Low-voltage switchgear MNS

Installation, handling and operation

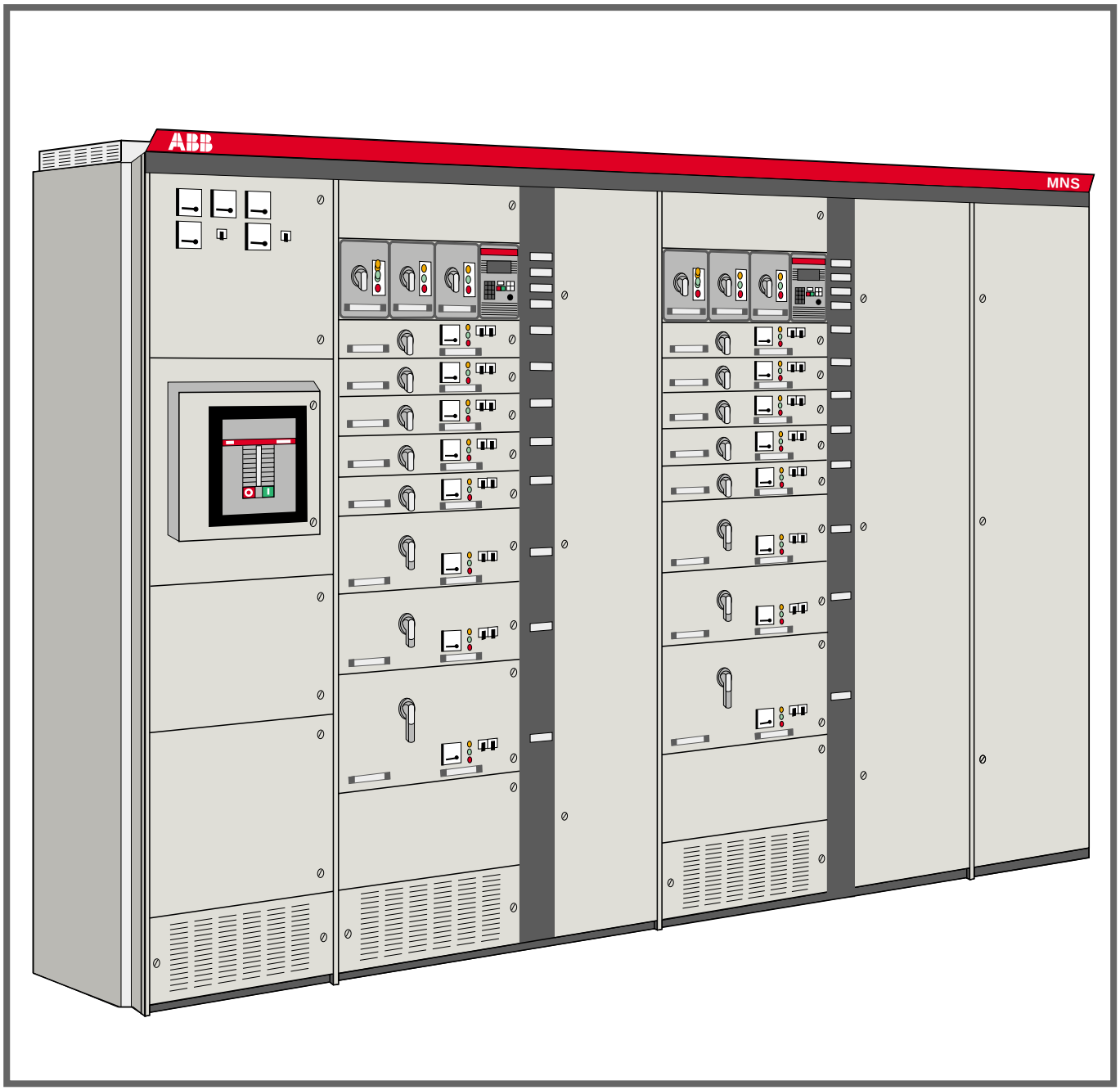


ABB Installation

Low-voltage switchgear MNS is available with rated currents up to 5000 A (IP 31) and can be equipped with:
– starters and distribution units of withdrawable design (W units)
– distribution units and group boards of removable design (R units)

List of contents

Handling and unpacking

The switchgear cubicles are delivered in the form of ready assembled complete units with horizontal busbars. Each cubicle is protected with plastic wrapping and securely attached to a loading pallet.

Check the delivery against the accompanying advice note.

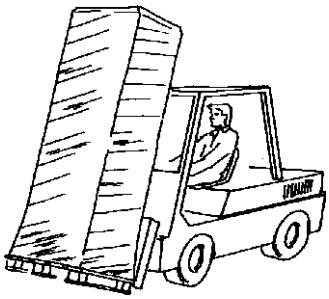
Handle the cubicles carefully. They are most easily transported using fork-lift trucks.

When hoisting with an overhead travelling crane or other hoists:

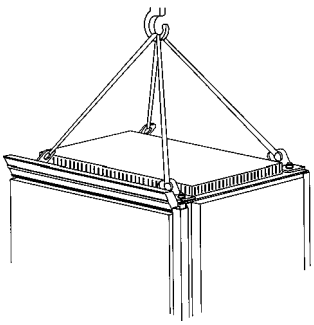
1. Use the lifting eye bolts attached to the top of the cubicles.
2. Insert the lifting sling shackles into the holes in the eye bolts.
3. Adjust the length of the slings so that the angle between them does not exceed 60°.

If the cubicles are not to be installed directly, they should be stored in a dry place protected from dust. The plastic wrapping should be kept on as a protection.

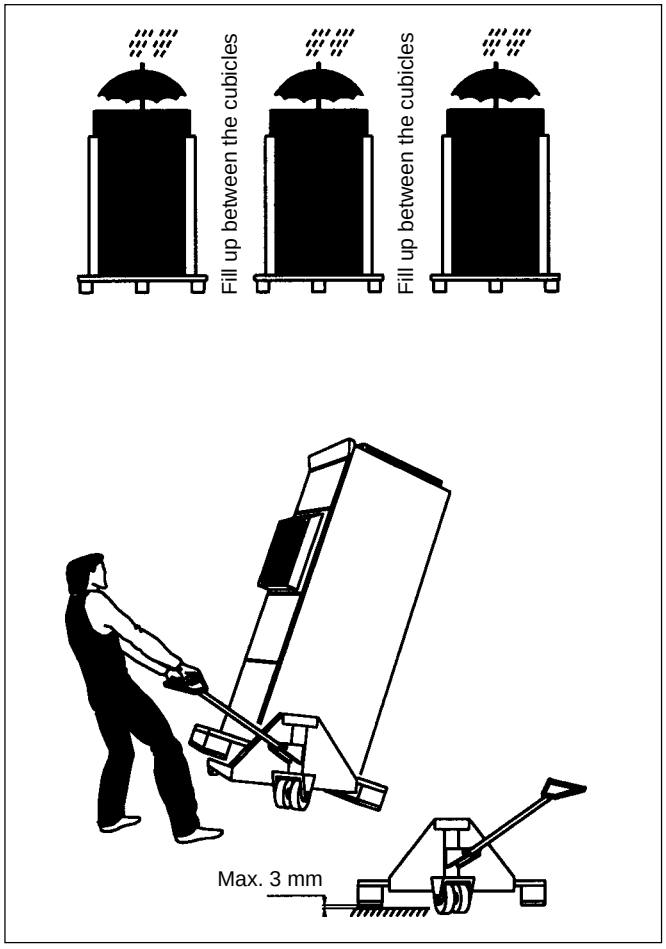
Avoid fixing adhesive marking labels to painted surfaces. If they are left on too long, the paint may become discoloured.



The cubicles are most easily transported using a fork-lift truck.



Lifting with a hoist or overhead travelling crane.



Warning! Cubicles may easily tip over when transported with a hand-pulled truck. The truck must not be raised more than 3 mm when moving a cubicle on a pallet.

Cubicle types, overview

Circuit-breaker cubicle for ACB
Cubicle widths up to 1200 mm.

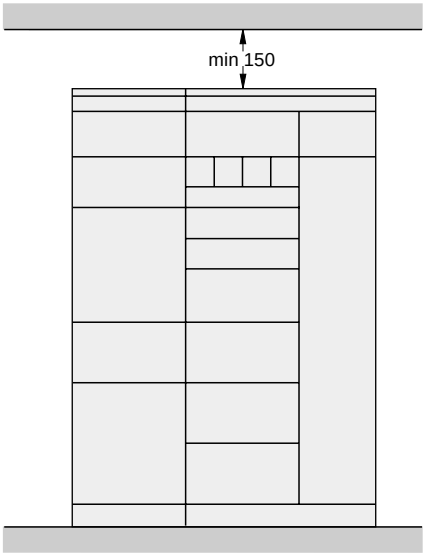
Disconnector cubicle
Cubicle width 800 mm.

Apparatus cubicle W/R
Cubicle width 600 + 400 or 600 + 600 mm.

Apparatus cubicle for free equipping
Cubicle width 400, 600 or 800 mm.

The following dimensions are the same for all types of MNS cubicles:

Height	2263 mm
Height module	50 mm
Depth	650 mm



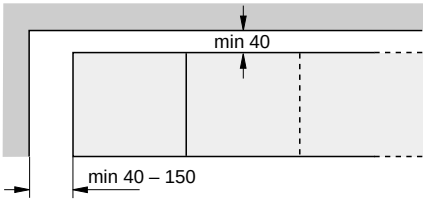
Free space above cubicle.

Clear space around cubicles

The area around the cubicles to be left clear should be at least 150 mm.

The distance between the cubicle´s rear panel and the wall, and between end panels and the wall, should be at least 40 mm.

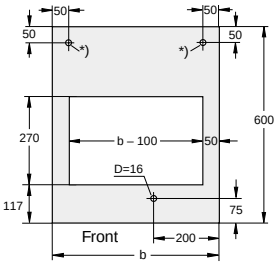
Apparatus cubicles with operating handles in the doors should be placed with a clearance distance of at least 150 mm from the left end panel to the adjacent wall so that the doors can be opened more than 90°.



Distance to wall.

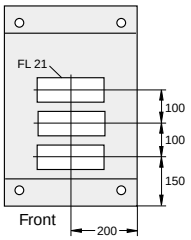
Drilling of holes

The drawings show the holes that can be drilled for external cables under the cubicles, in the base plate and in the roof plate.

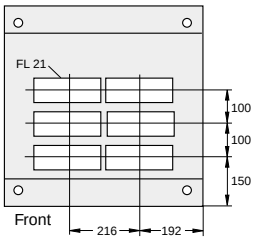


Drilling of holes in floor and base plate:
Circuit-breaker cubicle, b = 600,800,1000,1200
Disconnector cubicle, b = 600, 800
Apparatus cubicle, b = 400, 600, 800

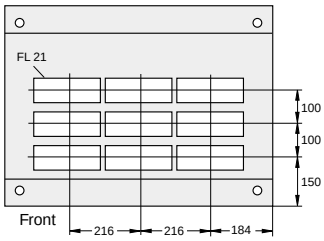
**) Not to be used when a cubicle is fixed to a wall.*



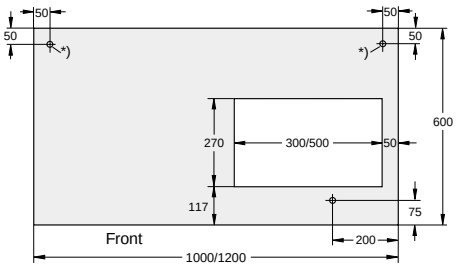
Drilling of holes in roof plate:
Apparatus cubicle, b = 400



Drilling of holes in roof plate:
Apparatus cubicle, b = 600

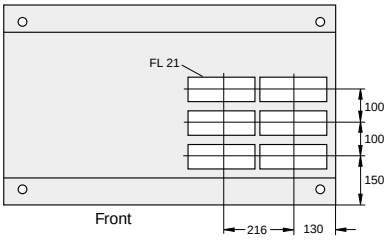


Drilling of holes in roof plate:
Apparatus cubicle, b = 800

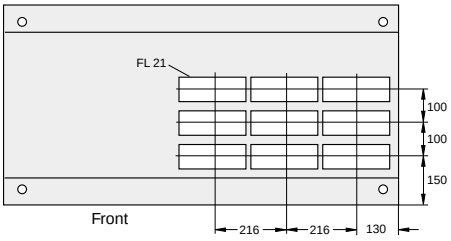


Drilling of holes in floor and base plate:
Apparatus cubicle W, b = 600 + 400, 600 + 800

**) Not to be used when a cubicle is fixed to a wall.*



Drilling of holes in roof plate:
Apparatus cubicle W, b = 600 + 400

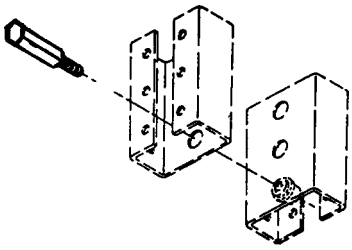


Drilling of holes in roof plate:
Apparatus cubicle W, b = 600 + 600

Alignment of cubicles

The flooring should be flat and even and carefully chosen for cubicle erection so that several cubicles can be bolted together without necessitating further measures.

If the floor is not sufficiently flat, this may result in panels and doors jamming. The height of the cubicles can be adjusted by inserting sheet metal shims between base plate and floor.



Bolting cubicles together.

Bolting together of cubicles

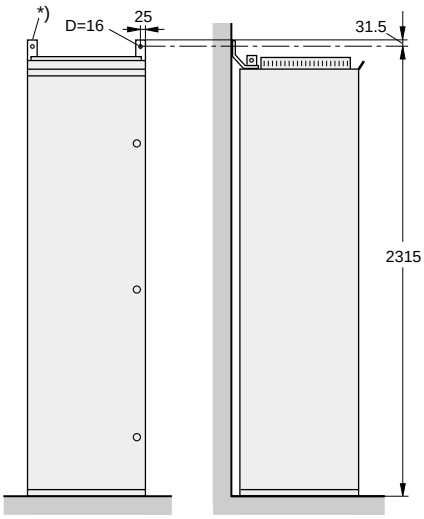
Any height adjustment of cubicles necessary must be carried out before bolting them together.

At the front, the frames are to be bolted together at **four** places: There are four clearance holes for M6 hexagonal headed bolts in the front right-hand frame post of cubicles, and corresponding threaded holes (ready-mounted threaded bushings) in the left hand post. The threaded holes are located 112.5 mm, 762.5 mm, 1437.5 mm and 2087.5 mm above the floor plane.

At the rear, the frames are bolted together at **three** places: 112.5, 2087.5 and depending on whether the cubicles are fitted with an upper or lower busbar system, the frames are bolted together 762.5 mm (upper busbar system) or 1437.5 mm (lower busbar system) above the floor plane.

The maximum tightening torque is 5 Nm.

Five distance bolts (article no. 1TSA2 21671-90) for bolting cubicles together are provided in a plastic bag to be found attached in the cable compartment of each cubicle.



Placing against a wall.

**) Only for the cubicle furthest to the left.*

Attachment

Placing against a wall
The cubicle furthest to the left in a row of cubicles is to be fixed to the wall with the help of **two** wall attachment brackets and to the floor with a bolt through the front of its base plate, positioned 200 mm from the right-hand side of the cubicle. Other cubicles in the row are to be fixed to the wall with **one** wall attachment bracket and to the floor with a bolt through the front of their base plates.

