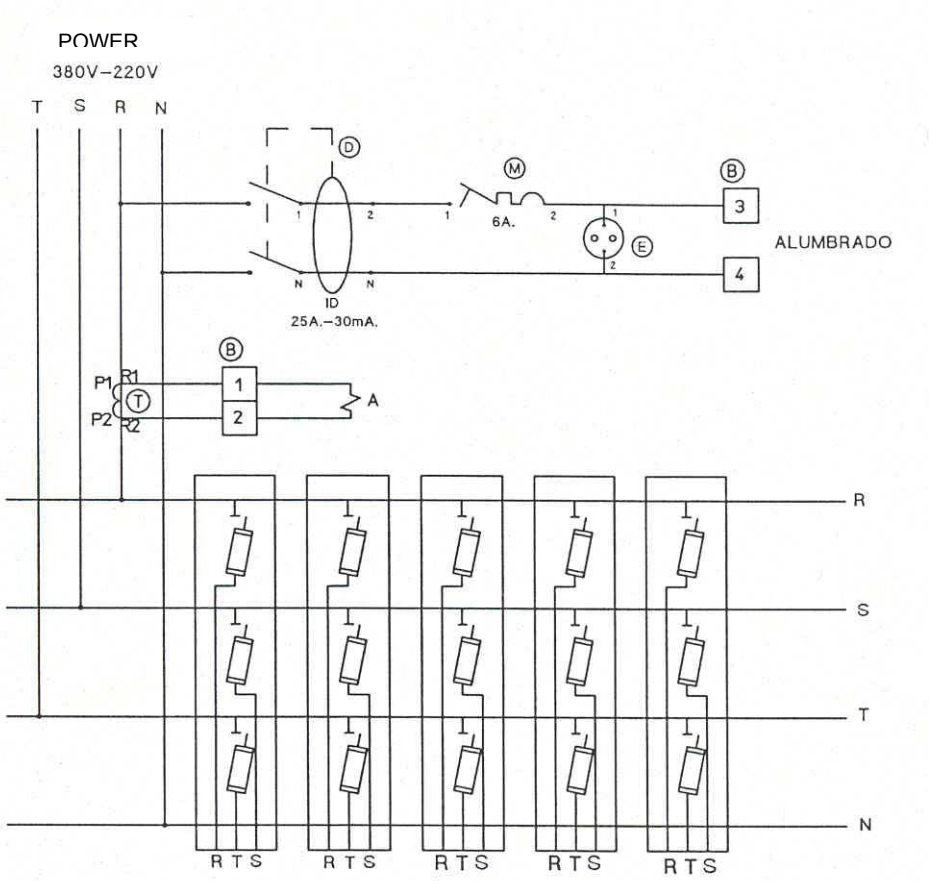


Fig 8.4

8.4.2 Electrical Diagram



M	6 A / 20 KA MAGNETOTHERMIC SWITCH (CURVE C)
B	PASSAGE TERMINALS
D	20 A – 30 mA DIFFERENTIAL SWITCH
E	10 A TWO-POLE SOCKET
T	1000 / 5 15 VA CLASS 0.5 TRANSFORMER
A	AMMETER MAXIMETER (SCALE OF 6 A)

Fig. 8.5

8.4.3 LV Cable Connection

The functional unit's phase output is effected via the screws on the lower part of the three-phase bases.
The tor for electrical connections is as follows:

METRIC	TOR [Nm]	
	Steel 8.8	Stainless A2
M-12	56	
M-10	32	

8.4.4 Handling the Bases

When handling the switchboard, UNE-EN 50110-1 and UNE-EN 50110-2 standars must be taken into consideration.

8.4.5 Inserting Fuses

Inserting or replacing a fuse can be carried out on the fuse rail, in the open position or in the remove position. To remove the fuse from the base release the mechanical lock that secures the fuse to the fuse rail. To perform this operation just to press the trigger of the cover.

8.4.6 Disconnection - Connection

Disconnection. Pull the fuse rail handle in order to make it turn on its shaft and remove the fuse blade from the base contacts.

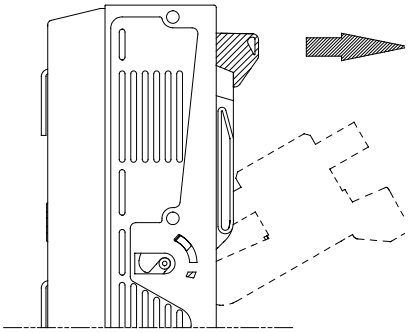


Fig. 8.6

Reverse the previous movement to connect.

8.4.7 LVS Fuse Rating

When selecting the fuses to protect the LV circuit, follow the fuse selection criteria specified in the technical guides for network protection and the regulations on the choice of fuses from the Utility that owns the Transformer Substation.

Some of the factors to be considered are:

- Rated Current of the circuit to be protected.
- Thermal characteristic of the circuit to be protected.
- Transformer power.
- Length of the cables to be protected.

The following is a recommendation for selecting fuses for the LV switchboard, chosen in terms of selection criteria:

LOW VOLTAGE FUSE RATING	
CABLES	**Transformer power** (250 kVA ÷ 630 kVA)
Underground conductor, single-pole RV type, Aluminium	
50 mm^2 / 50 mm^2	125 A
95 mm^2 / 50 mm^2	200 A
150 mm^2 / 95 mm^2	250 A
240 mm^2 / 150 mm^2	315 A
Overhead conductor, single-pole RZ type, Aluminium	
3x50Al/54.6 Al	125 A
3x95Al/54.6 Al	200 A
3x150Al/80 Al	250 A

Note: gG fuses in compliance with UNE-EN 60269

8.4.8 Electrical Characteristics

Rated usage voltage	U_e	440 V
Rated insulation voltage	U_i	
Phase-to- Phase		2.5 kV
Phase-to-Ground		10 kV
Lightning impulse supported voltage 1.2/50 µs		20 kV
Rated current	I	1000 A
Output rated current	I	400 A
Number of outputs with 400 A bases (630 kVA)		5
Number of outputs with 400 A bases (400 kVA)		3
Short duration rated current 1 s	I_{cw}	20 kA
Peak value of I short duration adm	I_{pk}	50 kA
Rated frequency		50 Hz

TECHNICAL-COMMERCIAL DEPARTMENT:

www.ormazabal.com