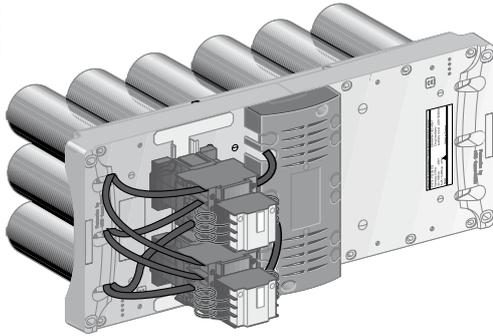


Varpact

Power factor correction module

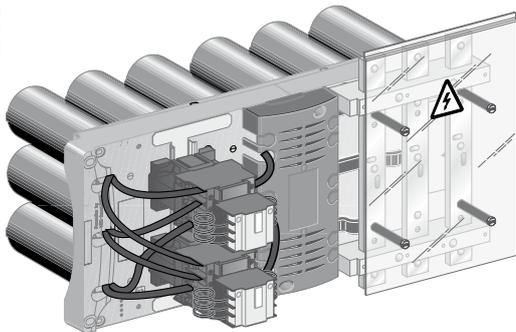
User guide

DB109721



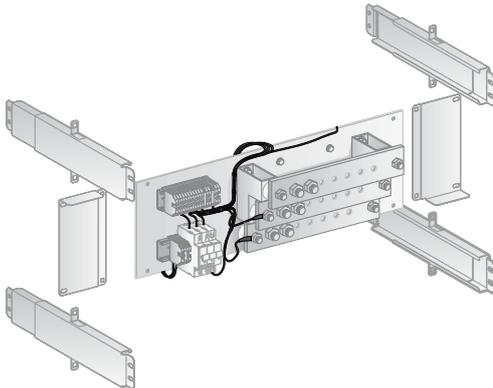
Module without busbar

DB109722



Module with busbar

DB110456



Connection module

Reception

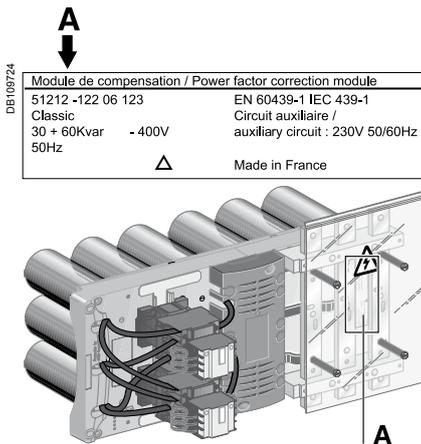


Fig. 1: power factor correction module rating plate.

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.

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

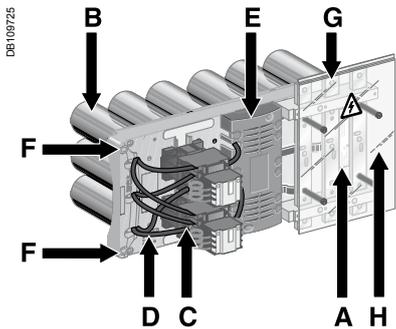


Fig. 2: power factor correction module.

Varpact power factor correction module (Fig. 2)

- A : rating plate
- B : capacitors
- C : contactors with preinsertion resistor
- D : contactor coil connection terminals
- E : terminal shield
- F : 4 fixing points
- G : modular busbar (30 x 10 mm) if fitted
- H : modular busbar screen.

Sliding rails (Fig. 3)

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 and that the inter-module spacing is correct.

- sold in pairs
- to be ordered separately (ref. 51670).

Extension plates W650, W700 and W800 (Figs. 4, 5 and 6)

They allow the power factor correction modules to be fitted into 650, 700 and 800 mm wide cubicles.

- to be ordered separately:
- I : extension plate W650 (ref. 51635)
- J : extension plate W700 (ref. 51637)
- K : extension plate W800 (ref. 51639).

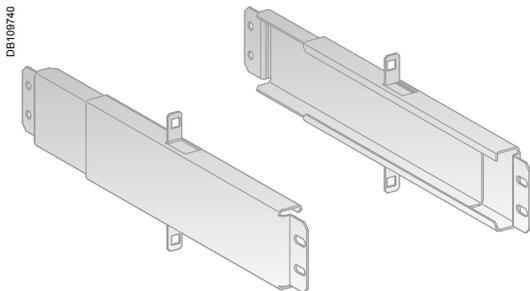


Fig. 3: sliding rails.

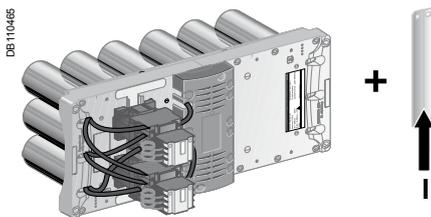


Fig. 4: extension plate W650.

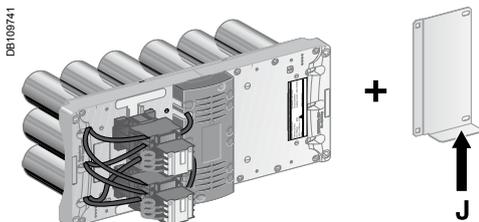


Fig. 5: extension plate W700.

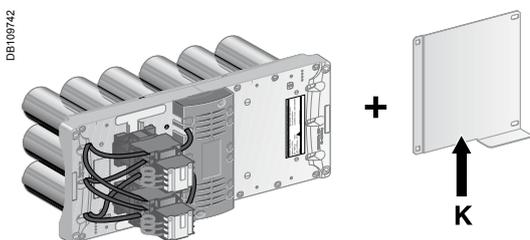


Fig. 6: extension plate W800.

