



Okken

high dependability switchboard
for power distribution up to 6300A
and motor control

Installation Guide



Merlin Gerin

Square D

Telemecanique

Schneider
 Electric

Get more with the world's Power & Control specialist

	pages
General	
■ introduction	5
□ introduction	5
□ safety recommendations	5
Equipment receiving	
■ packing	6
□ general	6
□ packing	6
■ handling	7
□ general	7
□ handling by the bottom	7
□ handling by the top	8
□ handling by the top of 230 cubicles	9
■ storage	10
□ precautions	10
Installation	
■ tools	11
□ tools required	11
□ assembly types	11
□ tightening torque	12
□ marking vernish	12
■ preparing the site	13
□ general	13
□ column floor fixing points	13
□ front connection	14
□ rear connection	15
□ top connection	16
□ bottom connection	17
■ panelling the columns	18
□ side panels	18
□ rear panels	18
□ doors	18
□ roofs	19
□ IP42 cover plates and grids	19
■ installing the columns	20
□ identifying columns	20
□ fitting the columns	20
□ fixing and assembling	21
□ Internal arc withstand complements	22
■ electrical connections	23
□ fishplating the main busbar	23
□ linking the protective conductors	24
□ equipment protection	24
Connection	
■ connecting the power cables	25
□ general	25
□ connection through the top	26
□ connection through the bottom	26
□ effective zone of cables run	26
□ connection to connection bars in Form 4 box	27
□ connection directly to device terminals	27
□ form 4 by case	28
□ form 4 by sleeve	28
□ connection to connection bars inf 630A	29
■ connecting by KT busbar trunking	34
□ general	34-36

	pages
■ connecting the auxiliary circuits	37
□ cable routing	37
□ connection	37
■ finishing	38
□ finishing	38
□ cleaning	38
Commissioning	
■ instruments	39
□ measuring and of monitoring switchgear required	39
■ Masterpact NW, NT, Compact NS	40
□ mounting and installation	40
■ FU up to 630A	41
□ plug-in Polyfast	41
□ disconnectable Polyfast	41
□ disconnectable mounting plate	41
□ fixed and plug-in on mounting plate	41
□ drawers	42-44
■ checking and testing	45
□ checks	45
□ energising equipment for the first time	46
□ precautions to be taken when switchboard has been switched off for a long period	46

Introduction

Okken is a switchboard made up of a number of modular sections. Such a design facilitates transportation, installation and maintenance.

The horizontal busbars are connected between sections by splicing.

Prior to shipping, every Okken switchboard has been submitted to the 3 routine tests, as per IEC 60439-1 (wiring and electrical working, protective measures and insulation) and inspected visually, mechanically and electrically by a trained technician of the Quality Inspection department.

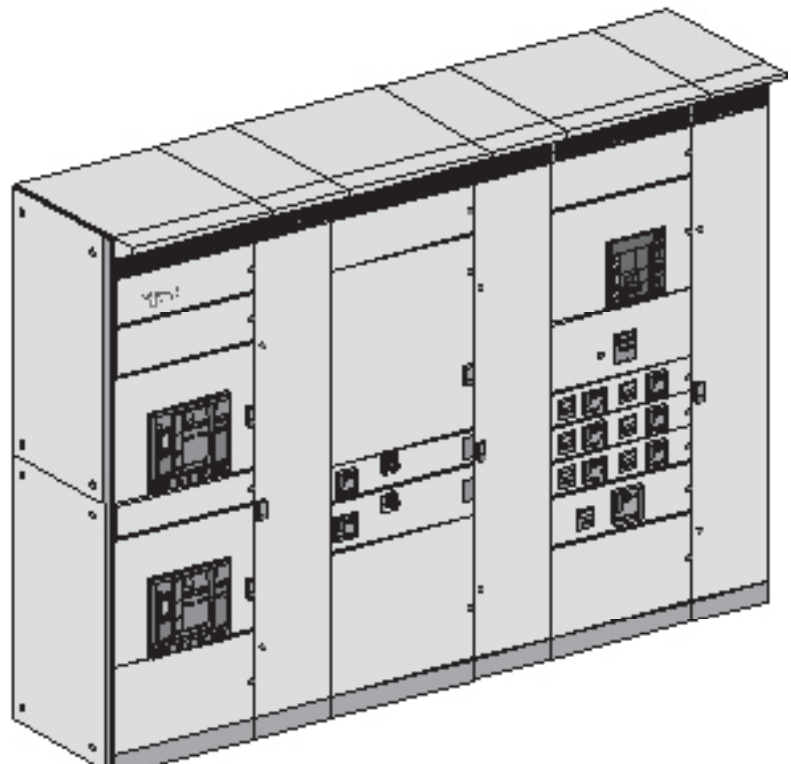
Safety recommendations

Correct operation of Okken switchboards requires that handling, installation and operation be carried out exclusively by qualified personnel:

- qualified to work near live equipment
- trained to all applicable safety practices.

During the installation and connecting operations, the switchboard must be de-energised so as not to expose personnel to electric shock hazards.

Failure to comply with these instructions and with those recalled in this guide may result in very serious or even fatal accidents of operators or in damage to the switchboard.

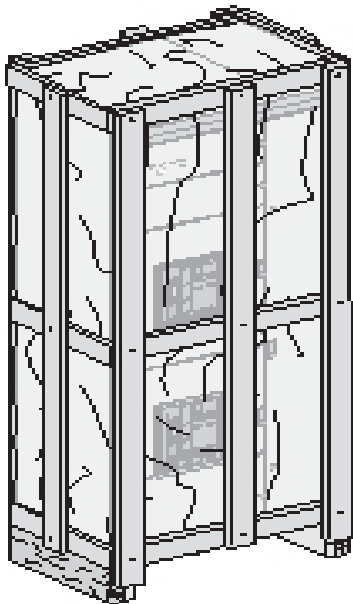


General

Some precautions must be taken when receiving the switchboard:

- on receipt of the equipment and before handling it, check that the cases and packing materials used for transportation have not been damaged and that all items on the packing list have been effectively delivered
- even if the packing appears to be in good condition, do not hesitate to unpack the equipment in the presence of an authorised transport agent
- check consignment contents and weight. Thoroughly check the equipment to make sure that no damage or shocks have occurred which may impair insulation or operation
- if necessary, check that the information given on the switchboard nameplate, located on the incoming section, conforms to that given on the delivery slip
- in case of damage or missing parts, inform the transport agent by registered mail.
- After this inspection, put back the plastic protection cover.

Packing



Standard packing

The Okken switchboards are normally dispatched column by column, or in sections of 2 juxtaposed columns.

Exceptionally, they may be made of sections of 3 columns, in the case of coupling with 2 incomer columns for example.

Each parcel is identified by marking giving:

- the project number
- the weight
- the packing (parcel number and number of parcels)
- the position of the centre of gravity
- the storage and handling instructions.

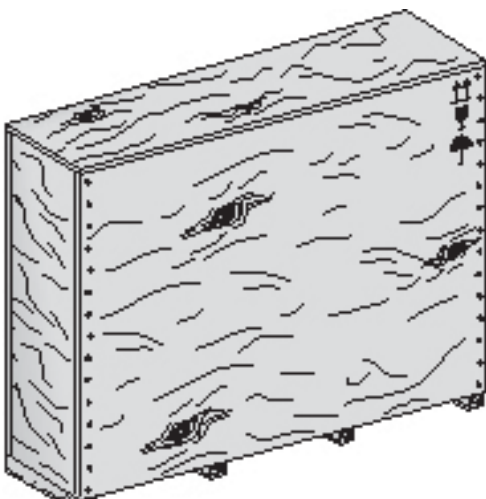
Standard packing

The column(s) are protected by a plastic cover in a crate. The lower ventilation grids are delivered separately. They are not mounted so as to allow handling of the column by the bottom. In the same way, the withdrawable devices $\geq 3200A$ are usually packed separately.

Sea packing

The column(s) are protected by a heat-welded cover containing desiccant bags and are installed in a ventilated wooden or plywood crate.

As a rule the sea crates do not weigh more than 5 tons.



Sea packing

General



Final unpacking of the equipment will preferably take place just before the switchboard is installed, as close as possible to its final installation site.

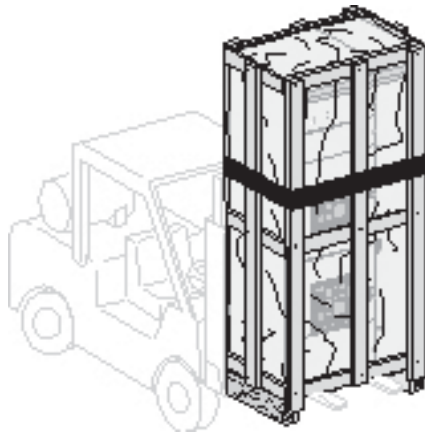
The dimensions, weight and handling instructions for the columns are marked on the packing.

As a guideline, the average weight of a column is 650 kg but the 6300A columns (L=1150, D=1400) can weight from 1500 kg to 2000 kg)

Sections should always be handled in the upright position with care. There is a risk of toppling of the column due to the high position of the centre of gravity.

Avoid any column movement by making them swivel jerkily.

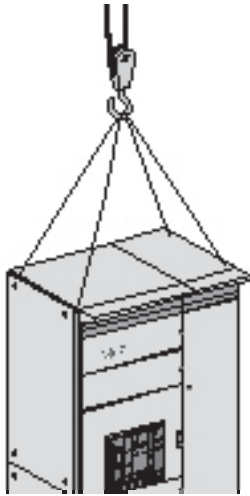
Handling by the bottom



The columns are designed with a built-in plinth and can be moved by the front or the rear using a pallet truck or a adapted fork-lift truck.

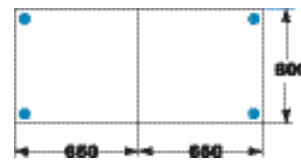
In this case, the columns must be **lifted with care and held in place during transport**, either manually or by strapping them onto the handling machine, if movement is over large distances or bumpy.

Handling by the top

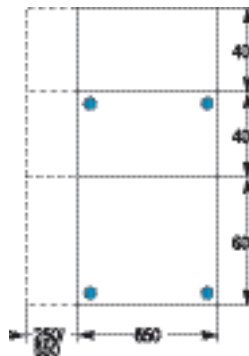
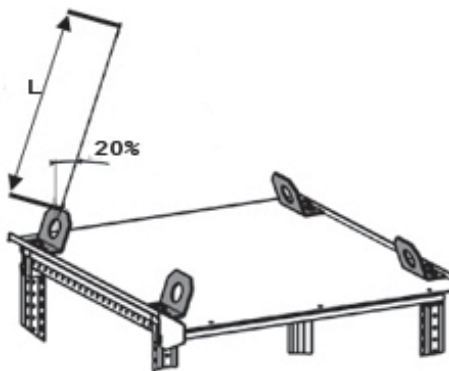


- if cranes or travelling cranes are used, you must use slings that are sufficiently resistant and in good condition
- latching must be on the 4 column lifting lugs
- adjust sling length according to switchboard dimensions so that their orientation is in the prolongation of that of the lifting rings. the angle compared to the vertical is of $20^\circ \pm 5^\circ$ (see sketch)
- do not tilt the column during transportation.
- take care to equally distribute the load on the 4 rings.

