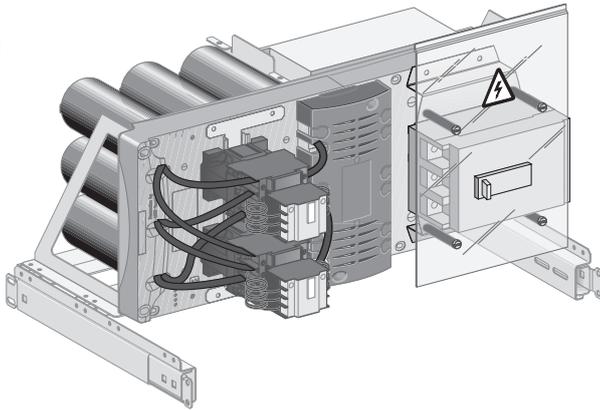


Varpact Harmony

Power factor correction module with harmonic filter reactor

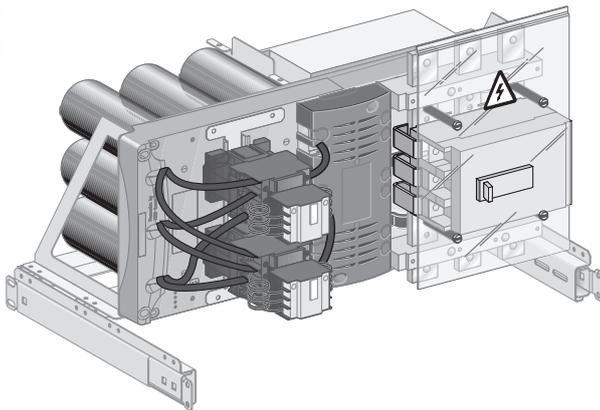
User guide

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Module without busbar

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Module with busbar

Reception

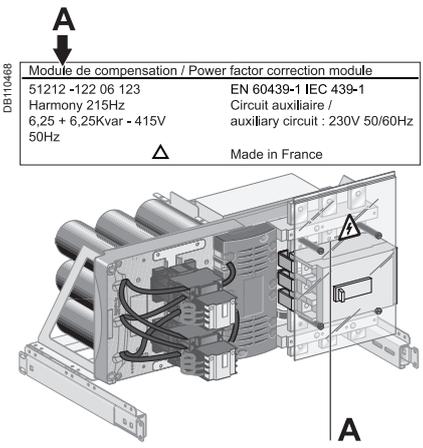


Fig. 1: power factor correction module rating plate.

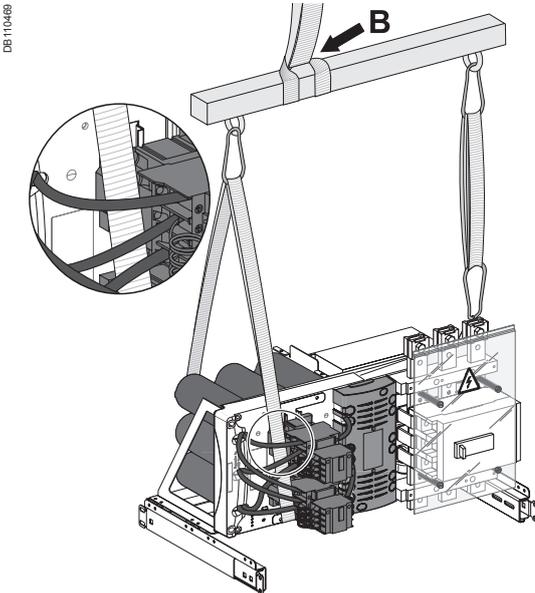


Fig. 2: example of handling using slings.

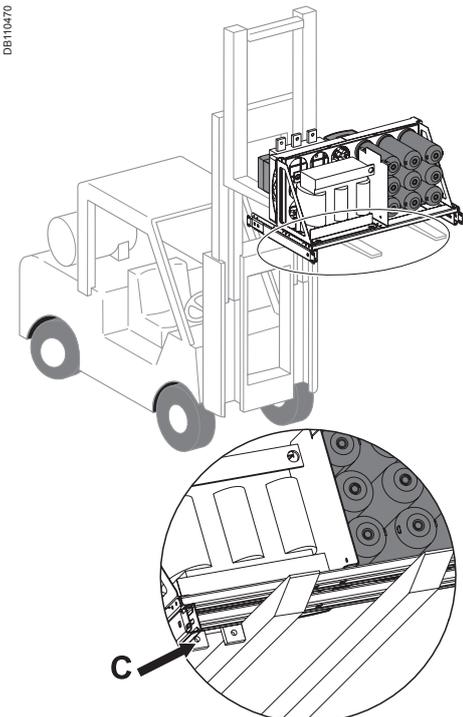


Fig. 3: example of handling using a forklift truck.