Description (cont.)

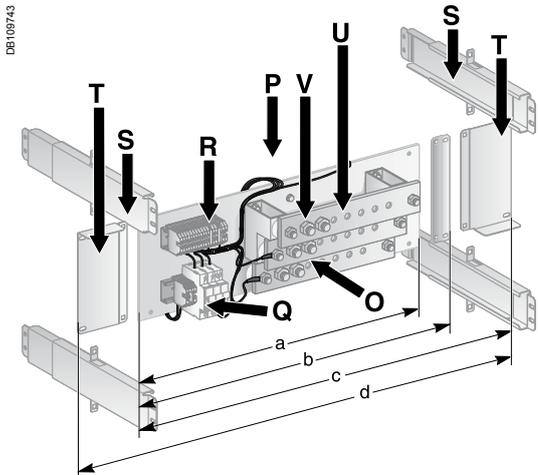


Fig. 7: connection module
 a : cubicle W = 600 without extension plate
 b : cubicle W = 650 with extension plate W650
 c : cubicle W = 700 with extension plate W700
 d : cubicle W = 800 two extension plates W700

Connection module, IP00 (Fig. 7)

It allows the following to be connected:
 ● power and control cables of the power factor correction module contactors (maximum of 5 power factor correction modules)
 ● cubicle supply cables.

The connection module (ref. 52800) is supplied with:

- 4 fixing rails
- 3 extension plates.
- O : 3 power connection bars (800 A max), marked L1, L2, L3
- P : voltage transformer to feed contactor coils 400/230 V; 250 VA
- Q : control circuit protection fuses
- R : contactor coil distribution terminals
- S : sliding rails, for assembly into 400 and 500 mm deep cubicles
- T : extension plates for assembly into 650, 700 or 800 mm wide cubicles
- U : connection for power factor correction module: 5 x Ø10 holes per phase
- V : connection for customer incoming cables: 2 x M12 bolts per phase.

Technical characteristics

- capacitor sizing rated voltage according to the Varpact model
- capacitance value tolerance: -5, +10 %
- insulation class:
 - 0.69 kV
 - 50 Hz, 1 min withstand: 3 kV
- maximum allowable overload
 - current:
 - Classic model: 30 % max.
 - Comfort model: 50 % max.
 - voltage: 10 % (8h out of 24h as defined in IEC 60831)
- watts loss:
 - without busbar:
 - ≤ 1.9 W/KVAr (at maximum current) for the Classic model
 - ≤ 2.3 W/KVAr (at maximum current) for the Comfort model
 - with busbar:
 - ≤ 2 W/KVAr (at maximum current) for the Classic model
 - ≤ 2.4 W/KVAr (at maximum current) for the Comfort model
- protection degree: front face protected against direct contact
- colour: RAL 7016
- standards: IEC 60439-1, EN 60439-1, IEC 61921.

Sizes and weights

- power factor correction module "with busbar" (Fig. 8): 19 kg max.
- connection module "without busbar" (Fig. 9): 16 kg max.

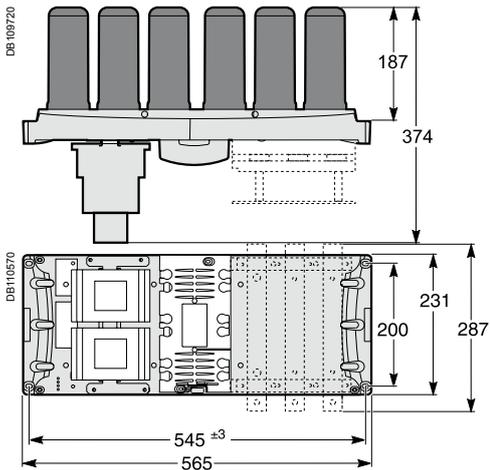


Fig. 8: power factor correction module dimensions.

View from A

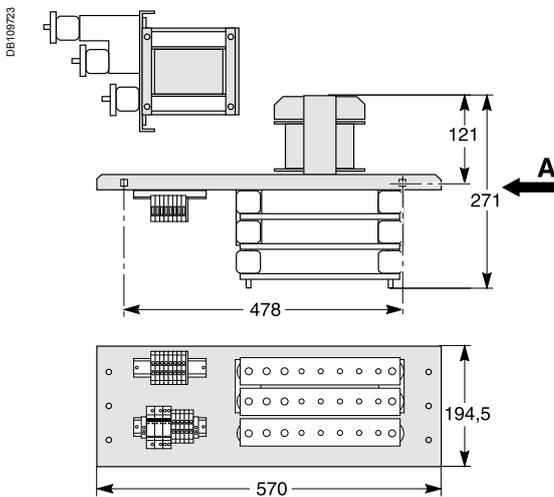


Fig. 9: connection module dimensions.

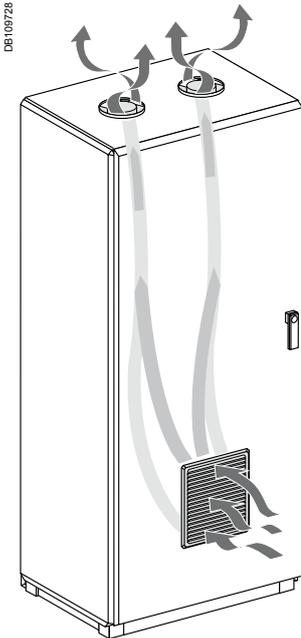


Fig. 10: air flow.

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. 10)

The capacitors, contactors and electrical connections dissipate heat:

- Classic model: 2 W/KVAr max.
- Comfort model: 2.4 W/KVAr max.

