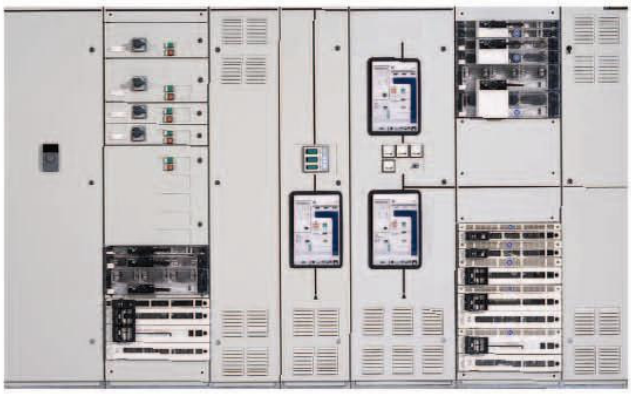
GE Consumer & Industrial
Power Protection

SEN Plus

Pan-European metalclad Low voltage system

The heart of your business



User Manual

GE imagination at work

Rev. 00-141106

Table of Contents

User Manual

Overview

Introduction

This document describes the operation and maintenance of the SEN Plus. Read this book before taking the column into operation to ensure correct handling, operation and proper maintenance from the beginning. Keep this book available for the operator(s).

Contents

This document contains the following topics.

Control Centre with plug-in modules

Overview

Introduction This chapter discusses the Control Centre and its correct use.

Contents This document contains the following topics.

Introduction

Overview

Introduction	This chapter discusses briefly the general principle of the Control Centre.
Contents	This document contains the following topics.

Introduction

Principle

The Control Centre is subdivided in three functional zones:

- Busbar zone
- Equipment zone
- Cable zone

Busbar zone

The busbar zone is located at the rear of the column and contains the main horizontal and vertical busbar system. Internal separation sheets are dividing the busbar zone from the equipment and cable zone and are protecting the operator against accidental-contact with hazardous life parts.

Equipment zone

The standard equipment zone, is separated from the cable zone by means of the individual sides of the module installed. Additional separation sheets can be provided to segregate the equipment zone from the cable zone in the event of uninstalled modules.

Cable zone

The cable zone is designed for fast and comfortable cabling.

General characteristics

Overview

Introduction

This section discusses briefly the main segments of the column and the main segments of the modules.

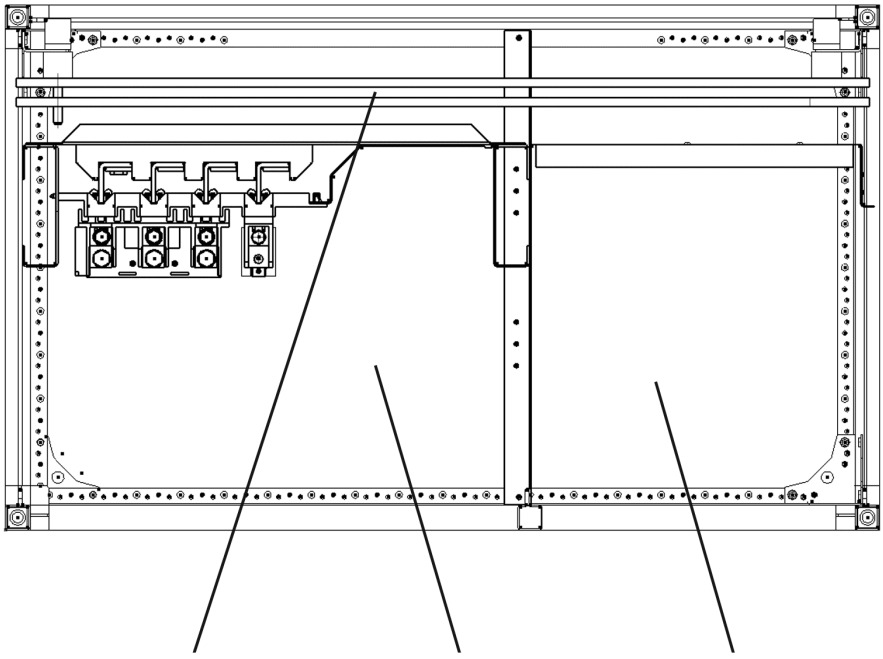
Contents

This document contains the following topics.

Functional segments of the column

Principle The column is subdivided in three functional zones.

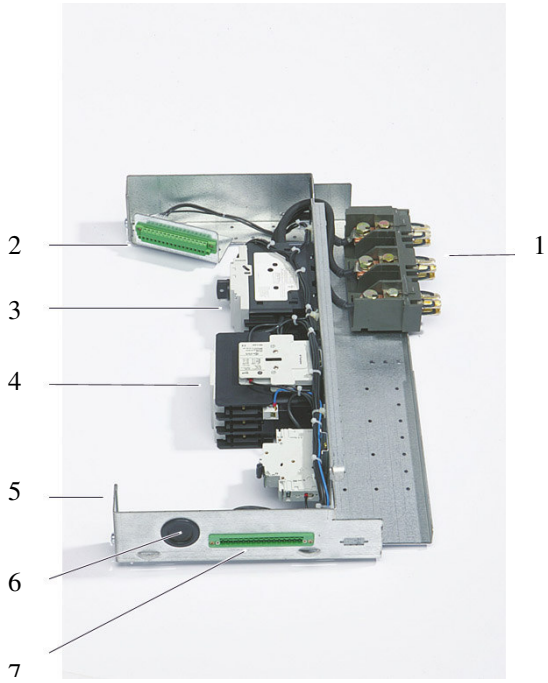
Illustration The following illustration shows the three functional zones of a Control Centre.



Main components of a motor starter application

Illustration

The following illustration shows the main components of the motor starter application.



Components

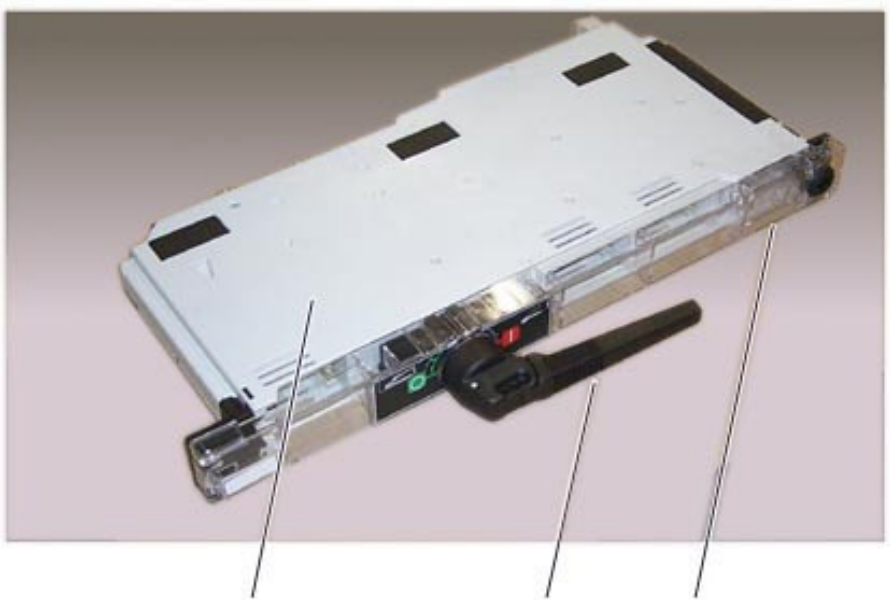
The following table gives an overview of the main components of a motor starter application.

Part	Function
1	Incoming plug (line side)
2	18 pole plug (optional for door-wiring)
3	Main breaker
4	Contactor
5	Frame
6	Cable entry for main outgoing cables
7	16 pole plug (control plug)

Main components of a fused load break switch module

Illustration

The following illustrations show the main components of a load break switch module.



1 2 3

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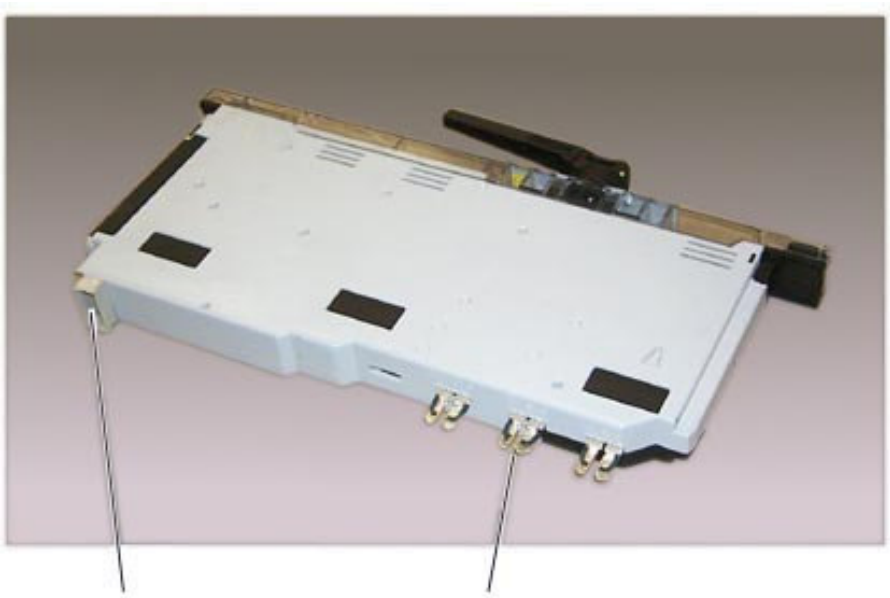
Main components of a fused load break switch module, *Continued*

Illustration ***(continued)***



Components

The following table gives a survey of the main components of a load break switch module.

Part	Function
1	load break switch module
2	Handle
3	Door
4	16 pole plug (option)
5	Incoming stabs

Opening a door

Overview

Introduction This section describes how to open the door of the different modules.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents This document contains the following topics.

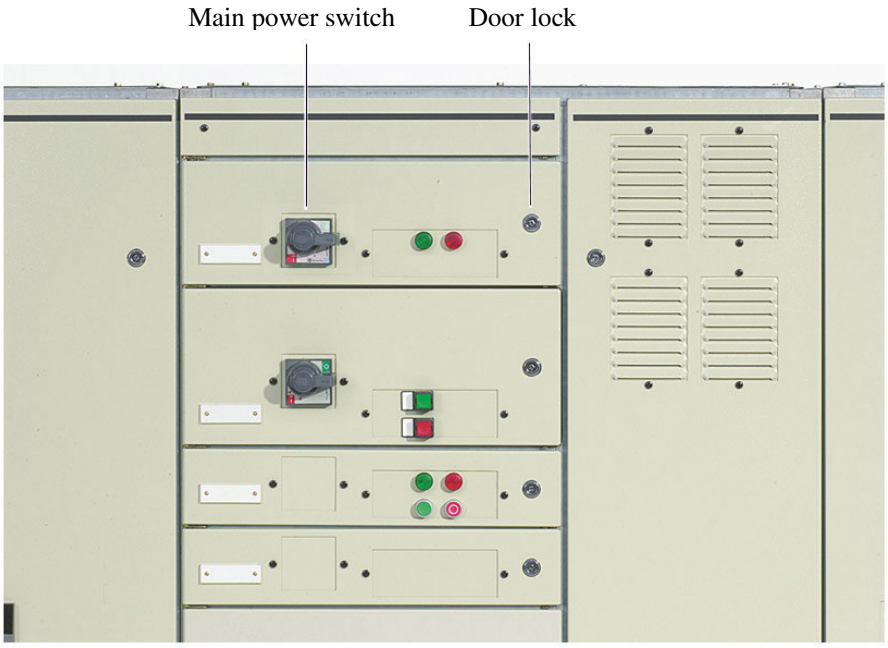
Opening the door of a module

Principle

The door of a module which is provided with a main power switch can only be opened if the main power switch is turned off.