Reception of equipment

- the addressee is always responsible for the risks and perils of transporting our goods, shipped as carriage forward or carriage paid to
- we decline all responsibility for missing items or damage attributable to the carrier. If need be, send your complaints by registered mail to the carrier
- make sure there are no missing items and that the equipment has not been subject to a shock likely to have affected its insulation or operation
- check the electrical characteristics indicated on the rating plate (A Fig. 1) correspond to those on the order form
- in the event of a non-conformity, indicate the shipping note reference when submitting your complaint.

Handling

- unpack the equipment at the place where it is to be installed
- avoid shocks and deformation to the equipment.

Handling using slings (Fig. 2):

- ⚠ Warning: the reactor accounts for 3/4 of the module's weight. Take this into consideration when positioning the sling B.
- ⚠ Pay attention to the reactor's cables and connections.

Handling using a forklift truck (Fig. 3):

- ⚠ Warning: the reactor accounts for 3/4 of the module's weight. Take this into consideration when positioning the truck's forks under the module.
- ⚠ Pay attention to the lower part of the modular busbar C.

Storage

- store the devices in a dry and well ventilated place that is sheltered from rain, water projections, chemical agents and dust
- cover the equipment with a tarpaulin or something similar that effectively protects it from dust, rubble, paint, etc.
- storage temperature: -20 °C to +45 °C.

Warranty

The equipment is factory cabled and inspected. Any modification could affect the warranty.

Description

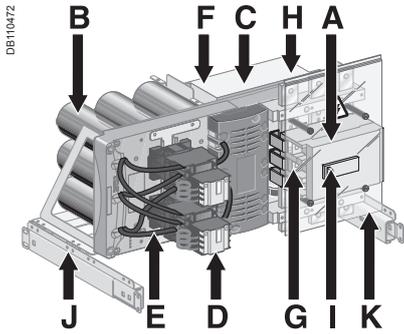


Fig. 4: power factor correction module.

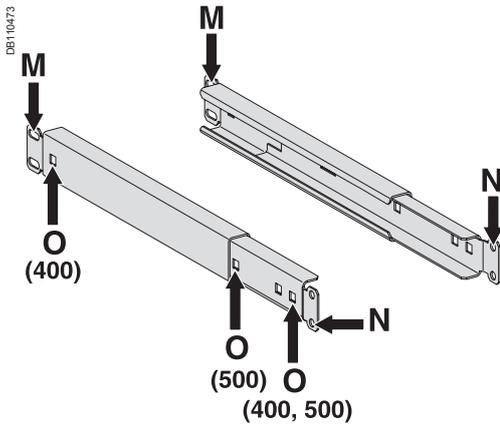


Fig. 5: sliding rails.

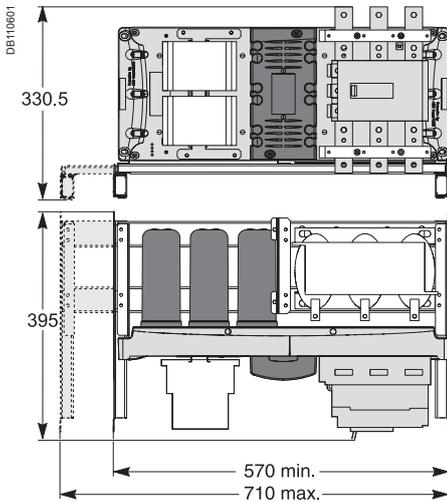


Fig. 6.

Varpact Harmony power factor correction module (Fig. 4)

- A : rating plate
- B : capacitors
- C : harmonic filter reactor
- D : contactors
- E : contactor coil connection terminals
- F : reactor thermal safety mechanism (in series with contactor coil supply)
- G : modular busbar (30 x 10 mm) if fitted
- H : modular busbar fish plates
- I : protection circuit-breaker
- J : width adjustable support rails
- K : modular busbar screen.