The following ventilation rules must therefore be respected:

- air flow within the cubicle must be from the bottom to the top.
- for natural ventilation, the cross-section of the top opening must be at least 1.1 times that of the bottom opening.
- for forced ventilation, extractor type ventilators should be fitted on the top of the cubicle.
- the size of the openings must be compatible with the protection index (IP).

If the cubicle protection index (IP) is ≤ 3X

Reactive power (kVAr at 400 V - 50 Hz)	Type of ventilation	Air entry	Min. real air flow (m ³ /hour)
Power ≤ 100 kVAr	Natural	200 cm ²	
Power from 100 to 200 kVAr	Natural	400 cm ²	
Power ≥ 200 kVAr	Forced		≥ 0.75 times the power in kVAr

If the cubicle protection index (IP) is > 3X

Reactive power (kVAr at 400 V - 50 Hz)	Type of ventilation	Min. real air flow (m ³ /hour)
All power ratings	Forced	≥ 0.75 times the power in kVAr

For example: for an installed power of 200 kVAr, the real air flow must be 150 m³/h.

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
- battery power:
 - 600 kVAr (400 V)/column max. for the Classic model
 - 450 kVAr (400 V)/column max. for the Comfort model.

Installation (cont.)

Positioning the fixing rails (Figs. 11 and 12)

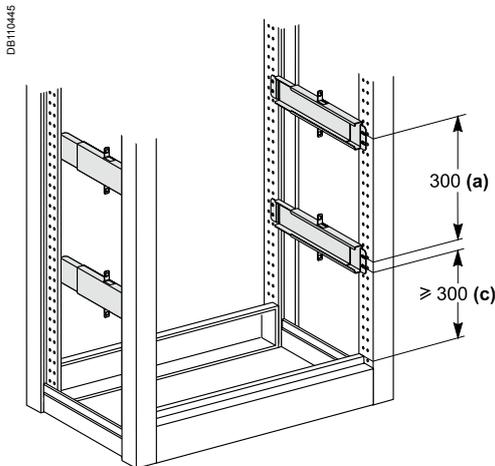
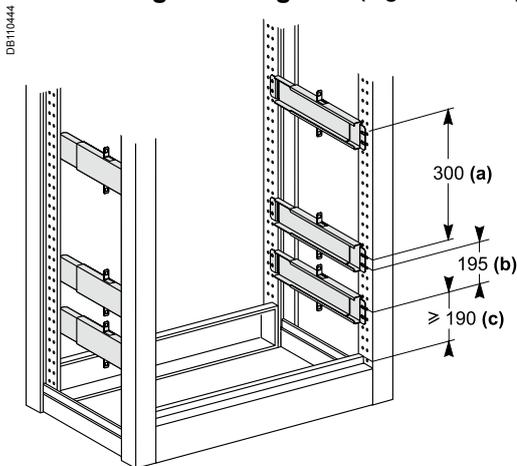


Fig. 11: installation with connection module.

Fig. 12: installation without connection module.

- (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. 13)

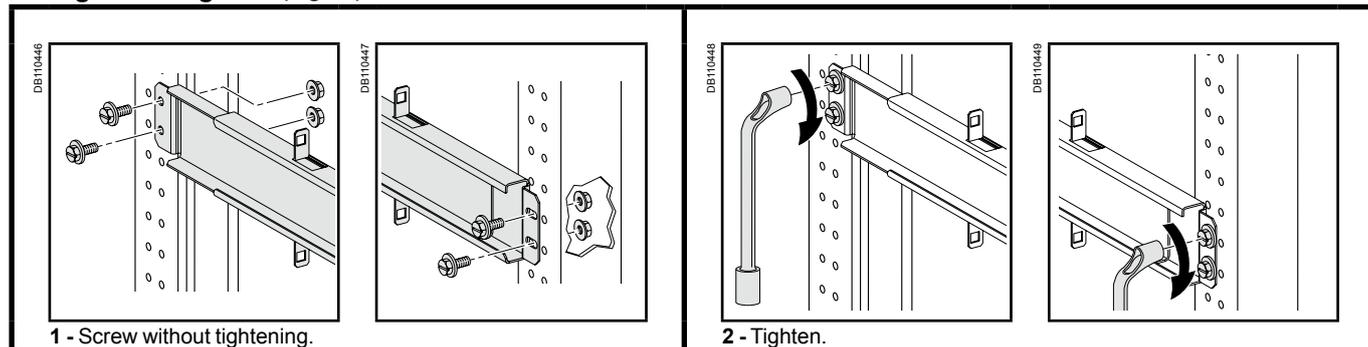


Fig. 13: fitting the fixing rails to the cubicle uprights.

Fitting the modules to the fixing rails (Fig. 14 y 15)

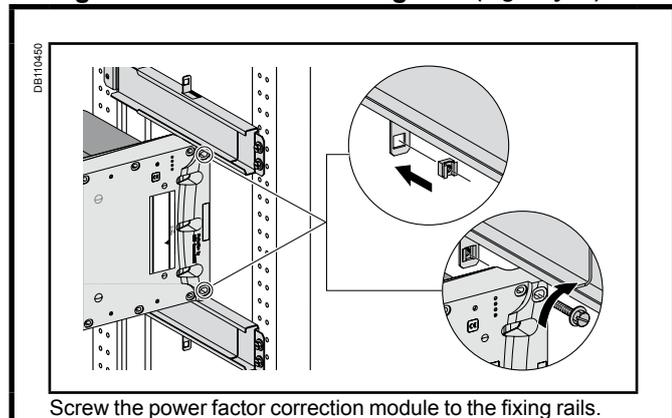


Fig. 14: power factor correction module.