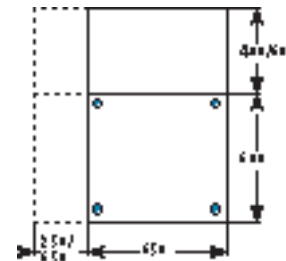
Implementations of the lifting lugs and slings length L (mm)



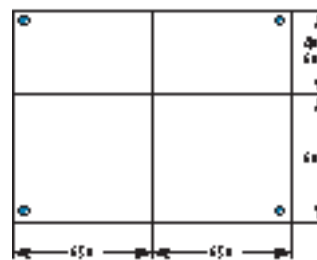
slings: $1500 \leq L \leq 2300$
 or lifting beam: $L=650$
 with slings $700 \leq L \leq 1000$



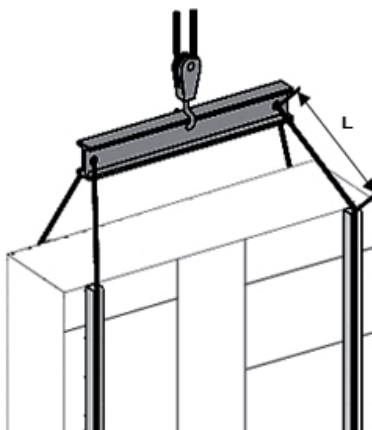
slings: $800 \leq L \leq 1100$



slings: $700 \leq L \leq 1000$



slings: $1500 \leq L \leq 2300$
 or lifting beam: $L=650 \times 400$ or 600 with slings $700 \leq L \leq 1000$

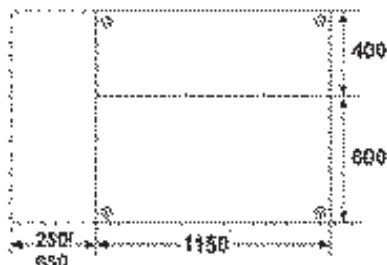


In the special case of an assembly with more than 2 columns, you must :

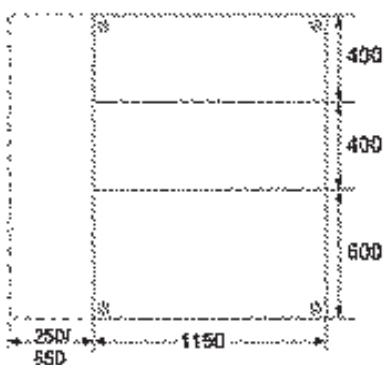
- bring the switchboard as close as possible to its installation site in its original packing
- use a lifting beam with slings supporting the switchboard by the bottom

Handling by the top of 230 columns (4000 - 6300A)

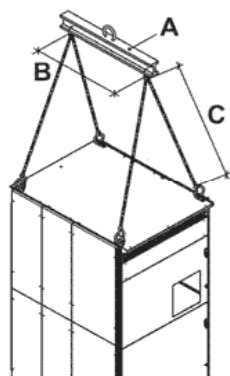
Implementations of the lifting lugs and slings length L (mm)



2 double-strand slings (minimum strength per sling=1200 kg) :
 $1300 \leq L \leq 1900$ + compulsory lifting beam, installed across the column's depth: $600 \leq L \leq 1000$



2 double-strand slings (minimum strength per sling = 1200 kg):
 $1300 \leq L \leq 1900$
 + compulsory lifting beam, installed across the column's depth:
 $1000 \leq L \leq 1500$
 NB: this way of lifting is also appropriate for the 6300A coupling compartments W650 - D1400



Column 230

	D1000 (mm)	D1400 (mm)
B	600/1000	1000/1500
C	1300/1900	1300/1900

A : lifting strength = 1500/3000 kg
 C : lifting strength = 1200 kg for 2 slings

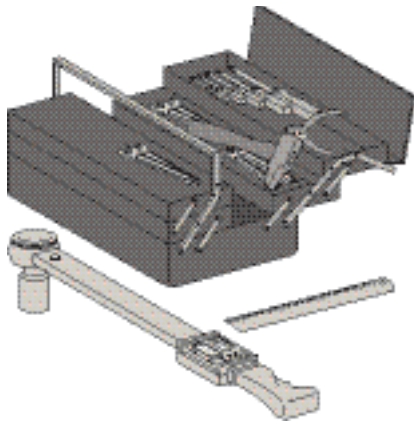
The 4 slings must have an equal length

Precautions

Precautions to be taken for Okken storage:

- Okken is intended for use indoors. The equipment must therefore be stored upright in a dry and ventilated location, protected from rain, extreme temperatures, streaming, dust and chemical agents
- never store Okken outside, even under a tarpaulin
- the columns must preferably remain packed until they are installed. Should work be in progress nearby or on the premises, cover the columns with a cover protecting them efficiently against dust, gravel, paint and cement
- acceptable storage temperature is -10°C to $+40^{\circ}\text{C}$
- to ensure easy, risk-free handling, the columns, in view of their great weight, must be stored on a stable, rigid floor.

Tools required



- torque wrench
- bush ratchet
- bush of 10
- bush of 13
- bush of 16
- bush of 17
- bush of 18
- bush of 19
- Torx 8 bit
- Torx 10 bit
- Torx (8 and 10) and recess screwdriver or screwing/un-screwing machine, with appropriate bits
- clamps for column alignment
- rubber mallet
- hydraulic jacks that can operate in horizontal position and are used to lift the columns and, if necessary, move them sideways.

Specific tools

Torque wrench

- torque wrench features
 - strength: 75 N.m
 - reduced thickness for some tightenings on the busbars



■ FACOM torque wrench

A type of torque wrench (FACOM brand) have the strength and the features needed for not very accessible tightenings (fishplates ...)

Tool's references:

- SP3723 = wrench's shaft, essential
- SP3721 = extra-thin pawl adapter, indispensable
- SP3722 = pawl for ordinary sockets, optional (to be fitted on the SP3723 shaft)

SP3721 pawl extra-thin sockets references + SP3723 shaft:

- SP2709 = 13 mm extra-thin low socket
- SP2709A = 13 mm extra-thin high socket
- SP4369 = 16 mm extra-thin low socket
- SP4370 = 16 mm extra-thin high socket
- SP2710 = 17 mm extra-thin low socket
- SP4371 = 19 mm extra-thin high socket
- SP4372 = 19 mm extra-thin low socket

BBT conversion modules special tip

■ 87808 : indispensable extended tip for tightening the conversion modules on the BBT junction blocks
It fits on an ordinary torque wrench

Assembly types

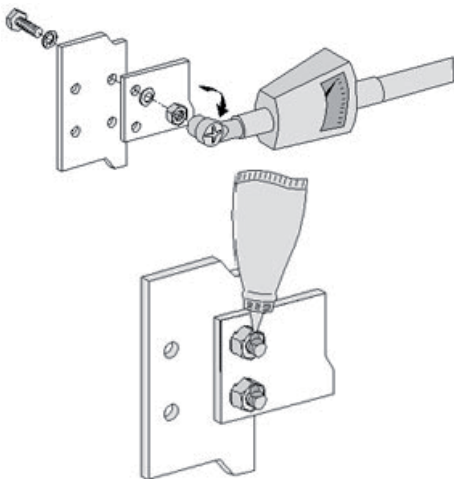
- splicing: busbars
 - bush of 16 and 17 for M10 screw
- assembling: columns
 - bush of 10 for M6 screw
 - bush of 16 and 17 for M10 screw
- floor fixing:
 - bush of 16 and 17 for M10 screw
- fitting the roofs and lifting lugs:
 - bush of 19 for M12 screw.

Tightening torque

- recommended tightening torque for mechanical and electrical connections with 8.8 class screws.

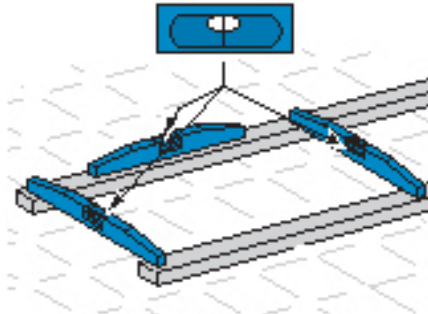
Diameter of screw	Tightening torque (N.m) (with nut + contac washer)
M4	3.5
M5	7
M6	13
M8	28
M10	50
M12	75

Marking varnish



- After tightening each electrical connection to the appropriate torque, apply some varnish between the nut and the screw (or else, between the screw's head and the copper bar or the device for tightening on a threaded part)
- The varnish isn't supposed to block the screw
It allows operator inspection, to check that the nut has been tightened, but also facilitates the identification of any loose nuts during the switchboard's lifetime
- Varnish features:
coloured acrylic varnish, indelible and able to resist a 150°C temperature
Schneider Electric recommends a red varnish as a standard to identify the panelbuilder's work.
Other colours can be used by the contractor or any operators entitled to work on the switchboard after its commissioning.

General



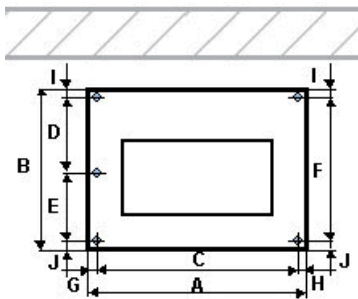
The place of installation of the switchboard must be clean. We recommend that the floor is even: + or - 2 mm/m (in this case the columns can be fixed using studs).

For floors with evenness > 2 mm/m, you must provide U, T, I sectioned supports, whose straightness and level must be checked in both directions.

Systematic use of sectioned supports is recommended to simplify mechanical assembly between columns and fishplating of busbars.

If possible, apply a dust-proof paint on the floor to limit pollution inside the switchboard.

Also provide the necessary space if future extensions are foreseen.



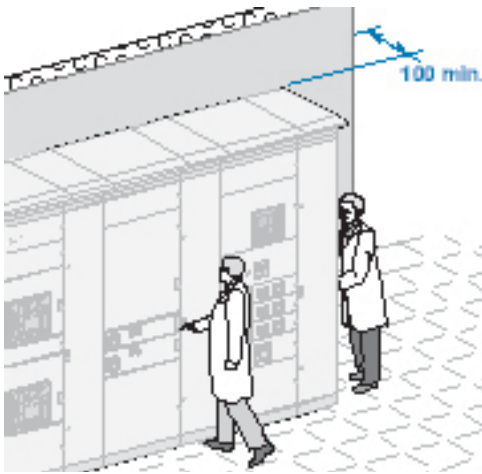
Column floor fixing points

A	B	C	D	E	F	G	H	I	J
650	600	565	262.5	262.5		42.5	42.5	37.5	37.5
650	400	565			325	42.5	42.5	37.5	37.5
450	600	365	265.5	262.5		42.5	42.5	37.5	37.5
450	400	365			325	42.5	42.5	37.5	37.5
350	600	265	262.5	262.5		42.5	42.5	37.5	37.5
350	400	265			325	42.5	42.5	37.5	37.5
250	600	165	262.5	262.5		42.5	42.5	37.5	37.5
250	400	165			325	42.5	42.5	37.5	37.5

- Columns should always be handled in the upright position with care. There is a risk of toppling due to the high position of the centre of gravity.
- the fixing points to be used are specified depending on the connection direction (front or rear)

Preparing the site

Front connection

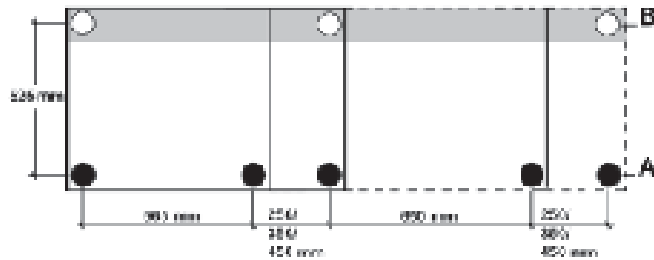
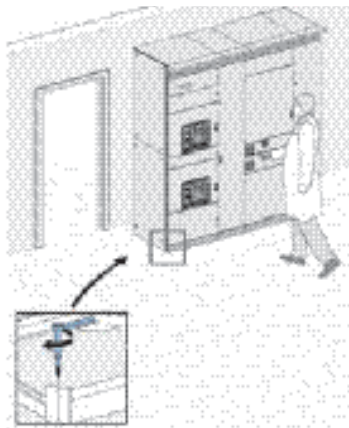


Provide a minimum space of 100 mm behind the switchboard to allow proper ventilation. In the case of compensation of energy cubicle, ventilated, this minimal space will be 200 mm.

A minimum space of 1200 mm (1500 mm for 4 pole NW 40b/50/63 devices) must be arranged at the front of the switchboard to allow complete opening of doors and handling of a device using a fork-lift truck.

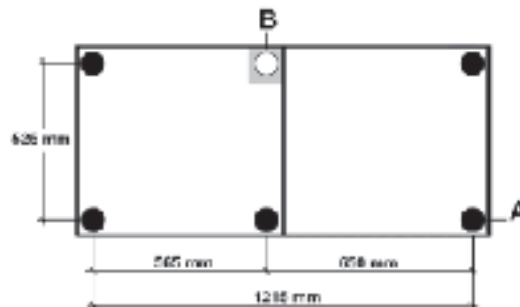
Provide 500mm above the switchboard for Horizontal busbar fishplating.