Illustration

The following illustration shows the main power switch and door lock.



Procedure

The following procedure describes the opening of the door.

Step	Action
1	Turn off the module's main power switch (if provided).
2	Unlock the door lock of the module.
3	Open the door.

Opening the door of a load break switch module

Principle

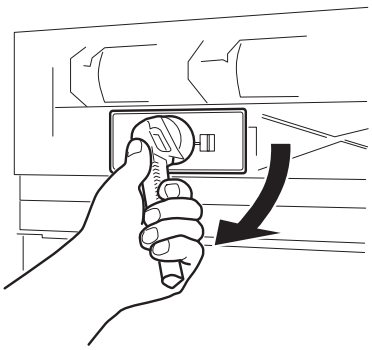
The door is locked by means of the main power switch and a door lock.

Illustration

The following illustration shows the switches for opening the door.

Procedure

The following procedure describes the opening of the door.

Step	Action	Illustration
1	Turn off the main power switch of the afected module.	_
2	Open the double-bearded lock(s).	_
3	Simultaneously pull and turn the main power switch.	
4	Open the door.	_

Inserting/removing a module

Overview

Introduction

This section describes how to insert and remove the modules.

Warning!

The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents

This document contains the following topics.

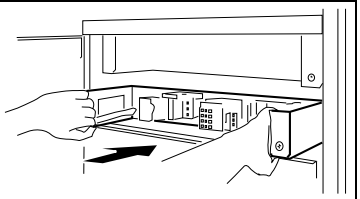
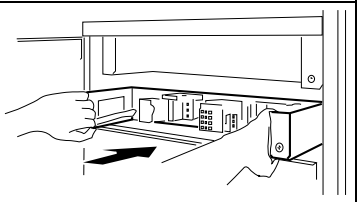
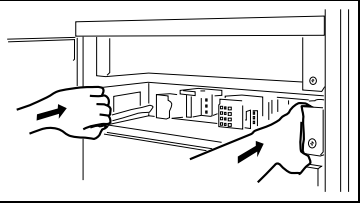
Inserting a module

Principle

A module can easily be inserted or removed in order to be repaired or replaced by another type.

Procedure

The following procedure describes how to insert a module.

Step	Action	Illustration
1	Slide the module above the bottom plate into the column.	
2	Push the module completely into the compartment.	
3	Make sure that the module is positioned in its furthermost backward position.	

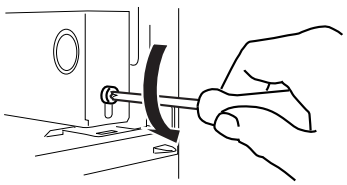
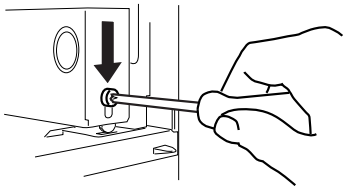
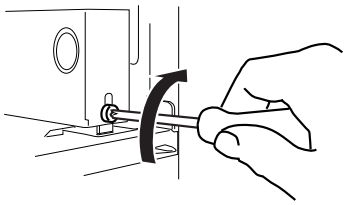
Locking the module in the compartment

Principle

The module is locked on both sides by two tongues through the bottom plate and the guides.

Procedure

The following procedure describes how to lock a module in a column compartment.

Step	Action	Illustration
1	Loosen the screws on the module.	
2	Slide the screws completely down so that the tongues are positioned through the cut-out.	
3	Tighten the screws again.	

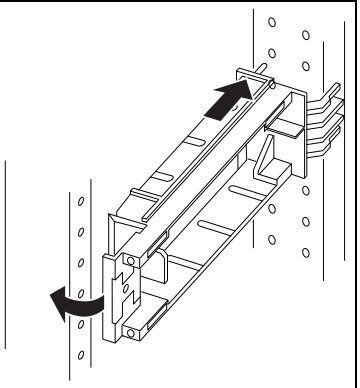
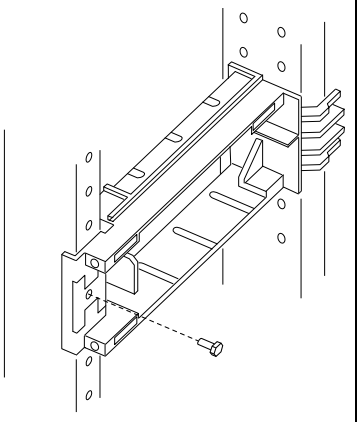
Inserting a load break switch module

Principle

The load break switch modules can easily be inserted or removed in order to be repaired or replaced by another type.

Procedure

The following procedure describes how to insert a load break switch module.

Step	Action	Illustration
1	Mount the connector guide. Note: 1) Make sure that the pins are in the vertical frame part. 2) Make sure that the spacer is between the profile and the connector.	
2	Fix the connector guide.	
3	Repeat step one and two for installing the guide on the opposite site.	_

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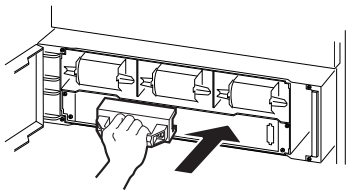
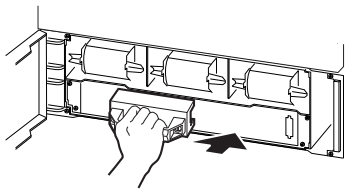
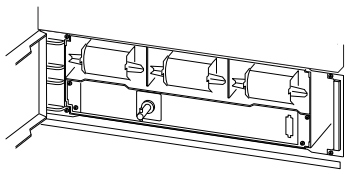
Inserting a load break switch module, *Continued*

Procedure
(continued)

Step	Action	Illustration
4	Slide the module into the column.	
5	Push the module completely into the column.	
6	Make sure that the module is positioned in its furthermost backward position.	

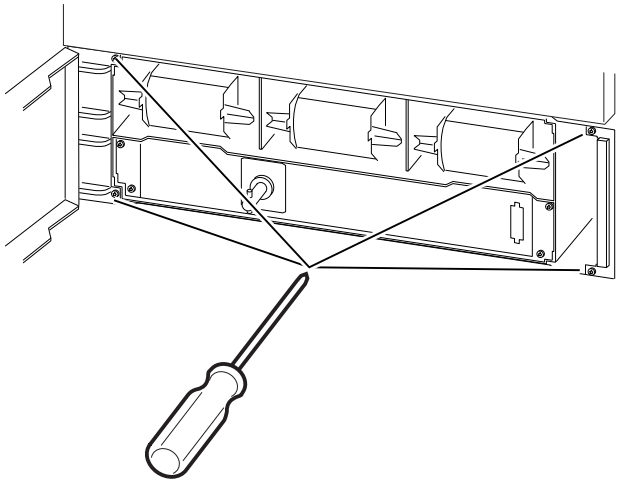
Locking the load break switch module in the compartment

Principle

The module is locked on both sides by four locking bolts.

Illustration

The following illustration shows the position of the four locking bolts.



Removing a module

Principle

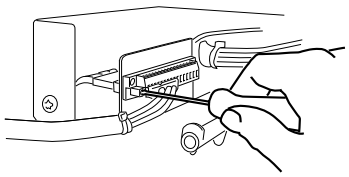
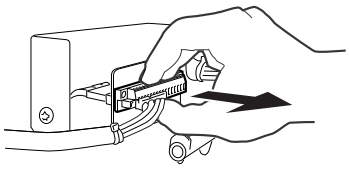
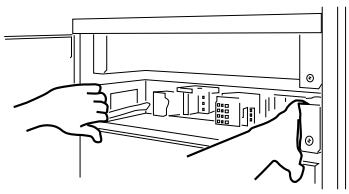
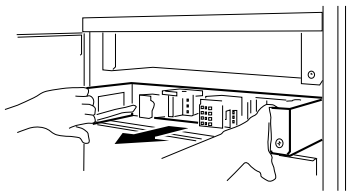
A module can easily be removed in order to be repaired or replaced by another type.

Attention

Always disconnect the power before disconnecting power supply cables.

Procedure

The following procedure describes how to remove a module from a column compartment.

Step	Action	Illustration
1	Open the door.	See “Opening the door of a module”
2	Loosen the mounting screws of the 18 pole plug for door wiring and the 16 pole “side” plug.	
3	Disconnect the plugs.	
4	Disconnect the main cables from the module.	See “Connecting the main cables”
5	Loosen the modules mounting screws.	See “Removing the bottom plate ”
6	Take the module by the front plates.	
7	Pull the module out of the column.	

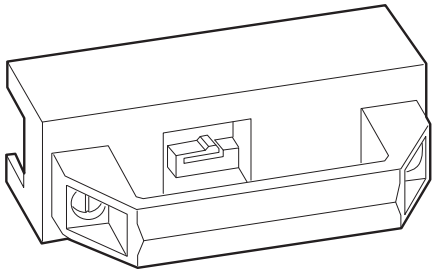
Removing a load break switch module

Principle

The motor load break switch module can easily be removed in order to be replaced.

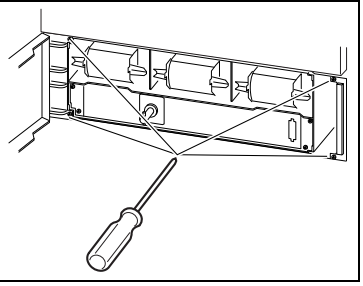
Special tool

The following illustration shows the special tool required for pulling out the module.



Procedure

The following procedure describes how to remove a load break switch module from a column compartment.

Step	Action	Illustration
1	Open the door.	See “Opening the door of a load break switch module”
2	Disconnect the power supply from the module.	_
3	Screw the four mounting screws loose.	

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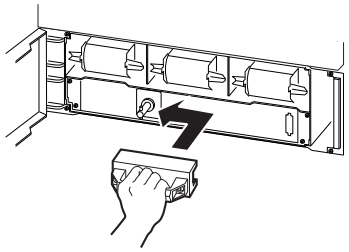
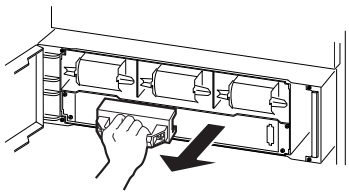
Removing a load break switch module, *Continued*

Procedure
(continued)

Step	Action	Illustration
3	Shove the special extraction tool over the pin of the door switch.	
4	Pull the module out of the column.	

Connecting a module

Overview

Introduction This section describes how to connect the modules.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents This document contains the following topics.

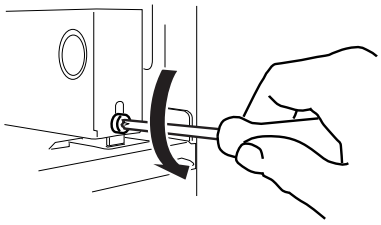
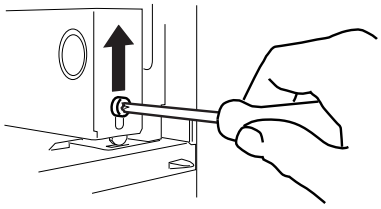
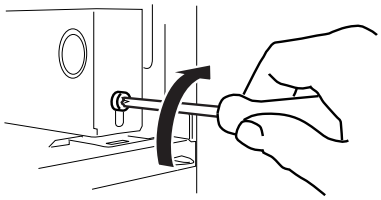
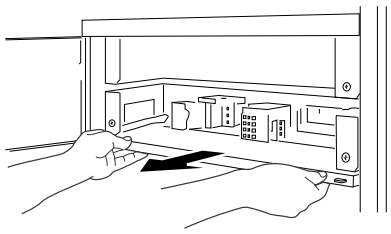
Removing the bottom plate (for small modules)

Principle

The module must be unlocked from the bottom plate in order to remove the plate.