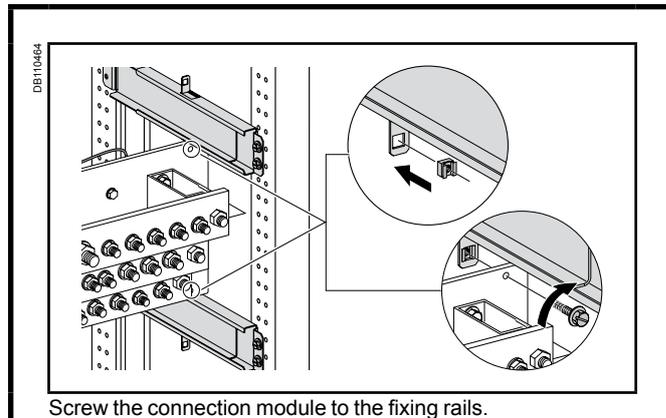


Fig. 15: connection module.

Installation (cont.)

In cubicle W = 600 mm

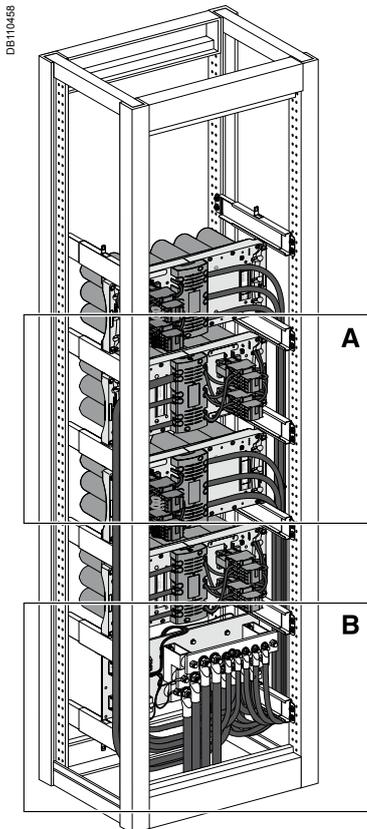


Fig. 16: cubicle W = 600 without busbar.

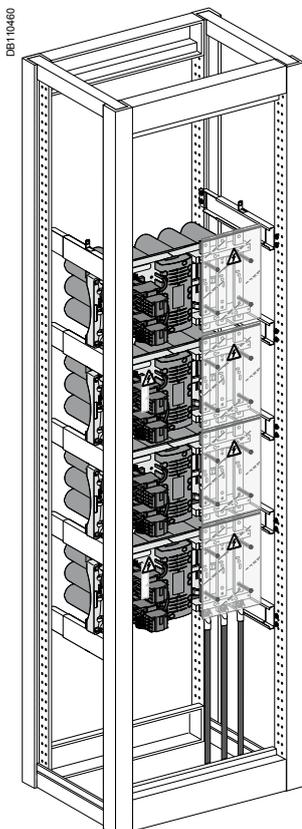


Fig. 18: cubicle W = 600 with busbar.

Recommended installation in W = 600 mm cubicle

Alternate the installation of the power factor correction modules to spread the cables over both the left and right sides of the cubicle (Fig. 16).

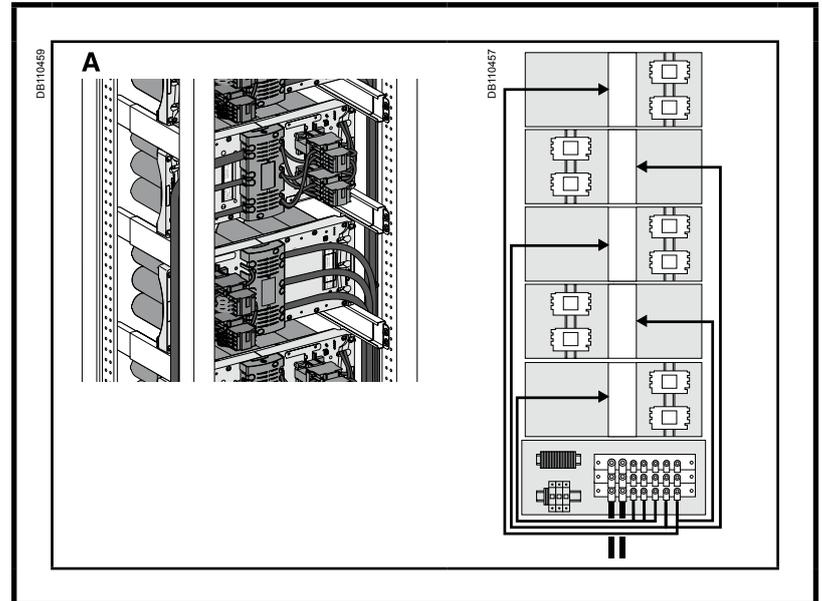


Fig. 17: electrical cable layout diagram.

Cabling the connection module

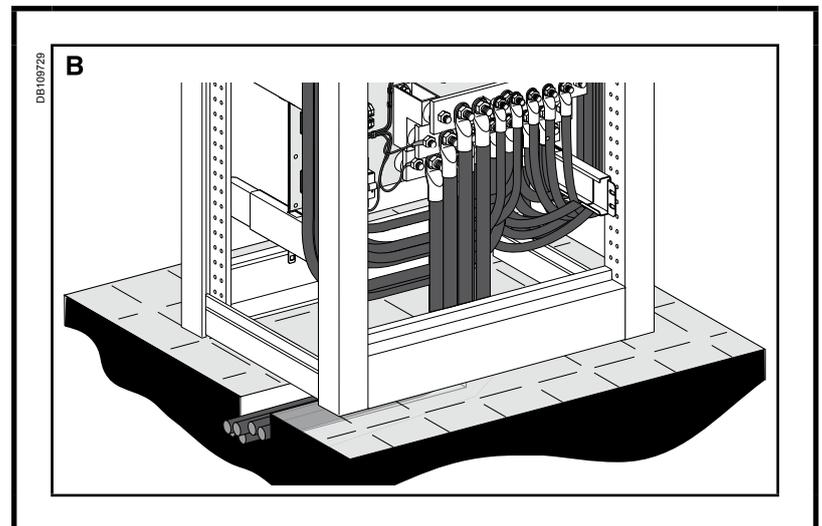


Fig. 19.