Ground fastening points layout



Example: switchgear cubicle + compartment D600

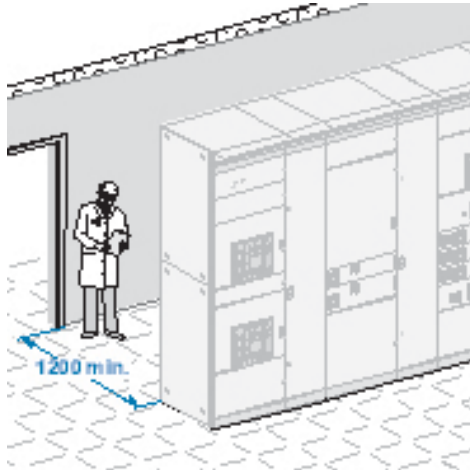
particular case



Example: 3200A incoming cubicle + coupling

- : recommended fixing point recommended
- : compulsory fixing point

Rear connection



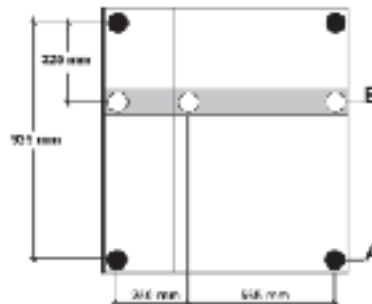
Provide a minimum space of 1200 mm behind the switchboard to allow complete opening of the rear doors and the intervention of an operator.

A minimum space of 1200 mm (1500 mm for 4 pole NW 40b/50/63 devices) must be arranged at the front of the switchboard to allow complete opening of doors and handling of a device using a fork-lift truck.

Provide 500mm above the switchboard for Horizontal busbar fishplating.

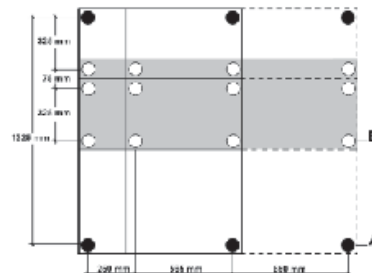
Ground fastening points layout

- rear connection depth 1000/1200



Example: switchgear cubicle + compartment

- rear connection depth 1400



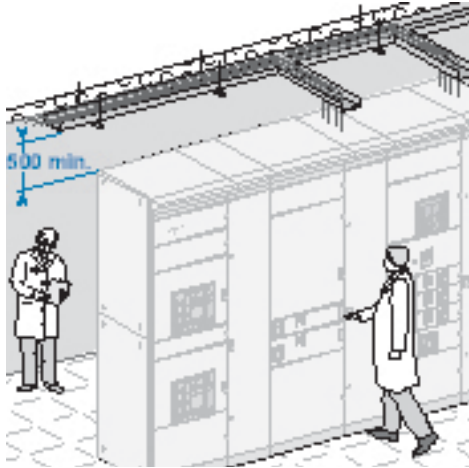
Example: switchgear cubicle L650 D600 + 2 rear compartments L650 D400

- : recommended fixing point
- : compulsory fixing point

Preparing the site

Top connection

Provide a minimum space of 500 mm above the switchboard for connection by cables or busbar trunking and fishplating of the busbar.

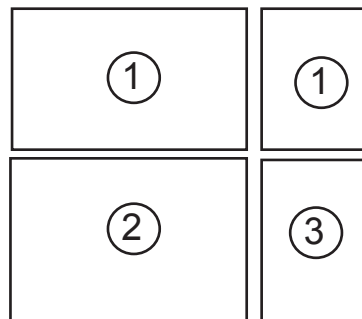
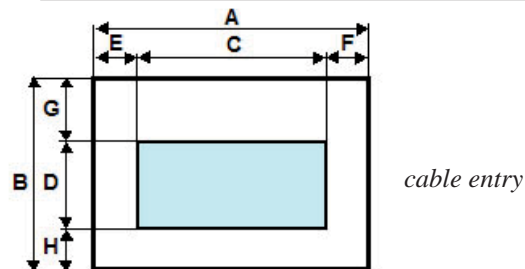


Cable entry from the top without busbar

A	B	C	D	E	F	G	H
compartment : zone (1)							
650	600	570	560	40	40	20	20
650	400	570	360	40	40	20	20
450	600	370	560	40	40	20	20
450	400	370	360	40	40	20	20
350	600	270	560	40	40	20	20
350	400	270	360	40	40	20	20
250	600	170	560	40	40	20	20
250	400	170	360	40	40	20	20

Cable entry from the top with busbar

A	B	C	D	E	F	G	H
cubicle 115* : zone (2)							
650	600	460	210	120	70	335	55
cubicle 70* : zone (2)							
650	600	290	200	110	250	360	40
compartment : zone (3)							
650	600	570	260	40	40	320	20
450	600	370	260	40	40	320	20
350	600	270	260	40	40	320	20
250	600	170	260	40	40	320	20



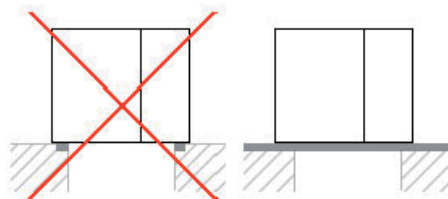
various zones inside the switchboard

*cubicle 115: distance between axes of busbar 115 mm. Equipped with Masterpact NW/NT and Compact NS 630b/1600

*cubicle 70: distance between axes of busbar 70 mm. Equipped with functional units ≤ 630A and, in some cases, with Masterpact NT/Compact NS 630b/1600

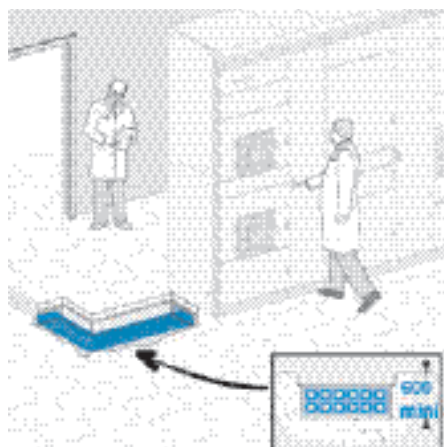
Bottom connection

The connection cables will be routed:
 - either in a duct fitted under the columns
 - or under a false floor.



In the first case, the duct will have a width inferior to the column's depth, or fitted with rails or transverse sections (these are compulsory for columns fitted with rear compartments).

In the latter case, the switchboard must be installed on a metal chassis designed to support column weight (650 kg on average for a column < 4000 A). The slabs of the false floors will be adjusted so as to respect the degree of protection of the switchboard.

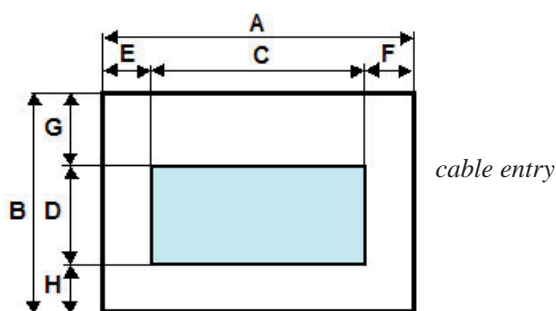


In both cases, provide a minimum depth of 500 mm (600 mm recommended) to respect the bending radius of the cables.

Provide a 500 mm space above the switchboard to allow the H-BB fishplating.

Cable entry from the bottom

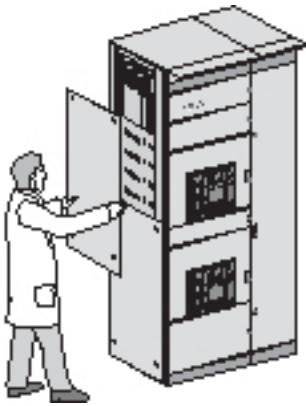
A	B	C	D	E	F	G	H
cubicle 115*							
650	600	450	170	140	60	355	75
cubicle 70*							
650	600	530	240	60	60	340	20
compartment							
650	600	530	560	60	60	20	20
650	400	530	360	60	60	20	20
450	600	330	560	60	60	20	20
450	400	330	360	60	60	20	20
350	600	230	560	60	60	20	20
350	400	230	360	60	60	20	20
250	600	130	560	60	60	20	20
250	400	130	360	60	60	20	20



*cubicle 115 : distance between axes of busbar 115 mm. Equipped with Masterpact NW/NT and Compact NS 630b/1600

*cubicle 70 : distance between axes of busbar 70 mm. Equipped with functional units ≤ 630A and, in some cases, with Masterpact NT/ Compact NS 630b/1600

Side panels



- disassembly
- disassemble the upper 1/2 panel by unscrewing the 4 screws
- disassemble the lower 1/2 panel by unscrewing the 4 screws
- store the 1/2 panels to protect them from impacts.
- assembly
- store the lower 1/2 panel
- screw but do not tighten 4 screws beginning with the top screws
- permanently tighten when all the screws have been fitted
- store the upper 1/2 panel
- screw but do not tighten 4 screws beginning with the top screws
- permanently tighten when all the screws have been fitted
- the edging sections should be stuck on the cubicle after the panel assembly on the site. All contact areas must be perfectly clean.

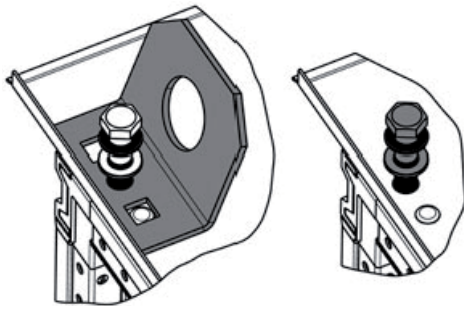
Rear panels

- disassembly
- unscrew the 6 screws starting with the bottom screws
- remove the panel and store it so it is protected from impacts
- assembly
- store the panel
- screw but do not tighten the 6 screws beginning with the top screws
- permanently tighten when all the screws have been fitted

Doors

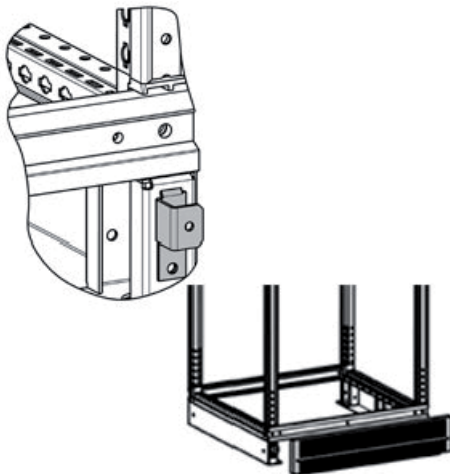
- disassembly
- remove the earth braid if the doors are fitted with one
- disassemble the door pins beginning with the bottom one, then, if applicable, the middle one
- disassemble the top door pin. In the case of a partial door, the top pin is fitted upside down (head downwards). It is held in place by a clip
- remove the door and install it so that it is protected from impacts.
- assembly
- position the door on the hinge pins
- fit the door pins, beginning with the top one. In the case of a partial door, the top pin is fitted upside down (head downwards). It is held in place by a clip
- fit the other door pins
- if necessary, put back the earth braid
- check proper operation of the handle and its locking system.

Roofs



- disassembly
- unscrew the 6 screws and remove the lifting lugs
- remove the roof and store it sheltered from impacts
- assembly
- position the roof
- screw it on (with or without lifting lugs)
(hex-head screw 12 x 25 + waterproofing washer + contact washer per fixing point)

IP42 cover plates and grids



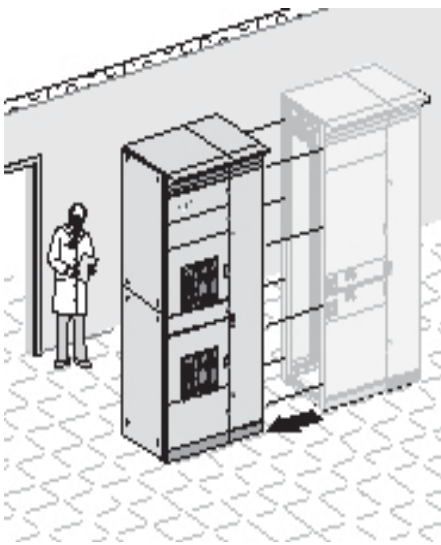
- securing the bottom supports and the grids or cover plates
- M6x13 TF screw (87182 : 1000 screws)
- In order to ease handling the columns by the bottom, and avoid damage during transportation, the fixing supports and grids (or IP42 strips) at the bottom of the columns have to be mounted on the site after the switchboard's installation
They aren't mounted on the switchboard at the delivery (supplied separately)

Identifying columns

Each column is identified by a digit or a letter at the top of the column.
 It corresponds to the serial number assigned to each column switchboard drawing.
 Some devices are too heavy to be dispatched in their column. They will be sent separately and are identified by:

- the number of the column in which they will be installed
- the reference of their position in this column.