Procedure

The following procedure describes how to remove the bottom plate.

Step	Action	Illustration
1	Loosen the modules mounting screw.	
2	Slide the screw upwards.	
3	Tighten the screw.	
4	Repeat step 1 to 3 for the other screw.	_
5	Extract the bottom plate.	

Connecting the main cables

General rule

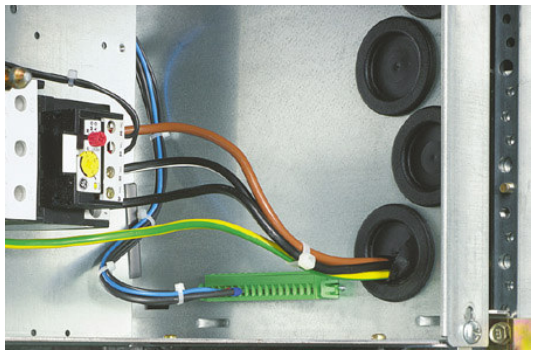
The main cables are connected directly to the electrical component.

Remark

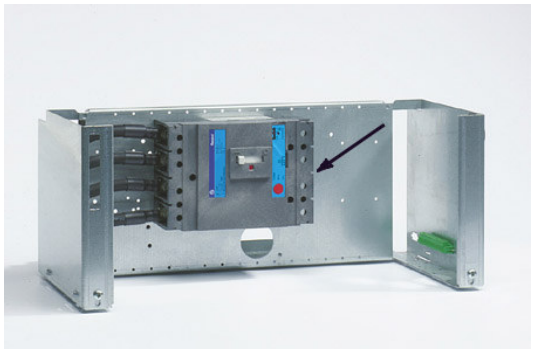
The connection of external cables is easier when the bottom plate is removed.

Example

- The main cables must be connected to the last electrical component for a motor starter application.



- The main cables must be connected directly to the circuit breaker (place indicated by the arrow) for a feeder application.



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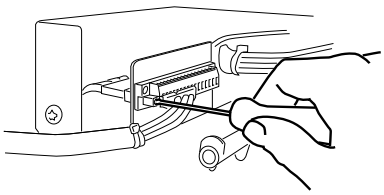
Connecting the auxiliary cables

General rule

The auxiliary cables are connected by means of a 16 pole plug at the side of the module (see “main components of a module”). The plug-in is secured by means of two bolts.

Illustration

The following illustration shows the securing of the plug-in.



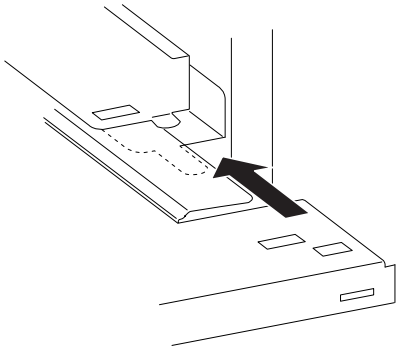
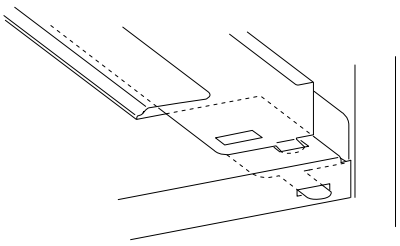
Inserting the bottom plate

Principle

Always insert the bottom plate to make a separation between the different modules.

Procedure

The following procedure describes how to insert the bottom plate.

Step	Action	Illustration
1	Slide the plate into the column in such a way that the borders of the plate are between the guides of the column.	
2	Push the plate forward between the conduits until the tongues are through the cut-outs.	
3	Make sure that the plate is positioned in its furthermost backward position.	_

Replacing a compartment door

Overview

Introduction

This section describes how to replace a compartment door.

Warning!

The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents

This document contains the following topics.

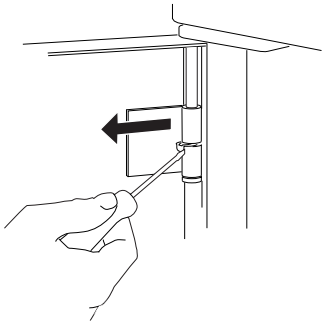
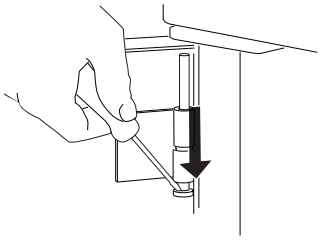
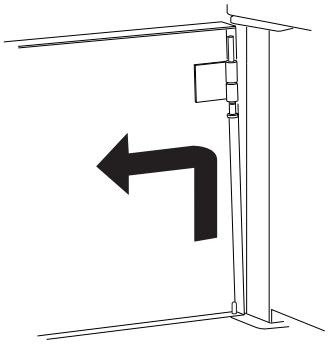
Replacing a compartment door

Principle

A compartment door can easily be replaced by another.

Procedure

The following procedure describes how to replace a compartment door.

Step	Action	Illustration
1	Open the door.	See “Opening the door of a module”
2	Disconnect the plug-in module.	See “Disconnecting cables from the compartment door”
3	Remove the circlips.	
4	Pull out the pin.	
5	Unhitch the compartment door.	
6	Mount the new compartment door.	See “Mounting a compartment door”

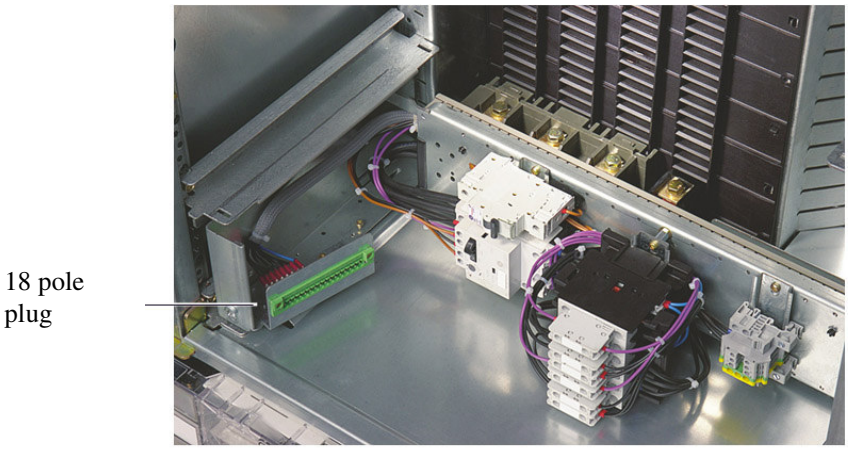
Disconnecting cables from the compartment door

Principle

The cables from the compartment door (for indicator lamps, controls, etc.) are connected with the module by means of a 18 pole plug.

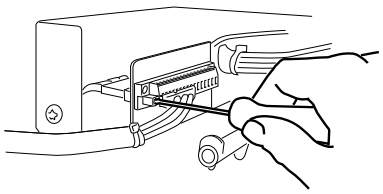
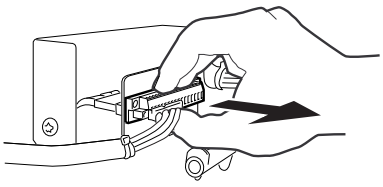
Illustration

The following illustration is showing the position of the plug.



Procedure

The following procedure describes how to disconnect the plug.

Step	Action	Illustration
1	Loosen the 2 tightening screws from the 18 pole.	
2	Pull out the plug from the socket.	

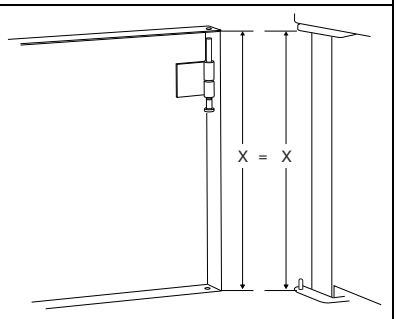
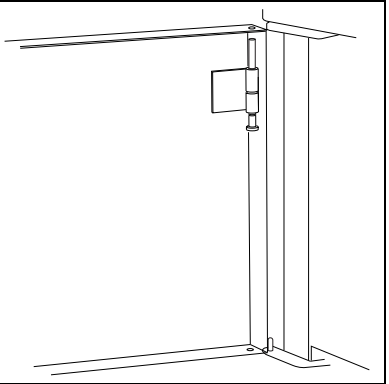
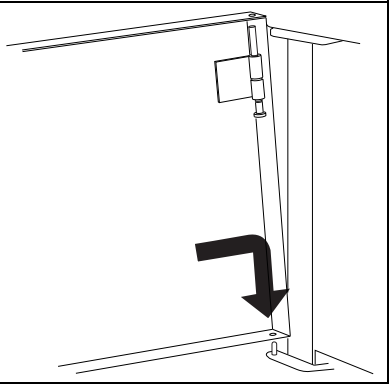
Mounting a compartment door

Principle

The different types of doors can easily be installed on the column.

Procedure

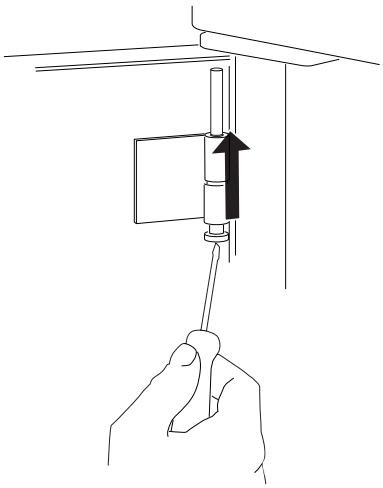
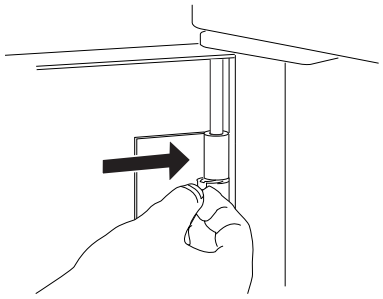
The following procedure describes the mounting of a compartment door.

Step	Action	Illustration
1	Are the hinge brackets correctly positioned according to the height of the door? • When yes, go to step 3. • When no, go to step 2.	
2	Reposition or mount a hinge bracket so that the door can be positioned between the two brackets.	
3	Mount the door over the pin of the bottom bracket.	

Continued on next page

Mounting a compartment door, *Continued*

Procedure
(continued)

Step	Action	Illustration
4	Shove the pin in the upper hinge.	
5	Mount the circlips.	

Removing the IP20 shroud from the vertical busbar

Overview

Introduction This section describes how to remove the protective IP20 shroud from the busbar.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts (busbars in the back!). Before carrying out any adjustments switch off the voltage.

Contents This document contains the following topics.

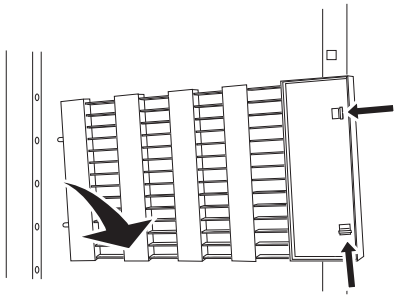
Removing the IP20 shroud from the vertical busbar

Principle

The vertical busbars is protected against direct contact by means of a IP20 shroud. If necessary (e.g. for maintenance) the shrouds can be removed as described below.

Procedure

The following procedure describes how to remove the IP20 shroud.

Step	Action	Illustration
1	Unlock the 2 latching tongues from the frame while pulling the shroud from the busbars.	

Change module arrangement

Overview

Introduction

Modules can have different sizes. The column arrangement can easily be adjusted for installing another size.

Warning!

The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents

This document contains the following topics.

Example: replacing 2 modules size 5E by 1 module size 10E

Principle

The compartment of a module can easily be adjusted to contain a module of another size.