Free-standing arrangement
The cubicle furthest to the left in a row of cubicles is to be fixed to the floor using **two** bolts through the rear of its base plate (after removing the rear panel), 50 mm from the sides of the cubicle, and with a bolt through the front of its base plate, 200 mm from the right-hand side of the cubicle. Other cubicles in the row are to be fixed with **one** bolt through the rear of their base plates (after removing the rear panel), 50 mm from the right-hand side of the cubicle, and with a bolt through the front of their base plates, 200 mm from the right-hand side of the cubicle.

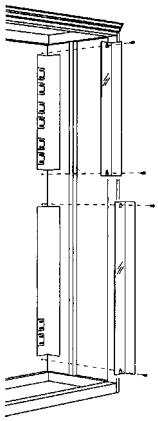
Recommended screw diameter: 10 mm.

Interconnection ot horizontal busbars

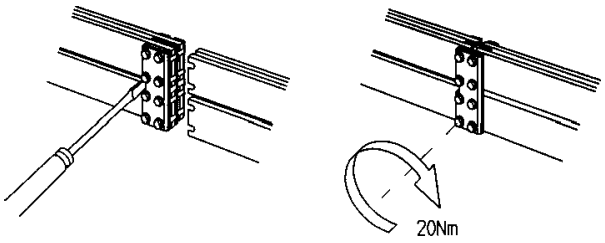
Connection of the horizontal busbars between the cubicle units should take place from the front of the cubicles.

1. Remove the polycarbonate shields in front of the bars to allow access to the point of interconnection.
2. Unscrew the bolts in the joint pieces.
3. Move over the joint pieces to the bars in the cubicle alongside.
4. Tighten the bolts with a torque wrench, 20 Nm.
5. Fit the polycarbonate shields back on.

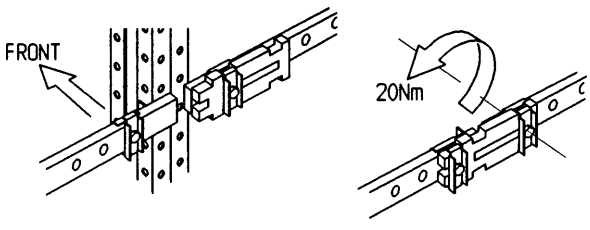
In the case of several parallel phase bars, the joint pieces should be placed as shown in the diagram.



Removal of polycarbonate shields.



Coupling of phase bars.

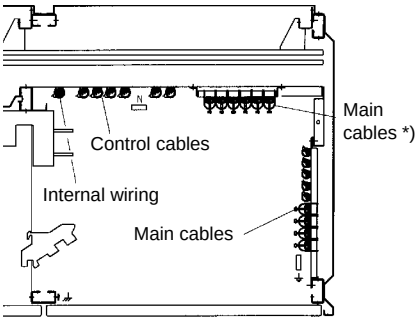


Coupling of N and PE bars.

Laying of external cables

Apparatus cubicle

All external cables to apparatus cubicles are to be laid in the area intended for cables.



Cable compartment.
**) Only with 600 mm cable compartment.*

Main cables

In the 400 mm cable compartment there are five rails on the right-hand cubicle wall, for fixing of main cables using cable hangers. Slimmer cables are best fixed to the rails by crossing two smaller bunching straps.

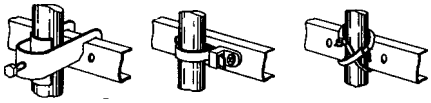
In the 600 mm cable compartment there are in addition five rails on the rear wall, for fixing of main cables.

Auxiliary cables

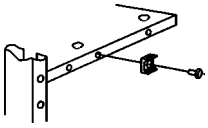
Internal wiring and operating voltage supply cables should be attached using bunching straps in special attachment holes to the left at the rear of the cable compartment. Control cables should be attached using strap attachments and bunching straps on the rear wall. (Bunching straps are delivered with the cubicles.)

For withdrawable units, there is a strap attachment on the right hand side of the cassette plate for supporting the weight of the operating cables.

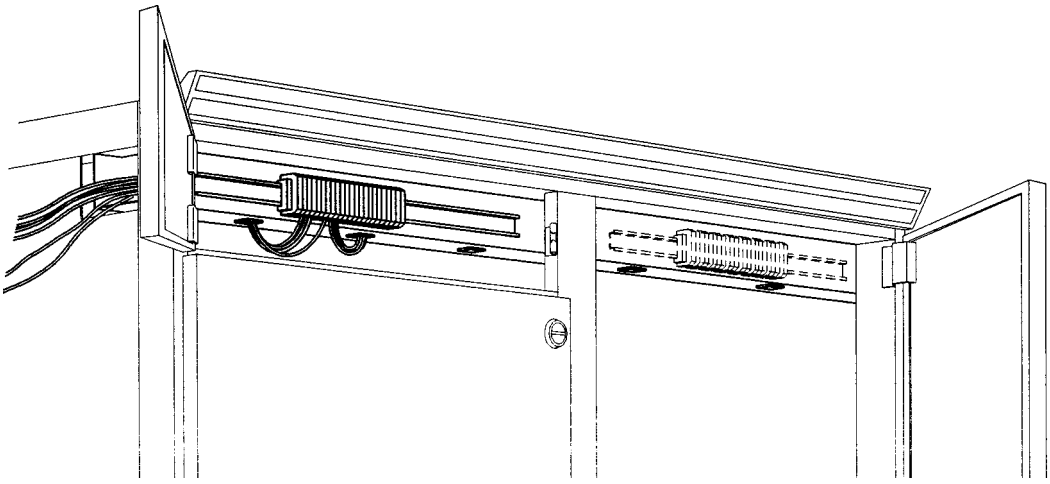
Under the top door there is a cable duct intended for connections between cubicles. The cable duct also serves as an attachment rail for cubicle terminal boards.



Cable clamping straps.



Strap attachment.

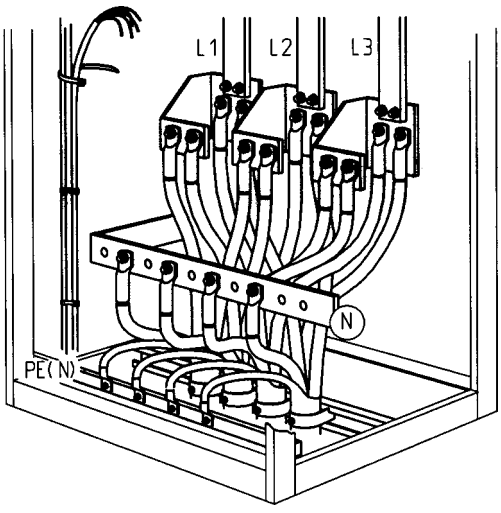


Cable duct for operating cables between cubicles. Attachment rail for cubicle terminal boards.

Circuit breaker cubicles, disconnector cubicles, cubicles for extra equipment

Main cables

The main cables are supported with fixing clamps in anchoring rails which can be attached in depth at different levels and matched to terminal bars and cables.



Auxiliary cables

Operating cables are supported with bunching straps in the cable brackets fixed to the ends of the cubicle. Operating cables can be placed on either side, depending on where the terminal board is placed.

Connection of circuit-breaker cubicles and disconnector cubicles

Cable cross-sectional areas, main circuits

Max. connectable area	mm²
Cubicle design A, cable connection from below	
Disconnector cubicle	
1250 – 1600 A	8//240
2500 – 3200 A	20//240
Circuit-breaker cubicle ACB	
1250 – 2000 A	8//240
2500 A	12//240
3200 A	20//240
4000 A	24//240
Cubicle design A, cable connection from below	
Circuit-breaker cubicle ACB	
1250 – 1600 A	6//300
2000 – 2500 A	8//300
3200 – 4000 A	12//300

Cable cross-sectional areas, auxiliary circuits

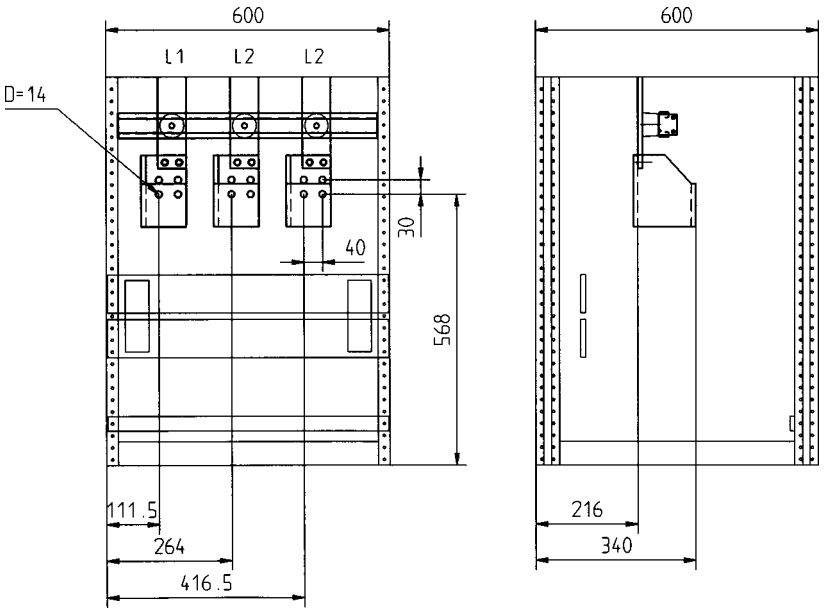
Auxiliary circuit cables are to be connected to terminal boards.

Max. connectable area	mm²
Fixed	4
Disconnectable	10

Dimension drawings

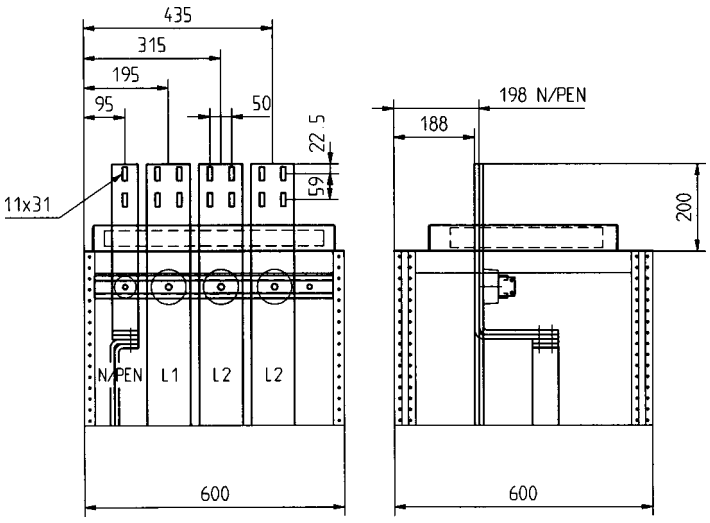
Disconnector cubicle, cable connection from below

OETL 1250 A



Disconnector cubicle, busbar connection from above

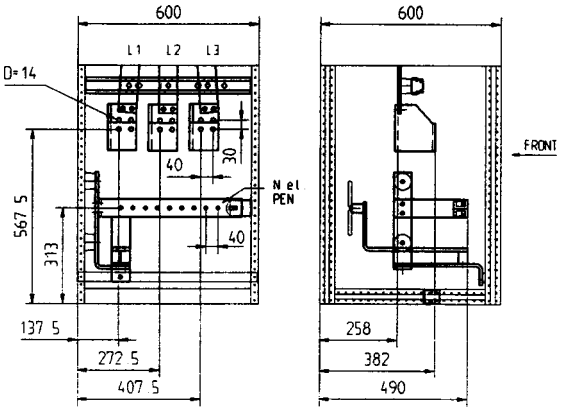
OETL 2500 A



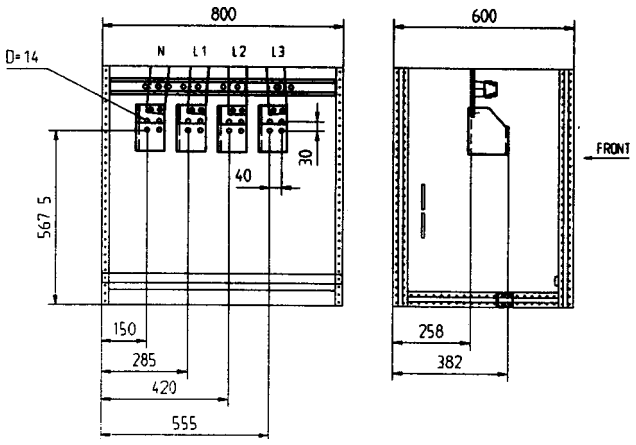
Dimension drawings

Circuit-breaker cubicle, cable connection from below

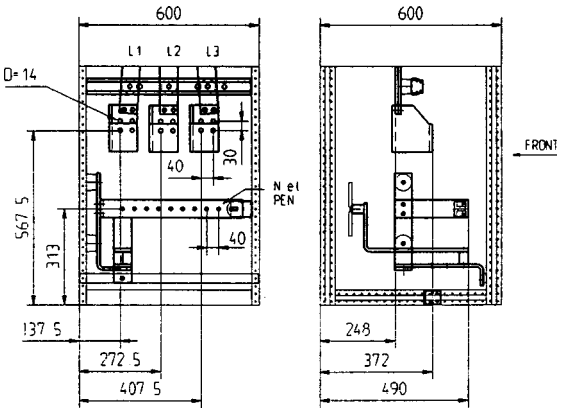
MEGAMAX 1250 A 3-P



MEGAMAX 1250 A 4-P



MEGAMAX 1600 A 3-P



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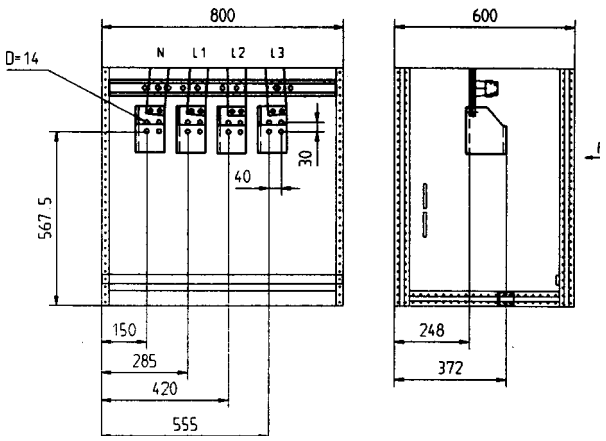

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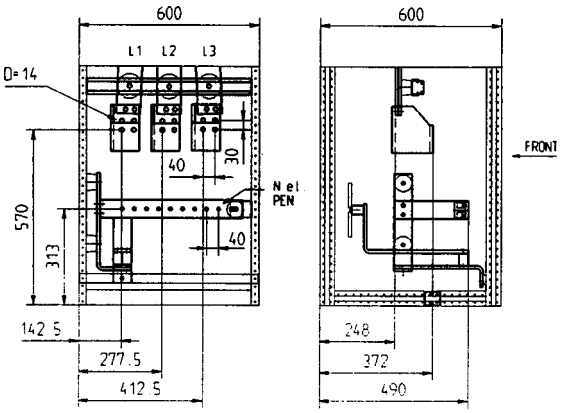