Installation (cont.)

In cubicle W = 650, 700 or 800 mm

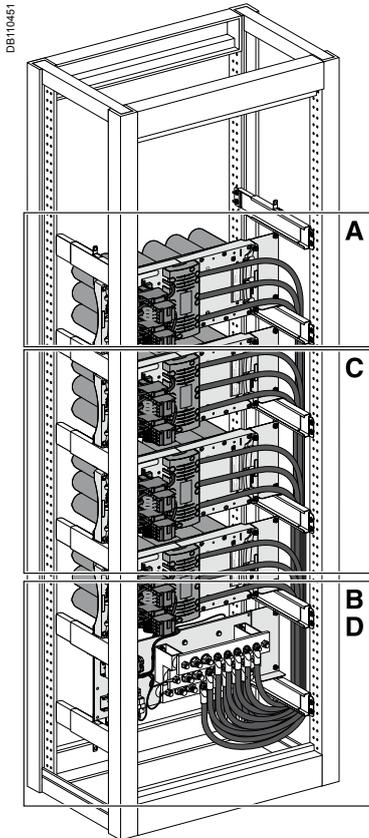


Fig. 20: cubicle W = 700 without busbar.

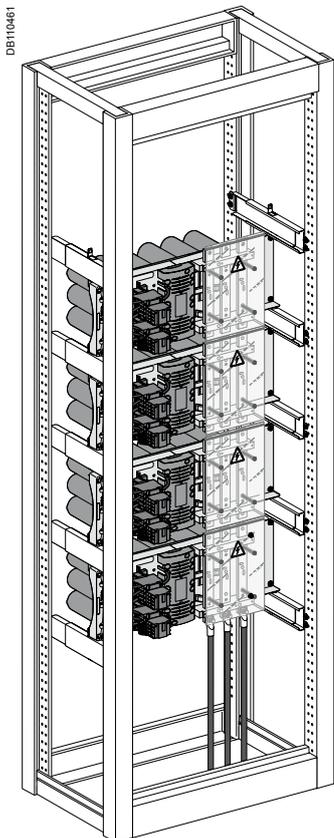


Fig. 23: cubicle W = 700 with busbar.

Fitting the extension plates W650, W700 or W800 (Figs. 21 and 22)

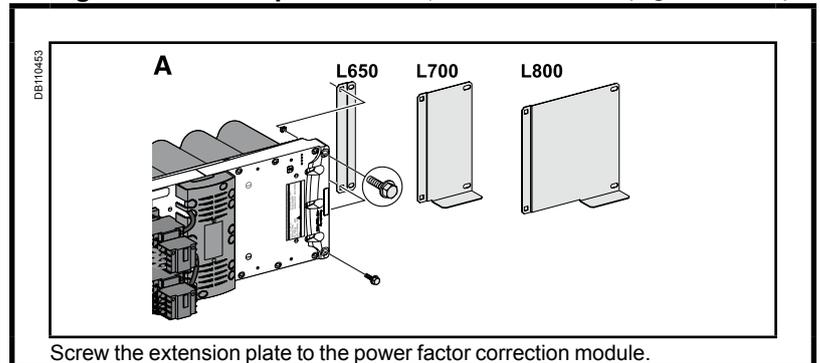


Fig. 21: power factor correction module.

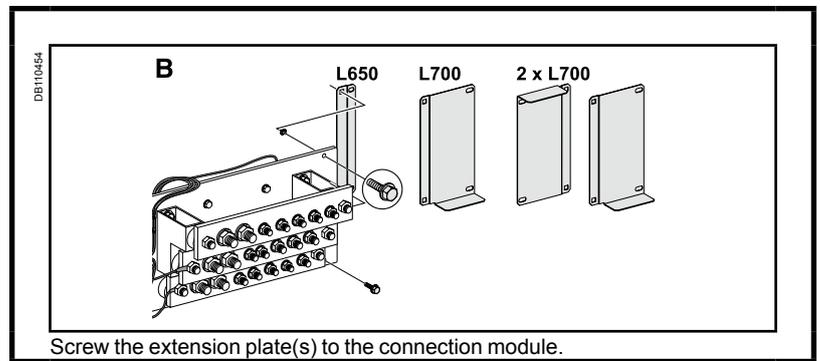


Fig. 22: connection module.

Fitting the modules into the cubicle

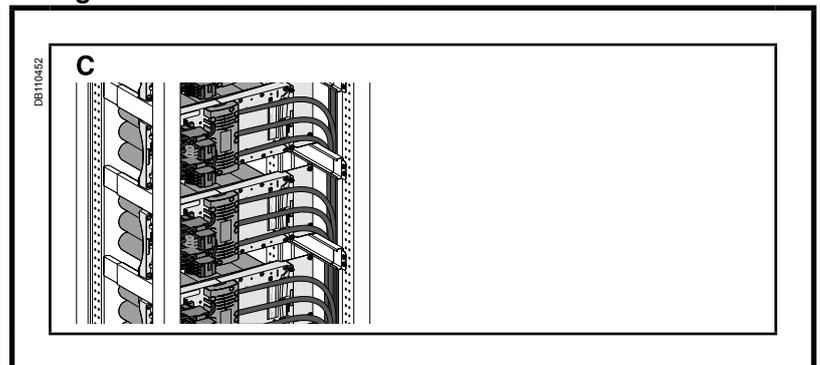


Fig. 24.