Procedure

The following procedure describes how to replace 2 modules size 5E by 1 module size 10E.

Step	Action	Instruction
1	Open the door of the 2 modules size 5E.	"Opening the door of a module"
2	Remove the bottom plate of the upper module.	"Removing the bottom plate "
3	Disconnect the cables from the compartment door. Attention: If the 16 pole plug is used this one must also be disconnected.	"Disconnecting cables from the compartment door"
4	Disconnect the main and auxiliary cables.	_
5	Remove the 2 modules size 5E.	"Removing a module"
6	Remove the 2 guiders of the upper module size 5E.	
7	Replace the doors by the door of a 10E module.	"Replacing a compartment door"
8	Insert the 10E module.	"Inserting a module"
9	Connect the 10E module.	"Connecting a module"

Control Centre with withdrawable modules

Overview

Introduction This chapter discusses the Motor Control Centre and its correct use.

Contents This document contains the following topics.

Introduction

Overview

Introduction This chapter discusses briefly the general principle of the Motor Control Centre.

Contents This document contains the following topics.

Introduction

Principle

The Motor Control Centre is subdivided in three functional zones:

- Busbar zone
- Equipment zone
- Cable zone

Busbar zone

The busbar zone is located at the rear of the column and contains the main horizontal and vertical busbar system. Internal separation sheets are dividing the busbar zone from the equipment and cable zone and are protecting the operator against accidental-contact with hazardous parts.

Equipment zone

The standard equipment zone, is separated from the cable zone by means of vertical separation sheets. Additional covers can be provided to close the contact holes of the auxiliary control terminal in the separation sheet in the event of uninstalled modules.

Cable zone

The cable zone is designed for fast and comfortable cabling.

General characteristics

Overview

Introduction

This section discusses briefly the main segments of the column and the main segments of the modules.

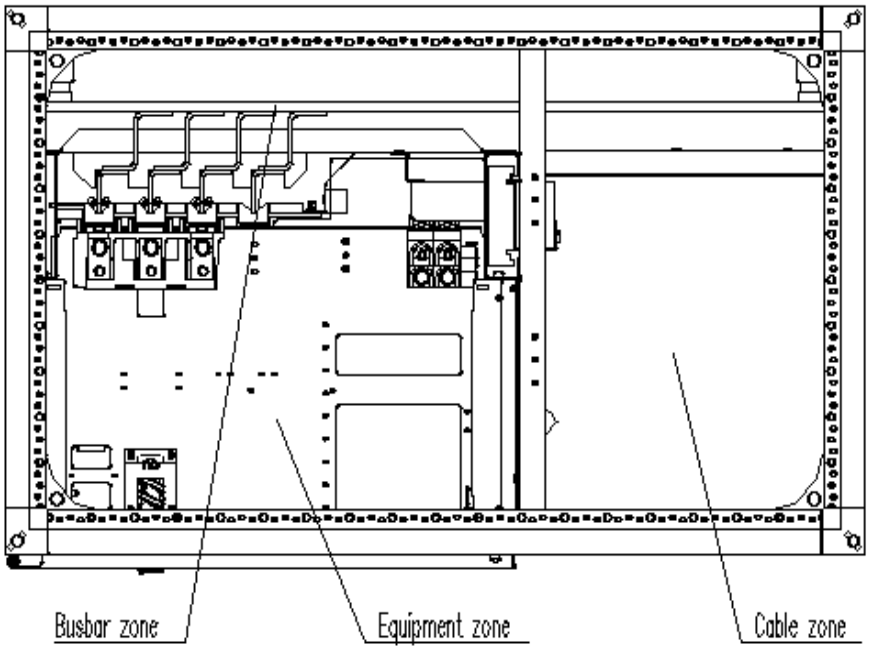
Contents

This document contains the following topics.

Functional segments of the column

Principle The column is subdivided in three functional zones.

Illustration The following illustration shows the three functional zones of a Control Centre.



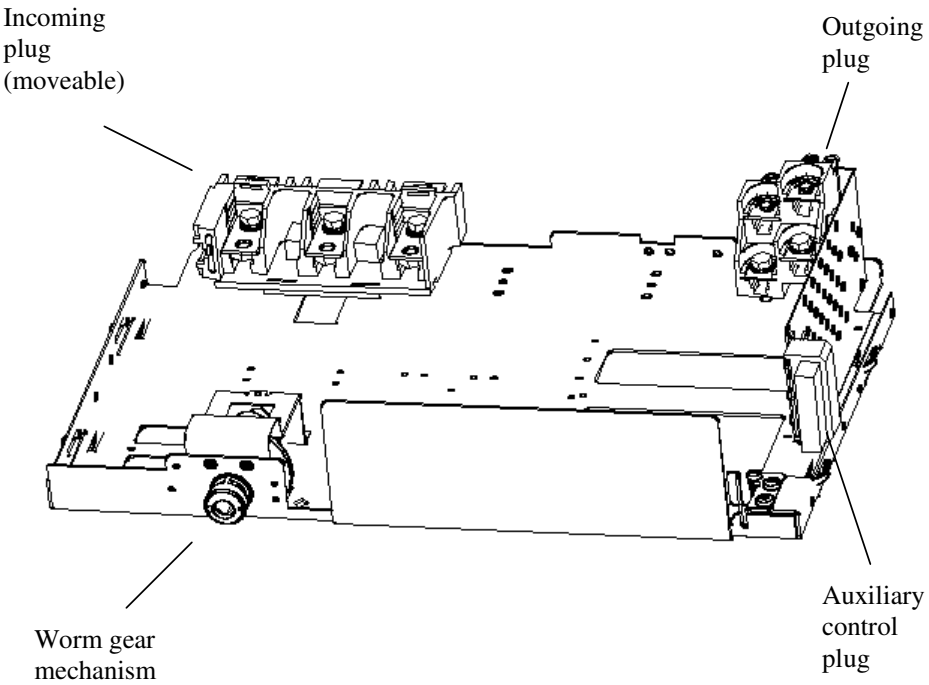
Functional parts of the module.

Principle The withdrawable modules have incoming, outgoing and control terminals. The incoming terminal is movable respect the base of the module. The outgoing and control terminals are fixed to the module. The instrument plate is fixed to the tray.

Notice The operations on the worm gear mechanism are only allowed with closed doors.

Functional segments of the column, *continued*

Ilustration



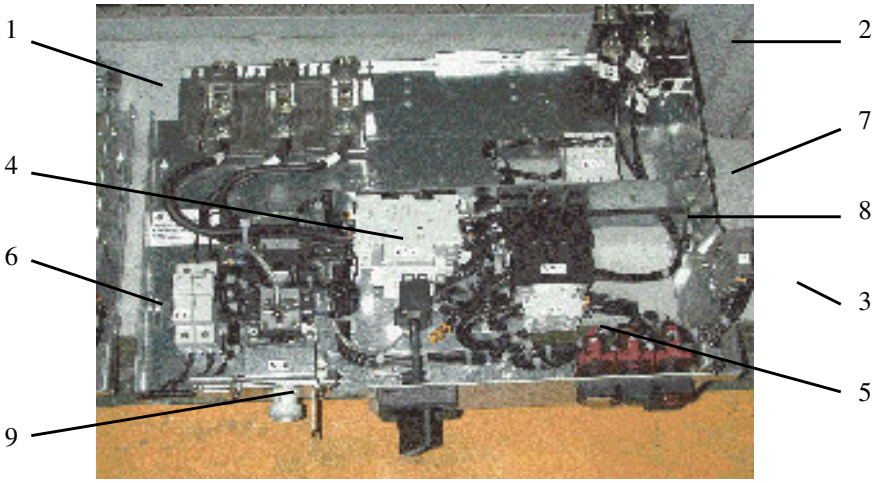
Plugs types.

Principle	The Motor Control Centre has three kinds of plugs: • Incoming plug • Outgoing plug • Auxiliary control plug
Incoming plug	The incoming plug is located at the rear left side of the module and allows the connection of the main circuit of the tray to vertical busbars.
Outgoing plug	The outgoing plug is located at the rear right side of the module and allows the connection of the main circuit of the module to the outgoing plug in the column. The terminals for cable connection are located in rear of the cable compartment.
Auxiliary control plug	The auxiliary control plug is located at the right side of the module and allows the connection to the female (in the column). The standard plug has 24 pins. An additional 24-pin auxiliary control plug can be provided if a higher number of pins is required.

Main components of a motor starter application

Illustration

The following illustration shows the main components of the motor starter application.



Components

The following table gives an overview of the main components of a motor starter application.

Part	Function
1	Incoming plug
2	Outgoing plug
3	24 pole aux. control plug
4	Main breaker
5	Contactor
6	Base plate
7	Side walls
8	Mounting plate
9	Worm gear mechanism

Worm gear mechanism operation.
Overview

Introduction

This section discusses briefly the function of the worm gear mechanism and the terminals positions.

Contents

This document contains the following topics.

Operating the worm gear.

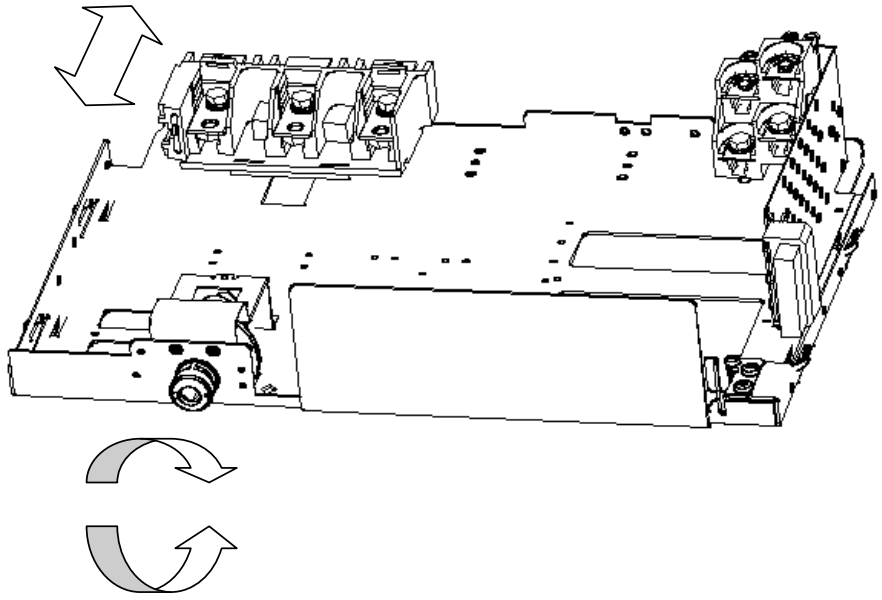
Principle

The mechanism to remove the incoming plug is a worm gear which moves a slide fixed to the incoming terminal. The movement of the worm gear provokes the movement of the incoming terminal respect the tray base, connect or disconnect the incoming plug from the vertical busbar.

To move the worm gear, one external “T” tool is required. The access to the worm gear is protected by a cover, which can be locked with up to 3 padlocks.

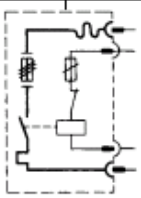
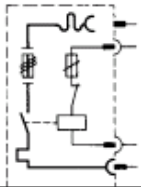
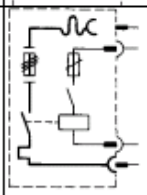
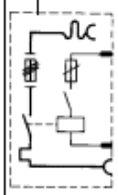
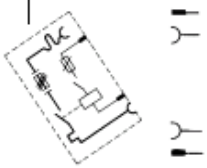
Illustration

The following illustration shows how to operate the worm gear..



Operating positions of the withdrawable module

Illustration The following illustration shows the different positions of the module respect to the column and terminals positions.