Sliding rails (Fig. 5)

They allow the power factor correction modules to be fitted into all 400 or 500 mm deep universal cubicles.

They automatically ensure the module is at the correct depth.

- M : Ø7 x 15 oblong holes
- N : Ø7 round holes
- O : module fixing points (adjustment according to cubicle depth)

Technical characteristics

- capacitor sizing rated voltage according to the Varpact Harmony model
- matching order: 2.7 (135 Hz) – 3.8 (190 Hz) – 4.3 (215 Hz)
- capacitance value tolerance: -5, +10 %
- insulation class:
 - 0.69 kV
 - 50 Hz, 1 min withstand: 3 kV
- maximum allowable overload:

Matching order	2.7 (135 Hz)	3.8 (190 Hz)	4.3 (215 Hz)
Current (max.)	12 % at 400 V	19 % at 400V	30 % at 400 V
Voltage	10 % (8h out of 24h as defined in IEC 60831)		

- operating ambient temperature (electrical room):
 - maximum temperature: 40 °C
 - average temperature over a 24 hour period: 35 °C
 - average temperature over a 1 year period: 25 °C
 - minimum temperature: -5 °C
- watts loss: ≤ 8 W/kVA
- protection degree: front face protected against direct contact
- colour: RAL 7016
- standards: IEC 60439-1, EN 60439-1, IEC 61921.

Sizes and weights

- harmony power factor correction module (Fig. 6):
20 to 60 kg depending on power rating.

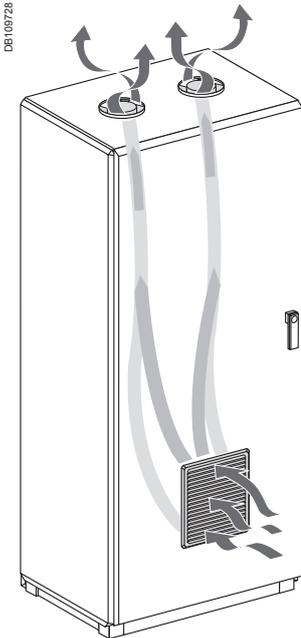


Fig. 7: air flow.

Ambient air temperature

The ambient air temperature surrounding the electrical cubicle must be within the following limits:

- maximum temperature: 40 °C
- minimum temperature: -5 °C
- average temperature over a 24 hour period: 35 °C
- average temperature over a 1 year period: 25 °C.

Ventilation rules (Fig. 7)

The capacitors, harmonic filter reactors, contactors, circuit-breakers and electrical connections dissipate heat: 8 W/kVA.

The following ventilation rules must therefore be respected:

- forced ventilation is compulsory. Extractor type ventilators should be fitted on the top of the cubicle
 - the real air flow m^3/h (taking into account air entry and exit load losses) must be greater than or equal to 2.5 times the installed power (kVA).
- For example: for an installed power of 200 kVA, the real air flow must be 500 m^3/h
- air flow within the cubicle must be from the bottom to the top.

Applications

The ventilation rules listed above are applicable in the following conditions:

- cubicle size
 - height $H = 2000$ mm
 - width $W = 700$ or 800 mm
 - depth $D = 400$ or 500 mm
- power ≤ 250 kVA/400 V - 50 Hz per column and for all cubicle protection indexes (IP).

Installation (cont.)

Positioning the fixing rails (Fig. 8)

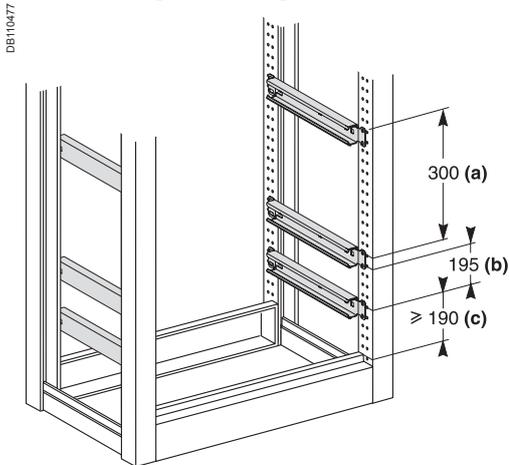


Fig. 8.