Cabling the connection module

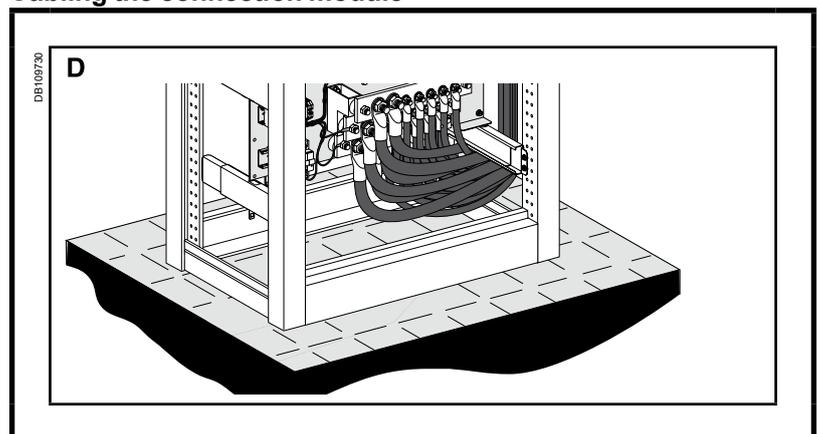


Fig. 25.

Installation (cont.)

In cubicle W = 650, 700 or 800 mm

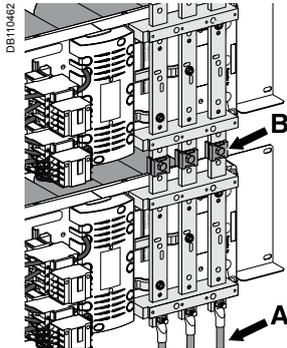


Fig. 26: fish plate assembly detail.

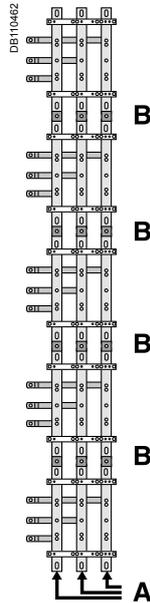


Fig. 27: full busbar.

Busbar electrical connection

Maximum continuous current (I_{mp}) \leq 630 A (Figs. 26 and 27)

1 single busbar from top to bottom.

A : busbar supply cables, lower part.

B : fish plates.

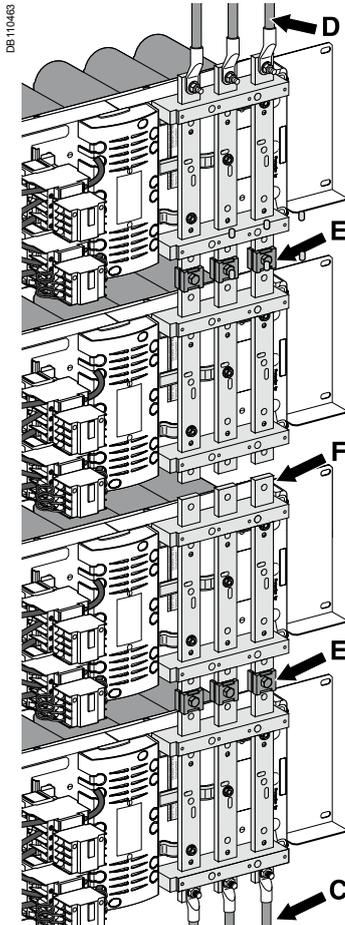


Fig. 28: fish plate assembly detail.

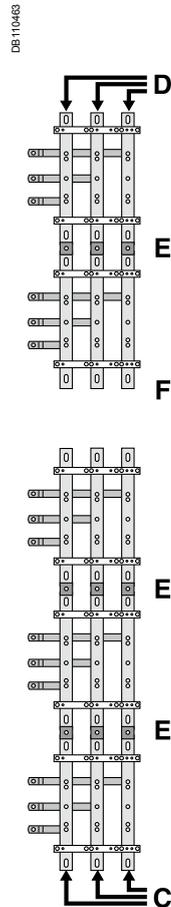


Fig. 29: full busbar.

Maximum continuous current (I_{mp}) $>$ 630 A (Figs. 28 and 29)

2 distinct busbars

C : busbar supply cables, lower part.

D : busbar supply cables, upper part.

E : fish plates.

F : do not fit fish plates in the middle of the cubicle in order the 2 busbars remain independent.

Installation (cont.)

Choice of cables

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

The maximum continuous current (I_{mp}) to be taken into account is:

- 1.36 x I_n: Classic power factor correction module
- 1.5 x I_n: Comfort power factor correction module.

Power factor correction cubicle nominal current: where U = mains supply voltage

$$I_n = \frac{Q}{U\sqrt{3}} \quad Q = \text{reactive power of the cubicle}$$

Tightening torques

- terminal pads for the power factor correction module without busbar: 14 Nm
- fish plates of the power factor correction module with busbar: 30 Nm
- connection module:
 - M10 bolt: 50 Nm
 - M12 bolt: 75 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	LC1Dvar60	LC1Dvar90
	LC1D25	LC1D40	LC1D80
Pull-in cos Φ = 0.75	70 VA	245 VA	245 VA
Holding cos Φ = 0.3	8 VA	26 VA	26 VA