Designation of positions	Position indication	Plug-in contact Main incoming	outgoing	control	Interlocking switch of the wormgear	Insert and switch position: mech. separated	mech. connected with the cubicle withdrawn, mech. interlocked: inserted
Connected (operating position)		ON	ON	ON	ON		
Test position		OFF	ON	ON	ON		
Standby position		OFF	ON	ON	OFF		
Disconnected (isolated position)		OFF	OFF	OFF	OFF		
Removed position		OFF	OFF	OFF	OFF		

Opening a door

Overview

Introduction This section describes how to open the door of the different modules.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents This document contains the following topics.

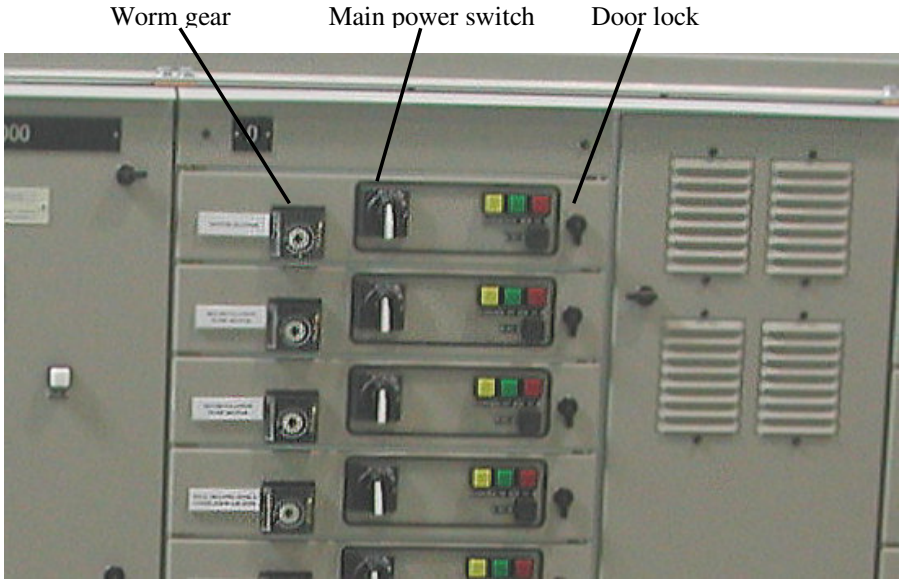
Opening the door of a module

Principle

The door of a module that is provided with a main power switch can only be opened if the main power switch is turned off and the worm gear is in off position.

Illustration

The following illustration shows the main power switch and door lock.



Procedure

The following procedure describes the opening of the door.

Step	Action
1	Turn off the module's main power switch.
2	Remove the padlock from the worm gear cover (if provided).
3	Using the T-tool turn the worm gear to the OFF position.
4	Unlock the door lock of the module.
5	Open the door.

Inserting/removing a module

Overview

Introduction This section describes how to insert and remove the modules.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents This document contains the following topics.

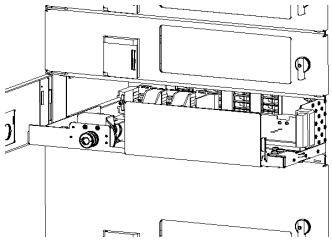
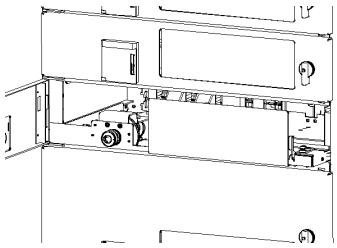
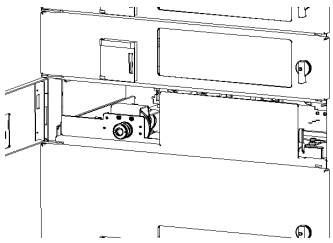
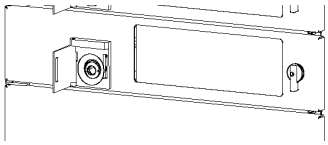
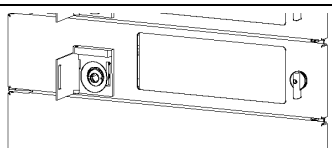
Inserting a module

Principle

A module can easily be inserted or removed in order to be repaired or replaced by another type.

Procedure

The following procedure describes how to insert a module.

Step	Action	Illustration
1	Slide the module above the bottom plate into the column.	
2	Push the module completely into the compartment.	
3	Make sure that the module is positioned in its furthermost backward position (latch on the right hand side of the tray should be parallel to the instrument plate) - see next chapter	
4	Close the door.	See chapter “opening a door”
5	Open the plastic cover of the module interlock and insert the “T” tool into the worm gear.	
6	Turn the “T” tool clockwise until the ON position.	
7	Close the plastic cover.	- See chapter “opening a door”
8	Close the padlock (if provided)	- See chapter “opening a door”

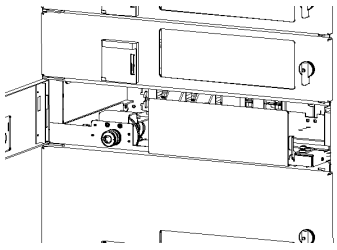
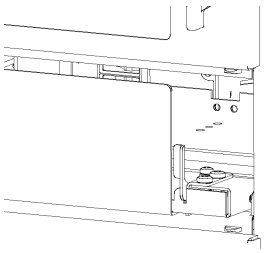
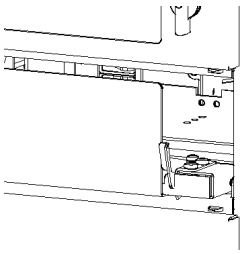
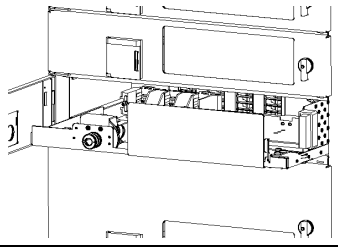
Locking/Unlocking the module in the compartment

Principle

The module is locked on one side by one latch through the bottom plate.

Procedure

The following procedure describes how to lock and unlock a module in a column compartment.

Step	Action	Illustration
1	Slide the module slowly above the bottom plate into the column until it reaches the furthermost backward position - the latch on the right hand side of the module snaps into the second cut-out of the bottom plate – the module is in ***standby position***.	
2	Make sure that the module is positioned in its furthermost backward position - the latch that is situated at the right hand side of the tray should be parallel to the instrument plate.	
3	To move the module to ***disconnected (isolated)*** position pull the latch towards yourself and pull the module towards yourself until the latch snaps into the first cut-out of bottom plate.	
4	To remove the module out of the column pull the latch toward yourself and then pull toward yourself until the module is drawn out of column.	

Removing a module

Principle

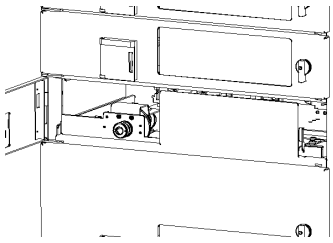
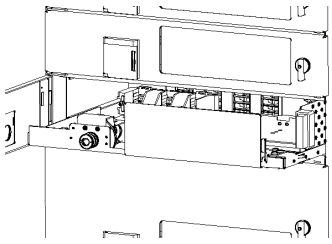
A module can easily be removed in order to be repaired or replaced by another type.

Attention

Before opening doors assure that the worm gear is in OFF position.

Procedure

The following procedure describes how to remove a module from a column compartment.

Step	Action	Illustration
1	Unlock padlock (if accessible).	See chapter “opening a door”
2	Insert the “T” tool to worm gear and turn to the OFF position. Afterwards take out the tool.	See “Mechanism position”
3	Open the door.	See “Opening the door of a module”
4	Take the module by left hand at the left of the worm gear, and the right hand in the blocking part.	
5	Pull the module out of the column.	

Connecting a module

Overview

Introduction This section describes how to connect the modules.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents This document contains the following topics.

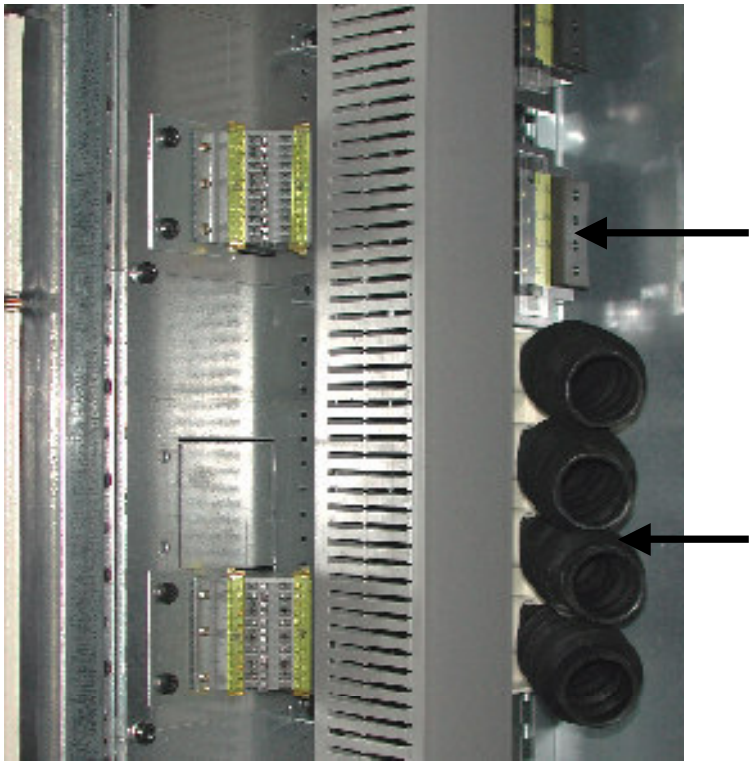
Connecting the main cables

General rule

The main cables are not connected directly to the electrical component. The connection is made to the outgoing terminals mounted in the cable compartment.

Example

- The main cables must be connected to the outgoing terminals situated in the rear left side of the cable zone (place indicated by the arrow).



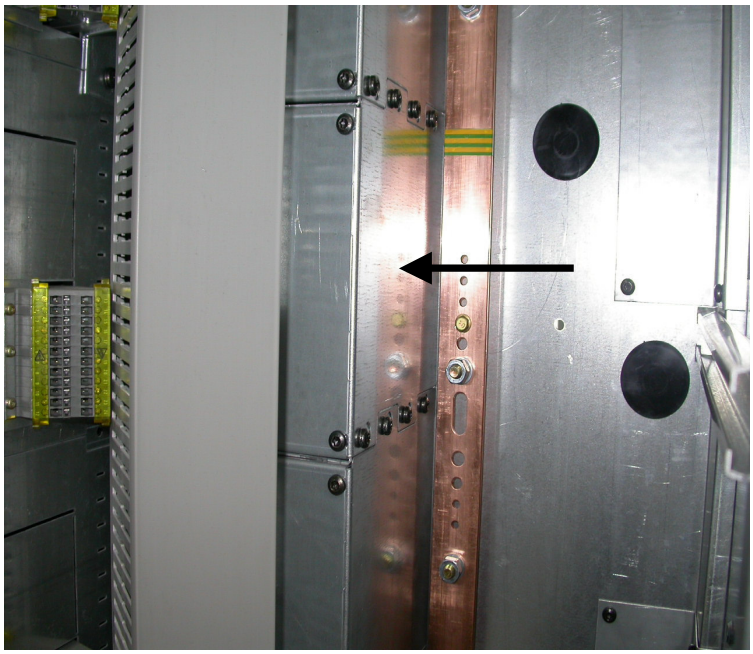
Connecting the main cables in cubicles with separation form 4b type 7

General rule

The connection of the main cables of each functional unit is made to the outgoing terminals mounted in the cable compartment that are additionally separated from other cable connections by rigid barriers out of sheet-metal.