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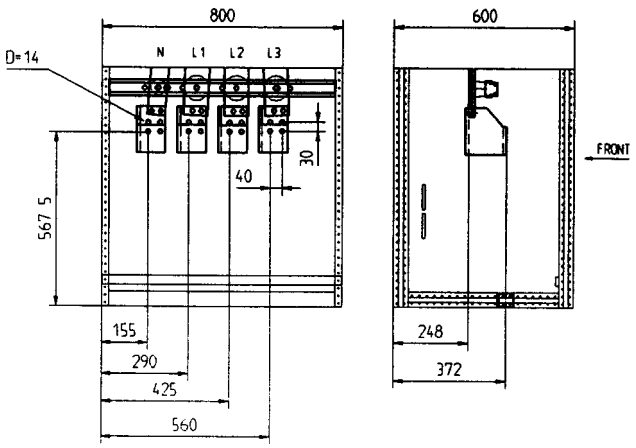
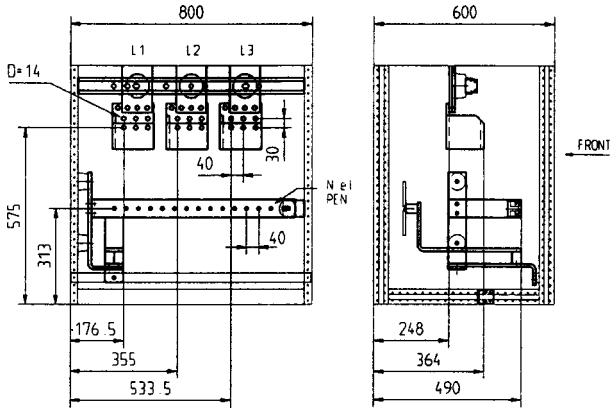


Dimension drawings

Circuit-breaker cubicle, cable connection from below

MEGAMAX 2500 A 3-P



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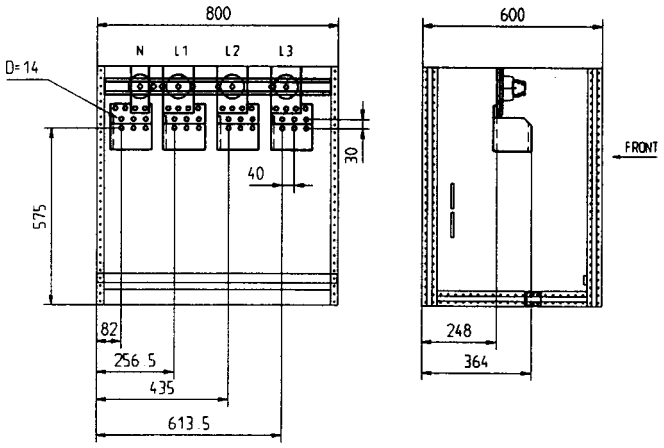
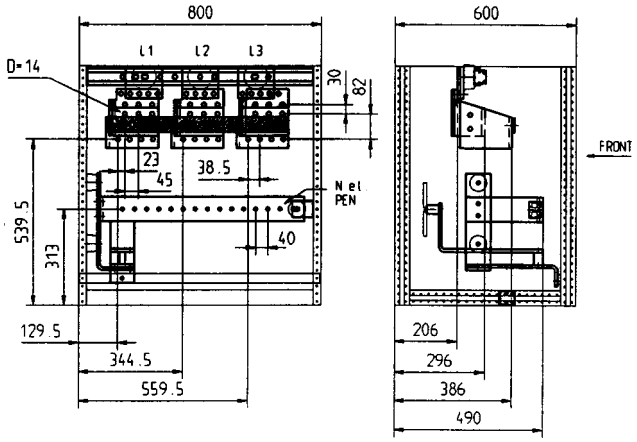
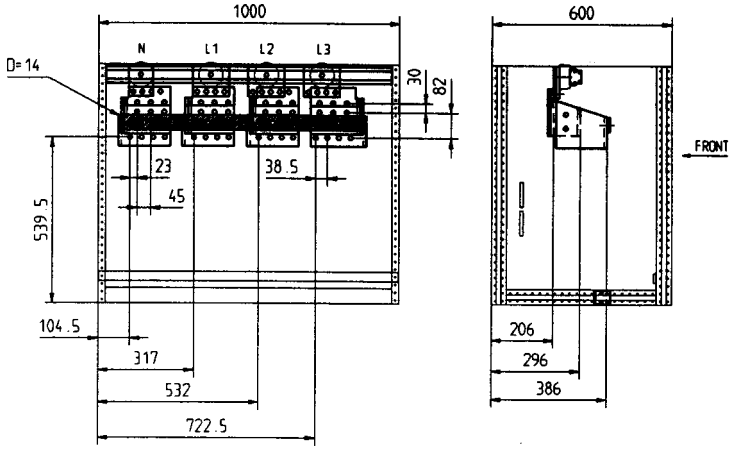


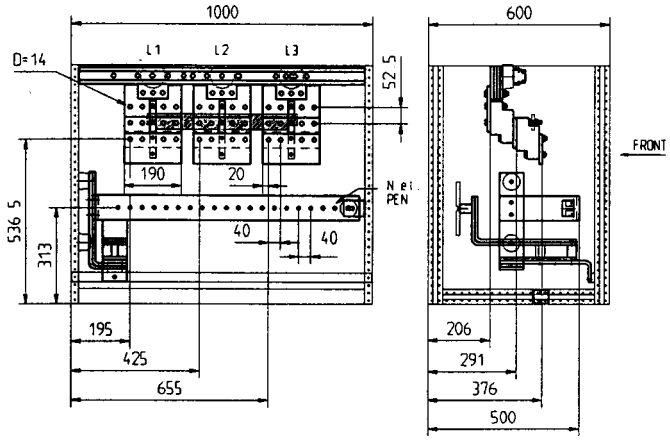
MEGAMAX 3200 A 3-P



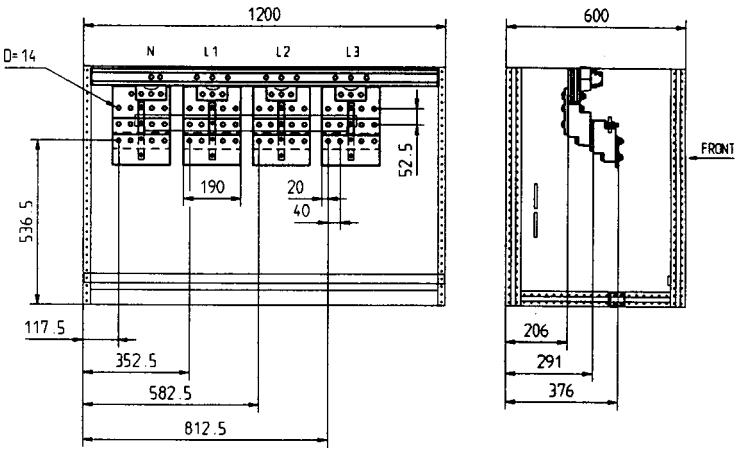
MEGAMAX 3200 A 4-P



MEGAMAX 4000 A 3-P



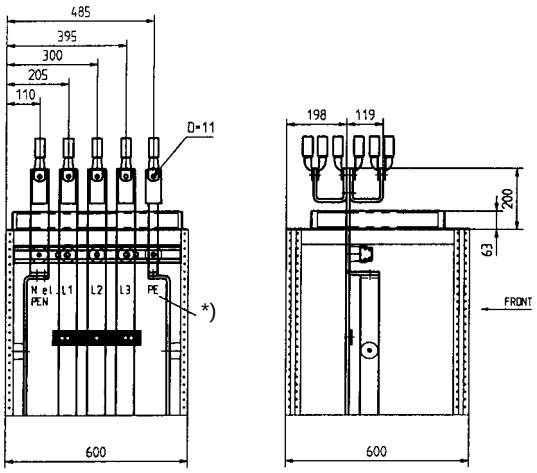
MEGAMAX 4000 4-P



Dimension drawings

Circuit-breaker cubicle, cable connection from above

MEGAMAX 1250 A 3-P



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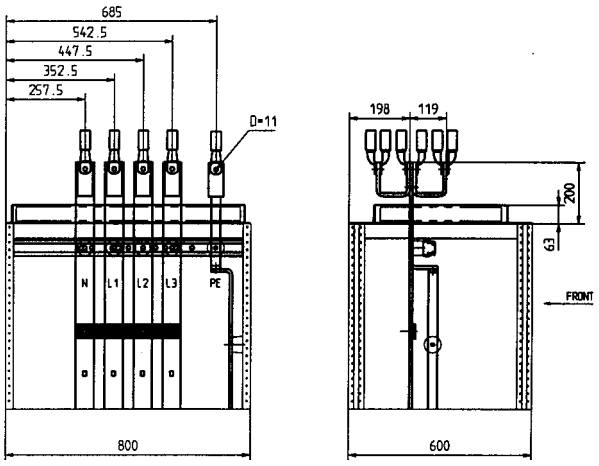
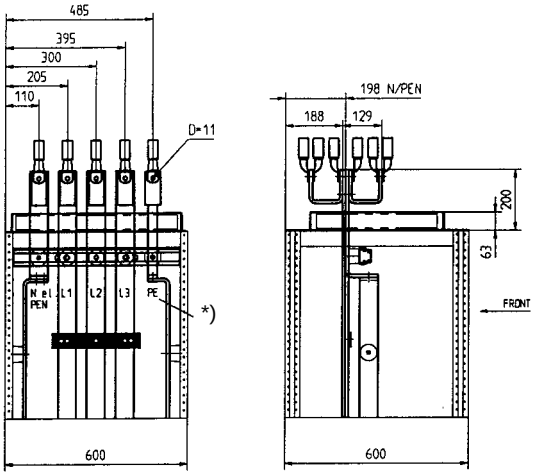


MEGAMAX 1600 A 3-P



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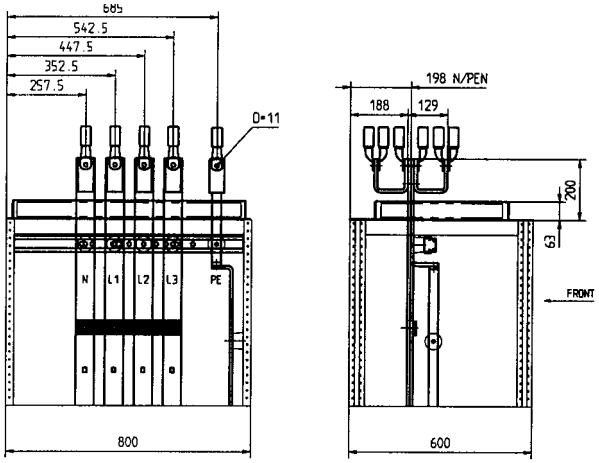

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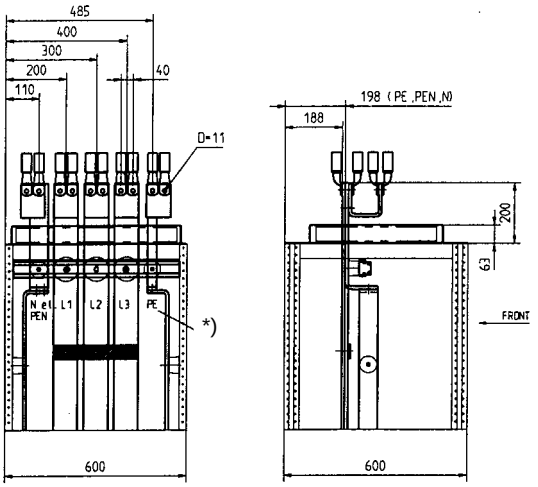
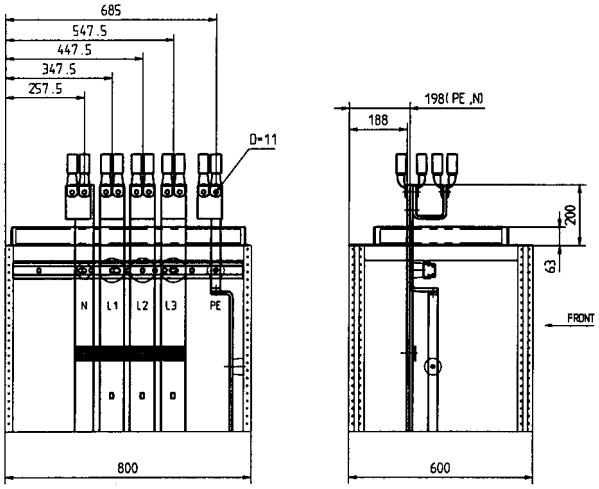


MEGAMAX 2000 A 4-P

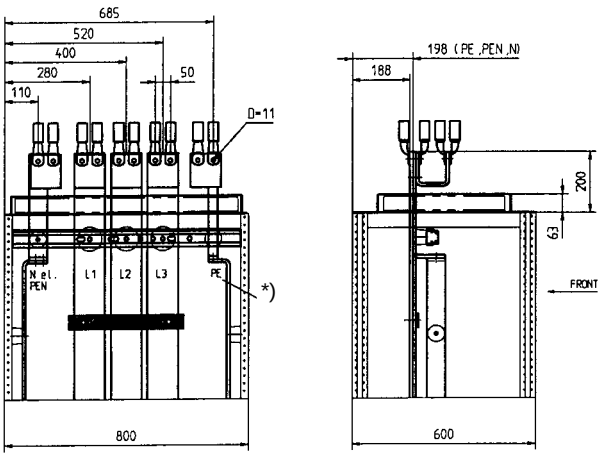


*) Only when connection is made with a 5-conductor system.