(a) Distance between two fixing rails for installing modules.

(b) Height of a connection module.

(c) Minimum recommended height for easy connection.

Fitting the fixing rails (Fig. 9)

The fixing rails are fitted to the module for transport.

Remove them in order to fit them into the cubicle.

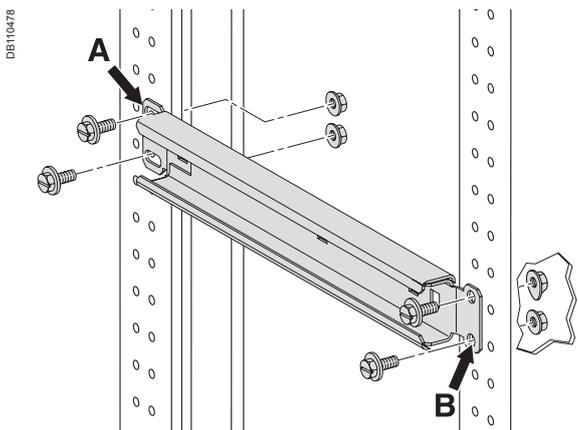


Fig. 9.

Screw the fixing rail to the uprights at A and B

Installation (cont.)

In cubicle W = 700 or 800 mm

Assembling the modules

Module assembly order

It is recommended you start with the top module.

Assembling the first module (Fig. 10)

1 - Measure the width **W** between the cubicle's uprights. Remove the barriers for protection against direct contact.

2 - Adjust the external width of the module's support rails to **W - 5 mm**.

3 - Tighten the width adjustment locking screw.

4 - Line up the module in front of the cubicle and introduce the module's support rails into the fixing rails fitted to the cubicle's uprights.

5 - Position the module in its final position by sliding it in the fixing rails.

6 - Fix the module to the fixing rails:
 ● loosen the width adjustment screws.

7 - Fit and tighten:
 ● the fixing screws for the left rail
 ● the fixing screws for the right rail.

8 - Tighten the width adjustment screws.

Fig. 10.

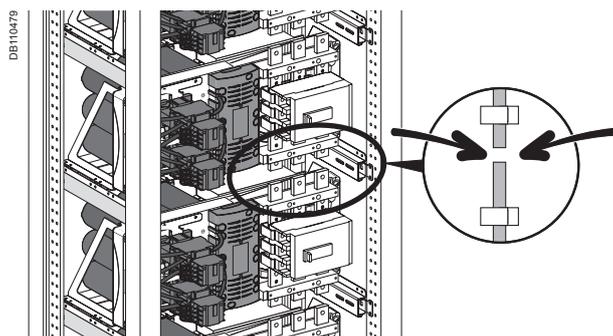


Fig. 11.

Assembling the other modules

- carry out steps 1 to 6.
- before carrying out step 7, check the depth-wise alignment of the busbars with respect to each other (Fig. 11).
- carry out steps 7 and 8.

Installation (cont.)

In cubicle W = 700 or 800 mm

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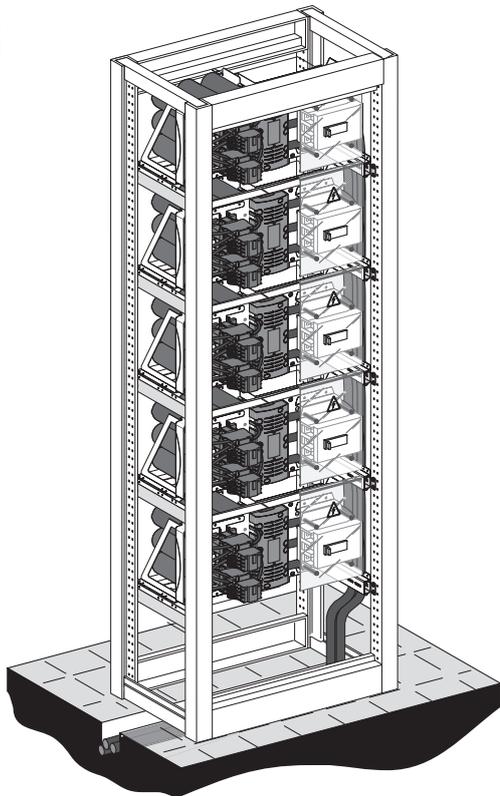


Fig. 13: cubicle without busbar.