Example

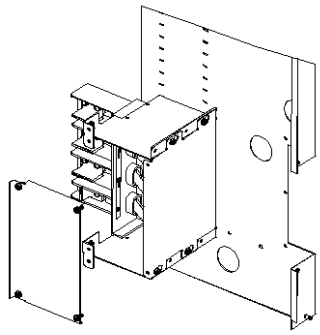
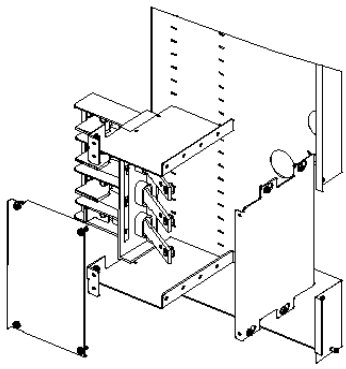
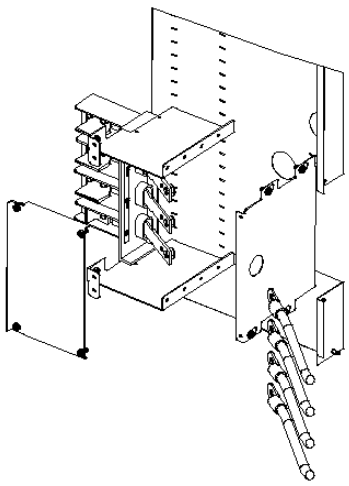
- The main cables must be connected to the outgoing terminals situated in the rear left side of the cable zone (place indicated by the arrow) through the cut-outs in the metal barriers.



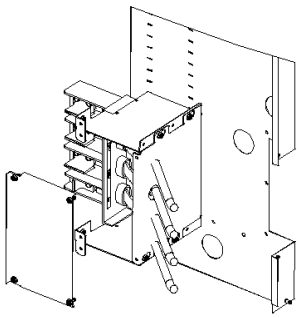
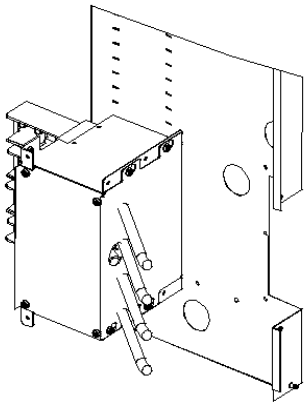
Connecting the main cables in cubicles with separation form 4b type 7, *Continued*

Procedure

The following procedure describes how to connect the cables in cubicles with separation form 4b type 7.

Step	Action	Illustration
1	Unscrew the bolts on one side cover of the separation box .	
2	Unscrew the bolts on the second side cover of the separation box.	
3	Make a hole (holes) in a side separation cover, and pull through the cable (cables).	

Connecting the main cables in cubicles with separation form 4b type 7, *Continued*

Step	Action	Illustration
4	Connect the cables to the clamps of the outgoing terminal and screw the side cover to the construction.	
5	Screw the second side cover of the separation box	
6	Repeat steps 1-5 to the other separation boxes.	-

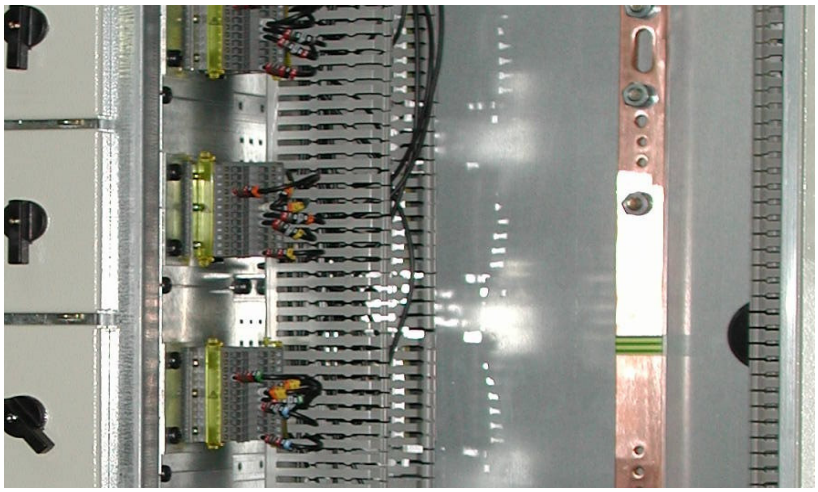
Connecting the control cables

General rule

The control cables are connected by means of a 24-pole plug mounted at the side of the module (see ”main components of the module”) and the 24-pole socket mounted in the vertical separation.

Illustration

The following illustration shows the cable connection to the auxiliary control terminal.



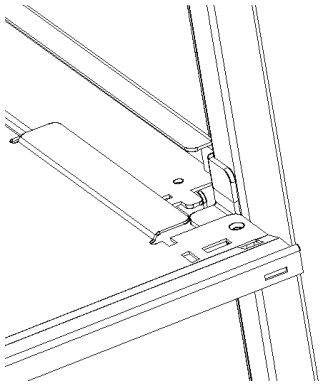
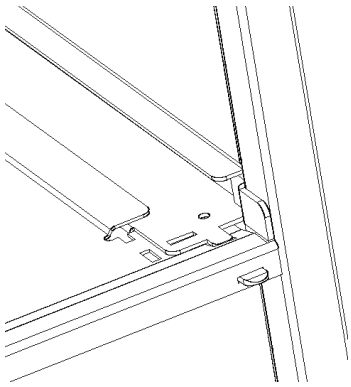
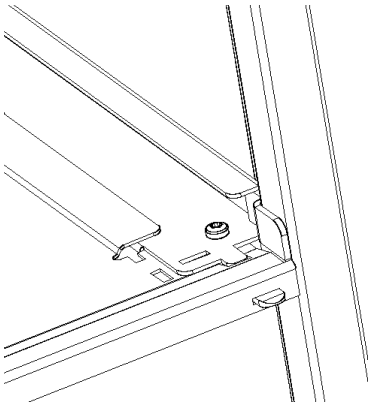
Inserting the bottom plate

Principle

Always insert the bottom plate to make a separation between the different modules.

Procedure

The following procedure describes how to insert the bottom plate.

Step	Action	Illustration
1	Slide the plate into the column in such a way that the borders of the plate are between the guides of the column.	
2	Push the plate forward between the conduits until the tongues are through the cutouts.	
3	Make sure that the plate is positioned in its furthermost backward position and screw it with the guides.	

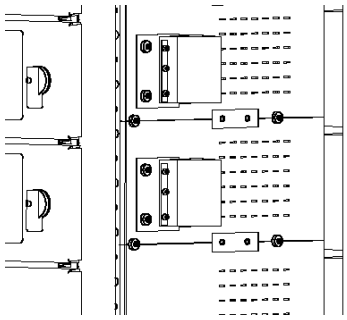
Removing 24-pole auxiliary control plug.

Principle

The 24-pole plug can be removed if the relevant module is removed and all the control cables are disconnected.

Procedure

The following procedure describes how to remove the 24-pole aux. control plug.

Step	Action	Illustration
1	Remove the relevant module.	See “Removing a module”
2	Open the cable compartment door.	-
2	Disconnect the control cables.	See “Connecting the control cables”
3	Screw the two mounting screws loose.	

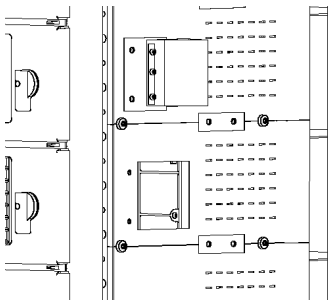
Removing the vertical separation between the cable and equipment compartment.

Principle

The vertical separation between the cable compartment and the equipment compartment is required to achieve the degree of protection of IP 2X.

Procedure

The following procedure describes how to remove the vertical separation.

Step	Action	Illustration
1	Open the cable compartment door.	-
2	Remove the 24 pole aux. control plug	See “Removing the 24 pole aux. control plug”
3	Screw the four mounting screws loose.	

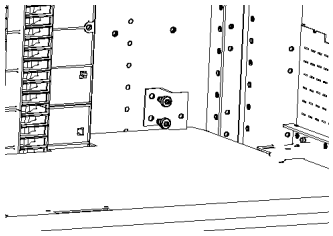
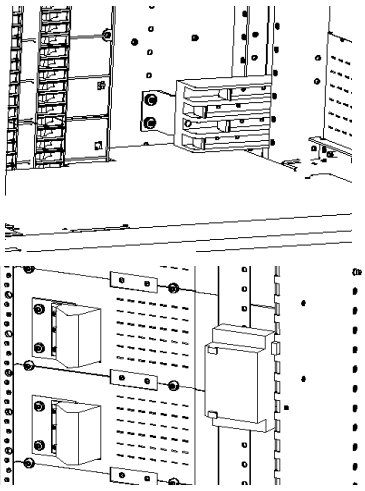
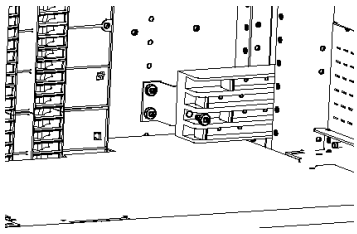
Mounting the outgoing plug in the column.

Principle

The outgoing plug in cable compartment can be easily inserted or removed in order to be repaired or replaced by another type..

Procedure

The following procedure describes how to mount the outgoing plug.

Step	Action	Illustration
1	Mount the support for the outgoing plug.	
2	Mount the outgoing plug. Note: Make sure that the pins are in the vertical part frame.	
3	Fix the outgoing plug.	

Change module arrangement

Overview

Introduction

Modules can have different sizes. The column arrangement can easily be adjusted for installing another size.

Warning!

The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts. Before carrying out any adjustments, maintenance or repair, switch off the voltage of the affected module(s).

Contents

This document contains the following topics.

Example: replacing 2 modules size 5E by 1 module size 10E

Principle

The compartment of a module can easily be adjusted to contain a module of another size.

Procedure

The following procedure describes how to replace 2 modules size 5E by 1 module size 10E.

Step	Action	Instruction
1	Open the door of the 2 modules size 5E.	See “Opening the door of a module”
2	Remove the 2 modules size 5E.	See “Removing a module”
3	Remove the bottom plate of the upper module.	See “Removing the bottom plate ”
4	Open the cable compartment door.	-
5	Disconnect the main and control cables.	See “Connecting control cables “ and “Connecting the main cables”
6	Remove the auxiliary control plug.	See “Removing the 24-pole aux. control plug “
7	Remove the cable chanel support (if necessary)	-
8	Remove the vertical separation sheet.	See “Removing the vertical separation between the cable and equipment compartment”
9	Remove the upper module guides.	-
10	Remove the outgoing plug of upper module.	See “Mounting outgoing plug in the column”
11	Cover the opening above the outgoing plug with a plastic cover.	-
12	Replace the vertical separation sheet by the vertical separation of a 10 E module.	See “Removing the vertical separation between the cable and equipment compartment”
13	Mount the auxiliary control plug.	
14	Replace the doors 5E by the door of a 10E module.	See “Replacing a compartment door”
15	Insert the 10E module.	See “Inserting a module”
16	Connect the 10E module.	See “Connecting a module”

Power Centre

Overview

Introduction This chapter discusses the general characteristics of the Control Centre.

Contents This document contains the following topics.

Introduction

Overview

Introduction This chapter discusses briefly the general principle of the Power Centre.

Contents This document contains the following topics.

Introduction

Principle

The Power Centre is subdivided in three functional zones:

- Busbar zone
- Equipment zone
- Cable zone

Busbar zone

The busbar zone is located at the rear of the column and contains the main horizontal and vertical busbar system. Internal separation sheets divide the busbar zone from the equipment zone and protect the operator against accidental contact with hazardous live parts. Additional separation sheets can be provided to segregate the equipment zone from the cable zone.