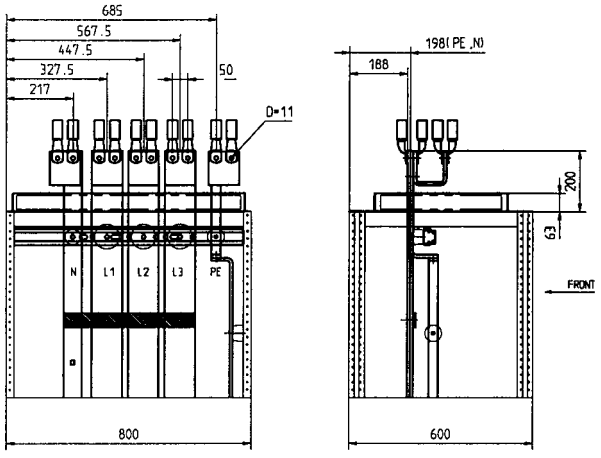
Dimension drawings

Circuit-breaker cubicle, cable connection from above

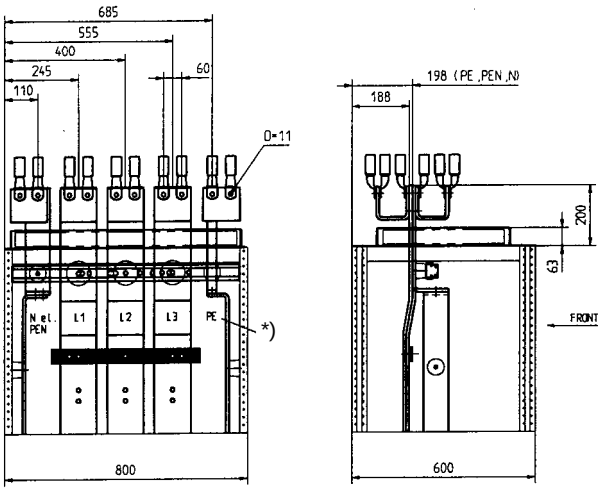
MEGAMAX 2500 A 3-P



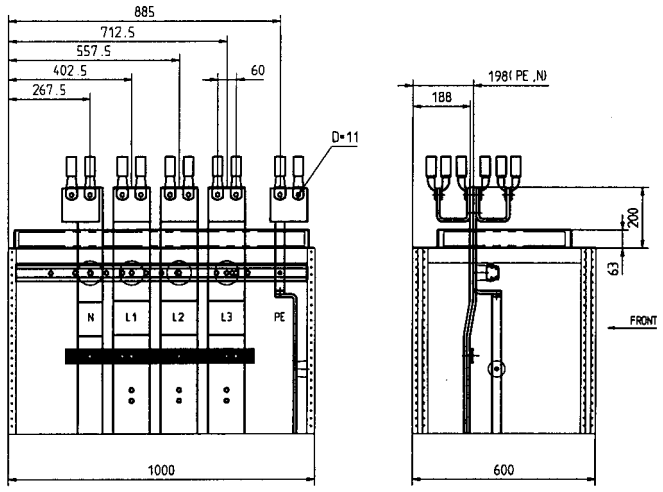
MEGAMAX 2500 A 4-P



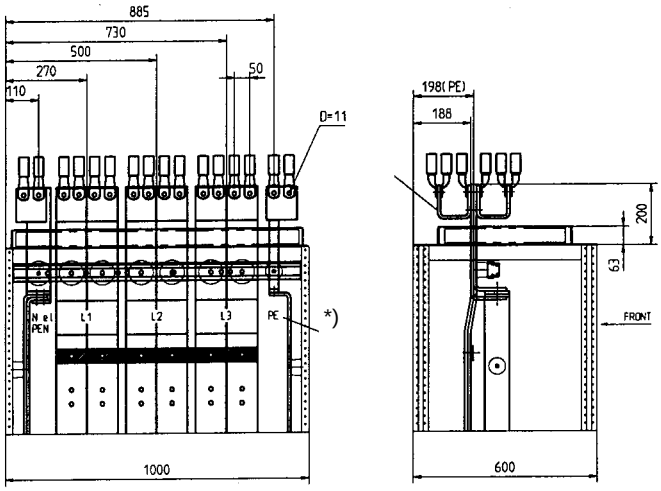
MEGAMAX 3200 A 3-P



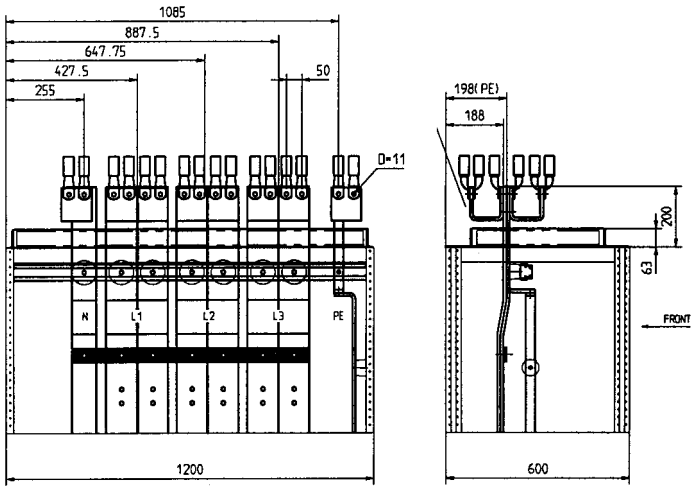
MEGAMAX 3200 A 4-P



MEGAMAX 4000 A 3-P



MEGAMAX 4000 A 4-P

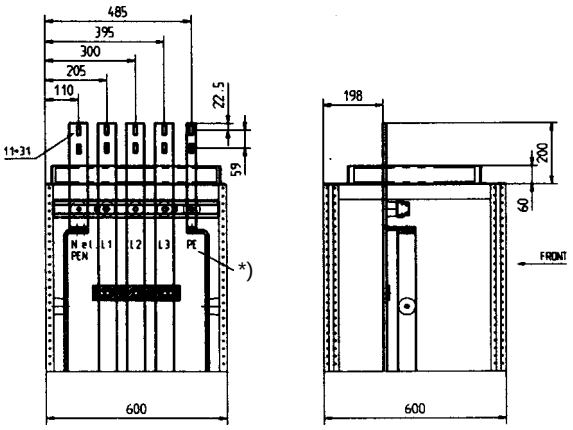


*) Only when connection is made with a 5-conductor system.

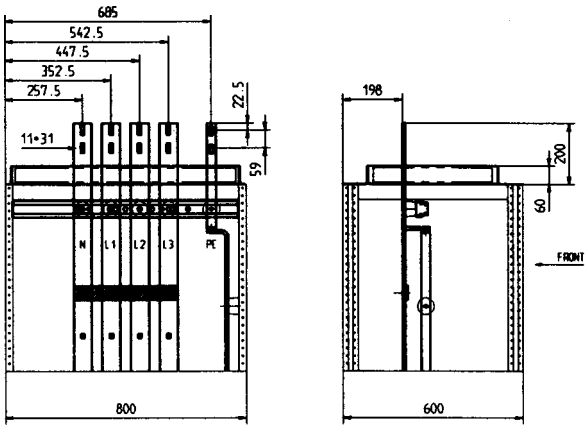
Dimension drawings

Circuit-breaker cubicle, busbar connection from above

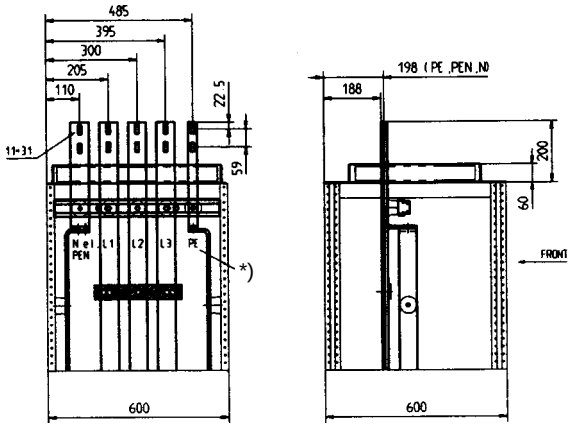
MEGAMAX 1250 A 3-P



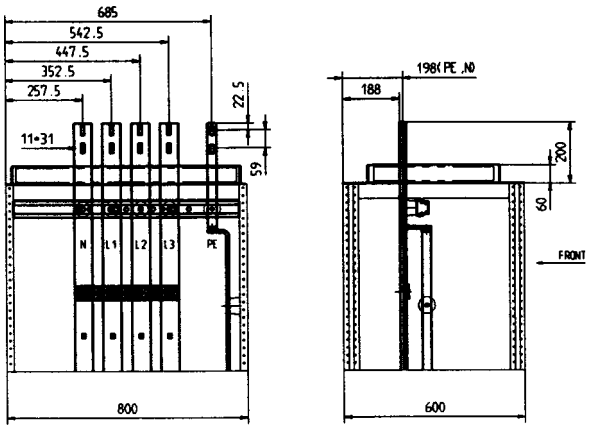
MEGAMAX 1250 A 4-P



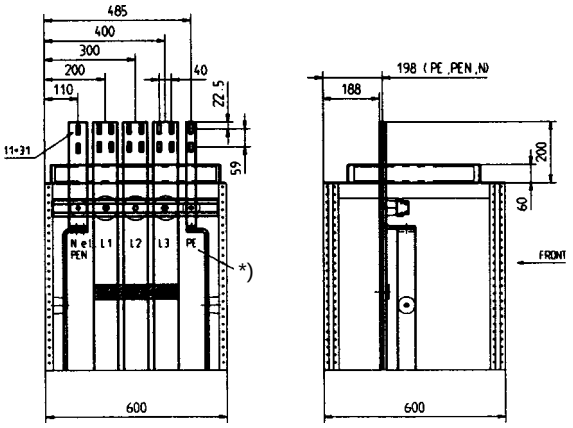
MEGAMAX 1600 A 3-P



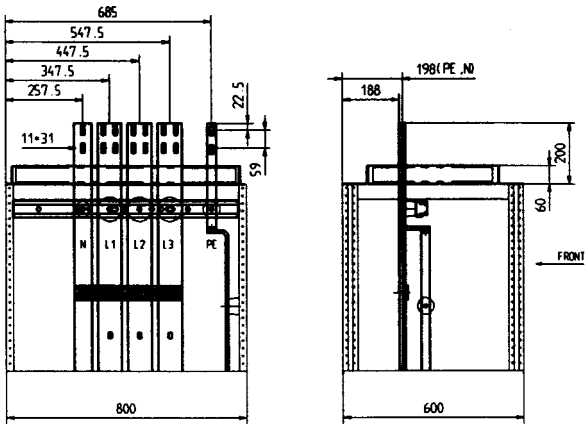
MEGAMAX 1600 A 4-P



MEGAMAX 2000 A 3-P



MEGAMAX 2000 A 4-P

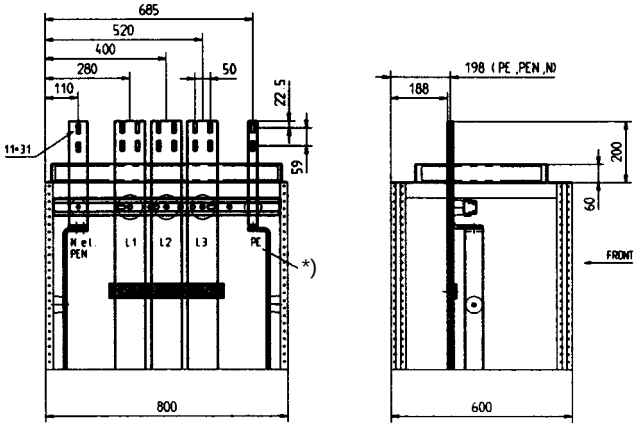


*) Only when connection is made with a 5-conductor system.

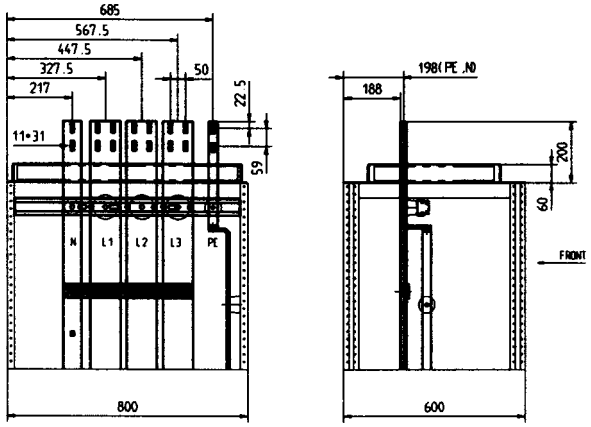
Dimension drawings

Circuit-breaker cubicle, busbar connection from above

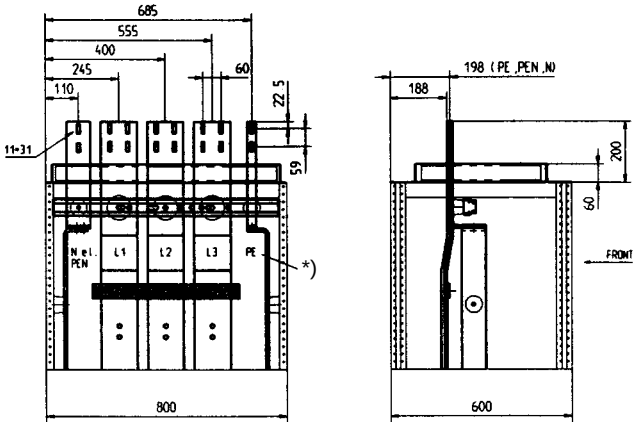
MEGAMAX 2500 A 3-P



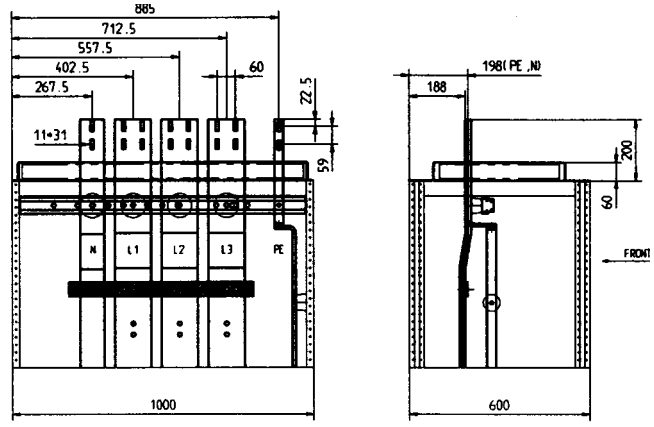
MEGAMAX 2500 A 4-P



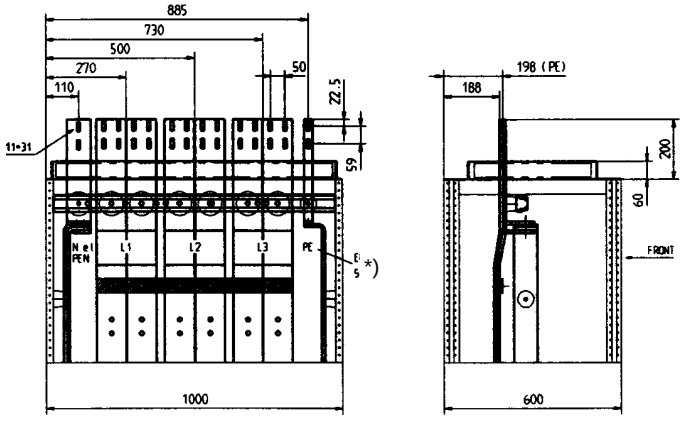
MEGAMAX 3200 A 3-P



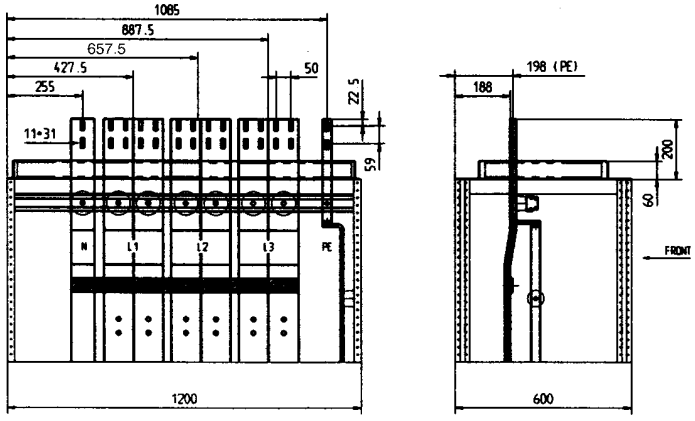
MEGAMAX 3200 A 4-P



MEGAMAX 4000 A 3-P



MEGAMAX 4000 A 4-P

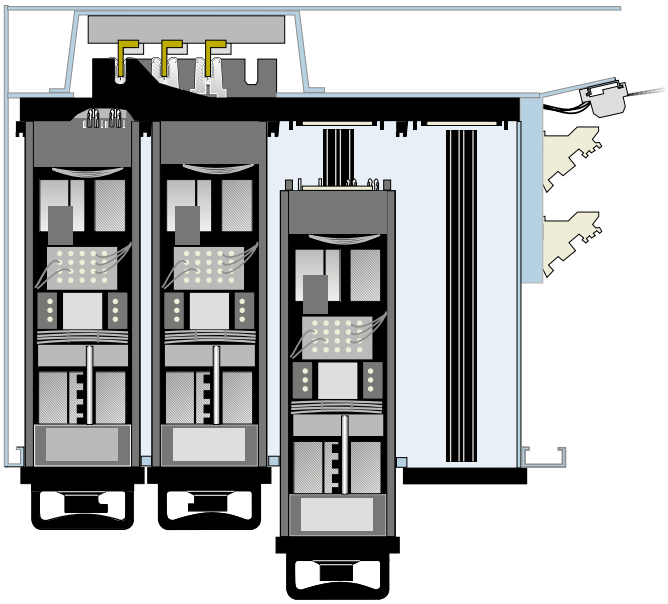


*) Only when connection is made with a 5-conductor system.