Fitting the columns

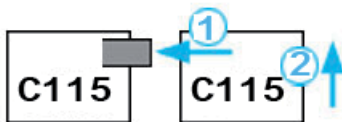


The layout consists of juxtaposing the columns in a logic order. The first column positioned may be the right or left one or even the middle one of the switchboard.

- bring up the columns to the site in the chosen assembly order
- remove the containers and the protection boards if necessary
- remove the panels to allow access to the cubicle assembly points and to the connection points
- disassemble the roof
- if necessary, disassemble the ventilation grids or bands (the bottom grids are delivered unmounted to allow handling of columns using a pallet truck).

115 cubicle particular case :

As the fishplates stick out at the right of the column, install the columns beginning from the left.
 Distance between axes of busbar 115 mm. Equipped with Masterpact NW/NT and Compact NS 630b/1600)



Fixing and assembling

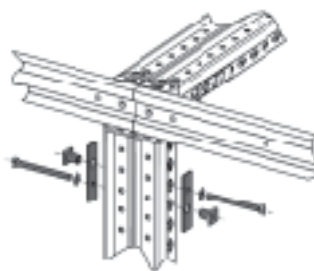
- fit the first column
- fix it to the floor using three M10 bolts having first checked its vertical position and support
- bring the second column up beside the first one
- adjust the position of the associated column (wedging at the right height, alignment of front panels)
- assemble the columns with one another:
 - 4 coupling kits, ref. 87171 on the top of frameworks
 - 2 M10 bolts on the plinths
 - 2 holding plates, ref. 87170 on the frameworks in the middle part. These plates are clipped on forcibly and are held in place by diameter 6 plastic rivets.

Position of rivets with respect to the bottom of the top cross-member:

- for a column H = 2350mm: 1294 mm
- for a column H = 2200mm: 1219 mm

If plate installation causes problems, they can be replaced by coupling kits, ref. 87171.

- identify the routing of strands or auxiliary wiring between columns. Take all necessary measures to avoid jamming or deterioration of wires when installing the columns
- protect the auxiliary wiring when it is routed near sharp edges by means of sheaths or grommets.

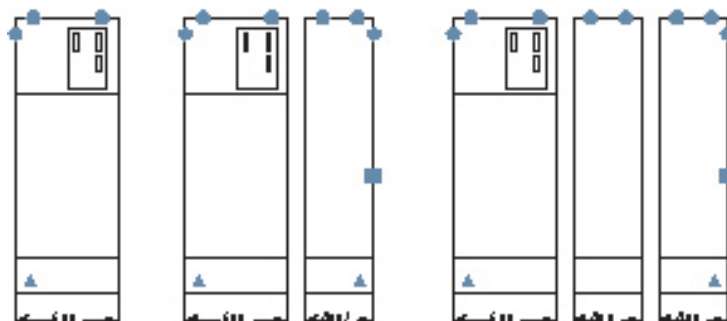


coupling kit ref. 87171



holding plate ref. 87170

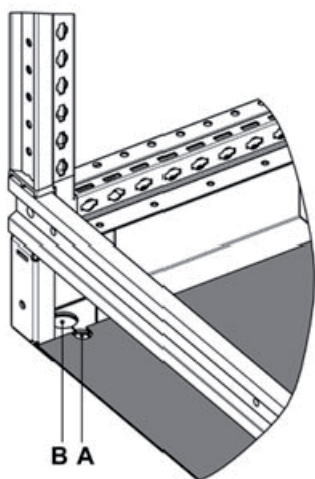
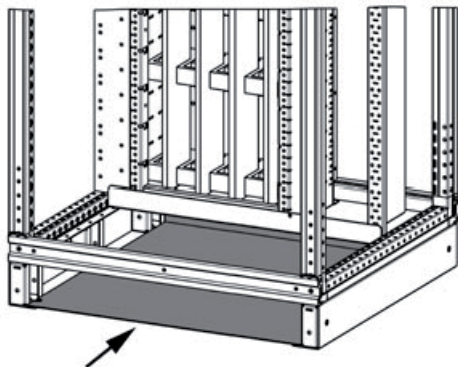
- install all associated columns in the same way



- compulsory binding by coupling kit ref. 87171
- compulsory binding by holding plate ref. 87170
- ▲ M10 bolt

Installing the columns

Internal arc withstand complements



- this item is compulsory for the arcing withstanding inside the column

It comes in addition with the parts installed by the panelbuilder

- the bottom plate delivered with the switchboard (part of the reference 87723) should be installed only at the bottom of the switchgear cubicles type 115, 70, 185 (W 650 mm)

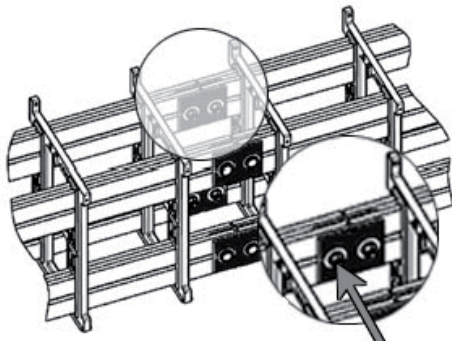
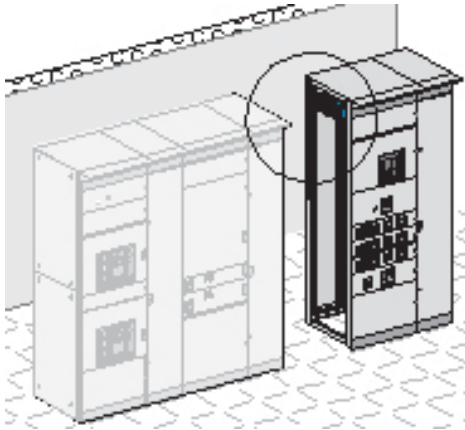
It is needless for cubicle 230 (W 1150 mm)

- slide the plate on the 2 plinths bends up to stop against the rear cross-member of the switchgear cubicle

- screw the plate to the ground, using the 2 holes A ahead the cubicle

The B holes are used for the column ground fastening

Fishplating the main busbar



Once the roof is disassembled, connect the bars to each other as described below:

- disassemble the top cross-pieces at each column juxtaposition so as to simplify access to the horizontal busbar
- loosen the fishplates positioned on the first column (assembled in workshop) and make them slide between the bars to be assembled.

For better access to the tightening points, we recommend that you begin by fishplating the bottom bars (Neutral, Phase 1), followed by the top bars (Phase 3 and finally Phase 2).

For busbars with 4 or 6 bars per phase, use a 5 mm max. thick bar or a screwdriver to slide the middle plate of the fishplate

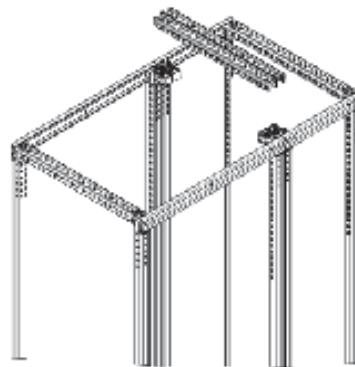
- a visual reference ((1)notch) lets you check that the fishplate is properly centred with respect to the bars to be assembled

- tighten the nuts using a torque wrench to the recommended tightening torque (50 N.m), **ensuring that the base of the screw head is properly positioned in the square recess of the washer**

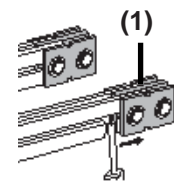
- mark all nuts with a dot of varnish.

note:

If the fishplate has to be completely removed, ensure, when putting it back, that the tightening nuts are towards the inside of the busbar in order to guarantee clearances.



disassembling cross-pieces

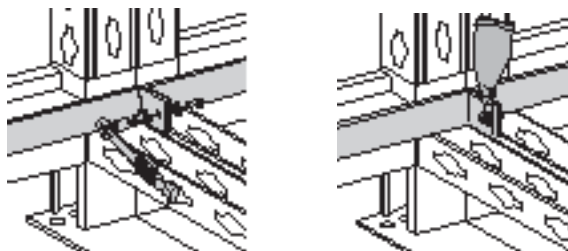


sliding the fishplate

Linking the protective conductors

The earthing bars of the various sections are connected together using M10 class 8.8 nuts and bolts equipped with contact washers

- set the bolts
- tighten the nuts at the required torque (50 N.m) using a torque wrench
- mark each nut with a drop of varnish

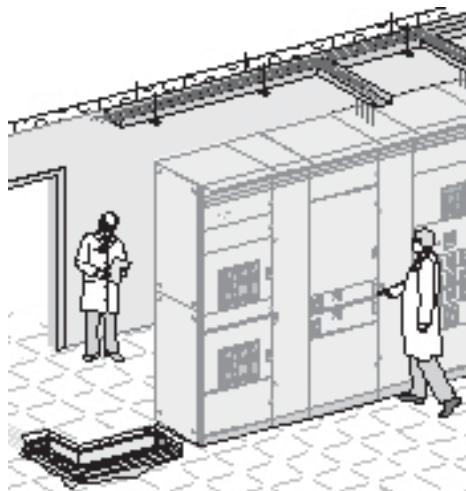


Equipment protection

Should the connection not be performed immediately after installation, the following precautions will prevent any dust or foreign material penetration:

- close all the doors
- reassemble the side and rear panels
- reassemble the roofs and top and bottom ventilation grids
- plug in the circuit-breakers and drawers
- seal temporary openings (cable entries)
- in case of works involving water drops or splashing (cement, welding...), it is necessary to put a cover on the switchboards.

General



- for protection of persons, first connect the switchboard's protective conductor to the earth connection
- flange cables as close as possible to the connections so as not to create excessive mechanical stresses on the device connection pads.
If cable glands are not used, also flange the cables as close as possible to the column entry point
- cables must never be routed in contact with or between live conductors (copper bars, etc.)
- the sharp edges of the framework placed on the cable route must be protected so as not to damage conductors
- comply with a minimum bending radius of 6 to 8 times cable outer diameter
- all the power connections must be made using class 8.8 bolts and nuts and tightened to the recommended torque (see chapter Installation)
- in the event of connection of aluminium cables on copper pads, use bimetal lugs or interfaces
- make strands circuit by circuit and fasten them on provided cable tie bars . The number of cables per strand depends on cable cross-section.

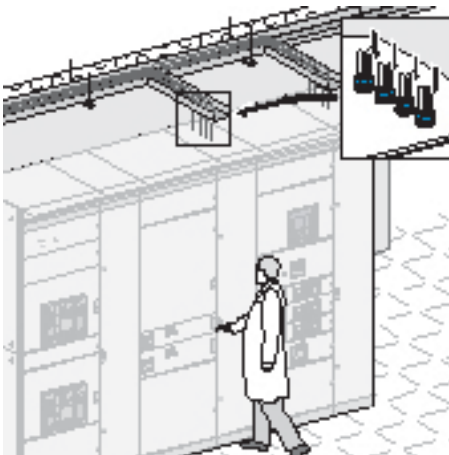
Cable cross-section (mm ²)	Number of cables per strand
≤10	8
16 < S ≤ 50	4
> 50	tie individually

- the strands are made using cable ties. The distance between them depends on electrodynamic stresses and on the type of tie used.

Type of tie (mm)	Maximum I _{cw} (kA/rms 1s)	Distance between ties (mm)
width : 4,5 mm load : 80 kg	10	200
	15	100
	20	50
width : 9 mm load : 80 kg	20	350
	25	200
	35	100
	45	70

Connecting the power cables

connection through the top

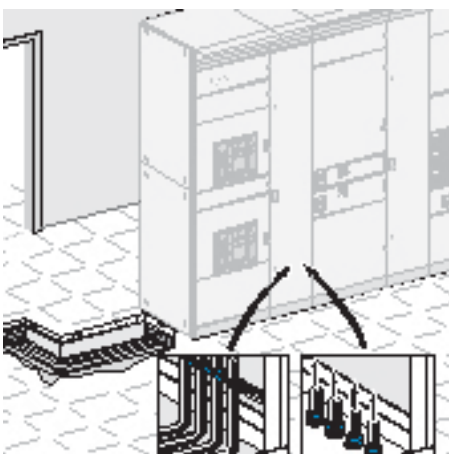


- remove the roof
- drill the holes required to install cable glands or grommets
- install the cable glands or grommets. They must comply with the required protection degree (IP)
- install the roof back
- run the cables through the glands or grommets
- run the cables in the intended compartments and secured them to cable tie-bars every 400 mm
- crimp the lugs and connect
- when tightness does not call for cable glands or when it is achieved by means of foam, cables can be routed in a rectangular cut-out in the roof. The removable beam then simplifies insertion of cables in the connection compartment.