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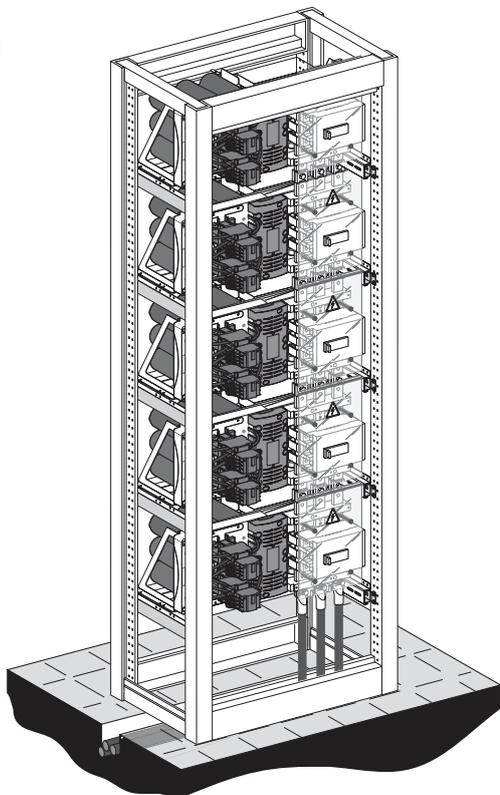


Fig. 16: cubicle with busbar.

Fitting the busbar fish plates

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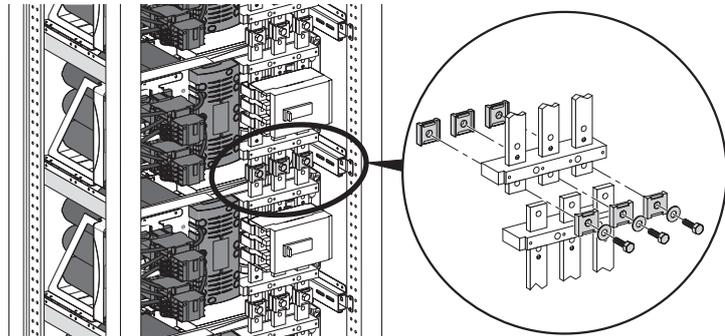


Fig. 12: fish plate assembly detail.

Busbar electrical connection

Maximum continuous current (I_{mp}) ≤ 630 A (Figs. 14 and 15)

1 single busbar from top to bottom.

A : busbar supply cables, lower part.

B : fish plates.

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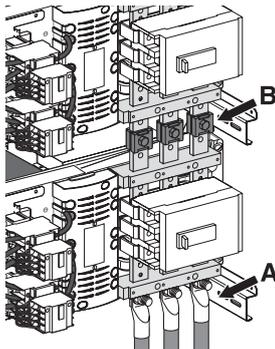


Fig. 14: busbar assembly details.

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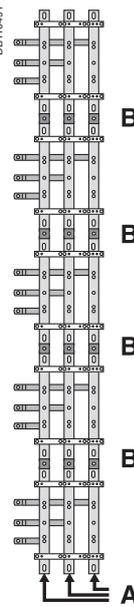


Fig. 15: full busbar.

Installation (cont.)