Connection of apparatus units

Withdrawable apparatus units 4 M/4, main circuits

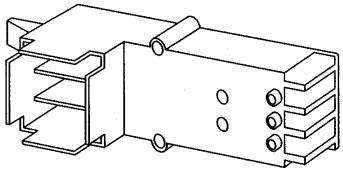
Max connectable area	1 x 10 mm^2



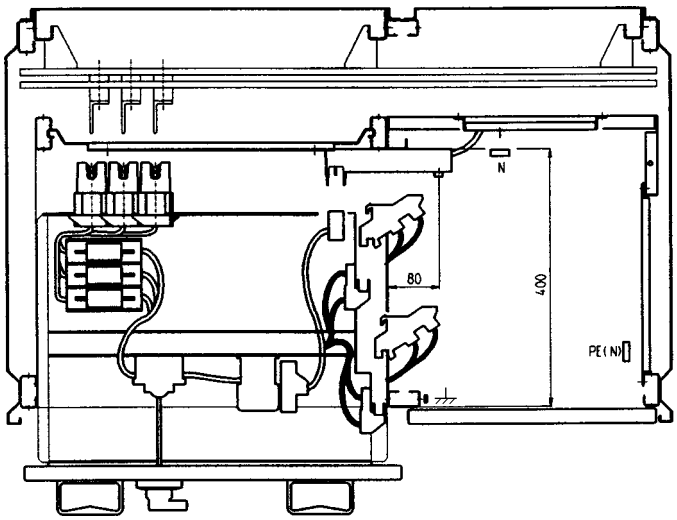
Main circuit terminal boards

Withdrawable apparatus units 2 M, main circuits

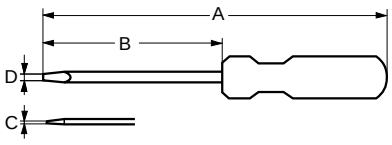
Max connectable area	1 x 25 mm^2



Connection unit for main circuits.
Phase interval = 18 mm.

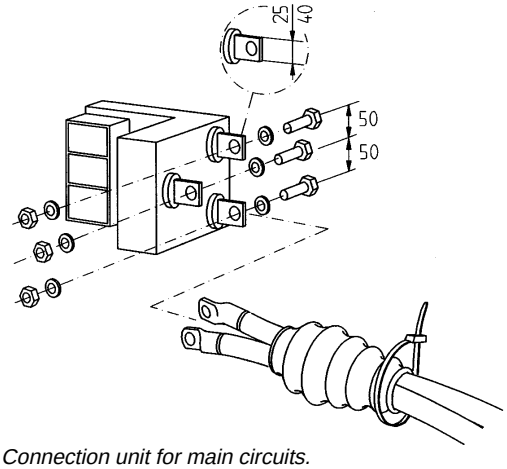


Requisite screwdriver size for connection unit's clamp		
Dimension	A	max. 235 mm
	B	min 80 mm
	C	1.0 mm
	D	5.5 mm

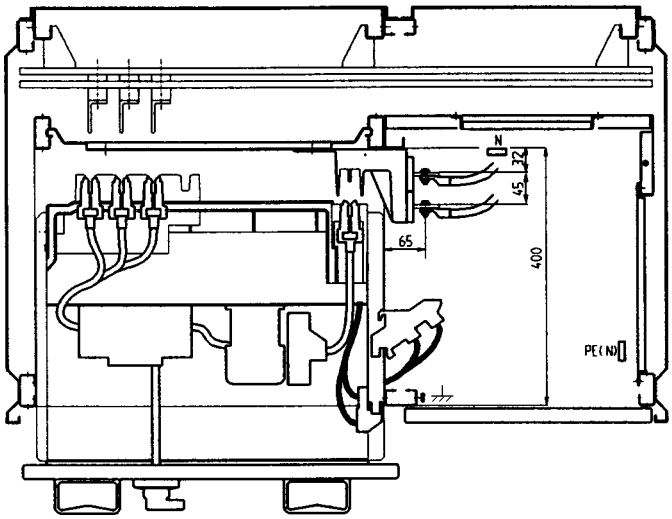


Withdrawable apparatus units 4 M - 12 M ≤ 400 A, main circuits

Connection unit size	Max. connectable area	Max. bolt dimension	Max. tightening torque	Cable shields per phase
3 x 160 A (25 mm)	1 x 120 mm^2	M10 x 30	45 Nm	1 x 120 mm^2
6 x 160 A (25 mm)	1 x 120 mm^2	M10 x 30	45 Nm	1 x 120 mm^2
3 x 400 A (40 mm)	2 x 240 mm^2	M12 x 35	80 Nm	2 x 240 mm^2

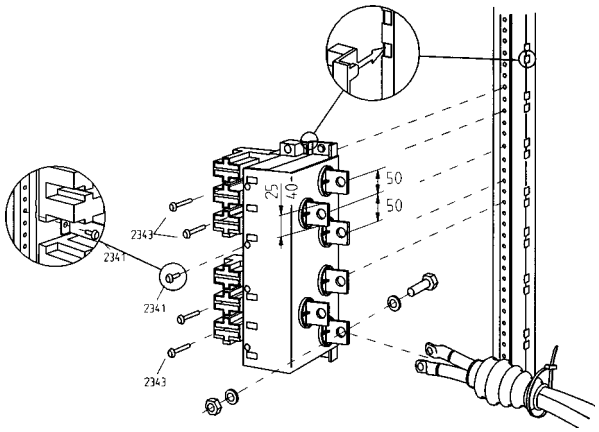


Connection unit for main circuits.
The cable shield protecting against inadvertent touching should be cut to fit the cable area. The shield should be secured with a clamping strap.

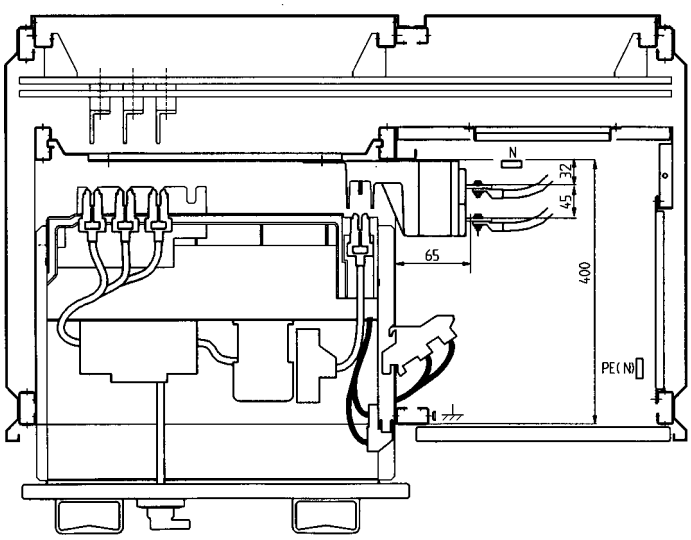


Withdrawable apparatus units 8 M - 12 M > 400 A, main circuits

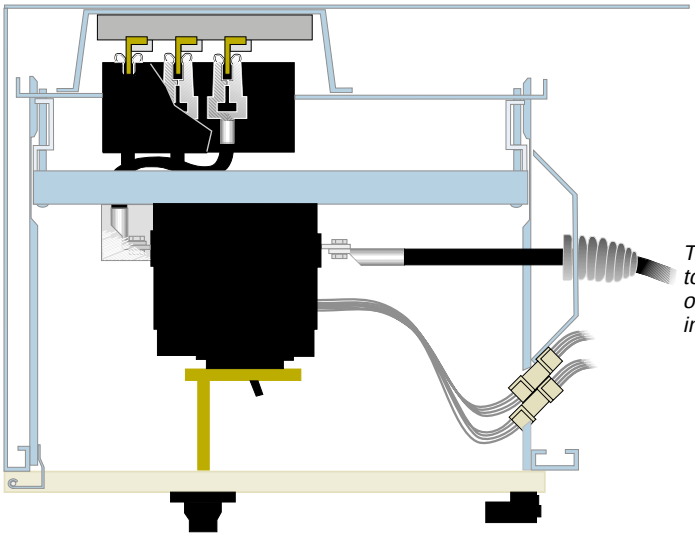
Connection unit size	Max. connectable area	Max. bolt dimension	Max. tightening torque
3 x 800 A	4 x 240 mm^2	M 12 x 35	80 Nm



Connection unit for main circuits.
The cable shield protecting against inadvertent touching should be cut to fit the cable area. The shield should be secured with a clamping strap.



Removable apparatus units, main circuits



The main circuits are to be connected direct to the apparatus terminals using a cable lug or cable clip. Cable shield protecting against inadvertent touching.

Apparatus unit		Connectable area, copper cable			Connectable area, aluminium cable		
Type	Size	Min. area mm²	Max. area cable lug mm²	Max. area cable clamp mm²	Min. area mm²	Max. area cable lug mm²	Max. area cable clamp mm²
MCCB ISOMAX N, fixed							
S3N 160	19 – 100 A	16 – 25	2//95	120	16 – 35	70	70
S3N 160	88 – 160 A	35 – 50	2//95	120	50 – 70	2//150	120
S3N 250	140 – 250 A	50 – 95	2//95	120	120 – 150	2//150	-
S4N 250	40 – 250 A	25 – 95	2//95	120	120 – 150	2//150	-
S5N 400	130 – 400 A	35 – 240	2//150	300	240 – 300	2//240	300
S6N 630	250 – 630 A	1x95 – 2//150	3//300	2//300	2//240	3//240	2//300
S6N 800	320 – 800 A	1x150 – 2//240	3//300	2//300	2//300	3//240	2//300
MCCB ISOMAX N, plug-in							
S3N 160	19 – 100 A	16 – 25	50	-	16 – 35	70	-
S3N 160	88 – 160 A	35 – 50	2//95	-	50 – 70	2//150	-
S3N 250	140 – 250 A	50 – 95	2//95	-	120 – 150	2//150	-
S4N 250	40 – 250 A	25 – 95	2//95	-	120 – 150	2//150	-
S5N 400	130 – 400 A	35 – 240	2//150	-	240 – 300	2//240	-
S6N 630	250 – 630 A	1x95 – 2//150	3//300	2//300	2//240	3//240	2//300
S6N 800	320 – 800 A	1x150 – 2//240	3//300	2//300	2//300	3//240	2//300
MCCB ISOMAX H, fixed							
S3H 160	19 – 100 A	25	2//95	120	25 – 35	2//150	120
S3H 160	88 – 160 A	35 – 50	2//95	120	70	2//150	120
S3H 250	140 – 250 A	50 – 95	2//95	120	120 – 150	2//150	-
S4H 250	40 – 250 A	25 – 95	2//95	120	120 – 150	2//150	-
S5H 400	130 – 400 A	35 – 240	2//185	300	240 – 300	2//240	300
S6H 630	250 – 630 A	1x95 – 2//150	3//300	2//300	2//240	3//240	2//300
S6H 800	320 – 800 A	1x150 – 2//240	3//300	2//300	2//300	3//240	2//300
MCCB ISOMAX H, plug-in							
S3H 160	19 – 100 A	25	70	-	25 – 35	70	-
S3H 160	88 – 160 A	35 – 50	2//95	-	70	2//150	-
S3H 250	140 – 250 A	50 – 95	2//95	-	120 – 150	2//150	-
S4H 250	40 – 250 A	25 – 95	2//95	-	120 – 150	2//150	-
S5H 400	130 – 400 A	35 – 240	2//185	-	240 – 300	2//240	-
S6H 630	250 – 630 A	1x95 – 2//150	3//300	2//300	2//240	3//240	2//300
S6H 800	320 – 800 A	1x150 – 2//240	3//300	2//300	2//300	3//240	2//300

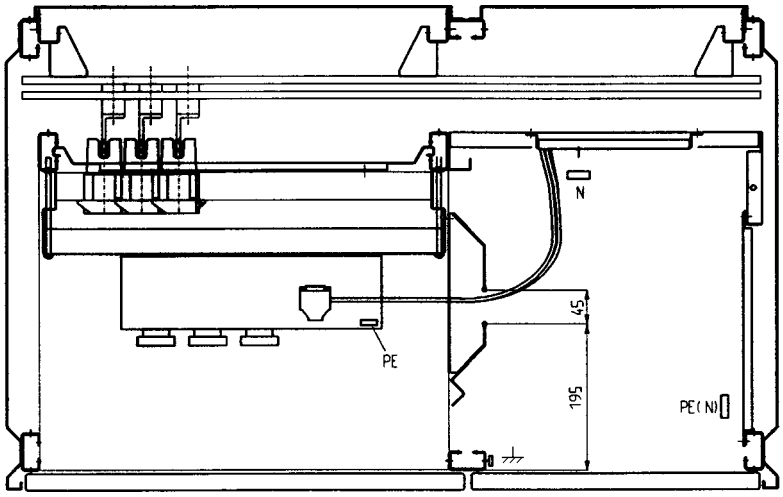
Continued on page 15

Removable apparatus units, main circuits

Continued from page 14

Apparatus unit		Connectable area, copper cable			Connectable area, aluminium cable		
Type	Size	Min. area mm²	Max. area cable lug mm²	Max. area cable clamp mm²	Min. area mm²	Max. area cable lug mm²	Max. area cable clamp mm²
MCCB LN, fixed							
LN 125	16 – 125 A	6 – 35	70	70	10 – 50	70	70
LN 200	125 – 200 A	50 – 70	70	70	70 – 120	70	70
LN 320	200 – 320 A	95 – 150	2//185	-	150 – 240	2//240	-
LN 500	320 – 500 A	240 – 300	2//300	-	300 – 2//150	2//240	-
LN 630	500 – 630 A	2//150	3//300	-	2//240	3//240	-
MCCB LN, plug-in							
LN 125	16 – 125 A	6 – 35	70	70	10 – 50	70	70
LN 200	125 – 200 A	50 – 70	2//95	120	70 – 120	2//150	120
LN 320	200 – 320 A	95 – 150	2//185	300	150 – 240	2//240	300
LN 500	320 – 500 A	240 – 300	2//300	2//300	300 – 2//150	2//240	2//300
Fuse/switch OESA							
	160 A	50	120	120	70	120	120
	250 A	95	300	300	150	240	300
	400 A	240	2//300	2//240	300	240	300
	630 A	2//150	3//300	2//300	2//240	3//240	2//300
	800 A	2//240	3//300	2//300	2//300	3//240	2//300

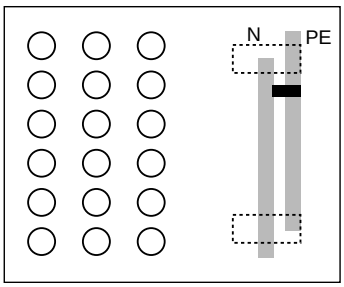
Screw-in fuse boards



Continued on page 16

Screw-in fuse boards, continued from page 15

Thread II, 25 A
With neutral and protective earth busbars.