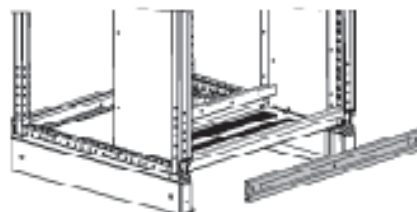


removable cross-member to simplify connection

Connection through the bottom



- remove the bottom plate
- drill the holes required to install cable glands or grommets
- install the cable glands or grommets. They must comply with the required protection degree (IP)
- fit the bottom plate back
- run the cables through the glands or grommets
- run the cables in the intended compartments and secured them to cable tie-bars every 400 mm
- if cable glands are not used, it may be easier to prepare the cable heads outside the switchboard (e.g. lug crimping) and then to topple them inside the column having first disassembled the bottom removable beam, as well as the ventilation grid or the strip.



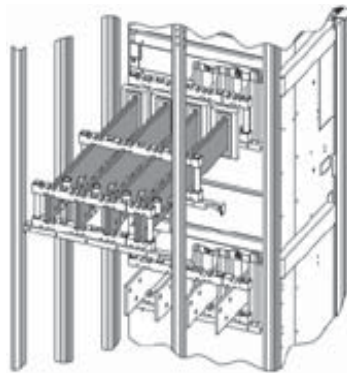
removable cross-member to simplify connection

Effective zone of cables run

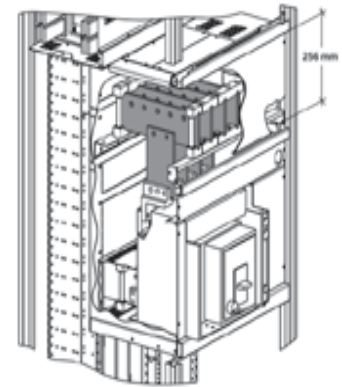
- see chapter «Installation»

Connection to connection bars in Form 4 box

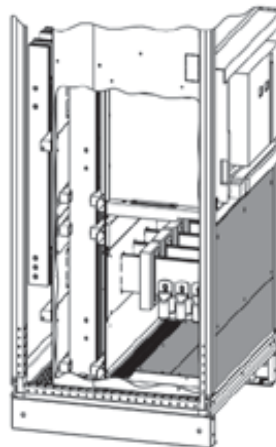
- Use lugs to connect to copper connection bars
- check the consistence between circuit and switchgear identifications
- when connections are made to several bars for each phase, position the lugs opposite one another and insert copper spacers
- comply with the insulation distances between phases of 14 mm min.
- mark all nuts with a dot of varnish after tightening to the recommended torque.



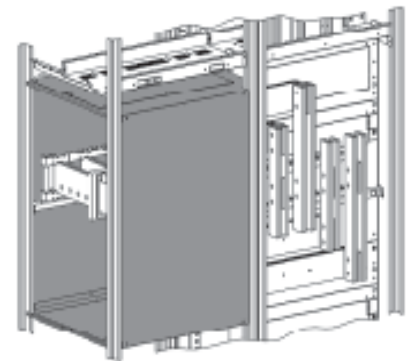
Rear connection



Top direct connection

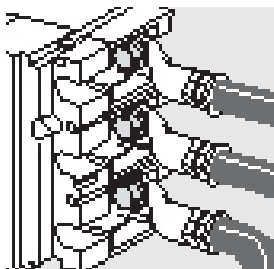


Bottom direct connection



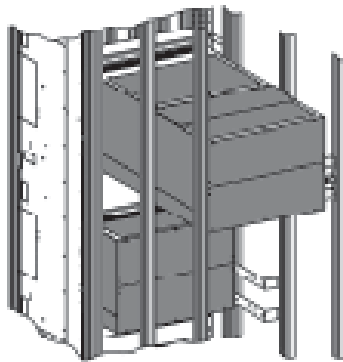
Side connection

Connection directly to device terminals

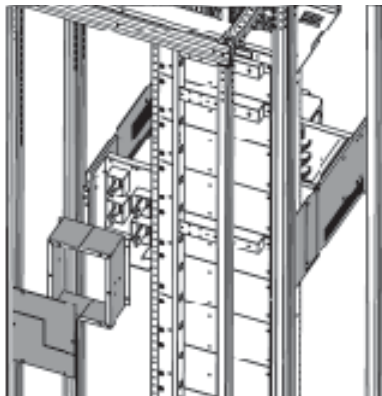


- when connections are made directly to the terminals of devices (disconnectable Polyfast), comply with the tightening torque recommended by the device manufacturer
- check that the length of the screws delivered with the apparatus is compatible with the lugs thickness
- comply with the safety perimeter around the apparatuses, defined by the manufacturer to guarantee their correct operation
- if necessary, position back after connection the phases separators and the terminal covers
- in the particular case of connection with armoured wires, please consult us.

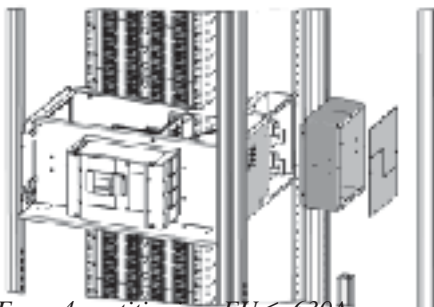
Form 4 box



Form 4 partitioning, Masterpact rear connection

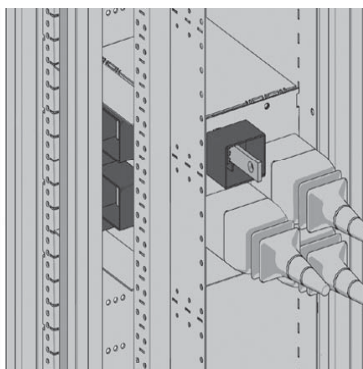


Form 4 partitioning, $FU \leq 630A$ rear connection



Form 4 partitioning, $FU \leq 630A$ front connection

Form 4 by sleeve

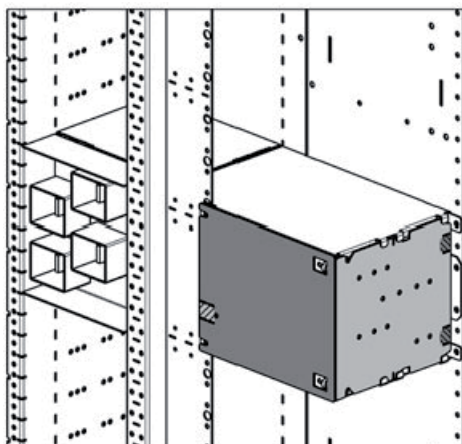


Form 4 sleeves, $FU \leq 630A$ front connection

- for Masterpact NW/NT/NS 630b-1600
- disassemble the cover plate allowing access to the device connection bars
- connect, conforming with the insulation distances
- cut out the part of the cover disassembled in order to let cables pass through, while preserving the necessary degree of protection IP2X mini
- reassemble all the covering
- for $FU \leq 630A$
- disassemble the Form 4 box to access the device connection bars
- connect, conforming with the insulation distances
- reassemble the Form 4 box without the insulating removable and cuttable plate
- cut out the insulating plate in order to let cables pass through, while preserving the necessary degree of protection
- put back the insulating plate.

- position the sleeve on the cable before crimping the lug
- crimp the lug
- connect the cable
- slide the sleeve on the cable so that all the live parts are protected.

Connection to connection bars inf 630A



Plug-in FU <= 630A in Polyfast drawer(70-2)

Connection principles :

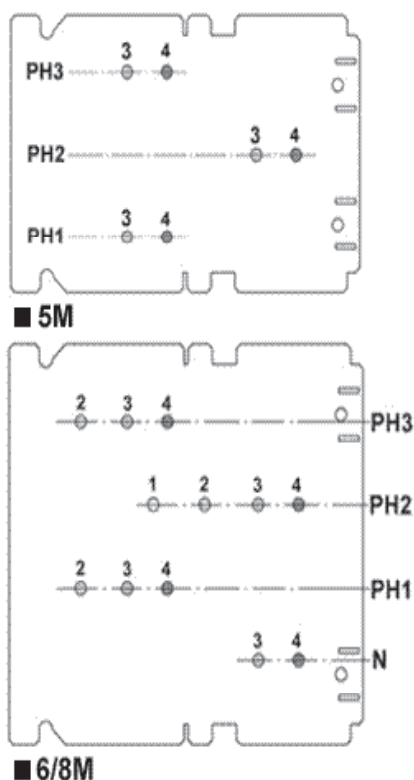
- use anti-rotation plates (87188 : 100 plates) to ease accessing to and tightening the lugs on the connection pads. They allow the use of a single tool.
- comply with insulation distances near metallic parts: 14mm for Ue<=690V
- place the bolt's head on the plate's side every time there is a risk of no respecting the insulation distance

Drilling the cable plate :

- dismount the F4 boxes 2 insulating plates
- drill the cable plate on the marked location as shown in the drawings on the next pages, following the indications given in the facing tables, which indicate :
 - the drilling diameter, depending on the cable section ± 1 mm.
 - The holes leave sufficient clearance for an easy operating and ensures an IP2 after the cable connection
 - the drillings' position, from case to case

Drilling diameter	
Cable (mm ²)	Drilling ± 1 mm
95	27
120	29
150	31
185	32
240	34
300	37

Drilling the 3P SC cable plate

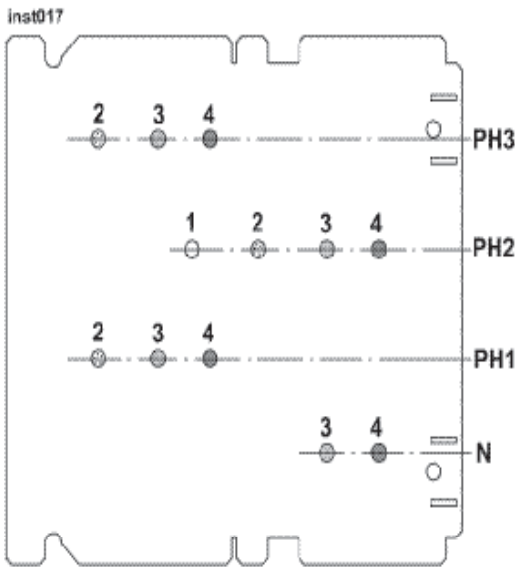


Cable plate drilling nr				
Nr of Mod.	In max		Nr	
			1 Cable	2 Cables
5	250A - 3P	Sans TC	3	3 - 4 (1)
6	250A - 3P	1 TC RS 2G	1	
6	250A - 3P	1 TC RS 2P	2	
6	250A - 3P	Sans TC	3	3 - 4 (1)
8	630A - 3P	1 TC RS 2G	1	
8	630A - 3P	1 TC RS 2P	2	
8	630A - 3P	Sans TC	3	3 - 4 (1)

(1) : 95 mm² max, CU lug

- 300 mm² cables are connected only with CU lugs

Drilling the 4P SC cable plate :

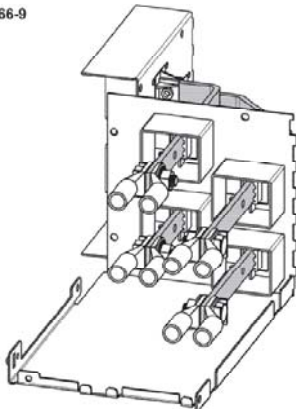


Cable plate drilling nr.				
Nr of	In max		Nr	Nr
Mod.			1 Cable	2 Cables
7	250A - 4P	Sans TC	1	
7	250A - 4P	1 TC RS 2G	2	
7	250A - 4P	1 TC RS 2P	3	3 - 4 (1)
9	630A - 4P	Sans TC	1	
9	630A - 4P	1 TC RS 2G	2	
9	630A - 4P	1 TC RS 2P	3	3 - 4 (1)