Cable zone

The cable zone is designed for fast and comfortable cabling.

General characteristics

Overview

Introduction This section discusses briefly the main segments of the column.

Contents This document contains the following topics.

Functional segments of the column

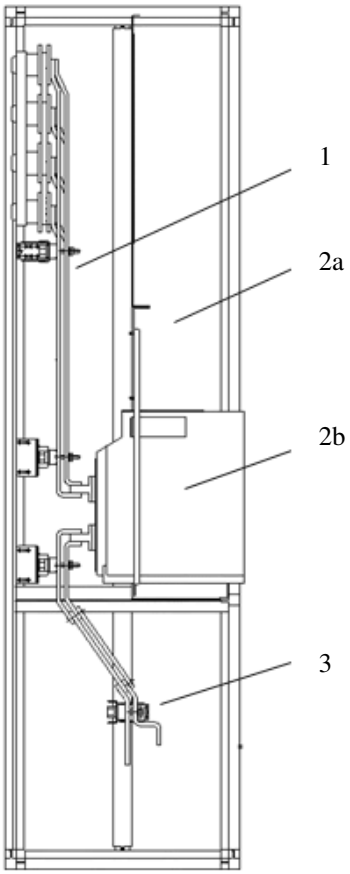
Principle

The column is subdivided in three functional zones.

Illustration

The following illustrations show the three functional zones of a Power Centre:

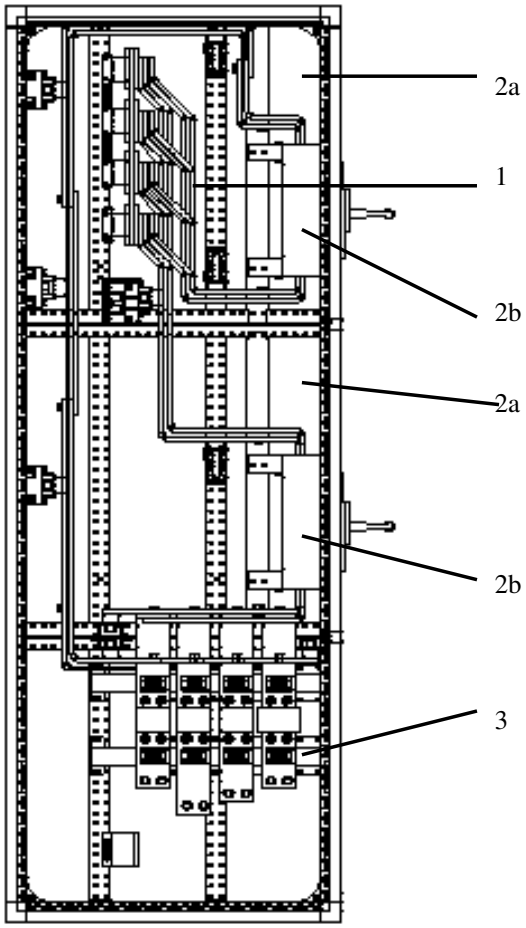
- the incomer with air circuit breaker type M-Pact,



Continued on next page

Functional segments of the column, *Continued*

Illustration - the outgoing feeder with moulded case circuit breakers type Record Plus.



Continued on next page

Functional segments of the column, *Continued*

Components

The following table gives an overview survey of the main components of a Power Centre.

Part	Function
1	Busbar zone
2a	Equipment zone
2b	Equipment zone
3	Cable zone

Installation of a column

Overview

Introduction This section describes the correct handling of columns.

Warning! The operator must apply all relevant safety precautions including those mentioned in this book. Take all precautions to prevent accidental contact with hazardous live parts.

Contents This document contains the following topics.

Storage of columns

Overview

Introduction This section describes the factors that must be taken into account for storing a column.

Contents This document contains the following topics.

Storage of columns

Principle	To protect the column during storing certain factors must be taken into account.
Storing place	The switchboards must be stored in dry, ventilated rooms.
Ambient temperature	-20 °C to +55 °C (short term up to +70 °C, not longer then 24h)
Damaged packaging	Any damaged packaging shall be renewed in order to protect the assembly against harmful pollution during storage.
Relative humidity of the atmosphere	65 % max

Transport of a column

Overview

Introduction This section describes the correct way to transport a column.

Contents This document contains the following topics.

Transport of a column

How to move a section?

A vertical section is be moved in an upright position. The section can hang or stand.

Transport

Use a crane or fork-lift truck for transport.

Limitations

The following table describes the limitations that should be taken into account for transport.

	Max. width	Max. weight
Single switchboards	---	1000 kg
Transport sections of Power Centres with busbar cross-sections 2x100x10 and higher	1,5 m	---
Other transport sections	2 m	2000 kg

Measures for transporting a Control Centre

The following measures must be followed for transporting a Control Centre.

- Modules for motor Control Centres remain inside the column during transport.
- The plug-in modules shall be interlocked (see ”locking the module in the compartment”).
- The withdrawable modules shall be interlocked and the worm gear mechanism should be in ON position (see ”Locking/Unlocking the module in the compartment” and ”Operating positions of the withdrawable module”)

Measures for transporting a Power Centre

The following measures must be followed for transporting a Power Centre with ACB type M-PACT.

- Circuit breaker type M-PACT frame size 1 remains inside the column during transport.
- The withdrawable module shall be in “ON” position.
- Circuit breaker frame size 2 shall be shipped seperately.

Continued on next page

Transport of a column, *Continued*

Preparing for transport

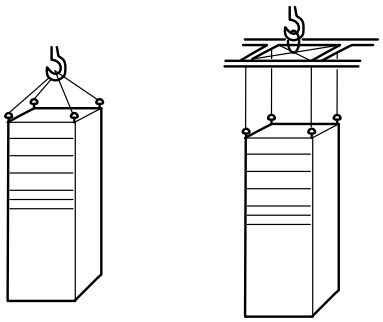
The following table gives an overview of the preparations for transport.

Step	Action
1	<table><tr><th>If the transport is done...</th><th>then...</th></tr><tr><td>with a fork-lift truck,</td><td>the column is bolted on a (wooden) transport pallet.</td></tr><tr><td>with a crane,</td><td>the four lifting latches on top are used with hexagon head bolts M12x45 St 8.8.</td></tr></table>
2	The switchboard is covered on all sides with foil to protect the surface finish against damage.

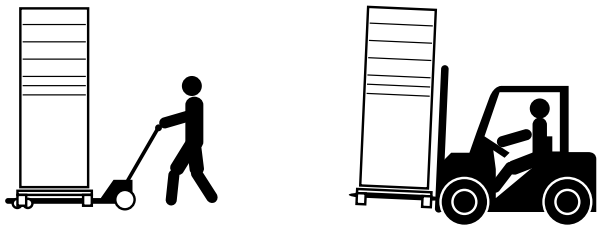
Transporting a column

The following illustrations show the suggested ways to transport a column.

- By crane



- By fork-lift truck



Erecting the column

Overview

Introduction This section describes how to erect a column.

Contents This document contains the following topics.

Erecting a column

Principle

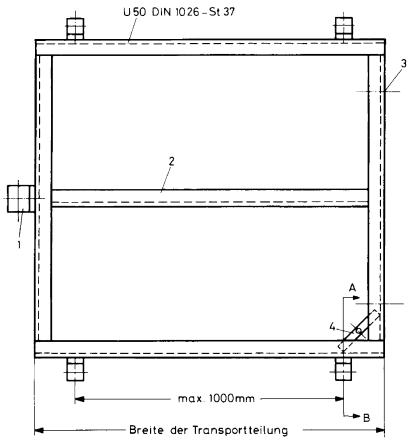
The column is erected on a well-aligned foundation frame or on a false floor construction.

Maximum fall

A maximum fall of 2 mm per m column width is acceptable.

Foundation frame

The following illustration shows the possible components on the foundation frame, depending on the column depth and arrangement.



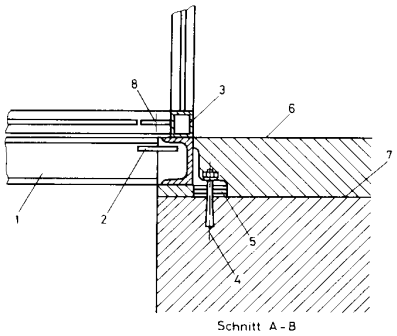
1. Only at the end of the switchboard
2. Only with 600 mm depth columns back-to-back arrangement
3. M10 - screw for a foundation frame
4. Column fish-plate

Continued on next page

Erecting a column, *Continued*

Erecting the column

The following illustration shows the erection scheme with the components for a column.



1. Foundation frame
2. Column fish-plate
3. Column frame
4. Load plug for M10
5. Adjusting plates
6. Top of composition floor
7. Top of concrete
8. Column assembly screw M12x50

Connecting the base frame to the column

Overview

Introduction This section describes the base frame and its correct use.

Contents This document contains the following topics.

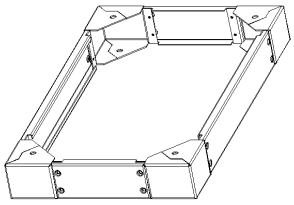
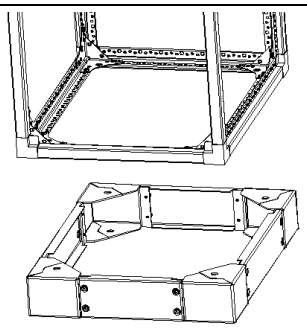
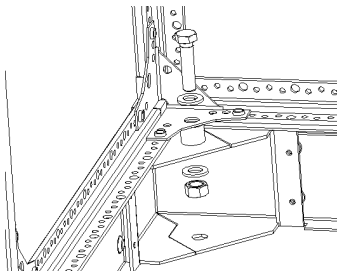
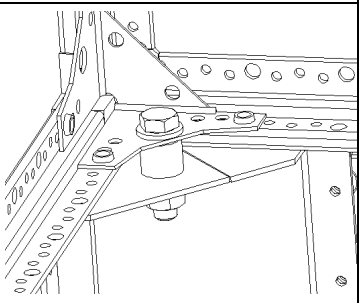
Connecting the baseframe to the column

Principle

A base frame can be added to the column to give more space for the final cabling.

Procedure

The following procedure describes how to connect the base frame to the column.

Step	Action	Illustration
1	Assemble the base frame.	
2	Place the column on the base frame.	
2a	Put a bushing between the base frame and the cubicle frame.	
2b	Make the connection with a hexagonal head screw M 12x50 St 8.8 through the cut-outs in the base frame and the cubicle and the bush.	
3	Repeat the step 2 for the other screws	-

Connecting two columns

Overview

Introduction This section describes how to connect two columns.

Contents This document contains the following topics.

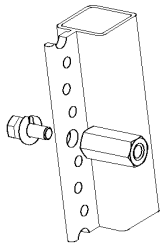
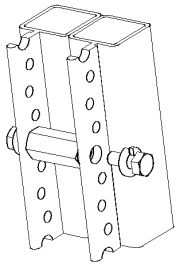
Connecting two columns

Principle

Several columns can be connected to make one panel.

Procedure

The following procedure describes how to connect two columns.

Step	Action	Illustration
1	Remove the side panels	_
2	Screw the M 6 x16 metric bolt from one side into the hexagonal bolt.	
3	Put the two panels next to each other. Screw the second bolt into the hexagonal bolt.	

Connecting the main busbar system

Overview

Introduction This section describes how to connect the busbars of two columns.

Contents This document contains the following topics.

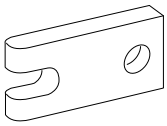
Connecting the main busbar system

Principle

The busbars of two or more columns can be connected.