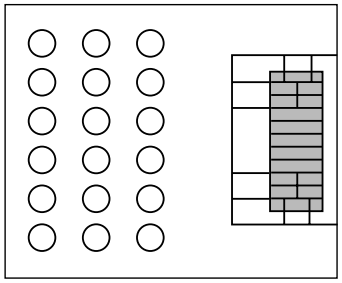


The neutral and protective earth busbars are provided with joint neutral disconnection and the requisite single-screw clamps for single-pole connection of all outgoing groups

Connectable area:
max. 10 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
18	6	8
9	3	6

Thread II, 25A
With row of terminal boards.

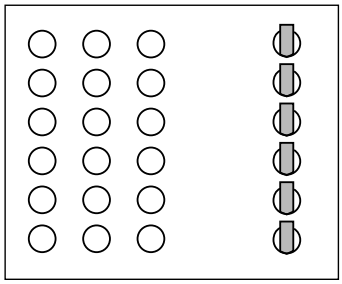


The groups are connected to a row of terminal boards which also contain disconnectable neutral boards for joint and individual disconnection of the groups. Protective earth bar with single-screw clamp and connection to the main neutral board are included.

Connectable area:
max. 6 mm^2, min. 1.5 mm^2 for 3-pole
max. 4 mm^2, min. 1.5 mm^2 for 1-pole

Number of groups 1-pole	3-pole	Height, modules
18	6	8
9	3	6

Thread II, 25 A
With group circuit-breaker 40 A

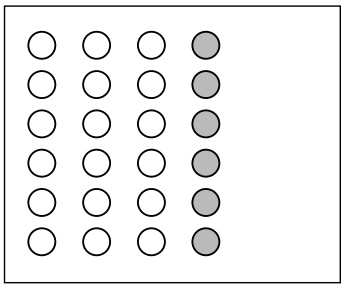


Each group is provided with a three-pole group circuit-breaker. The neutral and protective earth busbars have joint neutral disconnection and requisite single-screw clamps for connection of outgoing groups.

Connectable area:
max. 10 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
-	6	8

Thread II, 25 A
With extra row of fuses.



6 fuse sockets 25 A mounted on a phase bar alongside the normal three rows.

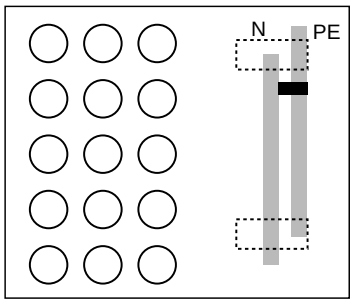
Connectable area:
max. 10 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
24	-	8
6	6	8

Continued on page 17

Screw-in fuse boards, continued from page 16

Thread III, 63 A
With neutral and protective earth busbars

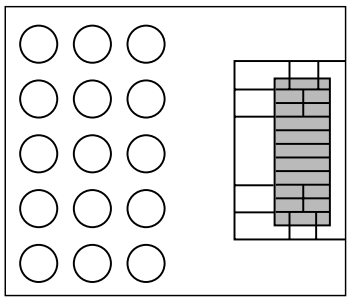


The neutral and protective earth busbars are provided with joint neutral disconnection and requisite two-screw clamps for 3-pole connection of all outgoing groups.

Connectable area:
max. 25 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
-	5	8
-	2	6

Thread III, 63 A
With row of terminal boards

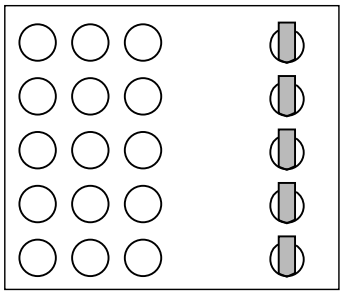


The groups are connected to a row of terminal boards which also contain disconnectable neutral boards for joint and individual disconnection of the groups. A protective conductor bar with two-screw clamp and connection the a main neutral board are included.

Connectable area:
max. 16 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
-	5	8
-	2	6

Thread III, 63 A
With group circuit-breaker 80 A

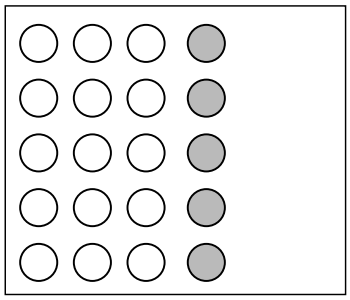


Each group is provided with a three-pole group circuit-breaker. The neutral and protective conductor busbars have joint neutral disconnection and requisite two-screw clamps for single-pole connection of outgoing groups.

Connectable area:
max. 16 mm^2, min. 1.5 mm^2

Number of groups 1-pole	3-pole	Height, modules
-	5	8

Thread III, 63 A
With extra row of fuses

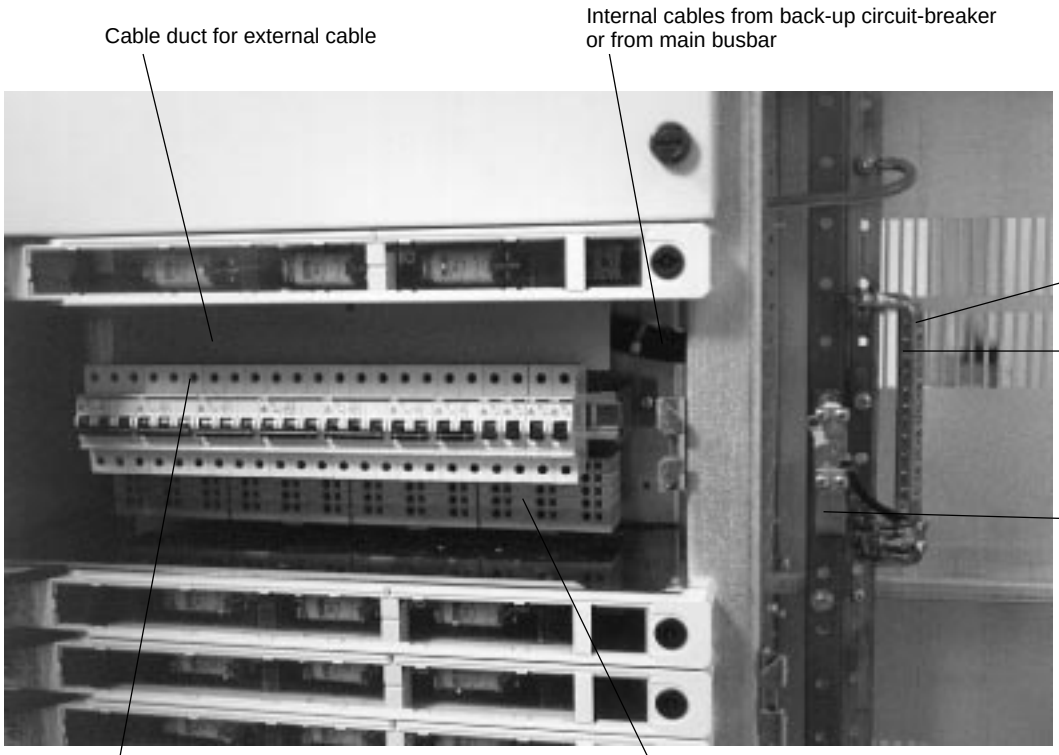


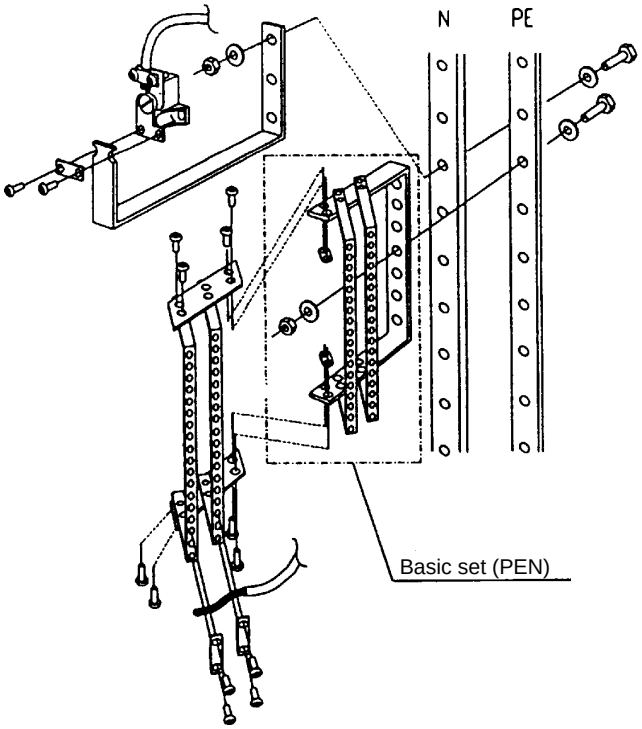
6 fuse sockets 25 A mounted on a phase bar along side the normal three rows.

Connectable area:
max. 25 mm^2, min. 1.5 mm^2 for 3-pole
max. 10 mm^2, min. 1.5 mm^2 for 1-pole

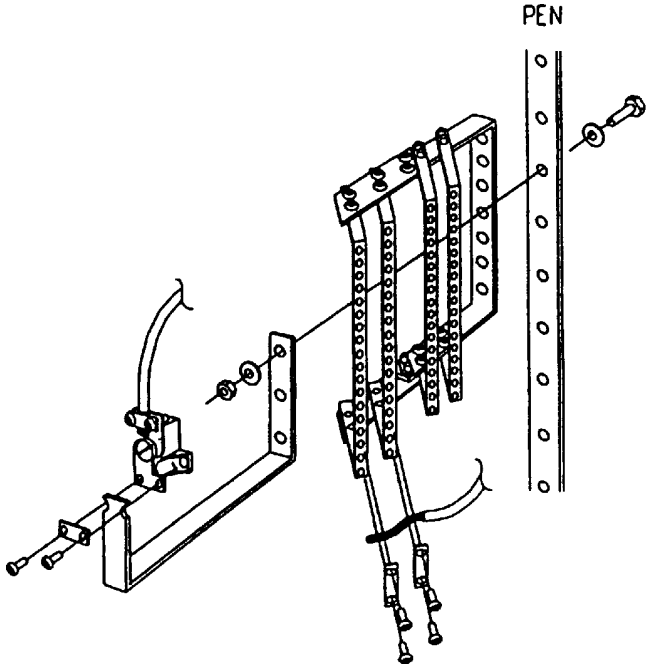
Number of groups 1-pole	3-pole	Height, modules
6	5	8

MCB terminals





PE + N placed in 5-conductor system



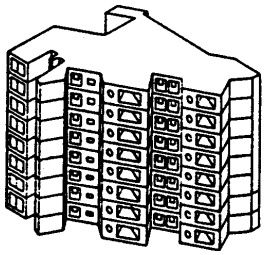
PEN/PE +N placed in 4-conductor system (neutral bar optional)

For withdrawable units, operating and signal cables are connected to terminal units (sliding contact units).

Max. connectable area: 1 x 2.5 mm^2 screw clamp + 2 x flat pin terminal 2.8 x 0.8.

Max. rated current/voltage: 10 A/500 V.

Connection of screened conductors is best done to an earthing bar located on the left front post in the cable area (option).



Connection unit for auxiliary circuits for withdrawable units 2M – 20M.

Auxiliary circuits, removable units

For removable units, signal cables are to be connected to plug-in ten-pole connection blocks.

Max. connectable area: 1 x 4 mm^2 screw clamp.

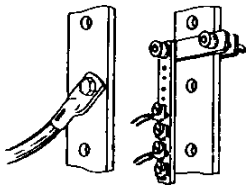
Max. rated current/voltage: 10 A/500 V.

Plug-in connection block for auxiliary circuits for removable units.

Protective earthing

The vertical protective earth busbar (PE) has holes 50 mm apart for cable lug connection down to 4 mm^2 conductor area. Conductors with areas of 1 – 10 mm^2 are to be connected to a smaller bar mounted on the large bar.

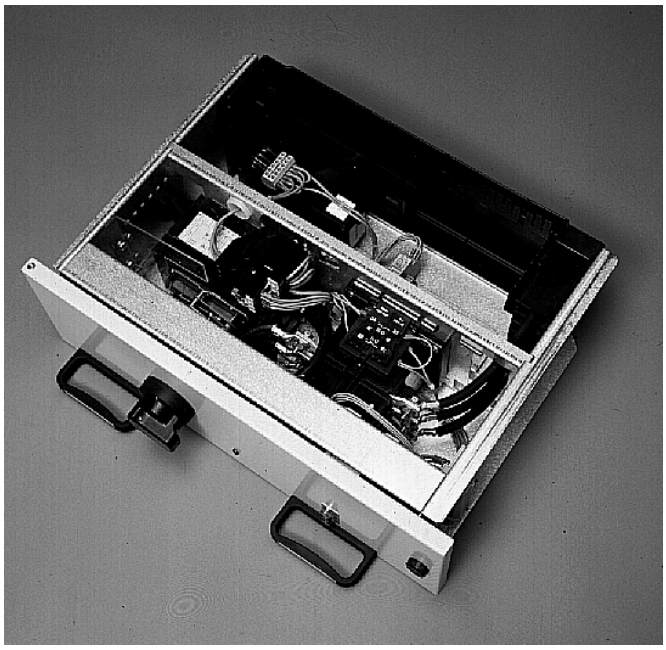
The PE busbar is located right at the back of the cable area to the left.



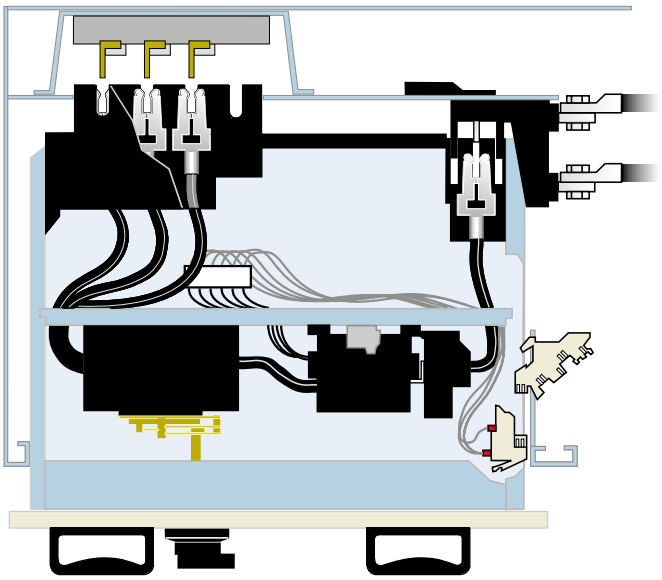
Vertical protective earth busbar (PE).