(1) : 95 mm² max, CU lug

- 300 mm² cables are connected only with CU lugs
- drawing : 6-8M 3 poles and 7-9M 4 poles cable plate drilling

mont266-9



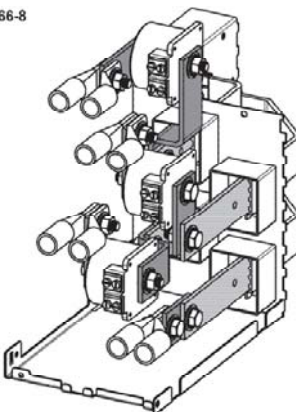
SC connections examples

Cutout after drilling

Example of SC connection with F4

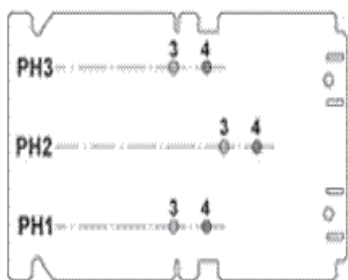
- connection without CT ≤ 9M

mont266-8

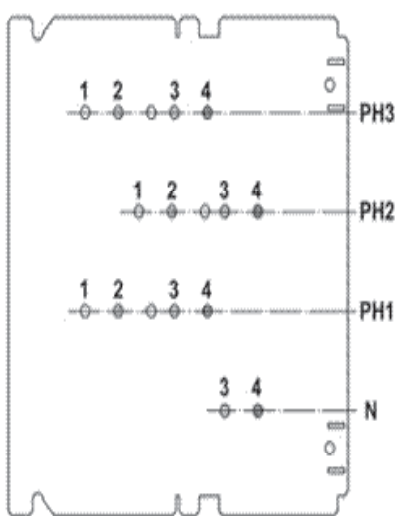


- connection with CT 12/14M

■ the copper pads, except from those held by the insulating bushings, must be studied and manufactured by the panelbuilder



■ 5M



■ 6/8M

Drilling the 3P RC cable plate :

Cable plate drilling nr				
Nr of Mod.	In max		Nr	
			1 Cable	2 Cables
5	250A - 3P	Sans TC	3	3 - 4 (2)
6	250A - 3P	1 TC RS 2G	1	1 - 2 (2)
6	250A - 3P	1 TC RS 2P	2	
6	250A - 3P	Sans TC	3	3 - 4 (2)
8	630A - 3P	1 TC RS 2G	1	1 - 2 (2)
8	630A - 3P	1 TC RS 2P	2	
8	630A - 3P	Sans TC	3	3 - 4 (3)

(2) : 150 mm² max

(3) : 240 mm² max

■ 300 mm² cables are connected only with CU lugs

Drilling the 4P RC cable plate :

Cable plate drilling nr				
Nr of Mod.	In max		Nr	
			1 Cable	2 Cables
7	250A - 4P	Sans TC	1	1 - 2 (2)
7	250A - 4P	1 TC RS 2G	2	
7	250A - 4P	1 TC RS 2P	3	3 - 4 (1)
9	630A - 4P	Sans TC	1	1 - 2 (2)
9	630A - 4P	1 TC RS 2G	2	
9	630A - 4P	Sans TC	3	3 - 4 (3)

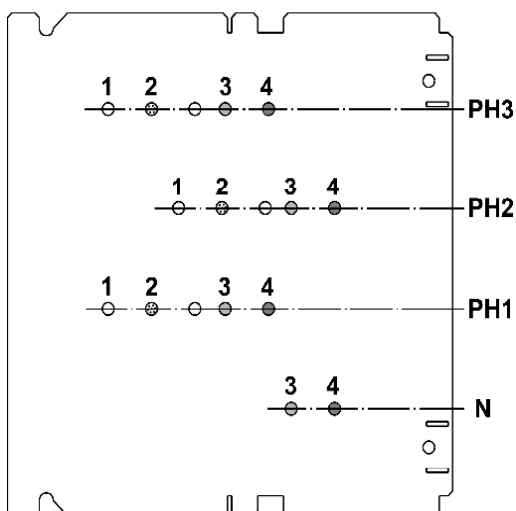
(2) : 150 mm² max

(3) : 240 mm² max

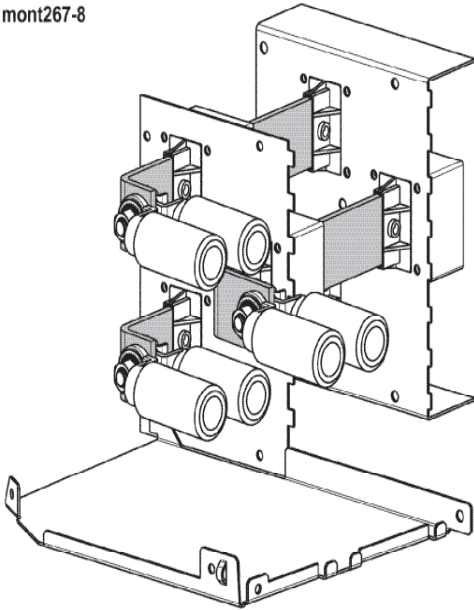
■ 300 mm² cables are connected only with CU lugs

■ drawing : 6-8M 3 poles and 7-9M 4 poles cable plate drilling

inst015

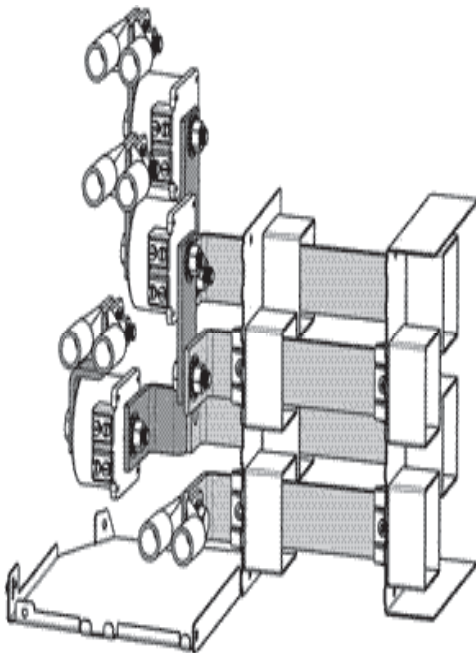


mont267-8



Example of RC connection with F4

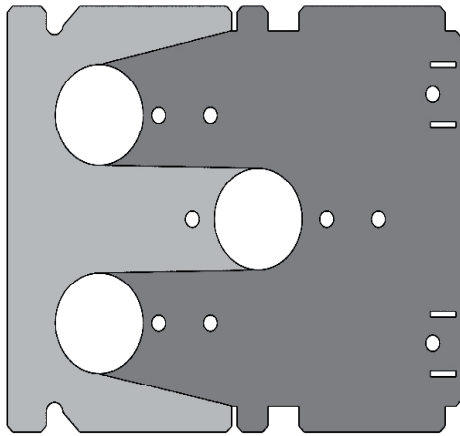
- connection without CT ≤ 9M



- connection with 12/14M

- the copper pads, except from those held by the insulating bushings, must be studied and manufactured by the panelbuilder

inst018

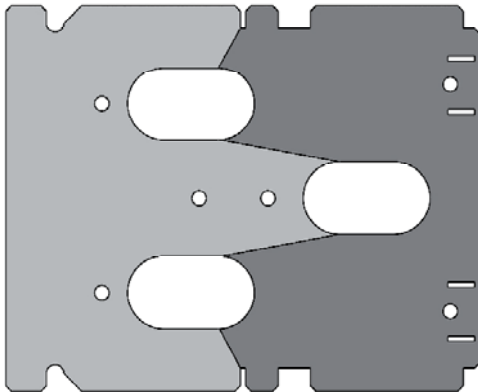


SC and RC connections :

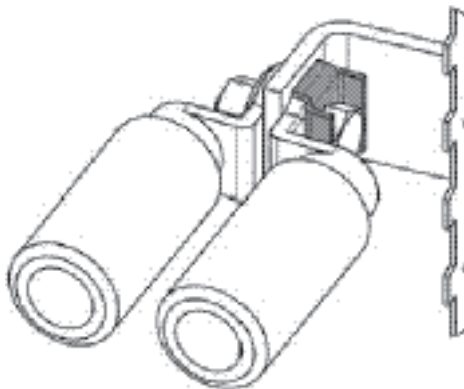
Plates re-assembly Cutout after drilling

- after drillings, cutout each plate following the explanatory drawings.
Each plate is cut in 2 parts which are mounted on the F4 boxes after the cables connection.
- put back the cut off plates after drilling :
 - slide the first part at the back of connected cables
 - slide and screw the second part at the front of cables
 - put back the other insulating plate
- drawing for 1 cable per phase

inst019



- drawing for 2 cables per phase



- The anti-rotation plates are indispensable for the contractor: they allow the cable tightening with only one tool
- Quantity : 1 plate per bolt at the connection point, to be delivered with the switchboard
- 87188 : 100 anti-rotation plates

Connection by KT busbar trunking

General

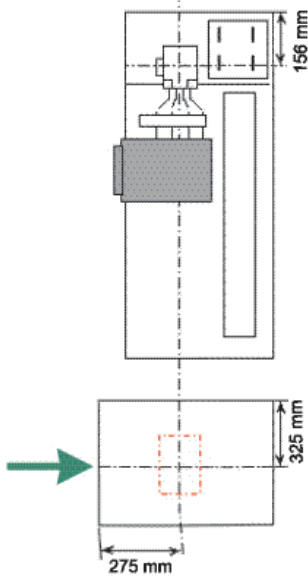
■ connection by BBT KT needs roof drilling according to the drawing enclosed in the waterproofing kit. The BBT waterproofing kit is compulsory and must be ordered together with the BBT.

■ the drawings show :

- switchgear position in depth (D 600/1000/1200/1400)
- switchgear position in height (T, M, B)
- position of the junction axle, from the roof from the front edge of the roof (→)
- position of the roof drilling gauge axle