Installation with connection module

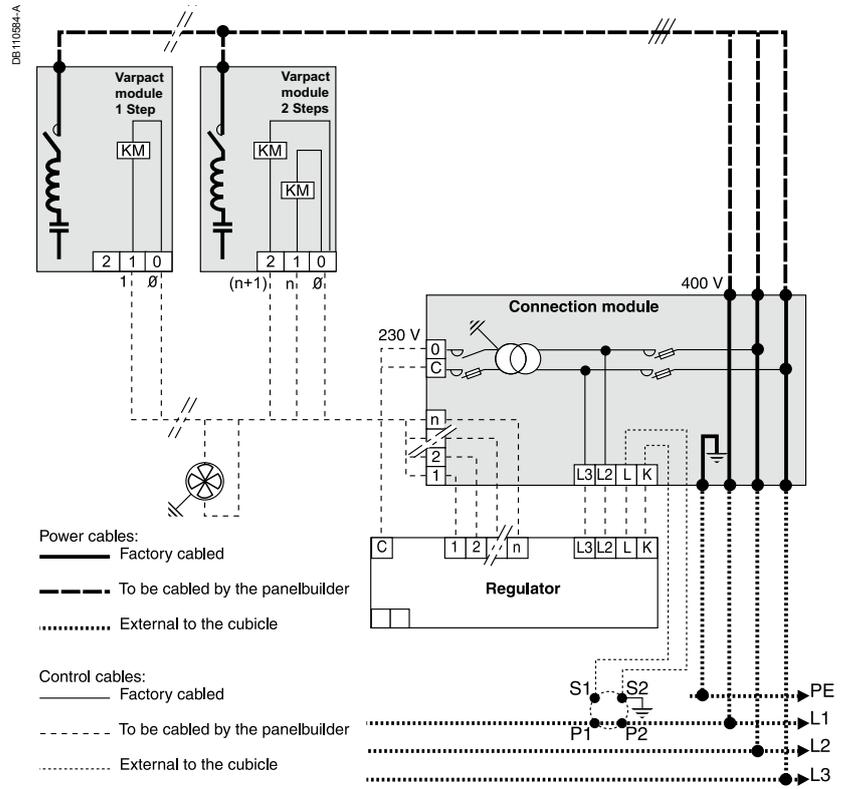


Fig. 30: electrical layout diagram.

Installation without connection module

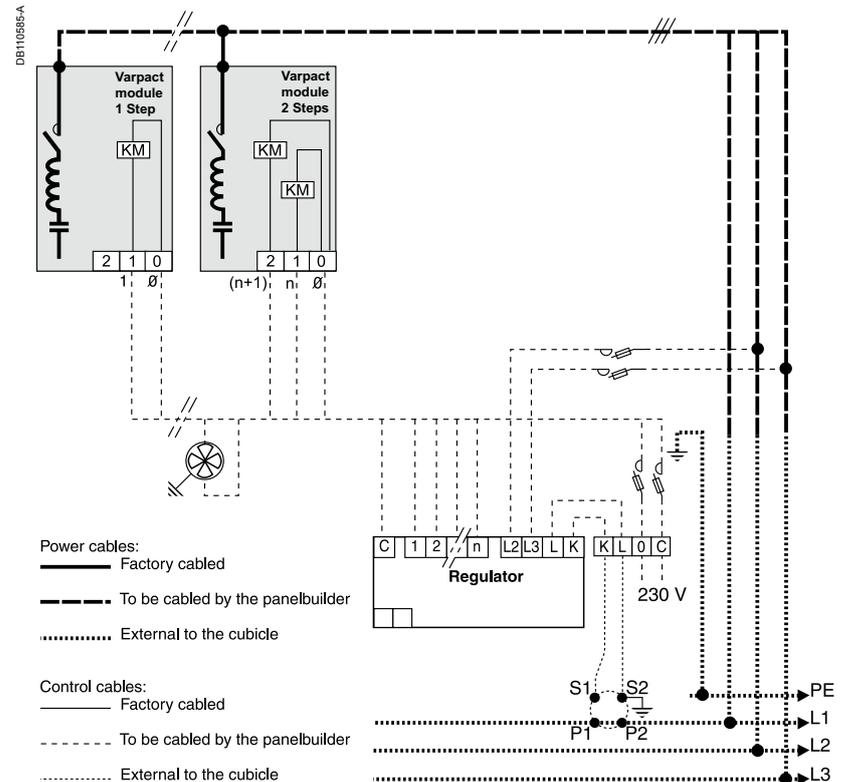


Fig. 31: electrical layout diagram.

Installation (cont.)

Fitting barriers for protection against direct contact

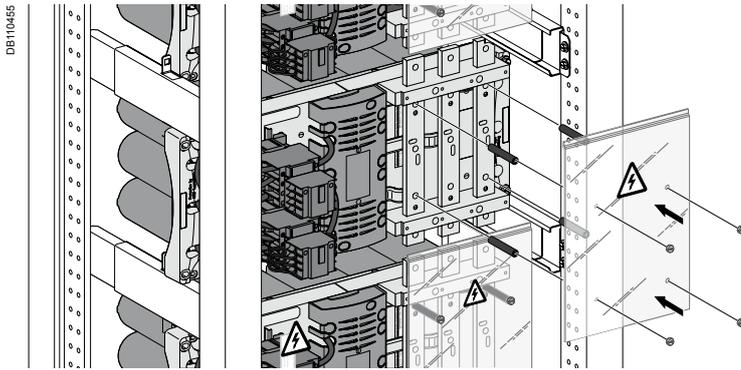


Fig. 32: assembly details for fitting the protection barrier for modules with busbar.