Cabling the modules

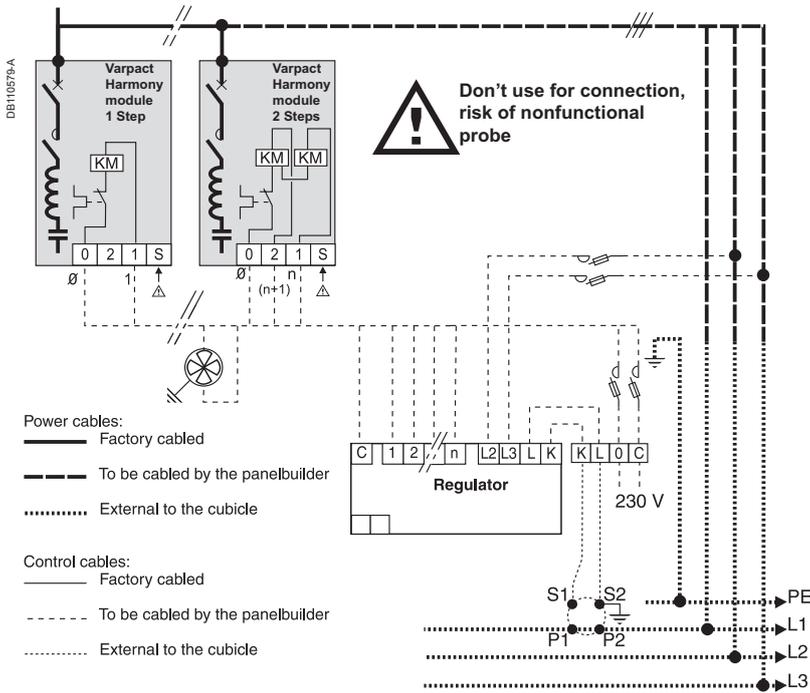


Fig. 17: electrical layout diagram.

Choice of cables

For an ambient temperature of 40 °C, the temperature inside the cubicle can reach 55 °C.

The connection cables to the Harmony power factor correction cubicle must be sized for the following maximum continuous currents I_{mp} :

400 V - 50 Hz

Matching frequency	Matching order	Relative impedance	I_{mp}
135	2.7	13.7 %	1.12 I_n
190	3.8	6.9 %	1.19 I_n
215	4.3	5.4 %	1.31 I_n

Harmony power factor correction cubicle nominal current:

$$I_n = \frac{Q}{U\sqrt{3}}$$

Where U = mains supply voltage
 Q = reactive power of the cubicle

The modular busbar is sized for a maximum continuous current I_{mp} of 630 A.

Tightening torques

- the connection cables to the busbar must be tightened to 50 Nm
- the connection cables to the circuit-breaker must be tightened to:
 - M6 bolt: 10 Nm
 - M8 bolt: 15 Nm
- the busbar fish plates must be tightened to 30 Nm.

Sizing the control circuit

Contactor coil pull-in and holding currents, as detailed in the table below, must be taken into consideration in order to correctly size the control circuit and its protection.

Contactor coil consumption at 20 °C, 230 V, 50/60 Hz

Contactor	LC1Dvar30 LC1D25	LC1Dvar60 LC1D40	LC1Dvar90 LC1D80
Pull-in: $\cos \Phi = 0.75$	70 VA	245 VA	245 VA
Holding: $\cos \Phi = 0.3$	8 VA	26 VA	26 VA

Installation (cont.)

Fitting barriers for protection against direct contact

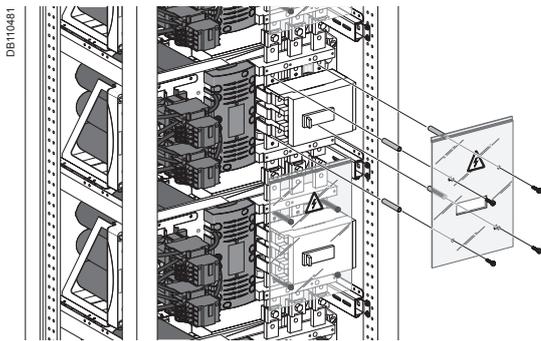


Fig. 18: protection barrier assembly details.

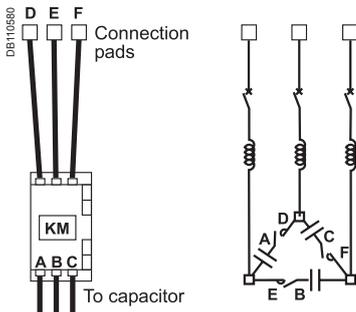


Fig. 19: break the triangle links.

Personnel protection

Each capacitor is fitted with discharge resistors which reduce terminal voltages to 50 V **one minute after de-energising**.

Before carrying out work on the equipment:

- remove its power supply
- wait until the compulsory discharge time has elapsed
- ensure each capacitor has been fully discharged by short-circuiting and earthing the contactor terminals.

Discharging the capacitors

- break the triangle links (Fig. 18)

To ensure capacitor discharge, successively short-circuit terminals: AE, BF and CD.

Checks

One month after energising, check:

- contactor terminal tightening torques.

Each year check:

- general cleanliness of the equipment
- filters and ventilation system
- terminal tightening torques
- proper working order of switching devices
- temperature in the premises: -5 °C to +40 °C max.
- ambient air temperature inside the cubicle: 50 °C max.
- capacitor capacitance, consult us if the capacitance value has changed by more than 10 %.