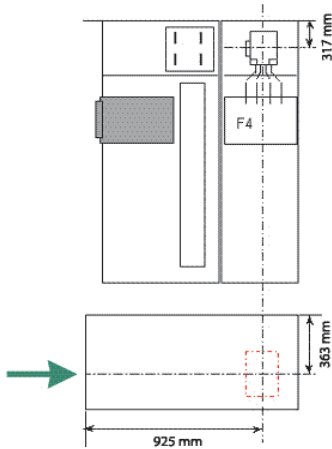
TDC - D600 - BBT interface <= 4000 A

■ switchgear position: T



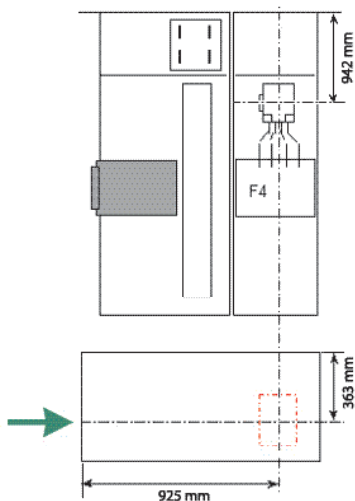
RC - D1000 - BBT interface <= 3200 A

■ switchgear position: T

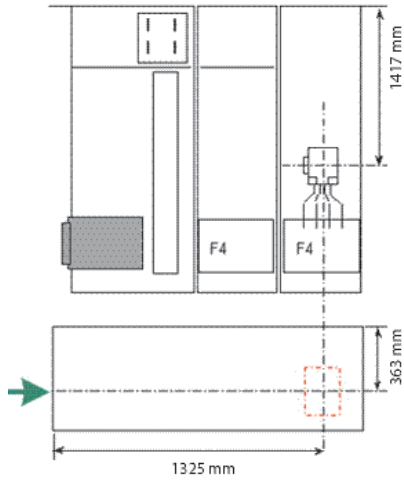


RC - D1000 - BBT interface <= 3200 A

■ switchgear position: M

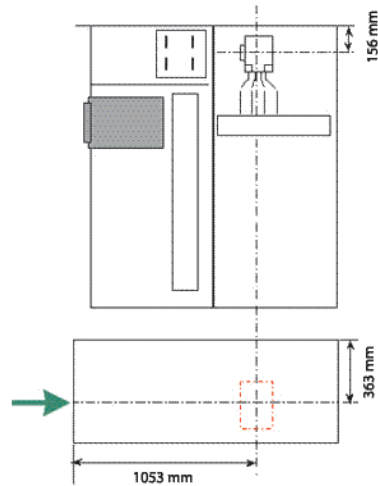


Généralités



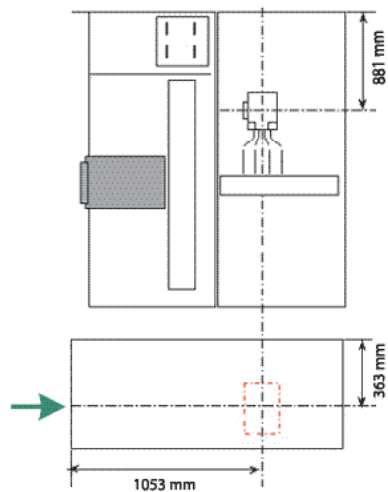
RC - D1400 - BBT interface 3200 A

■ switchgear position: B



RC - D1200 - BBT interface 4000 A

■ switchgear position: T



RC - D1200 - BBT interface 4000 A

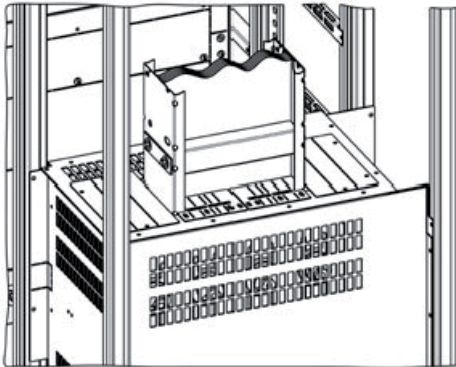
■ switchgear position: T

Connection by KT busbar trunking

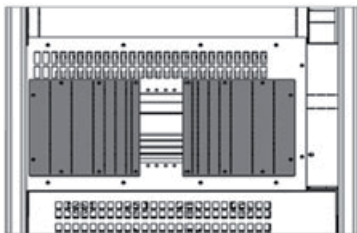
General

- connection of the KT BBT is made through the junction block, installed in the switchboard
- in 115-1/115-2 RC (junction block $\leq 3200A$), mount the blanking plates supplied by the panelbuilder (they are provided with the junction block's installation)

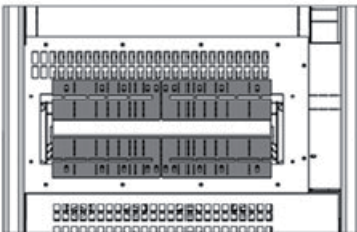
Connection of Busbar trunking



- connect the KT BBT on the junction block's installed in the switchboard
- Drawing : mounted set

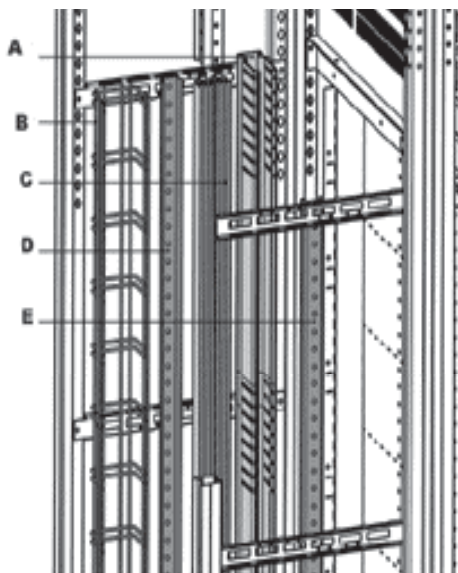


- mount the 2 lateral blanking plates, cutting out the central parts according to the BBT's width
 - mount the 4 front and rear blanking plates, cutting out the right and left part as per general drawing
- The oblong holes allows to fit as well to 3P BBT as to 4P BBT
- after mounting the blanking plates, the IP2x must be ensured



Connecting the auxiliary circuits

Cable routing



- A: trunking panelbuilder side
- B: trunking contractor side
- C: auxiliary busducts
- D: rail for auxiliary terminal blocks
- E: 1 or 2 rails for power terminal blocks

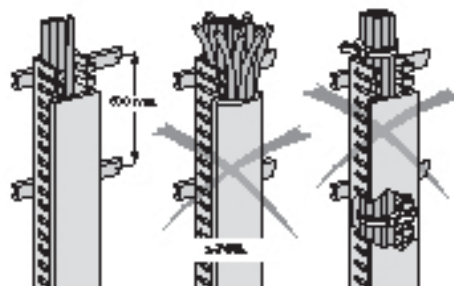
■ cabletrays

The auxiliary cables are routed on metal cabletrays. They must be flanged according to proper procedures.

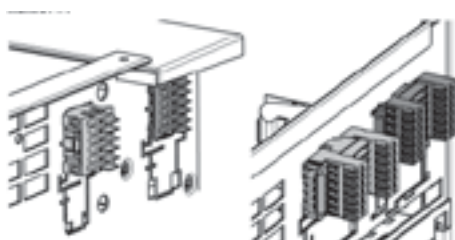
■ trunkings

The following rules must be complied with in traditional trunkings:

- trunking must be secured at least every 600 mm
- trunking must not be filled to more than 70% of capacity
- cables must not be tied inside trunking
- trunking must be secured using plastic screws to avoid any risk of damaging cables
- avoid routing auxiliary cables directly in contact with power cables.



Connection



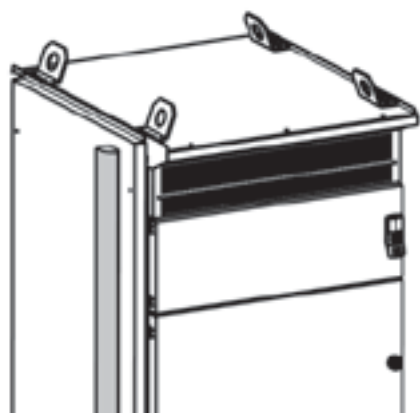
■ general

- all strands of a conductor must be inserted in the hole of the terminal
- tighten securely, taking care not to cut strands
- identify cables using references consistent with switch-board references in order to simplify future intervention.

■ connection of the auxiliary blocks of the Polyfast functional units

- front connection: direct connection on the fixed part of the block
- in rear connection: connection on a terminal block placed in the rear compartment.

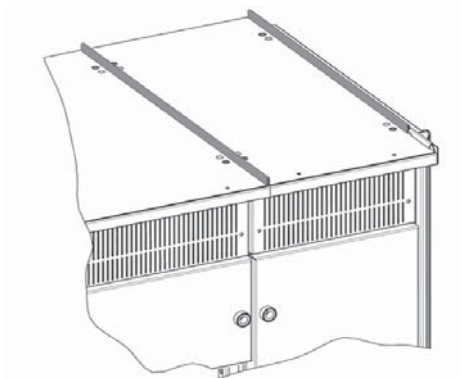
Finishing



edging sections position

■ reassemble:

- the roofs, without forgetting the seal and the cornice end covers
- the ventilation grids
- the rear panels
- the side panels
- the edging sections (ref. 87141 for columns H=2200 mm and ref. 87140 for columns H=2350 mm) delivered separately. They are stuck on side panels bend, situated on the front side of the switchboard
- the doors
- do not forget, if necessary, to create the equipotential bonding of the doors by means of an earth braid.



roof gasket mounting

detail of the roof gasket mounting:

- check the installation of the roofs and the side panels
- cut out lengths of gasket corresponding to the depth of the column
- install the gasket «in rider» on the jointed sheet sections
- check its good installation by a pressure of the hand over all its length.

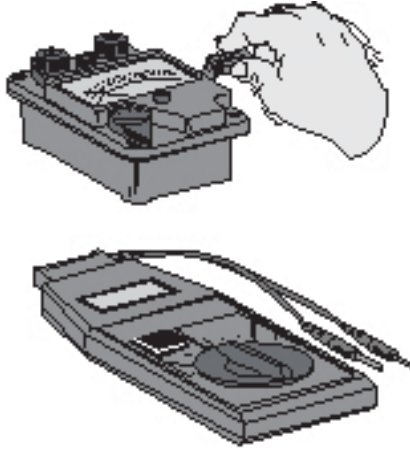
Cleaning

Practical rules

Cleaning the switchboard before packing

- remove dust from the inside using a vacuum cleaner : do not use blow cleaning as this may cause shavings and detritus to accumulate in a live area
- dust the outside
- if necessary, use a neutral dissolvent that will not damage the paint
- touch up paintwork if necessary
- check absence of foreign matter inside the switchboard (tools, screws and bolts) that could prevent it from operating properly

Measuring and of monitoring switchgear required

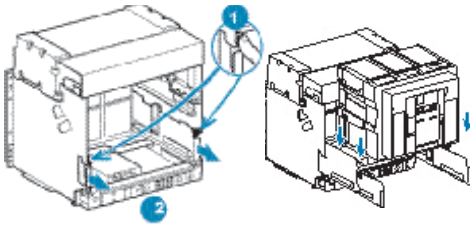


The following items are required for energising the switchboards:

- a magneto-electric generator
- a dielectric measuring unit (optional)
- a phase tester
- a phase sequence tester: rotophase
- a multimeter
- a vibrotest for locating poor auxiliary circuit connections
- a variable current source (AC, DC, recommended power 20A)
- a simulator (optional) with push-buttons, lights, measuring instruments.

Okken switchboards commissioning must be carried out by qualified personnel, entitled to work in the proximity of the voltage and trained with the safety instructions.

Mounting and installation

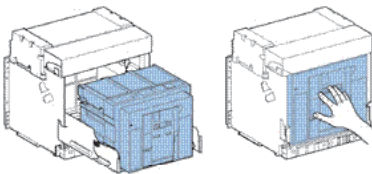


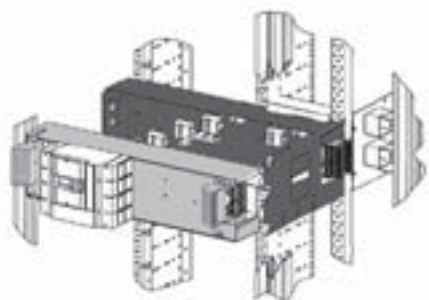
■ Putting into position

- unpack the devices, if they are packed separately
- check that they have suffered no damage that might inhibit correct operation
- before racking in the Masterpact, check that the chassis corresponds to the device
- press the release tabs and pull the rails out
- position Masterpact on the rails
- make sure the device rests on all four supports
- push the circuit-breaker into the chassis, taking care not to push on the control unit.

■ adjustments and operations

- refer to device leaflets

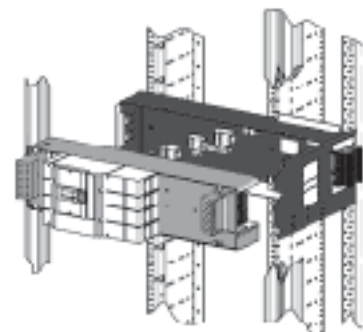


Plug-in Polyfast

- check that greasing of functional units clamps is effective
- check the correct fixing of Polyfast on its base plate (4 screws)
- check the presence of the terminal covers on the apparatus
- if necessary proceed with adjustment of the control unit
- close the apparatus: «ON» position.

■ removal

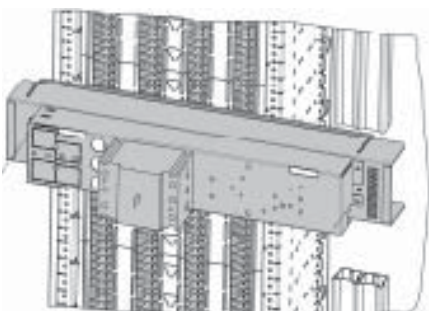
- open the apparatus: «OFF» position
- unscrew the 4 fastening screws of Polyfast on its base
- extract Polyfast by means of the 2 handles, holding it horizontal in order to maintain the fastening screws in position.

Disconnectable Polyfast

- check that greasing of functional units clamps is effective
- check the correct fixing of Polyfast on its base plate (4 screws)
- check the presence of the terminal covers on the apparatus
- if necessary proceed with adjustment of the control unit
- close the apparatus: «ON» position.

■ removal

- open the apparatus: «OFF» position
- remove the downstream terminal cover
- disconnect power cables
- unscrew the 4 fastening screws of Polyfast on its base
- extract Polyfast by means of the 2 handles, holding it horizontal in order to maintain the fastening screws in position.

Disconnectable mounting plate

- check that greasing of functional units clamps is effective
- check the correct fixing of the moving part on its base plate (2 screws)
- if necessary proceed with adjustment of the control unit
- close the apparatus: «ON» position.