Description

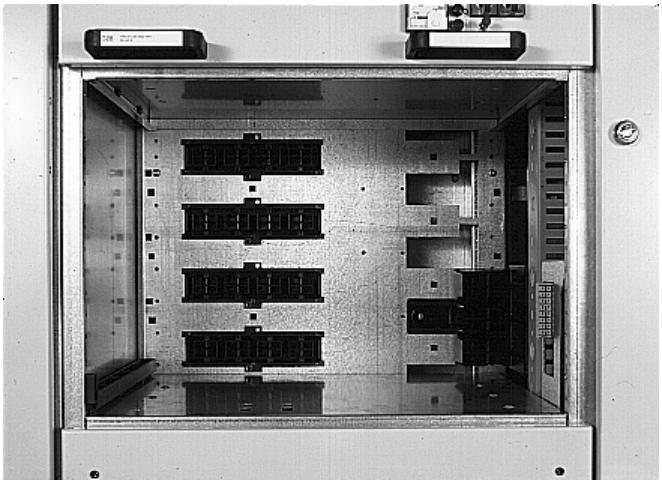
The withdrawable apparatus units have plug-in connection both for the incoming supply from the vertical busbar system and for outgoing cables. The units can be pulled out without having to unscrew any bolts. Interlocking takes place via the group´s operating handle. The auxiliary circuits are connected via multi-pole plug-in contact units. Unoccupied apparatus seats are screened off to minimise the risk of unintentional touching of live parts.



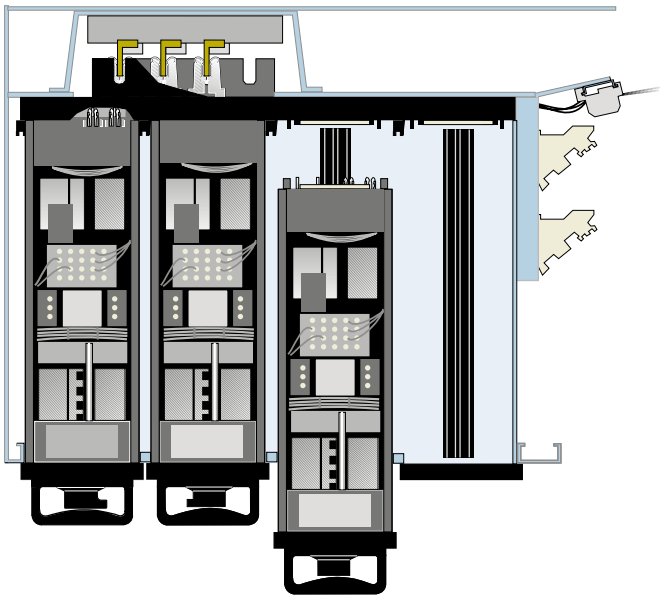
Withdrawable starter.



Withdrawable unit in disconnected position.



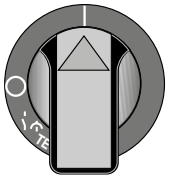
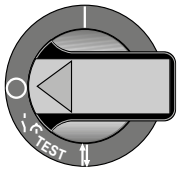
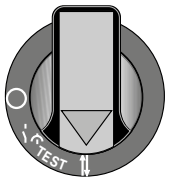
Unoccupied apparatus seat for withdrawable unit.



Compact unit with two units in operating position, one unit in disconnected position and one unoccupied apparatus seat.

Operation, normally wide unit

The unit has two fixed positions: connected position and disconnected position. The operating knob is used both for operating the power switch and for interlocking the apparatus unit. The knob has four different positions.

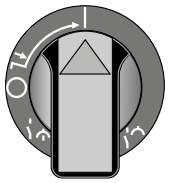
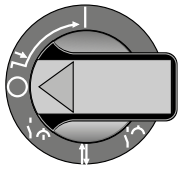
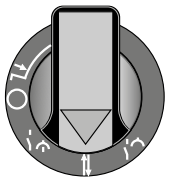
	Knob position	**Unit function when in connected position**
	On	All electrical circuits connected. Cover interlocked.
	Off	All electrical circuits disconnected.
	Test	Main circuits disconnected, auxiliary circuits connected.
	Move	All electrical circuits disconnected. The unit can be moved. When withdrawing from the connected position, the unit is automatically locked when it reaches the disconnected position *). For further movement outwards, the knob must be moved back to the move position.

The knob can be locked using up to three padlocks in the positions Off and Test.

*) Where the unit is in the disconnected position (see the figure on page 20) the position of the knob is of no importance since both the main and the auxiliary circuits are disconnected.

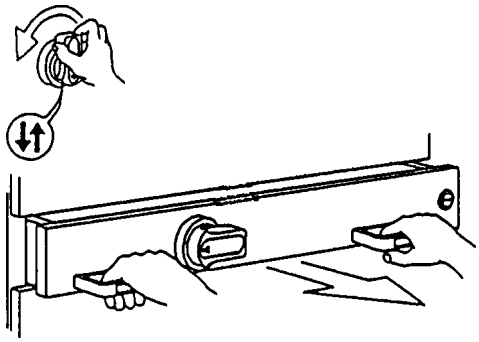
Operation, compact unit

The unit has three fixed positions: connected position, test position and disconnected position. The operating knob is used both for operating the power switch and for mechanical interlocking of the unit. A microswitch with two making and two breaking contacts is included for electrical interlocking. The knob has five different positions.

	Knob position	Unit function when in the connected position	Unit function when in disconnected position
	On	All electrical circuits connected. The unit interlocked in the connected position.	–
	Off To turn from ”0” to ”1”, the knob must be pressed in.	All electrical circuits disconnected. The unit interlocked in the connected position.	–
	Test	Main circuits disconnected, auxiliary circuits connected. The unit interlocked in the connected position.	–
	Move	All electrical circuits disconnected. The unit can be moved.	All electrical circuits disconnected. The unit can be moved.
	Disconnected	–	All electrical circuits disconnected. The unit can be moved. When withdrawing from the connected position, the unit is automatically blocked when it reaches the disconnected position (pulled out 30 mm from the run position). For further movement outwards, the knob must be turned back to the move position.

The knob can be locked with up to three padlocks in the positions Off and Test.

Withdrawing, normally wide unit



The unit is in the run position (pushed right in).

1. Turn the knob to the Move position.

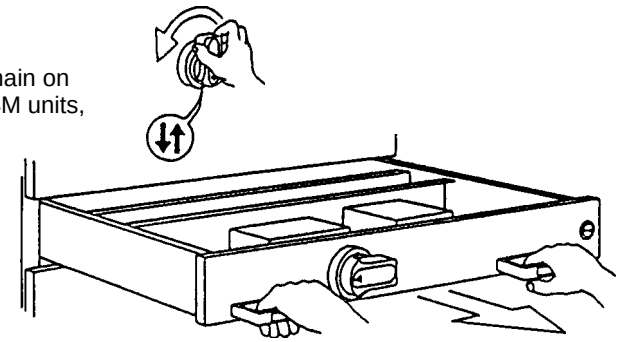
Pull (jerk) the unit out so far that it is automatically locked by the interlocking mechanism. Use the two handles. The operating knob must not be used as a handle when moving the unit.

When moving the unit, the knob immediately moves back to the 0 position when the unit starts moving. This is perfectly normal; continue moving without touching the knob.

2. The unit is now in the disconnected position.

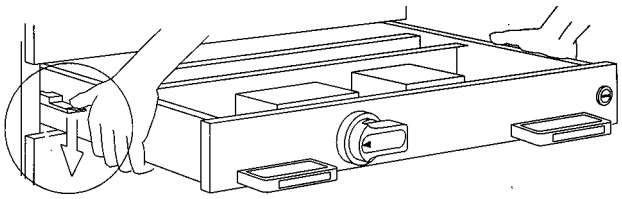
3. For further movement, turn the knob to the Move position.

4. The unit is now free to be pulled out to the safety stop.



Since the weight of the unit can prove to be too heavy if the hands remain on the handles, shift your grip when the unit is half-way out. For 2M and 4M units, grasp under the sides about half way along and pull the unit out against the safety stop. For 6M units and bigger, there should be two persons pulling the unit out of the cubicle. When the unit is withdrawn half-way, one person on each side should grasp the side of 6M units, or the handle on the sides of larger units, and pull the unit out against the safety stop. Since the unit now has its centre of gravity outside the cubicle the unit cannot be left in this position. Be careful when large, heavy units are handled so as to avoid injuries to persons nearby and damage to mechanical parts. To make handling of large units easier, and also from the ventilation point of view, they should be placed as far down in the cubicle as possible.

5. Before removing the unit from the cubicle, release the safety stop by pressing down the catch at the bottom of the left-hand side of the of the unit.



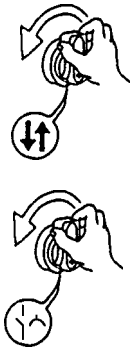
The catch is so placed that the correct balance is obtained when pulling out 2M and 4M units alone. For larger units, it is located so that it is easily accessible for the person standing on the left. For 2M and 4M units located at a level below chest height grasp under the sides about half way along and release the catch with your left thumb. If they are at a higher level, grasp under the unit on the guide plate with your right hand and release the catch with your left hand.

6. The unit is now ready to be pulled completely out of the cubicle

When using the special apparatus hoist available for ABB's apparatus units, this instruction should be followed up to point 3, after which the instructions supplied with the apparatus hoist should be complied with (1TSC 232-SE).

If a hoisting trolley is used for depositing the unit on, the unit can be placed on its guide plate, inserting wooden slats or similar underneath so as not to damage the front door and mechanism. When temporarily storing the unit on the floor, it should be placed with its left side (seen from the front) on the floor so as not to damage the unit´s withdrawal mechanism. The floor surface should be flat and smooth so as not to scratch the paintwork on the unit. For permanent storage on the module bottom plate, the unit should be blocked up so as not to damage the unit´s withdrawal mechanism and the underneath of the panel.

Withdrawing, compact unit



The unit is in the run position (pushed right in).

Turn the knob to the Move position.

The unit is now ready to be pulled out of the cubicle completely. Use the handle (the operating knob must not be used as a handle when pulling out the unit).

When moving to the disconnected position, turn the knob by hand to the disconnected position while pulling (jerking) the unit out of the Run position. Pull outwards until the unit is blocked in the disconnected position. To pull the unit out completely from the disconnected position, return the knob to the Move position, whereupon the unit is free to be pulled out.

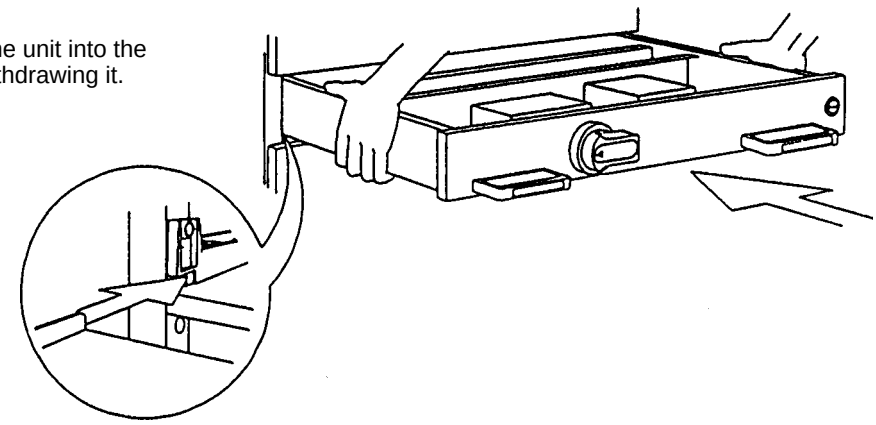
Insertion, normally wide unit

From the handling point of view, insertion of the unit into the cubicle takes place in the same manner as withdrawing it.

1. Check that the guiding edge of the unit fits into the slot in the guide rail.

Push in the unit carefully until it is stopped by the interlocking mechanism.

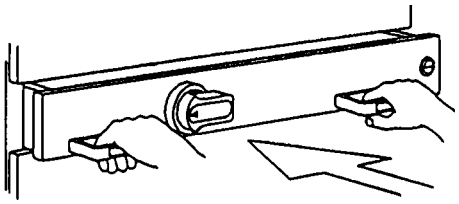
The unit must not be left in this position since it is unblocked.



2. Turn the knob to the Move position.

Push in the unit until it is blocked by the interlocking mechanism.

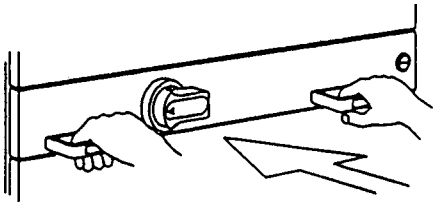
3. The unit is now in the disconnected position.



4. For further movement inwards, turn the knob to the Move position.

5. The unit can now be pushed into the connected position.

Check that the unit is properly blocked by trying to pull it out without touching the knob. The knob should now be in the horizontal position.



Insertion, compact unit

From the handling point of view, insertion of a unit into a cubicle takes place in the same manner as when withdrawing it.

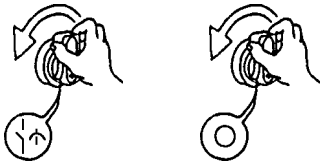
1. Check that the unit´s guiding edge fits into the slot in the control rail.

2. Turn the knob to the Move position.

Push the unit in to the connected position.

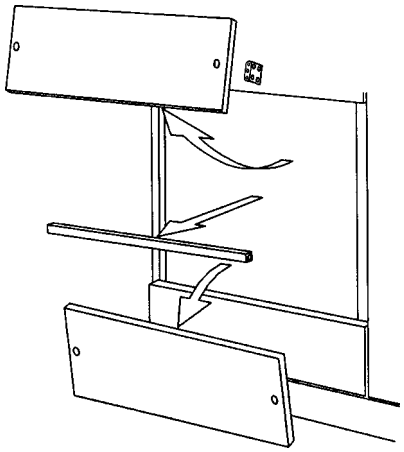
3. Turn the knob to the Test position or Off position.

Check that the unit has been properly blocked by trying to pull it out without touching the knob.



Extension

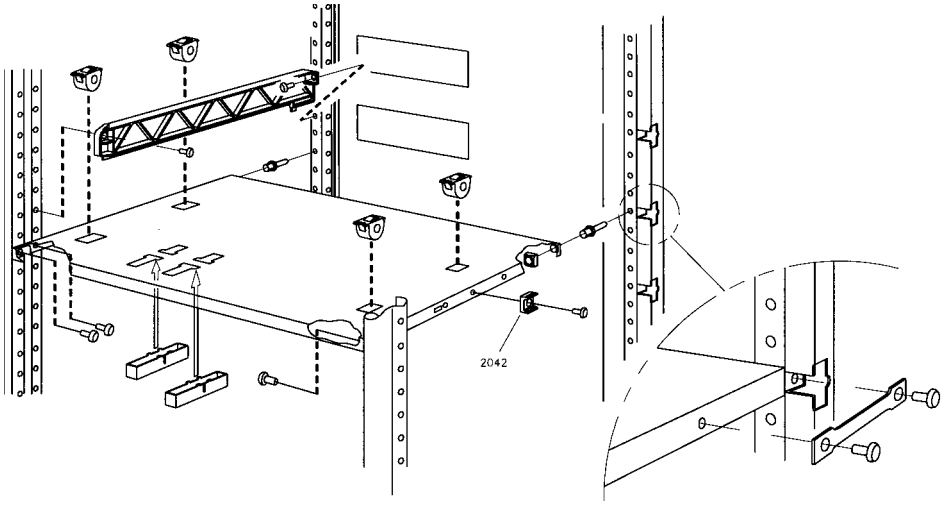
Extension of the equipment can take place with the switchgear live, but it is naturally preferable to work with the voltage switched off.