Safety

All the operations described in this guide must be carried out whilst respecting current safety standards, and under the responsibility of a competent authority.

Maintenance (cont.)

Working on the connection module current circuit

Before starting work

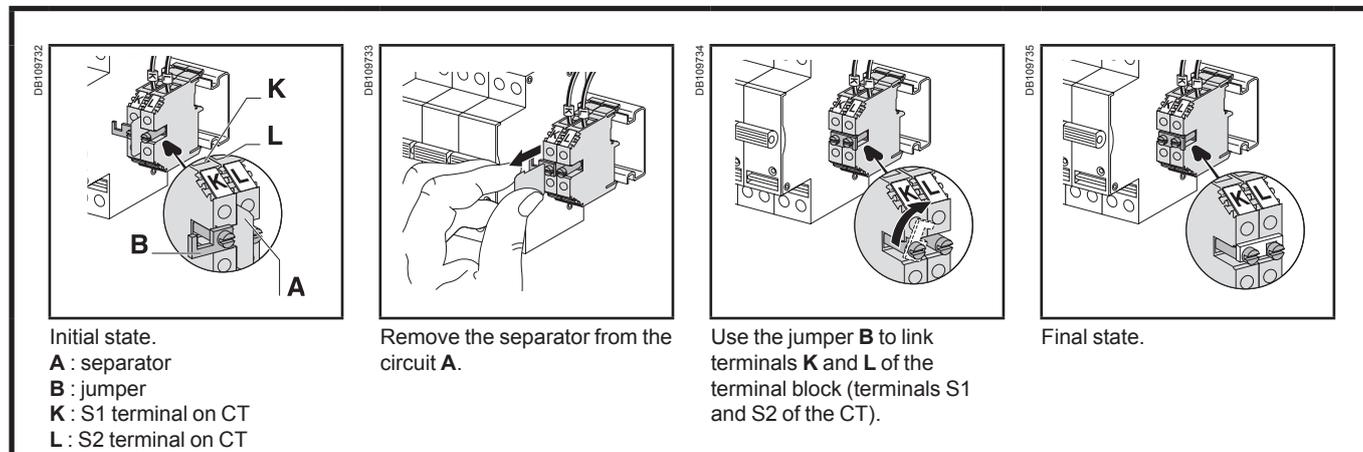


Fig. 20.

Warning
 Risk of destroying the current transformer if the secondary is open-circuit.

After finishing work

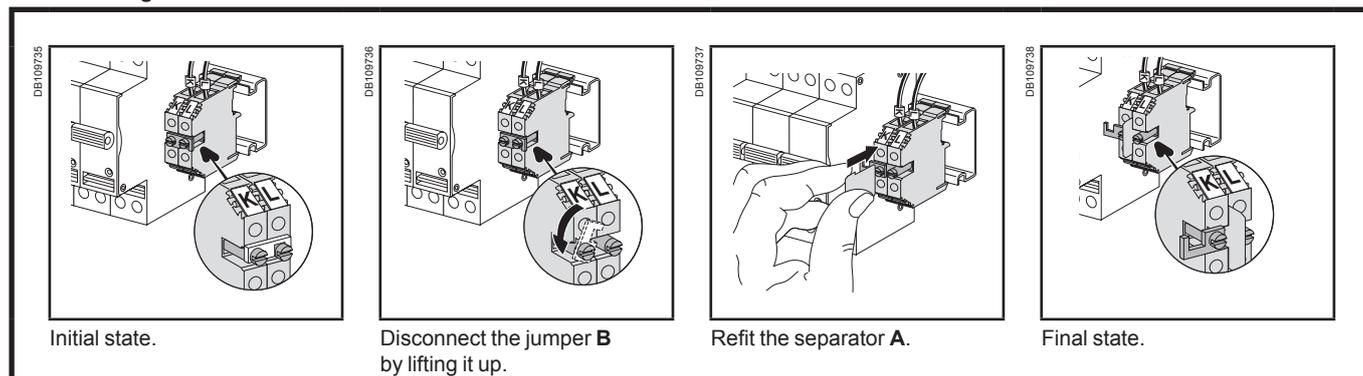


Fig. 21.

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