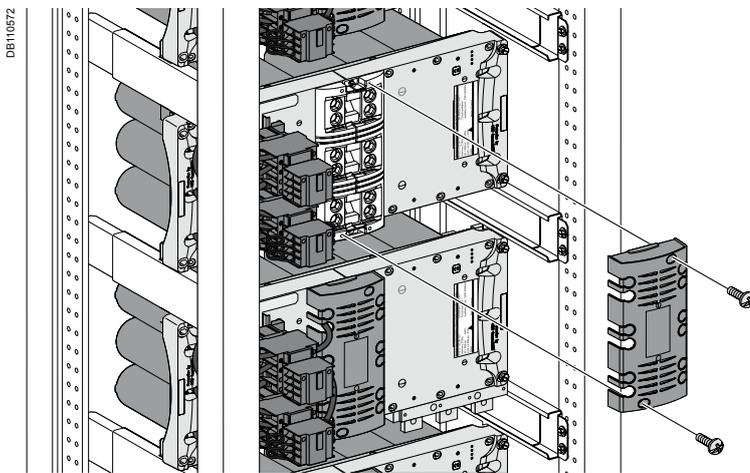


Fig. 33: assembly details for fitting the protection shield for modules without busbar.

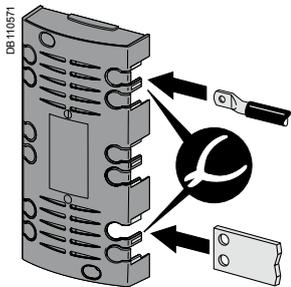


Fig. 34: protection shield cut-out details.

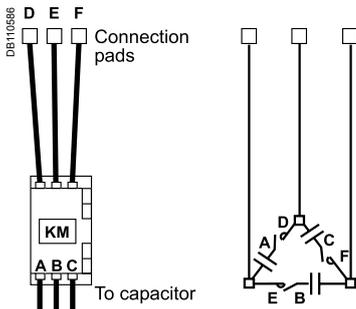


Fig. 35: break the triangle links.

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. 35)

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

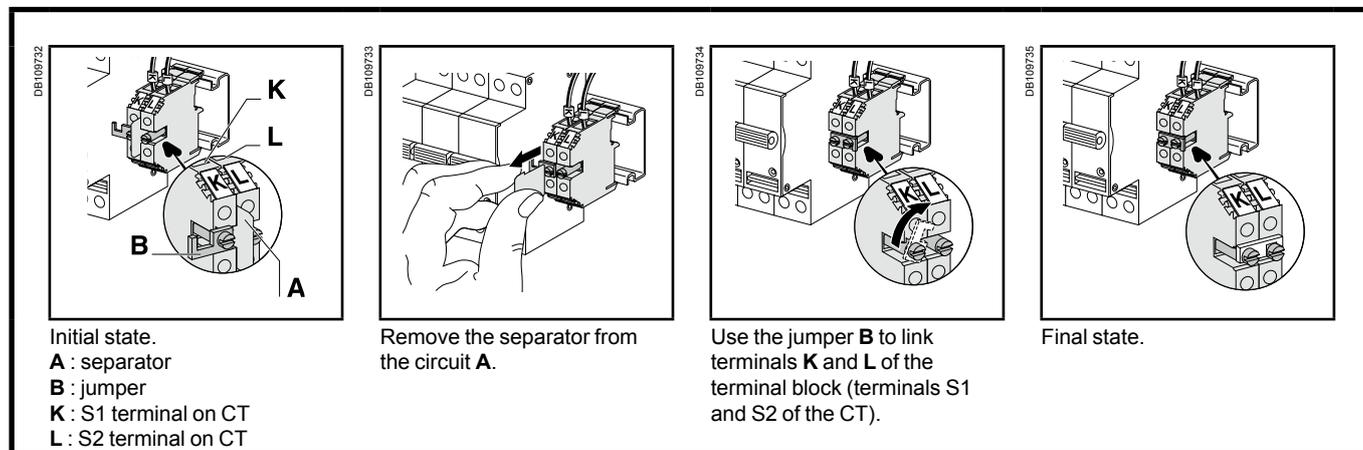


Fig. 36.



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

After finishing work

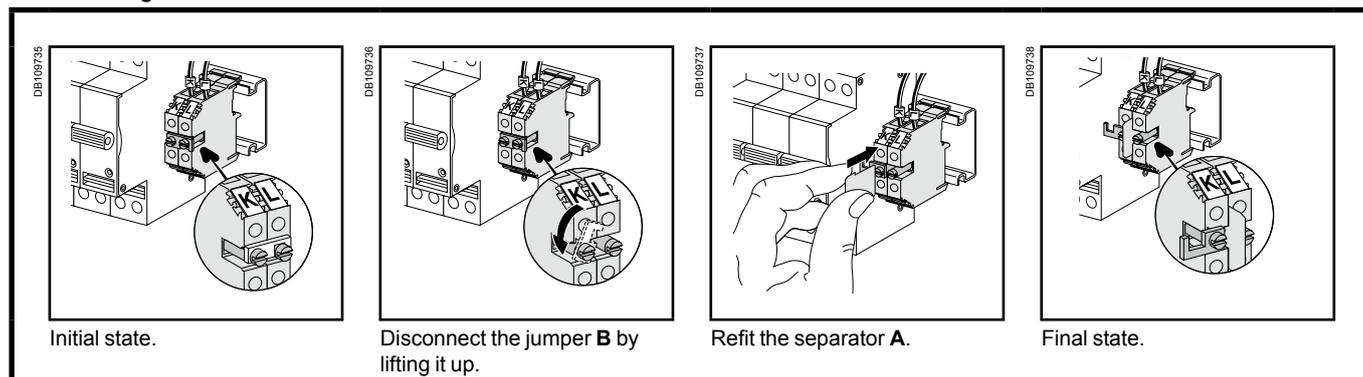


Fig. 37.

Notes

Notes

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