■ removal

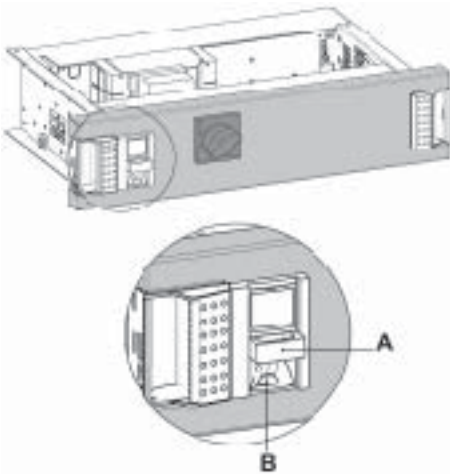
- open the apparatus: «OFF» position
- disconnect the power terminal block
- disconnect the auxiliary terminal block
- unscrew the 2 fastening screws of the mounting plate on its base
- extract the mounting plate, holding it horizontal in order to maintain the fastening screws in position.

Fixed and plug-in on mounting plate

- check that greasing of functional units clamps is effective
- if necessary open the door to proceed with adjustment of the control unit
- close the apparatus: «ON» position.

- removal of an apparatus from its base (refer to the apparatus leaflet).

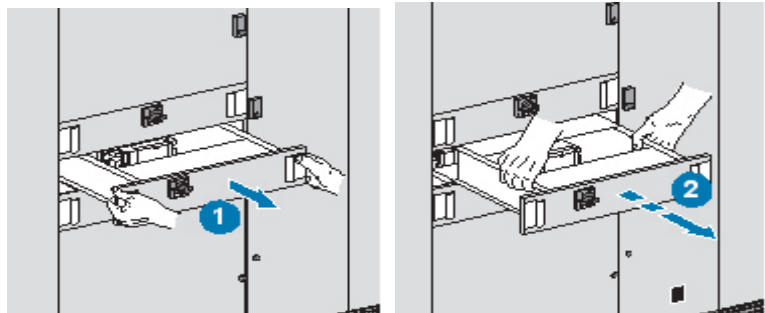
Drawers



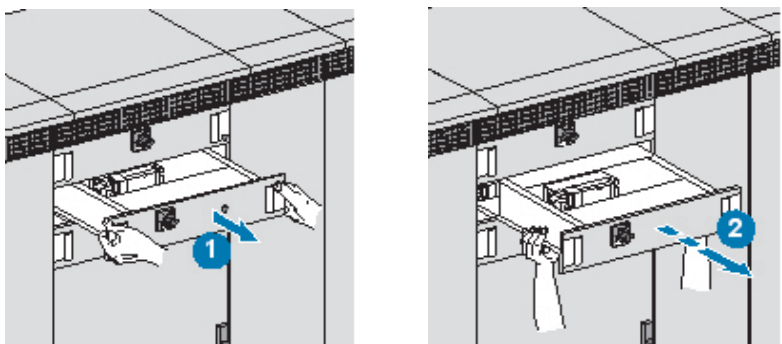
- general: passing from one position to another
 - operation of the drawer impossible apparatus closed: open the apparatus
 - seize the drawer by the handles and press and hold the red release button.
- The positions are visible on the indicator B located under the release button A
- plug-in: red
 - test: yellow
 - draw-out: green.

- withdrawing
- pass from the «connected» to the «test» position, then to the «disconnected» position
- the positioning mechanism locks the drawer in the selected position.

- removal
- pull the drawer with the handles to the pre-extraction hard point
- position the hands as indicated on the diagrams and extract the drawer
- be careful with grease present on the mechanisms.



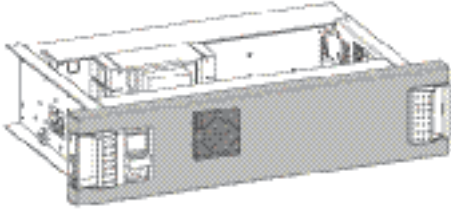
drawer implemented in the lower side of the column



drawer implemented in the upper side of the column

- putting into position
 - engage the drawer in its cell, positioning the hands as indicated on the diagrams
 - check that the apparatus is in open position
 - using the two handles, push the drawer to the «disconnected» position
- note:** if the drawers are equipped with mismatching device, check the consistence of drawer and cell.

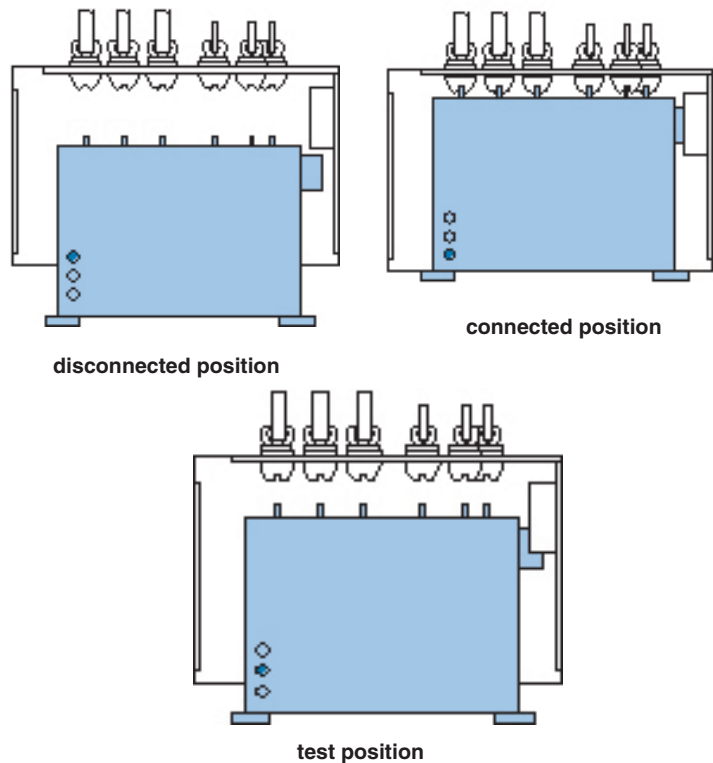
Drawers



- racking
 - seize the drawer by the handles
 - press and hold the red release button
 - push the drawer fully home to the «connected» position
 - the racking is correct if the positioning mechanism is locked

notes:

- 1 it is possible to go directly to the «connected» position when putting the drawer into position
- 2 the drawers equal or more than 12 modules need a more important stress on racking. Curtly impart a firm motion of wrists at full stroke.

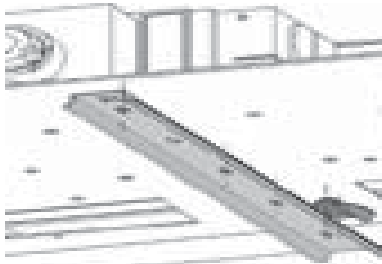
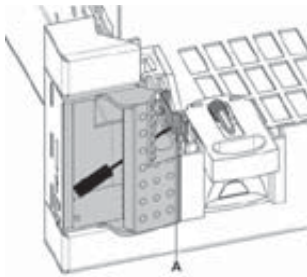
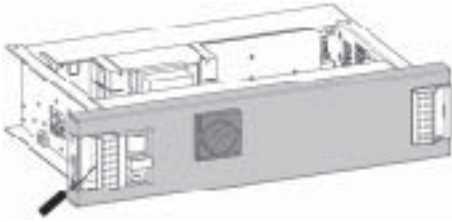


■ operation

- when the drawer is in the «test» or «connected» position, actuate the apparatus rotary handles or the control devices (push-buttons, selector switches) according to the electrical diagram
- rotary handle on Compact or GV:
 - turn clockwise toward «ON» to close
 - turn counter-clockwise toward «OFF» to open
 - marks placed on the rotary handle indicate the position:
 - white / ON: closed
 - green / OFF: open
 - tripped: fault.

- check that greasing of functional units clamps is effective

Drawers



Adjustments

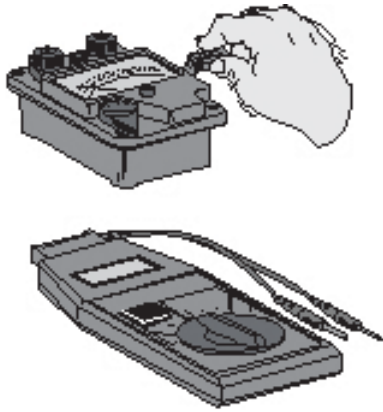
The front face of the drawer is swivelling and gives access to the devices adjustments.

- introduce a tool inside the left handle, press moderately in order to compress the leaf spring A and open the front panel using the red release button
- in the case of a drawer higher than 6 modules, remove the screw on the front panel
- open the door
- carry out the adjustments
- close again the gate. The spring goes back automatically in position.

note:

When the apparatus is closed, the voluntary opening of the door is possible if the «door closed locking» mechanism of rotary handle has been inhibited or removed.

Checking



■ check the insulation of auxiliary circuits using an electromagnetic generator

■ check operation of the auxiliary in the switchboards: energise and carry out operating tests for the various sequences

■ carry out overall insulation measurements.

If a TNC earthing system is used, carry out the insulation measurements on the phases only.

Measurements should be carried out using an insulation tester and with the system supplied by a voltage of at least 500V DC.

The insulation-resistance value must be equal to at least 1000 ohm/V.

If the overall insulation value is low, preheat the switchboard using a source of heat (resistor, light bulb) for at least 24 hours to remove humidity, then carry out the overall insulation measurements again.

■ dielectric tests have already been carried out in the factory (see the factory test report). Knowing that such tests subject the equipment to certain stresses (ageing, etc...) it is advisable not to repeat them

If another test is expressly required by the customer, apply a coefficient of 0,8 to the factory test value

■ final connections and checks:

- reconnect the earth electrodes disconnected for the insulation and dielectric measurements

- check the electrical continuity of the protective conductors of the assembly (presence of contact washers, presence of equipotential connectors for doors, etc...)

- check all the tightenings made on the site, except if already marked with varnish :

* electrical connections, using a torque wrench

* mechanical connections

* ground fastening

- miscellaneous checks:

* mechanical locking of switchgear

* markings on the switchboard, on power and control conductors

* visual inspection of outside surfaces and paint. Touch up any scratches or other defects.

■ check that original greasing of functional units clamps is effective.

If necessary, lightly grease their electrical contacts (grease ref. 87635).

Energising equipment for the first time

- rack in the Masterpact devices (see Masterpact handbook)
- plug-in removable circuit-breakers (see relevant leaflet)
- plug-in drawers, if any
- check that all protective circuit-breakers are in the open (OFF) position
- set the Masterpact control units (see Masterpact handbook) to protect the network and, if applicable, the low-voltage distribution outgoers
- set the thermal-magnetic or electronic trip units of the protective circuit-breakers
- for motor-control feeders, set the motor-protection circuit breakers magnetic releases and the thermal relays, or the «motor» circuit-breakers and motor protective relays, according to the nameplate of the motor to protect
- check that the phase rotation or index is consistent with the supplies one
- one after the other, energise the power circuits in the switchboard, checking each time that the loads are supplied and operate correctly
- carry out the operating tests:
 - operating sequence
 - controls, indications, measurements, protection
 - remote-control mechanism
 - electrical interlocks.

note: the first energising of the switchboard is potentially dangerous, due to the faults undetected during the preliminary checks. It must be carried out by a qualified technician.

Before any intervention switch-off the equipment. A hazard of electric shock, burns or explosion are inherent in use of electrical equipment.

Failure to observe these instructions may result in severe bodily injury, death or damage to the switchboard.

Precautions to be taken when switchboard has been switched off for a long period

- check that nothing has been left inside the board (especially if modifications have been carried out)
- clean all components
- check the insulation (if the value is below 4 megaohms, preheat the board to get rid of humidity and condensation)
- before applying voltage make sure that all outgoing circuits are in «open» position to avoid a too high current surge when closing the main circuit-breaker
- progressively close the breakers.



Schneider Electric Industries SAS

Postal address:

BP 18

F-73804 Montmélián Cedex

Tél : +33 (0)4 79 75 48 00

Fax : +33 (0)4 79 84 28 36

www.schneider-electric.com

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

Publication: Schneider Electric Industries SAS

Design: Schneider Electric Industries SAS

Printing: Imprimerie des Deux-Ponts

SBSED001025EN
ART. 033408

01/2007