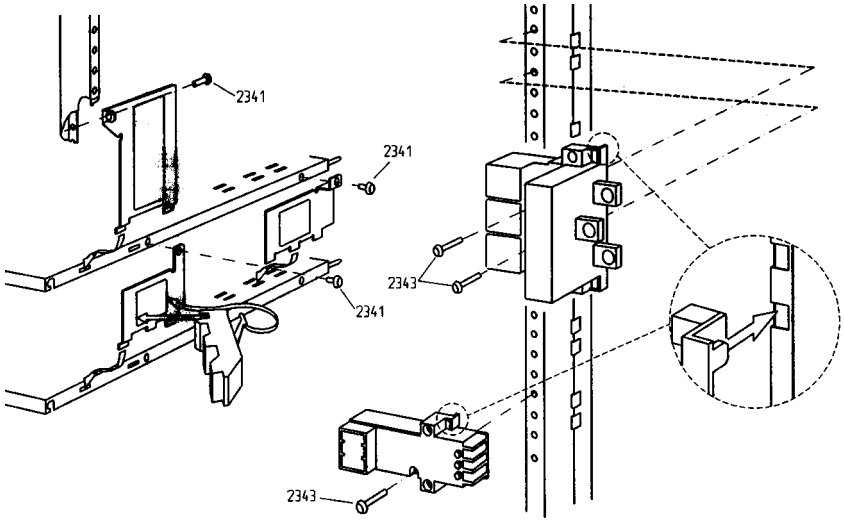
1. Remove the panel in question as well as the panel immediately below it.

Remove the panel bar as well (only at higher degree of protection).

2. Insert and mount a new cassette plate and guide rail.



4. Mount connection units for main and auxiliary circuits.



5. Connect up cables for main and auxiliary circuits.

Follow instructions for connecting up apparatus units.

6. Fit the panel below the new unit back in and push the unit into place.

Follow instructions for inserting units.

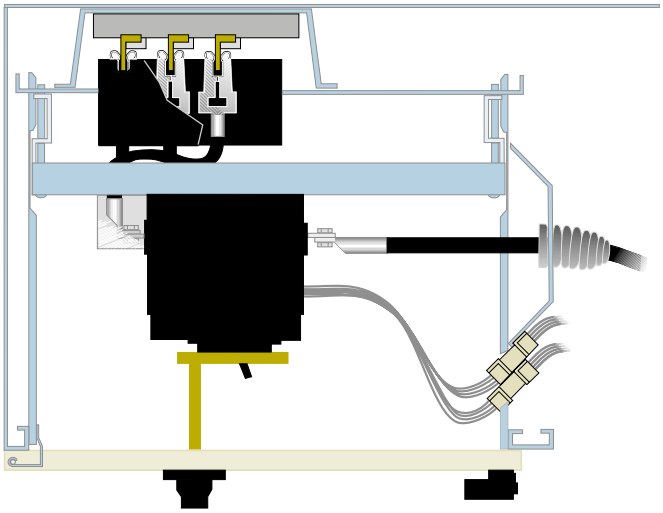
Since the units are protected against adjacent units via cassette plates, and the terminals are provided with cable shields, no further measures need be adopted when carrying out extensions with the equipment live.

Before energising the equipment, see the instructions under ”Concluding work” and ”Check-list upon commissioning”.

In general, it is important when extending equipment that the relevant regulations regarding measures that are to be adopted, such as marking with sign-plates, etc., are complied with.

Description

The removable apparatus units have plug-in connection for the incoming supply from the vertical busbar system, whereas the outgoing cables are connected permanently direct to the apparatus terminals. The units can be taken out after the outgoing cables have been disconnected and four fixing bolts removed. The auxiliary circuits are connected via multi-pole plug-in contact units.

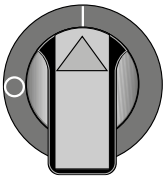


Removable R unit.

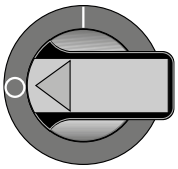
Removable unit in connected position.

Operation

The operating knob has two positions.



Knob position	Unit function
On	All electrical circuits connected. Panel interlocked.

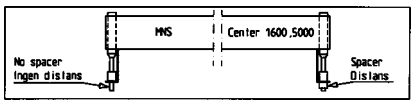


Off	All electrical circuits disconnected. The unit can be removed after disconnecting cables and removing fixing bolts.

Replaceability, MNS – Center 5000/1600

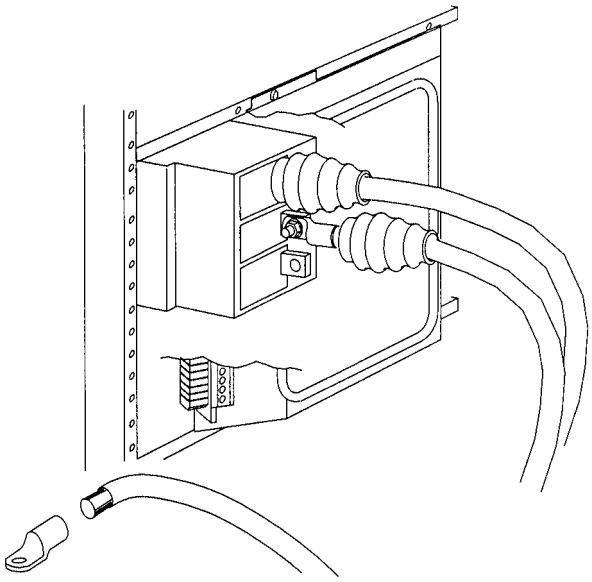
Removable apparatus units (R units) supplied before Week 40, 1995 do not fit and should not be used in MNS cubicles. Their apparatus plates have the wrong dimensions for MNS, leading to plug-in contacts not fitting properly.
The mark of a non-replaceable R unit is that the plug-in holder consists of **3 or 4 single-pole holders.**

R units supplied after Week 40, 1995 can be used in both MNS and Center 5000/1600 if proper spacing using spacer set 1TSA2 21518-A is applied in Center 5000/1600. (Standard design for Center 5000/1600 after Week 40, 1995.)
No spacing is allowed in MNS cubicles.
The mark of a replaceable R unit (with the aid of spacers) is that the plug-in holder consists of **a 4-pole holder** and that the apparatus plates are marked with a label.



Marking label for a replaceable R unit.

Removing a unit

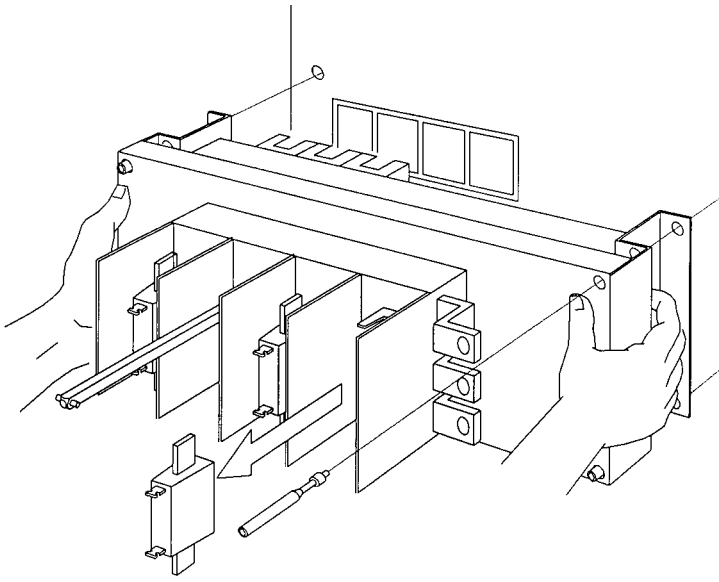


1. **Set the knob in the 0 position (breaker off).**
2. **Open the panel and remove any fuses.**
3. **Check that there is no voltage at the apparatus terminals (that the equipment is not live).**
4. **Detach the main cables.**

   Pull out the cables through the hole in the group's end panel. (Remove any screens and cable shields.)

   Protect the cable ends against any live parts in the cable area.
5. **Disconnect any connection units for operating cables.**
6. **Remove the four fixing bolts.**
7. **The unit is now free and can be taken out.**
8. **Close the panel.**

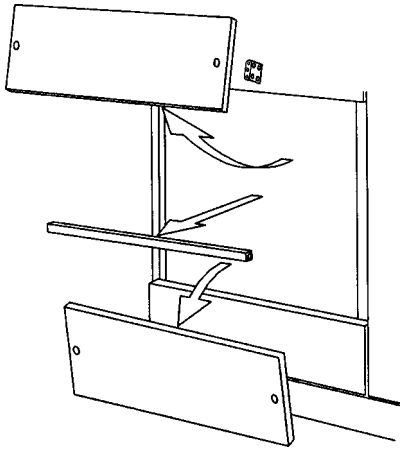
Mounting a unit



1. **Open the panel.**
2. **Set the handle in the 0 position (breaker off) and remove any fuses.**
3. **Insert the unit and bolt it fast (four fixing bolts).**
3. **Test that there is no voltage at the apparatus terminals (that they are not live).**
4. **Connect up the connection units for the operating cables.**
5. **Connect the main cables, fit screens and cable shields.**
6. **Fit fuses, where applicable.**
8. **Close the panel.**

Extension

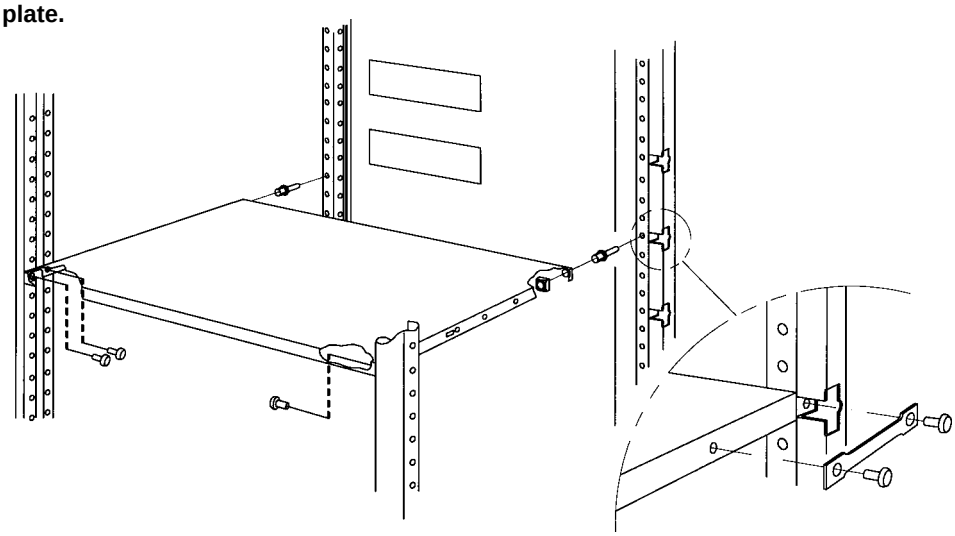
Extension of the equipment can take place with the switchgear live, but it is naturally preferable to work with the voltage switched off.



1. Remove the panel in question as well as the panel immediately below it.

Remove the panel bar as well (only at higher degree of protection).

2. Insert and mount a new cassette plate.



3. Fit the panel below the new unit back on.

4. Check that no main fuses are mounted in the new unit.

5. Mount the unit in the cubicle.

Follow instructions for mounting units.

6. Check that there is no voltage at the terminals after the first apparatus.

7. Connect up cables for main and auxiliary circuits.

Follow instructions for connection of apparatus units.

8. Fit on the panel and the lock shackle.

9. Adjust the shaft so that the door interlocking in the ’1’ position works.

10. Close the panel.

Since the units are protected against the adjacent units via cassette plates, and the terminals are fitted with screens against the cable cubicle, no further measures need be adopted when extending the equipment in live conditions.

Before energising the equipment, see the instructions under ”Measures to be adopted before energising”, page 29.

In general, it is important when extending equipment that the relevant regulations regarding measures that are to be adopted, such as marking with sign-plates etc., are complied with.

Concluding work

Remove wire ends and debris from cable stripping, etc.
Wipe off any grease and dirt.
Check that tools and assembly material have not been left in the cubicles.
Vacuum-clean the cubicles.

Check-list upon commissioning

There follows a list of points to be observed when inspecting and testing a directly earthed system.

In the case of indirectly earthed systems, a check must always be made that all metallic parts are correctly earthed. Check the earth fault protection signal as well.

Apart from this check-list, local and current national regulations and instructions must be complied with.

1. ❒ Insertion of fuses

Insert all necessary fuses in the main and auxiliary circuits.

2. ❒ Checking of fuses

Check that all fuses agree with the apparatus list and the circuit diagram.

3. ❒ Setting of MCCBs

Set instantaneous and thermal tripping of MCCB units, based on load and selectivity.

The instantaneous protection for incoming circuit-breakers and large distribution breakers can be temporarily set at the lowest value to ensure the fastest possible tripping in the event of a short circuit during commissioning.

4. ❒ Checking of current transformers

Check that the secondary winding in all current transformers is connected (under load). Otherwise the secondary windings must be short-circuited.

5. ❒ Setting of starters

Set the thermal overload protection at the rated current of the motor.

N.B. Setting above or below the scale range is not permitted.

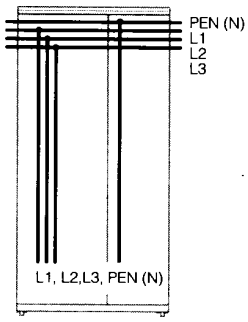
6. ❒ Check the main busbars

Make a visual inspection to see that the bolts in busbar joints between the cubicles are tight.

7. ❒ Check the PE and N bars

Carry out a visual inspection to ensure that the bolts in busbar joints between the cubicles are tight.

8. ❒ Check phase sequence and marking



9. ❒ Check internal connections

Check all internal connections between the cubicles.

10. ❒ Carry out insulation tests

10.1 Check that incoming supply is switched off.

10.2 Check that all operating voltages are switched off.

10.3 Check that all relays are switched off.

10.4 Check that all large MCCBs (incoming circuit-breakers) are disconnected.

10.5 Check the insulation on the main busbars using a megger with 1 or 0.5 kV. The insulation resistance should be ≥ 1 Mohm.

Phase	Insulation resistance Mohm
L1 – N	
L2 – N	
L3 – N	
L1 – L2	
L2 – L3	
L3 – L1	

10.6 Reconnect all relays , operating voltages and circuits that were disconnected during the insulation tests.

11. ❒ Energising the equipment

11.1 Check that incoming and outgoing circuit-breakers and disconnectors are off.

11.2 Check that all doors and covers in the switchgear are closed.

11.3 Switch on the supply and connect in the switchgear, if possible one cubicle or section at a time.

11.4 Check the phase sequence of a unit. It is enough to check one unit since the phase sequence has already been checked (point 8).

11.5 Check the units one at a time by:

- switching on the circuit-breaker
- checking the main circuit to the connected load
- checking that all important interlocking measures agree with the circuit diagram.

12. ❒ Final inspection

12.1 Check that all voltmeters, ammeters and wattmeters are in working order.

12.2 Check that all instantaneous protections that have been turned down during commissioning work are reset to their operating positions.

12.3 Check that no vibrations or noises occur in the busbar systems.

Warning - high currents

A short-circuit current in low-voltage switchgear is normally very high. Depending on the set tripping time, selectivity, etc., high short-circuit currents with relatively long duration can occur.

A short circuit can cause serious injuries to personnel and damage to material. It is therefore essential to use properly insulated tools and secured instruments in commissioning work.

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