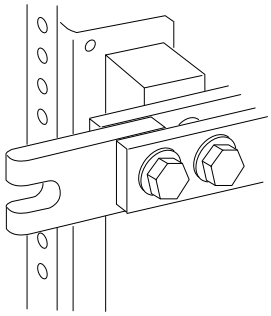
Fishplate

Fishplates are used for making the connection. The following illustration gives an example of such a fishplate.



Position fishplate

The following illustration shows the position of such a fishplate.

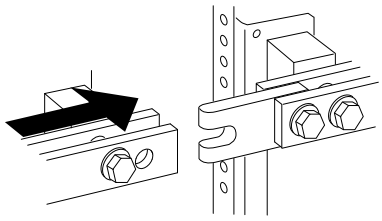
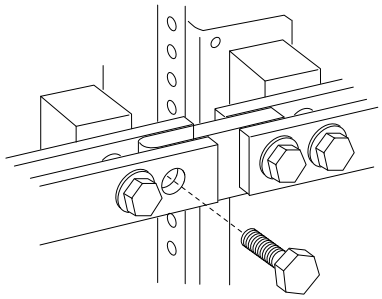


Continued on next page

Connecting the main busbar system, *Continued*

Procedure

The following procedure describes how to connect the main busbar system.

Step	Action	Illustration
1	Loosen the fixing screws of the busbar system without fishplates.	_
2	Move the columns together. The fishplate moves between the two busbar layers.	
3	Fix the connection (and column, see “connecting two columns”) when the fishplates are in the right position. Tighten the busbar fixing screws again.	
4	Check torque of fixing elements.	See “Torque values”

Torque values

Overview

Introduction

This section gives an overview of all torque values for bolt and screw connections in the column.

Contents

This document contains the following topics.

Torque values for mechanical connections

Where applied? The torques shall be applied for all mechanical screw joints in SEN Plus.

Property classes The stated values relate to property classes 5.8 to 8.8 for ungreased screws and nuts.

Deviating torques

Deviating torques are only admissible if:

- special manufacturer instructions have to be followed.
- special tightening torques are requested in drawings or manufacturing instructions.

Torques for hexagon head bolts

The following table gives a survey of the torques for hexagon head bolts.

	Hexagon head bolts			
	property class 5.8		property class 8.8	
Screw size	Nominal torques (+10%)	Minimum torques for maintenance	Nominal torques (+10%)	Minimum torques for maintenance
	Nm	Nm	Nm	Nm
< M 3	0,4	0,30	0,60	0,50
M 3	0,8	0,60	1,10	0,80
M 3,5	1	0,80	1,70	1,50
M 4	1,6	1,10	2,50	2,10
M 5	3	2,30	5,00	3,80
M 6	5,3	3,80	8,50	6,50
M 8	12	9,20	20,00	15,00
M 10	26	18,50	41,00	31,00
M 12	41	32,00	70,00	54,00
M 16	100	77	170,00	123

Continued on next page

Torque values for mechanical connections, *Continued*

Torques for taptite screws

The following table gives a survey of the torques for taptite screws.

	Taptite screws	
	Nominal torques (+10%)	Minimum torques for maintenance
screw size	Nm	Nm
< M 3		
M 3		
M 3,5		
M 4		
M 5	7	2,30
M 6	15	3,80
M 8	20	9,20
M 10		
M 12		
M 16		

Unused connection screws

Unused connection screws (e.g. spare installations) have to be tightened with a tightening torque of 0,2 – 0,3 Nm.

Torque values for electrical connections

Where applied?

The torques shall be applied for all electrical screw joints in SEN Plus.

Property classes

The stated values relate to property classes 5.8 to 8.8 for screws and nuts that are not greased.

Deviating torques

Deviating torques are only admissible if:

- special manufacturer instructions have to be followed.
- special tightening torques are requested in drawings or manufacturing instructions.

Torques for Terminals

The following table gives a survey of the torques for electrical terminals.

	Terminals general	
bolt size	nominal torques (+10%)	minimum torques for maintenance
	N.M.	Nm
< M 3	0,5	0,43
M 3	1,0	0,70
M 3,5	1,1	0,90
M 4	1,5	1,30
M 5	3,0	2,50
M 6	6,0	4,00
M 8	14,0	10,00
M 10	26,0	20,00
M 12	40,0	36,00
M 16	60,0	50,00

Unused connection screws

Unused connection screws (e.g. for supply or outgoing terminals) have to be tightened with a tightening torque of 0,2 – 0,3 Nm.

Cable connection in columns with two breakers

Overview

Introduction This section describes the cable connection in columns with two breakers.

Contents This document contains the following topics.

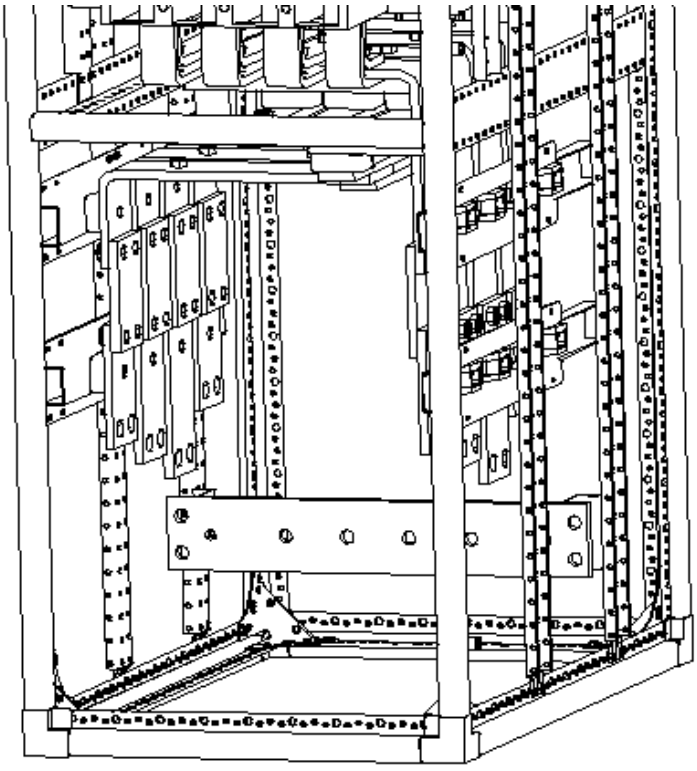
Cable connection in column with two breakers

Principle

The cable connection in column with two breakers. The N and PE rails are mounted in the same position like in standard column with one breaker.

Contents

The following illustration shows cable connection in column



Arrangement of external connections

Overview

Introduction This section contains a table of connectable cross-sections.

Contents This document contains the following topics.

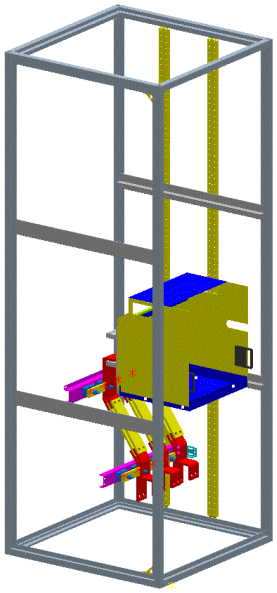
Table of connectable cross-sections

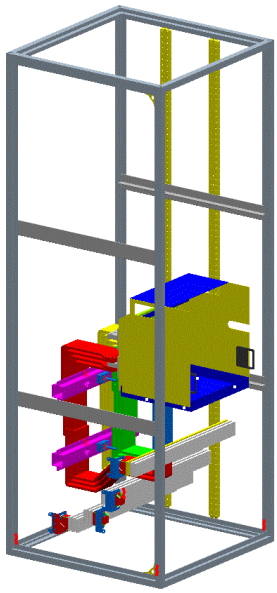
Method

The cable lugs are clamped by means of a screw.

Cabling zone

The following illustrations are showing the cabling zone of an air circuit breaker (examples).





Dilos

The following table gives an overview of the connectable cross-sections for a load break switch type DILOS.

Rated Current	Size	Risers L1 - L2 - L3	Number of cable per phase	Max. cross-section	Bolt diameter
A		*mm*		*mm²*	*mm*
1000	6S	60x10	2	240	16
1600	7S	2/50x10	4	240	16
2500	8S	2/80x10	8	240	16

Continued on next page

Table of connectable cross-sections, *Continued*

M-PACT

The following table gives a survey of the connectable cross-sections for an air circuit breaker type M-PACT.

Rated Current	Frame size	Risers L1- L2 - L3	Number of cable per phase	Max. cross-section	Bolt diameter
A		*mm*		*mm²*	*mm*
Connection direct to the riser					
1000	1	60x10	2	240	16
			4	150	12
1600	1	80x10	4	240	16
2500	1	2/80x10	8	240	16
Connection to auxiliary busbars					
3200	2	3/100x10	6 (12)	300	16
4000	2	4/100x10	8 (16)	300	16

Record Plus

The following table gives a survey of the connectable cross-sections for a moulded case circuit breaker Record Plus

Rated Current	Frame size	Risers L1- L2 - L3	Number of cable per phase	Max. cross-section	Bolt diameter
A		*mm*		*mm²*	*mm*
1000	K	40x10	2	240	16
		60x10	2	240	16
1250	K	2/40x10	4	240	16
		80x10	4	240	16
1600	1	2/40x10	4	240	16
		80x10	4	240	16

Final testing

Overview

Introduction

This section gives an overview of tests that should be carried out before putting the assembly into operation.

Contents

This document contains the following topics.

Final testing

Principle

Mechanical and electrical function tests should be carried out before putting the assembly into operation.

Mechanical function tests

The following mechanical function tests should be carried out before putting the assembly into operation:

- mechanical function check of electrical components according the relevant operating instructions
- check all connections to the protective conductor
- check if all barriers and obstacles are in place
- check correct function of the worm gear mechanism
- check correct opening and closing of doors - all doors shall be closed
- check correct function of all door locks
- check interlocking facilities of circuit breakers and doors
- general visual inspection of the assembly.

Electrical function tests

The following electrical function tests should be carried out before putting the assembly into operation:

- electrical function check of electrical components according the relevant operating instructions
- measure the insulation resistance of the assembly

  (the insulation resistance of the assembly should not drop below 1 MΩ)
- check all safety equipment as e.g. emergency off
- check the correct function of control-, monitoring- and measuring instrumentation
- check all control functions.

Maintenance

Overview

Introduction This section contains a checklist for inspection.

Contents This document contains the following topics.

Maintenance

Maintenance intervals

The maintenance intervals depend on the intensity of use of the switchgear installed in the switchboard.

Attention

Observe all relevant operating instructions of the electrical components as well as local requirements and standards.

Inspection interval

A visual inspection as well as a control of mechanical functions (e.g. interlocks etc.) of the assembly should be done every 4 years as a minimum.

An interval of <= 1 year is recommended.

Inspection

The following checklist can be applied as a guideline during inspection.

#	inspection	corrective action
1	inspection of service conditions	
2	inspection of the assembly	
3	inspection of the ventilation openings	clean ventilation openings / change dust filters
4	inspection of measures to achieve IP rating	
5	inspection of cables & glandings	
6	inspection on the effects of pollution	clean with dry piece of cloth or use vacuum cleaner / do not use high-pressure air !
7	inspection for damages	
8	inspection on the effects of corrosion	repair failures on surface / make dry if necessary
9	inspection of sub-assemblies & electrical components	maintenance in accordance with relevant component manuals
10	inspection of connectors & terminals	

Continued on next page

Maintenance, *Continued*

Inspection
(continued)

#	inspection	corrective action
11	check correct protection of electrical components & cables	change fuses if necessary
12	check settings of electrical components (e.g. overload & short circuit protection)	correct settings according the documentation of the electrical component
13	inspection of plug-in contacts	remove old grease, put new grease on
14	inspection of measures against electrical shock (PE conductor, PE connections)	check insulation resistance
15	check torque values for electrical connections	(see torque values for electrical connections)